ROLE OF FISCAL STIMULUS IN LIQUIDITY TRAP UNDER BOUNDED RATIONALITY AND HETEROGENEOUS EXPECTATIONS: THEORETICAL AND EMPIRICAL ANALYSIS

A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy in Economics

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Dedicated to my parents,

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Contents

List of Figures

List of Tables

Acronyms

AIC Akaike Information Criteria

ADF Augmented Dickey Fuller test

VECM Vector Error Correction Method

SBC Shcwarz Bayesian Criteria

DSGE Dynamic stochastic general equilibrium

GDP Gross domestic product

OLS Ordinary Least Square

VAR Vector Auto Regressive

SBP State Bank of Pakistan

SVAR Structural Vector Auto Regressive

Chapter 1

Summary

Fiscal policy is essential to regulate the performance of the economy, avoiding macroeconomic imbalances and achieving full growth potential. As a core component of government policy, fiscal policy focuses on taxation, public spending, and government borrowing. The primary objectives of fiscal policy are the provision of public services, the promotion of investment in public goods, the equitable distribution of wealth, economic growth, inflation, the balance of payments and ensuring economic stability. Effective fiscal policy is also required not to negatively affect consumption and investment decisions and ultimately economic growth through the level and structure of taxes. Fiscal policy has an advantage over monetary policy due to its direct impact on the generation of employment opportunities and the reduction in income inequality. Furthermore, in times of economic recession or liquidity trap when monetary policy fails to stimulate economic activities, the initiation of fiscal intervention as a stabilization tool is inevitable and impactful.

The main objective of this thesis is to examine the impact of fiscal policy in the context of Pakistan's economy. The central theme of this research revolves around three distinct, yet inter-

connected aspects concerning the effectiveness of fiscal policy. The first two essays adopt the New Keynesian modeling approach, addressing two different scenarios: a small open economy and a liquidity trap. The key advantage of using this approach is the diagnosis of policy implications and the way the corrective policy measures affect the variables of interest. This thesis further contributes by using the more realistic assumption of bounded rationality in the first two essays. Bounded rationality provides an intuitive analysis that how the economic agents make economic decisions in the scenarios of small open economy and liquidity trap, when they are unable to perceive the true economic conditions and also fail to make optimal decisions in the finite planning horizons. In the third essay, an empirical analysis is carried out to check the efficacy of fiscal policy in Pakistan, considering the debt dynamics in the country. This analysis confirms that debt dynamics take on a pivotal role in the implications of fiscal policy as a counter-cyclical stabilization tool and in mitigation of economic downturns and recessions. This dissertation thoroughly examines the implications of fiscal policy in both the closed and the open economy scenarios within the context of the Pakistan economy.

The first essay introduces a micro-economic framework based small open economy model. The basic structure of the first essay is built around the assumption that economic agents do not possess perfect knowledge and fail to make optimal decisions. The assumption of rationality has been criticized for its failure to account for agents' ability to make optimal decisions over an infinite time horizon. Particularly, when agents are considering new stabilization policies, the assumption of optimality is considered too stringent, especially within a finite time horizon (Woodford, 2013). Therefore, it is more practical and realistic to structure economic literature on the assumption of cognitive limitations and bounded rationality. Accordingly, the first essay incorporates the scenario of small open economy assuming that agents are boundedly rational and make economic decisions within a finite planning horizon. However, they also give priority to their financial status at the end of their planning horizon. The results of this essay offer a more comprehensive analysis, showing that an upturn in government spending becomes the cause of an expansion in economic output. The increase in this productivity consequently results in a reduction in both inflation and interest rates. Furthermore, the rise in government spending triggers a decrease in exchange rate and a decline in terms of trade. Conversely, an increase in consumption taxes and labor taxes results in a reduction in output and rise in inflation and interest rates. The analysis also affirms the existence of bounded rationality among the agents owing to which they fail to properly ascertain the economic situations. Accordingly, the impact of fiscal policy intervention becomes more pronounced in the shorter planning horizons than that of the longer planning horizon.

In the second essay, we uphold the concept of bounded rationality and explore the consequences of fiscal policy in the context of a liquidity trap. The theoretical and empirical literature provides evidence that in situations of extremely low inflation and interest rate, monetary policy fails to restore economic development and to bring the economy out of recession. Ultimately, the eventual implementation of fiscal policy interventions becomes imperative to stabilize the economy, promote its recovery, and mitigate the impact of recession. The theoretical framework of second essay is the modified version of the one used in the first essay. The theoretical framework is developed for a closed economy under liquidity trap. Furthermore, the analysis is enriched by assuming that the agents have heterogenous expectations about inflation and output. More precisely, a portion of these agents adopts a backward-looking approach, while the remaining fraction adopts a forward-looking perspective about the economic conditions. The analysis conducts three different scenarios of liquidity trap as first, fundamental driven liquidity trap, second, expectations driven liquidity trap and third, a mixed liquidity trap. The results of this essay confirm that in absence of fiscal policy intervention, (i) the fundamental driven liquidity trap ends the economy into deflationary spiral and, (ii) the expectations driven liquidity trap pushes the economy into longer periods of recession. Similar outcomes are obtained when there is a greater proportion of backward looking agents in the economy. Nonetheless in all scenarios of liquidity trap, fiscal intervention through increased government expenditure and a reduction in consumption taxes effectively prevents deflationary spirals. The results of this essay further confirms that the boost in government spending stimulates both output and inflation, offering a solution to exit the liquidity trap while a reduction in consumption taxes also exerts a positive influence on both output and inflation. Conversely, a labor tax cut falls short in stimulating output and inflation, and, even exacerbate the risk of a deflationary spiral in the economy. This essay makes a valuable contribution to the fiscal literature of Pakistan by evaluating the efficacy of fiscal policy in the scenario of liquidity trap.

In the third essay, an empirical analysis is conducted to estimate the influence of fiscal policy in Pakistan. The relationship between debt and fiscal imbalances in Pakistan exhibits an inverse correlation that adversely impacts fiscal sustainability. The government's revenue and expenditure play a pivotal role in managing debt on the other hand debt dynamics also play role in the government expenditure and revenue determination. Consequently, the levels of debt have intense implications over the influence of fiscal policy on Pakistan's economy, similar to other developing nations. The empirical analysis is conducted following the methodology described by Favero and Giavazzi, 2007 and the SVAR identification strategy formulated by Blanchard and Perotti, 2002. This comprehensive essay maintains a keen focus on debt dynamics while assessing fiscal shocks and their eventual fiscal policy implications. This analysis confirms that an expansion in government spending has a positively significant and stimulating impact on output, whereas the influence of taxes on output is statistically insignificant and tends to bring a decline in output.

Chapter 2

Fiscal Policy in Small Open Economy under Bounded Rationality

2.1 Introduction

Fiscal policy is considered an established tool for economic stabilization and long run growth of an economy (Mountford and Uhlig, 2009; Alesina et al. 2019; Blanchard and Perotti, 2002). Fiscal policy can stimulate (restrain) economic development by increasing (decreasing) government expenditure and reducing(increasing) taxes. Considerable theoretical and empirical research has been undertaken to explore the macroeconomic effects of fiscal policy interventions in closed economies (Eggertsson, 2011; Zubairy, 2014; Ferraro and Fiori, 2023 and Ziegenbein, 2024). However, given the expanding size of the public sector in developing nations, along with increased international capital mobility and trade interconnectivity, there is a growing necessity to study fiscal policy models in the context of an open economy. Fiscal policy analysis in an open economy provides an expanded interpretation of the economic indicators by considering the exchange rate and terms of trade channels (Benigno and Paoli, 2005). Specifically, the impact of fiscal policy shocks is contingent on various trade-specific factors, including the level of trade openness, type of exchange rate regime, and the level of public debt (Ilzetzki, Mendoza and Végh, 2013). Hence, it is crucial to assess the effectiveness of fiscal policy within the context of an open economy framework.

The traditional dynamic macro models are based on the assumptions of full information and rational expectations. The assumption of rationality plays a pivotal part in the efficacy of policies since it depends on policymakers' capacity to anchor expectations in the economy. However, potential inaccuracies in specification of expectations might result in distortions in parameter estimations and the implied dynamics of the model (Hohberger et al., 2024). Therefore, it is essential to assess the impact of fiscal multipliers associated with different fiscal instruments on the economy, in the presence of more realistic assumptions of cognitive limitations.

The fiscal policy analysis is mostly based on full-information rational expectations. Agents in the economic system anticipate changes in taxes and government spending well in advance of their actual implementation (Yang, 2008; Leeper et al., 2013; Mertens and Ravn, 2010). However, dynamic macroeconomic models have faced criticism on the grounds that agents do not possess perfect knowledge and lack complete understanding of the true structure of the economy (Evans and Honkapohja, 2001; Sargent, 1993). Consequently, to accommodate such drawbacks, advanced macroeconomic modeling is being developed keeping in view experimental evidence on human judgement and cognitive limitations (Hommes, 2018). Branch et al., 2012 applied the concept of finite-horizon planning to examine and forecast the future dynamics of variables within an intertemporal decision problem. Farhi and Werning, 2019 and Gabaix, 2020 analyzed the implications of monetary and fiscal policy assuming that agents are not fully rational and cannot fully anticipate future. Their study specified that under the assumption of bounded rationality, the impact of fiscal policy enhances as the agents are myopic and non-Ricardian and consume more when they receive tax cuts or debt-financed transfers from the central bank. Hohberger et al., 2024 used the framework of Gabaix, 2020 and suggested a strong preference for myopic behavior and effectiveness of fiscal policy due to crowding out of private consumption and investment in the short run. Angeletos et al., 2022 indicated that business cycle fluctuations can be triggered by aggregate demand shocks, particularly when agents operate under the constraints of bounded rationality.

The comparison of bounded rationality with benchmark rational expectations explains that planning horizon has vivid impact over the behavior of economic indicators that leads to different policy implications (Ballinger et al., 2003). Carbone and Infante, 2012 conducted an experiment to check the optimal decision making of the agents under certainty, risk and uncertainty, when the agents were subject to very short planning horizon. The study concluded that even in case of a very short lifecycle, the intertemporal consumption problem might be too complex to be solved optimally. Lustenhouwer and Mavromatis, 2021 found that over finite planning horizons there is found dynamic inconsistency in the economic behavior of the agents due to forecast errors and cognitive limits of their planning horizons.

The effectiveness of fiscal policy in an open economy relies on numerous factors. Surjaningsih (2012) observed that, government spending is more useful in stimulating economic growth compared to taxation policies especially during recessions. Patonov (2016) examined a positively significant impact of government spending on GDP growth with the suggestion that taxation serves as a more reliable fiscal instrument. Pasichnyi (2017) also examined that managing the tax burden and structure is essential to harness the beneficial impact of fiscal policy in emerging markets. Conversely, Idris (2019) found that both monetary and fiscal policies significantly contribute to economic growth, with monetary policy being more effective. Ravn (2014) demonstrated a substantial but short-lived impact of fiscal stimulus on economic activity. Tervala (2008) also highlighted potential negative welfare impact of fiscal policy in small open economy particularly due to crowding-out effects of private consumption.

Pakistan faces several fiscal policy challenges, which have persisted over the years due to structural issues, economic mismanagement, and external shocks. The main issue is large fiscal deficits due to a mismatch between government revenues and expenditures and high non-development expenditures. Furthermore, the tax-to-GDP ratio in Pakistan is quite low due to widespread tax evasion, narrow tax, heavy reliance on indirect taxes instead of direct taxes and large share of informal economy. Debt sustainability and the resulting fiscal risk has been a challenge for the government. Public debt has reached unsustainable levels, with a significant portion of the budget allocated to servicing domestic and external debt. As an emerging economy Pakistan initially followed a fixed-peg exchange rate regime up to the early 1980s. Then under a financial sector reforms program switched to a managed float till 2000 and a market-based flexible exchange rate system thereafter (Khan and Qayyum, 2007). The main component of the open economy is exchange rate regime that affects all the other economic variables and the adjustment of fiscal policy (Yagci, 2001). Fixed exchange rate regime enhances confidence of the agents and removes uncertainty thus positively affect investment and growth. However, currency overvaluation under fixed exchange rate regime negatively affect the confidence of the investors in the long run (Ali et. al, 2016). Expansion of fiscal policy forces inflation to increase, however under fixed exchange rate regime market absorbs the shock and reduces the profit margin. In a nutshell, fixed exchange rate helps to maintain low inflation and support economic growth in presence of sound market structure. Karass (2012) examined that fiscal policy is quite effective under fixed exchange rate regimes and ineffective under flexible exchange rate regimes, reasoning that under flexible exchange rate regimes government expenditure crowds out private investment. Under flexible exchange rate, the expansion of government expenditure leads to increase in interest rate and appreciation of the domestic currency and will negatively affect the fiscal policy efforts to influence the economic activities. Under flexible exchange rate system, a fiscal expansion leads to decline in inflation and rise in real interest rates and nominal currency appreciation. However, amid nominal price rigidity, this results in a real exchange rate appreciation. The decline in international competitiveness, coupled with the resultant decrease in net exports, fully counteracts the impact of the fiscal expansion.

The findings of this essay illustrate that an increase in government spending correlates with an increase in output. This higher output level leads to decline in inflation and interest rate. Additionally, rising government spending results in a fall in real exchange rate and a decline in terms of trade. On the other hand, a rise in consumption tax and labor tax generates reduction in output, increase in inflation and nominal interest rate hike. The results of this essay are in confirmation with Shahid et al., 2016 that government expenditure has the tendency to stimulate the economy and the burden of higher tax has legitimate economic and business cost. According to Julio et al., 2021 the real exchange rate rises due to a budget imbalance brought on by tax cuts. Sanbeta, 2011 analyzed that developing countries heavily rely on the availability and cost of foreign exchange, as their production is heavily dependent on imported capital and intermediate inputs. As a result, the foreign exchange constraint in these countries leads to increased variability in economic activities when faced with similar domestic and external shocks. Furthermore, fiscal policy shocks are communicated to the domestic economy like Pakistan through the trade channel as well as the interest rate channel (Shah et al., 2021).

The findings further elaborate that the economic agents fail to properly ascertain the economic situations. In essence, economic decision-making may be optimal over the long term but may not align optimally over the short term. This study enhances the current body of literature on fiscal policy by providing analyses from two distinct perspectives. First, the analysis is conducted concerning the effects of fiscal policy instruments in a small open economy and second, the analysis is conducted in presence of finite planning horizons when agents are boundedly rational. In the developing countries, there is scarcity of economic literature that discovers the transmission mechanism of human beviours into the macroeconomic models. Haider et al., 2008 constructed New-Keynesian model for Pakistan economy but the analysis was confined to the monetary policy transmission mechanism. To that end, this study significantly enriches the existing literature by constructing the fiscal policy analysis considering finite planning horizon and bounded rationality.

This essay is structured as follows: Section 2 presents a literature review. Section 3 outlines the theoretical framework for fiscal policy under finite planning horizons. Section 4 delves into the calibration results, and Section 5 presents the conclusions drawn from the analysis along with policy recommendations.

2.2 Literature Review

In this section, literature review is divided into two sections. The first segment of literature review explains the influence of fiscal policy on the economy, while the subsequent section explores the impact of fiscal policy within the context of bounded rationality.

2.2.1 Fiscal Policy Effectiveness

The economic literature reflects the differing perspectives of Keynesian and classical economic schools of thought on economic policy, encompassing fiscal policy. The New Keynesian School promotes a proactive government role in the economy, particularly in times of economic decline. The advocates of Keynesian school of thought argue that governments should employ fiscal policy measures, such as heightened government spending and tax reductions, to invigorate demand and enhance economic activity amid recessions. In contrast, the Classical school maintains a stance favoring a restricted government role and deems government intervention in the economy as negligible.

Historically, fiscal policy has been the primary tool for improving the economic landscape in times of low aggregate demand and economic downturns. However, the key elements of an open economy significantly influence the overall effectiveness of fiscal policy. In this regard, the exchange rate regime helds a prominent role in shaping the impact of fiscal policy on the economy. Bank, 2006; Naqvi et al., 2019 estimated that fiscal shock has higher impact under fixed exchange rates. Ilzetzki et al., 2013 examined that fiscal policy instruments have smaller impact in the developing countries under floating exchange rate, meanwhile government consumption multiplier is negative due to high level of trade openness and high level of public debt, however government investment multipliers are positive in the developing countries. Khan and Qayyum, 2007 empirically examined that trade and financial liberations policies have significant impact over long run economic growth in Pakistan. However, the impact of real deposit rate and trade policy are not considerable in the short run. Ferrara et al., 2021 discovered that a boost in government expenditure led to exchange rate appreciation, rise in nominal interest rates, inflationary pressure, and a deficit in the trade. This outcome differs from the conclusions drawn in the majority of existing literature, and the discrepancy primarily arises from the identification of fiscal shocks in the study conducted by Ferrara et al., 2021.

According to an analysis by Easterly and Hebbel, 1993, trade deficits and fiscal deficits have a positive correlation, and real exchange rates follow the pattern or trend of the nation's fiscal deficits. Conversely, the research conducted by Fagbemi and Olatunde, 2020 revealed a significant negative correlation between the budget deficit and exchange rate, both over the long term and the short term. In all times, they also confirmed a positive, substantial relationship between the exchange rate and the national debt. However, Monacelli and Perotti's analysis suggests that the depreciation of exchange rate and the trade deficit in 2007 resulted from a surge in government spending. According to empirical research conducted in Pakistan, it has been observed that reducing public investment to decrease the deficit leads to an increase in the real exchange rate. The decrease in public investment has a negative effect on domestic output, which causes the exchange rate to increase. Rodriguez's hypothesis, 1989 offers a further explanation for this phenomenon. According to his hypothesis, when there is a trade deficit, an increase in public spending influences the real exchange rate. This influence arises from the fact that higher public spending implies a greater inclination of the public sector to allocate funds towards imports rather than domestic goods. Consequently, there is a surge in demand for imports, which contributes to the depreciation of the real exchange rate.

Traditional economic theory proposes that an expansion of government expenditure results in the appreciation of the real exchange rate. Studies conducted by Ravn et al., (2007) and Corsetti et al (2012) present intriguing counterarguments in this respect. Ravn et al., (2007) discovered that with rigid consumption habits, an expansionary fiscal policy leads to a depreciation of the real exchange rate and a decline in interest rate. In their study on the US economy, Corsetti et al., (2012) focused on the impact of a positive government spending shock and suggested that such a shock leads to economic agents anticipating future spending reversals, which in turn becomes a significant factor driving a decline in long-term interest rates and the real exchange rate. These findings challenge the conventional understanding and emphasize the importance of considering factors such as habits and agents' expectations when analyzing the relationship between fiscal policy, real exchange rate and interest rates.

The efficacy of fiscal policy hinges on diverse factors, encompassing the economic conditions, the timing of policy execution, and the specific instruments employed in fiscal policy measures. Konstantinou et al., 2011 simplified that the particular composition of the indicators of fiscal policy have substantial impact over the confidence of the economic agents which then have definite implications over the impact of fiscal policy on the economy. As in the era of economic depression, the tax hike will negatively affect the confidence of the households and firms, while the targeted government expenditure programs will boost their confidence. Friedman et al. 2016 analyzed the variations in the economic activities created due to announcement of tax shock and in the public debt target, and found that the news of decline in future tax cut has positive impact over output alike the impact of productivity shock in the economy. Forni et al., 2009 also confirmed that government expenditure shock has small and short-lived impact over private consumption however, labour tax cut and consumption tax cut have significant positive impact over consumption and output. Kumhof and Laxton, 2013 investigated that the welfare gains resulting from tax revenue gap rules are substantial compared to balanced budget rules. Ultimately, the preferred fiscal instruments, according to research, are transfers, consumption taxes, and labor income taxes.

The resources employed to maintain fiscal restraint and finance the public debt affect the final implications of fiscal policy on the economy. Fiscal policy indicators fail to influence economic situation when fiscal fundamentals are deteriorating and investors are concerned about debt sustainability. Then an expansionary fiscal shock can lead to appreciation of exchange rate if fiscal authority provides full backing for its debt, and towards depreciation of exchange rate/domestic currency, if investors believe that debt is not fully backed by future fiscal surpluses (Alberola et al. 2021). In a study conducted by Ganelli, 2005, it was indicated that fiscal policy relying on tax cuts financed through debt results in a rise in domestic consumption.. However, it also results in an appreciation of the exchange rate and a reduction in relative output in the short term. However, in the long run this appreciation of exchange rate is reversed due to implied decline in net foreign assets. While fiscal expansion sponsored by a balanced-budget escalation in government spending, results in crowding out of consumption and depreciation of domestic currency in the short run. Auray et al., 2013 estimated that the reduction in public debt through increase in capital taxes leads to rise in economic welfare while rise in consumption tax yields only a very small welfare benefit. While the increase in labor tax creates decline in welfare. The study also concluded that tax reforms in the presence of same debt-to-GDP ratio improves the domestic economy's international competitiveness. However, Eminidou et al., 2023 examined that a shock to government expenditure had a favorable impact on both output and consumption in a high-debt state. These reactions diverge from those seen in the state with low public debt, showing that the effect of fiscal policy shocks changes with public debt levels.

The examination of fiscal policy in both developed and developing countries by Honda et al., 2020 implied that in case of developing economies the impact of fiscal policy is small. This impact over output becomes insignificant after three years. In comparison this impact of fiscal policy is positively significant in the developed economies. Rashid et al., 2020 conducted an analysis of fiscal policy in Pakistan, which revealed empirical evidence indicating that a rise in government expenditure results in a moderate rise in output, inflation, interest rates, and the appreciation of the domestic currency. On the flip side, this fiscal boost negatively affects private consumption, investment, and exports; nevertheless, this impact diminishes over time. Nandi, 2020 found the similar evidence for the case of Indian economy. Kim and Kim (2005, 2018) conducted studies examining the effects of incomplete financial markets on tax policies. Their research revealed that in the context of incomplete financial markets these policies tend to be less countercyclical and, in certain cases, even become pro-cyclical. This shift occurs due to the role of consumption smoothing played by the current account, particularly when it comes to capital income tax.

In a study conducted by Alloza, 2022 the effectiveness of government spending shocks on economic activities was examined with a focus on both boom periods and economic downturns. The study revealed that government spending shocks exert a more substantial impact on economic activities during periods of economic expansion or boom, as compared to periods of economic downturns. Goemans, 2023 studied the economic situations in the Euro area countries and estimated fiscal policy multipliers. He estimated that in the times of economic uncertainty, an increase in government investment and consumption has larger impact on output than in normal times. Kim et al., 2023 examined for US that when monetary and fiscal policies are properly coordinated, government expenditure has a favorable impact on private economic activity. However, the study also uncovered that the effectiveness of expansionary fiscal policy fails in stimulating private economic activities in the presence of an aggressive monetary policy. Kocherlakota, 2022 investigated the efficiency of fiscal policy in stabilizing inflation and output using a Heterogeneous Agent New Keynesian (HANK) model. The study revealed that when there is a high level of debt, fiscal policy shocks are highly effective in stabilizing either inflation or output. Boug et al., 2022 examined the influence of fiscal policy on macroeconomic indicators and revealed that when considering a Taylor-type interest rate, the government expenditure multiplier was approximately 1. Conversely, the labour tax multiplier was estimated to be around 0.5.

2.2.2 Fiscal Policy under Bounded Rationality

Planning horizons has significant impact over the perception of the agents and the implied impact of fiscal policy shock. Zubairy et al., 2014 found that economic indicators are strongly stimulated by government expenditure however, this impact diminishes significantly over longer time horizons. On the contrary, tax cuts have a smaller impact on economic activities in the short term, but this effect magnifies over the long term. In this context, the pace at which public debt retires after fiscal expansion has significant stimulative impact over the economic activities and this affect increases over the long horizon. The study conducted by Forni and Gambetti, 2016 also provides supporting evidence for the fiscal foresight hypothesis. They discovered that changes in government expenditure can be predicted more accurately than GDP and consumption over a one-year timeframe. Nevertheless, they also discovered that this fiscal foresight proves more impactful in the medium term and becomes less dependable when extended beyond that timeframe.

The economic literature is majorly based on the assumption of rational expectations. Yet, agents do not consistently hold rational future expectations; while they may exhibit rational behavior in the long run, they may not necessarily act upon this in short run. Gabaix, 2020 examined the consequences of monetary and fiscal policy under the assumption that agents are not entirely rational and cannot fully anticipate the future. The study suggested that because agents tend to react myopically to distant events, forward guidance is significantly less effective. Furthermore, under the assumption of bounded rationality, the effectiveness of fiscal policy enhances as the agents are myopic and non-Ricardian. The study further explored that the economies are stable even at the zero lower bound due to myopic nature of the agents.

Hohberger et al., 2024 estimated for the US data and suggested a strong preference for myopic behaviour. The study further confirmed that fiscal policy is highly effective due to non-Ricardian behaviour of the agents while monetary policy is less powerful in anchoring expectations. Afsar et al., 2023 estimated an augmented New Keynesian model incorporating backward-looking agents and cognitive discounting, revealing compelling evidence of aggregate myopia.The study further elaborated that cognitive discounting, along with habit persistence and price indexation, is the main element to get the macro estimates that are well aligned with their corresponding micro estimates.

The economic decision making of the agents is majorly influenced by the availability of information. Coibion et al., 2015 explained that agents behave fully rational but their behaviour is subject to sticky information and information frictions. Eusepi et al., 2018 analyzed the fiscal foundations of inflation based on imperfect knowledge and adaptive learning for the US economy. The study revealed that since due to imperfect knowledge the economic agents are non-Ricardian, therefore public debt appears an important instrument to affect inflation. In addition, fiscal policy matters to stabilize inflation while an aggressive monetary policy is required to anchor inflation expectations.

2.3 The Model

The theoretical foundation of this essay is built upon the small open economy model formulated by Gali and Monacelli, 2005. While Gali and Monacelli's model serves as a micro-founded structural framework, therefore this study enhances its scope by incorporating finite planning horizons following Lustenhouwer and Mavromatis, 2021. This model for a small open economy encompasses both domestic and imported economies, along with the inclusion of Calvo-type price rigidities (Gali and Monacelli, 2005, 2008; Benigno and Thoenissen, 2008).

Small open economy is designed by assuming unit interval to symbolize the unlimited number of tiny open economies that make up the world economy. Furthermore, each individual economy is considered to be small enough that its domestic policy choices do not exert any influence on the decisions made by the world economy. In the context of the model being described, variables denoted with the "h-index" are associated with the domestic economy being modeled. On the other hand, variables marked with a star (*) symbolize the world economy as a whole. In this model, time is finite and agents make decisions about finite-planning horizon however, they are also concerned about the continuation value of their wealth after the end of their plannning horizon. Following Schmitt-Grohe and Uribe, 2003 it is assumed that international financial markets are not complete as the domestic agents have to face some adjustmnet cost while trading international nominal bonds, (Paoli, 2009). The cost of adjustment is directly proportional with the trading country's net foreign asset sustainability.

2.3.1 Households

The model economy is based on the assumption that households consist of a substantial number of individuals who make plans and decisions over a finite number of future periods. The main objective of the households is to maximize predicted discounted utility over the course of their planning horizon, following the budget constraint. Additionally, the households are also concerned about the level of wealth they anticipate attaining by the conclusion of their planning horizon (their wealth state in period T+1). Following Woodford, 2018 and Lustenhouwer and Mavromatis, 2017 the household utility function denoted as U(.) is composed of utility and leisure across the durations within their planning horizon. The model also includes a term featuring a function V(.) that demonstrates a rising trend in end-of-horizon wealth. Since the model assumes that households possess bounded rationality, they will rely on a heuristic to assess the value of their financial condition at the conclusion of the planning period.

The representative households choose consumption C_t, labour N_t, domestic bond holdings

B_t, and foreign assets F_t to maximize their utility function

$$E_t \sum_{s=t}^{t+T} \beta^{s-t} u(C_s, N_s) + \beta^{T+1} V \left(\frac{B_{t+T+1}}{P_{t+T}}, \frac{F_{t+T+1}}{P^*_{t+T}} \right) \tag{2.1}$$

where N_t is households working hours and C_t is composite consumption index. $\beta \in [0,1]$ is the inter-temporal discount factor that describes the time preference, while E_t is the type-specific expectation operator of households at time t. The composite consumption index C_t is formulated as

$$C_t = [(1-\alpha)^{\frac{1}{\eta}} C_{h,t}^{\frac{\eta-1}{\eta}} + (\alpha)^{\frac{1}{\eta}} C_{f,t}^{\frac{\eta-1}{\eta}}]^{\frac{\eta}{\eta-1}} \tag{2.2}$$

Where $\eta > 0$ defining the inter-temporal elasticity of substitution between domestic and foreign goods that refers to the measure of responsiveness of consumers to substitute between products manufactured within the home economy and foreign economy over time. $\alpha \in [0,1]$ measures the intensity of trade openness and it also shows the degree of home biasness. The consumption bundle consumed by the domestic consumers consisting of domestic goods $C_{h,t}$ and imported goods $C_{f,t}$, following the CES function are defined as under:

$$C_{h,t} = [\int_0^1 C_{h,t}(j)^{\frac{\epsilon-1}{\epsilon}} dj]^{\frac{\epsilon}{\epsilon-1}} \tag{2.3}$$

$$C_{f,t} = [\int_0^1 C_{f,t}(j)^{\frac{\epsilon-1}{\epsilon}} dj]^{\frac{\epsilon}{\epsilon-1}} \tag{2.4}$$

Here $\epsilon > 1$ denotes substitution elasticity between variety of goods produced and $j \in [0,1]$ is the variety of differentiated goods within any given country.The real budget constraints of the households is given as

$$(1+\tau_s^c)\left[\frac{P_{h,s}}{P_s}C_{h,s}+\frac{P_{f,s}}{P_s}C_{f,s}\right]+\frac{B_{s+1}}{R_{h,s}P_s}+S_s\frac{F_{s+1}}{R^*_{h,s}P_s}+\phi^h_{t+1}\leq(1-\tau_s^n)\frac{W_sN_s}{P_s}+\frac{B_s}{P_s} \\ +S_s\frac{F_s}{P_s}-\frac{T_s^l}{P_s}+\frac{\Xi_{h,s}}{P_s} \tag{2.5}$$

where $s = t, t+1, ...t+T$

Here $P_{h,s}$ refers to the price index of domestically traded goods, $P_{f,s}$ refers to the price index of tradeable goods within the foreign market (expressed in domestic currency) and P_s is the consumer price index (CPI) consisting on domestic and foreign inflation defined as $P_s = [(1-\alpha)P_{h,s}^{1-\eta} + (\alpha)P_{f,s}^{1-\eta}]^{\frac{1}{1-\eta}}$. Following Gali and Monacelli, 2005 the aggregate spending on consumption by households within the domestic economy is defined as:

$$P_sC_s = P_{h,s}C_{h,s} + P_{f,s}C_{f,s} \tag{2.6}$$

Therefore, the consumer budget constraint can be restated as under:

$$(1+\tau_s^c)C_s+\frac{B_{s+1}}{R_{h,s}P_s}+Q_s\frac{F_{s+1}}{R^*_{h,s}P^*_s}+\phi^h_{t+1}\leq(1-\tau_s^n)w_sN_s+\frac{B_s}{P_{s-1}\pi_s}+\frac{Q_s}{\pi^*_s}\frac{F_s}{P^*_{s-1}}-\tau_s^l+\Xi_{h,s} \tag{2.7}$$

Here B_s are the domestic nominal bond possessed by the domestic households at the begining of period t with $R_{h,s}$ as the nominal interest rate. $F_{h,s}$ describe the assets traded in international market by the domestic households, possessed in foreign currency (If the value is negative, it indicates foreign private debt) with $R^*_{h,s}$ as the interest rate on foreign bonds, S_s is the nominal exchange rate and Q_s is the real effective exchange rate. $\Xi_{h,s}$ is real dividends received by domestic firms, distributed equally among the households within the economy. C_s and N_s are the household's consumption and labor respectively and W_s is nominal wage rate. Furthermore τ_s^c and τ_s^n are consumption tax and labour tax rates respectively and τ_s^l indicates a lump sum tax.

The term β is the household's discount factor and ϕ^h_{s+1} refers to the adjustment cost associated with the change in real asset position when agents are engaged in foreign bond trading. Specifically in relation to deviations from their steady-state value, it is assumed to satisfy $\phi^h(0) = \phi^{h\prime}(0) = 0$. In small open economy models, the adjustment cost is employed to mitigate excessive investment volatility triggered by fluctuations between the interest rate on domestic bonds and interest rate on foreign bonds in the foreign markets (Schmitt and Uribe, 2003; Philippopoulos et al., 2017). This adjustment cost also takes into account that deviation from steady state level will incur losses to the agents. The adjustment cost over the purchase of foreign assets is defined as

$$\phi^h_{t+1} = \frac{\phi^h}{2R^*_{h,s}}[Q_s \frac{F_{s+1}}{P^*_s} - \frac{\bar{F}}{\bar{P}^*}]^2 \tag{2.8}$$

In the quadratic adjustment cost, the position of real foreign assets is evaluated in relation to a steady state real. ϕ^h is a positive parameter that measures adjustment cost in terms of value of the consumption index which is adjusted by the factor R^* for the sake of analytical convenience and without sacrificing generality (Benigno, 2009).

The value function of the household at the conclusion of the planning horizon defined as:

$$V(\tilde{B}, \tilde{F}) = (1-\beta)^{-1} u \left[\frac{\bar{X}}{1+\bar{\tau}^c} + \frac{1-\beta}{1+\bar{\tau}^c} \left(\tilde{B} + \bar{Q}\tilde{F} \right) \right] \tag{2.9}$$

where $\bar{X} = (1-\bar{\tau}^n)\bar{w}\bar{N} - \bar{\tau}^l - \bar{\Xi}$ comprises of steady-state labor income, lump-sum tax and profits. The value function describes the situation of no shock. Additionally, it also elaborates that variables beyond the direct influence of the household remain at their optimal levels. The households' assumption regarding the continuation of wealth after the finite planning horizon lead to the formulation of the following maximization problem

$$V(\tilde{B},\tilde{F}) = u(c) + \beta V(\tilde{B}',\tilde{F}') \tag{2.10}$$

subject to:

$$\beta(\tilde{B}' + \tilde{F}') \leq \bar{X} + \tilde{B} + \tilde{F} - (1+\bar{\tau}^c)C \tag{2.11}$$

Following Woodford (2018), it is articulated from this maximization criterion that the agents avail optimal inter-temporal consumption decisions while households income, taxes, prices, profits and interest rates and all other economic indicators remain at steady state level. In this context, the variables that can be adjusted are consumption and domestic and foreign assets. The value function described in equation (2.9) accounts for the assumption that the agents are assumed to be boundedly rational and lack sophisticated decision-making abilities to anticipate changes in variables beyond their planning horizon. However, by inducting the value function in Equation (2.1), households are able to make optimal choices. over their finite planning horizon.

The households utility function for consumption and leisure is stated as under

$$U(C_s, N_s) = \frac{(C_s)^{1-\sigma}}{1-\sigma} - \frac{(N_s)^{1+\varphi}}{1+\varphi} \tag{2.12}$$

Where σ and φ are intertemporal subsititution elasticity and labor elasticity, respectively. The optimization condition with respect to consumption, labor, bonds and foreign assts respectively are given as under:

$$(C_s)^{-\sigma} = \lambda_s(1+\tau_s^c) \tag{2.13}$$

$$(C_s)^{\sigma}(N_s)^{\varphi} = \frac{1-\tau_s^n}{1+\tau_s^c} w_s \tag{2.14}$$

$$\frac{(C_s)^{-\sigma}}{(1+\tau_s^c)} = \beta E_t \frac{(C_{s+1})^{-\sigma} R_s}{(1+\tau_{s+1}^c)\pi_{s+1}} \tag{2.15}$$

$$\lambda_s \left(1 + \phi^h (Q_s \frac{F_{s+1}}{P_s^*} - \frac{\bar{F}}{\bar{P}^*})\right) = \beta E_t \frac{\lambda_{s+1}}{\pi_{s+1}^*} \frac{Q_{s+1}}{Q_s} R_{h,s}^* \tag{2.16}$$

Equation (2.13) represents the optimal consumption condition. Equation (2.14) represents the optimal solution for work hours, stating that the best choice of labor-leisure balance requires that the marginal rate of substitution between work hours (leisure) and consumption is equal to the real wage. Lastly, equation (2.15) is the intertemporal Euler equation that governs the decision-making process for purchasing domestic bonds. It establishes a relationship between the marginal rate of substitution between consumption at time t and t+1 and the prevailing interest rate. Equation (2.16), the Euler equation for the foreign assets imply that if the households want to purchase an extra unit of foreign bonds, their consumption declines by one plus the adjustment cost times difference of foreign assets from the optimal steady state position.

Optimal choices regarding holdings in domestic bonds and foreign assets are derived for the optimal path up to period T-1, which represents one period before the end of the planning horizon. The state variables, in turn, establish the continuation value of households' utility at the conclusion of the time horizon. For B_{t+T} (domestic bonds at time t+T) and $F_{h,t+T}$ (foreign assets held by households at time t+T), the optimization process yields additional conditions that determine the maximization of utility for households at the end of their planning horizon. Accordingly, these conditions describe the behavior of households regarding future wealth beyond the specified planning period and play a vital role in establishing the optimal trade-off. The optimal solution for the periods beyond planning horizons are described as under

$$\frac{\lambda_{t+T}}{R_{t+T}} = \frac{\beta}{(1+\bar{\tau}^c)} E_t u' \left[\frac{\bar{x}}{(1+\bar{\tau}^c)} + \frac{1-\beta}{1+\bar{\tau}^c} \left(\frac{B_{t+T+1}}{P_{t+T}} + \frac{F_{t+T+1}}{P_{t+T}} \right) \right] \tag{2.17}$$

$$\lambda_{t+T} \frac{Q_{t+T}}{R^*_{h,t+T}} (1 + \phi^h [Q_{t+T} \frac{F_{t+T+1}}{P_{t+T}} - \frac{\bar{F}}{\bar{P}}]) = \frac{\beta}{(1+\bar{\tau}^c)} E_t u' \left[\frac{\bar{x}}{(1+\bar{\tau}^c)} + \frac{1-\beta}{1+\bar{\tau}^c} (\frac{B_{t+T+1}}{P_{t+T}} + \frac{F_{t+T+1}}{P_{t+T}}) \right] \tag{2.18}$$

Further, the real bond holdings adjusted based on steady-state output is measured as $b_t = \frac{B_t}{\bar{Y} P_{t-1}}$. Substituting for this expression in (2.17), (2.18) and (2.7) gives

$$\frac{\lambda_{t+T}}{R_{t+T}} = \frac{\beta}{(1+\bar{\tau}^c)} E_t u' \left[\frac{\bar{x}}{(1+\bar{\tau}^c)} + \frac{1-\beta}{1+\bar{\tau}^c} \left(\bar{Y} b_{t+T+1} + \bar{Y} \bar{Q} f_{t+T+1} \right) \right] \tag{2.19}$$

$$\lambda_{t+T} \frac{Q_{t+T}}{R^*_{h,t+T}} (1 + \phi^h [Q_{t+T} \bar{Y} f_{t+T+1} - \bar{Y} \bar{f}]) = \frac{\beta}{(1+\bar{\tau}^c)} E_t u' \left[\frac{\bar{x}}{(1+\bar{\tau}^c)} + \frac{1-\beta}{1+\bar{\tau}^c} (\bar{Y} b_{t+T+1} + \bar{Y} f_{t+T+1}) \right] \tag{2.20}$$

$$(1+\tau^c_s) C_s + \bar{Y} \frac{b_{s+1}}{R_{h,s}} + Q_s \bar{Y} \frac{f_{s+1}}{R^*_{h,s}} + \phi^h_{t+1} \leq (1-\tau^n_s) w_s N_s + \bar{Y} \frac{b_s}{\pi_s} + Q_s \bar{Y} \frac{f_s}{\pi^*_s} - \tau^l_s + \Xi_{h,s} \tag{2.21}$$

Constant Elasticity of Substitution (CES) framework is used to calculate the cumulative consumption indices for commodities produced for both the domestic and international markets. Therefore, the demand functions for domestic consumption $C_{h,t}$ and foreign consumption $C_{f,t}$ are defined as under:

$$C_{h,t}(j) = \left(\frac{P_{h,t}(j)}{P_{h,t}} \right)^{-\epsilon} C_{h,t} \tag{2.22}$$

$$C_{f,t}(j) = \left(\frac{P_{f,t}(j)}{P_{i,t}} \right)^{-\epsilon} C_{f,t} \tag{2.23}$$

where $P_{h,t} = [\int_0^1 P_{h,t}(j)^{1-\epsilon} dj]^{\frac{1}{1-\epsilon}}$ is the price index of the domestically produced goods, and $P_{f,t} = [\int_0^1 P_{f,t}(j)^{1-\epsilon} dj]^{\frac{1}{1-\epsilon}}$ is the price index for the goods trdaed from the foreign market (expressed in domestic currency units) and composite inflation is defined as $P_t = [(1-\alpha)P_{h,t}^{1-\eta} + \alpha P_{f,t}^{1-\eta}]^{\frac{1}{1-\eta}}$. It further follows that

$$\int_0^1 P_{h,t}(j) C_{h,t}(j) = P_{h,t} C_{h,t} \tag{2.24}$$

and

$$\int_0^1 P_{f,t}(j) C_{f,t}(j) = P_{f,t} C_{f,t} \tag{2.25}$$

are the budget constraints faced by the domestic agents. The optimal distribution of resources between domestically produced and imported goods is established by:

$$C_{h,t} = \left((1-\alpha)(\frac{P_{h,t}}{P_t}) \right)^{-\eta} C_t \tag{2.26}$$

$$C_{f,t} = \left(\alpha(\frac{P_{f,t}}{P_t}) \right)^{-\eta} C_t \tag{2.27}$$

2.3.2 Firms

In a model of monopolistic competition, there exists a continuum of firms that produce differentiated goods. The same households stated in section (2.3.1) own and operate the firms and employs the same heuristic approach to predict future conditions similar to the household. Each firm's primary goal is to maximize its profits through the implementation of pricing strategies. The production technology of each firm consists of sole labour force defined as under:

$$Y_t(j) = N_t(j) \tag{2.28}$$

The firms in this model are owned by the same boundedly rational households and make production plans for T periods ahead. Producers evaluate potential scenarios in period $t+T$ using a value function. It is assumed that the adjustment behavior of domestic prices follows the Calvo,1983 framework for price setting. Specifically, in each period, a fraction of $(1-\omega)$ firms are selected randomly to set the prices optimally, while $\leq [0,1]$ firms are not in the position to change their prices. This implies that ω firms reset their prices by indexing them to the previous period's inflation rate. The problem faced by each firm (j) that can adjust its price is to increase maximally the discounted value of its profits over the planning horizon and the anticipated value of its state at the conclusion of the planning horizon. Similar to Woodford (2018), the value function illustrates the continuation value of real profits in utility terms, dependent on the relative price. The value function further works on the assumption that the relative pricing behaviour of the firms is prone to fluctuate, while all other variables are considered to be at the stable state level. The value function is defined as:

$$\tilde{V}(r) = \frac{1}{1-\omega\beta}\bar{\lambda}(r)^{1-\epsilon}\bar{Y} - \frac{1}{1-\omega\beta}\bar{\lambda}(r)^{-\epsilon}\bar{Y}\bar{m}c \tag{2.29}$$

Demand for the domestic firm j's product $Y_{h,t}(j)$ comes from $C_{h,t}(j)$ domestic households' consumption, $C^*_{h,t}(j)$ foreign world's demand for good "j" produced in the home country and government consumption of the good "j". Thus, the demand function for each domestic firm is defined as product is

$$Y_{h,t}(j) = C_{h,t}(j) + C^*_{h,t}(j) + G_{h,t}(j) \tag{2.30}$$

The solution of the household's maximization problem and the demand functions yields the following

$$C^*_{h,t}(j) = \left(\frac{P^*_{h,t}(j)}{P^*_{h,t}}\right)^{-\epsilon} C^*_{h,t} \tag{2.31}$$

$$C_{h,t}(j) = \left(\frac{P_{h,t}(j)}{P_{h,t}}\right)^{-\epsilon} C_{h,t} \tag{2.32}$$

$$G_{h,t}(j) = \left(\frac{P_{h,t}(j)}{P_{h,t}}\right)^{-\epsilon} G_{h,t} \tag{2.33}$$

where, using the law of one price the following expressions are obtained $\frac{P_{h,t}(j)}{P_{h,t}} = \frac{\frac{P_{h,t}(j)}{S_t}}{\frac{P_{h,t}}{S_t}} = \frac{P^*_{h,t}(j)}{P^*_{h,t}}$ The aggregate demand is defined as under

$$Y_{h,t} = C_{h,t} + C^*_{h,t} + G_{h,t} \tag{2.34}$$

The above derived equations point to the derivation of individual firm's demand function as under

$$Y_{h,t}(j) = \left(\frac{P_{h,t}(j)}{P_{h,t}}\right)^{-\epsilon} Y_{h,t} \tag{2.35}$$

This equation implies that domestic good (j) demand is a function of its relative price, the price elasticity of demand ϵ and is in proportion to aggregate output Y_t. Firms adjust their prices with the aim of maximizing their profits. The new adjusted price denoted as $p_{h,t}(j)$ at time t is derived as under:

$$E^j_t \sum_{s=0}^{T} (\omega\beta)^s \lambda_{t+s} \left[(\frac{p_{h,t}(j)}{P_{h,t+s}})^{1-\epsilon} Y_{h,t+s} - (\frac{p_{h,t}(j)}{P_{h,t+s}})^{-\epsilon} mc_{h,t+s} Y_{h,t+s} \right] + \omega^{T+1}\beta^{T+1}\tilde{V}(\frac{p_{h,t}(j)}{P_{h,t+T}}) \tag{2.36}$$

where λ_{t+s} is the is lagrange multiplier of the household that runs firrm "j". The first order condition for profit maximization with respect to $p_t(j)$ is as under

$$\frac{p_{h,t}^{j}}{P_{h,t}}\left[E_t^j\sum_{s=0}^{T}(\omega\beta)^s\lambda_{t+s}Y_{h,t+s}(\frac{P_{h,t+s}}{P_{h,t}})^{\epsilon-1}+\frac{(\omega\beta)^{T+1}}{1-\omega\beta}\bar{\lambda}\bar{Y}(\frac{P_{h,t+T}}{P_{h,t}})^{\epsilon-1}\right]=\frac{\epsilon}{\epsilon-1}\left[E_t^j\sum_{s=0}^{T}(\omega\beta)^s\lambda_{t+s}Y_{t+s}\right.$$
$$\left.mc_{h,t+s}(\frac{P_{h,t+s}}{P_{h,t}})^{\epsilon}+\frac{(\omega\beta)^{T+1}}{1-\omega\beta}\bar{\lambda}\bar{Y}\bar{m}c(\frac{P_{t+T}}{P_{h,t}})^{\epsilon}\right] \tag{2.37}$$

2.3.3 Government Budget Constraint

The government issues bonds and also imposes labour tax τ_t^n, consumption taxes τ_t^c, and lump sum taxes T_t to manage its expenditure stream. Government budget constraint is expressed as under

$$\frac{B_{t+1}}{R_{h,t}}+S_t\frac{F_{t+1}^g}{R_{h,t}^*}+P_t\phi_{t+1}^g=B_t+S_tF_t^g+P_t^hG_t-\tau_t^cP_tC_t-\tau_t^nW_tN_t-T_t^l \tag{2.38}$$

Here the parameter ϕ^g describes the adjustment cost related to foreign debt and defined as

$$\phi_{t+1}^g=\frac{\phi^g}{2R_{h,t}^*}\left(S_t\frac{F_{t+1}^g}{P_t}-\bar{f}\right)^2$$

$B_t=\int B_t di$ is the aggregate bonds holdings, $N_t=\int N_t di$ aggregate labour, C_t aggregate consumption consisting on consumption of domestically produced goods and foreign consumption, and τ^c,τ^n,τ^l are consumption taxes, labour taxes and lump-sum taxes respectively. Here, R_t denotes nominal interest rate in period "t" over the domestic bonds and $R_{h,s}^*$ denotes rate of interest over the international assets and S_t isthe nominal effective exchange rate.

Let $D_t=B_t+S_tF_t^g$ articulates the total nominal debt in the period "t". The total debt is further distributed among the domestic private agents λ_tD_t where in equilibrium $B_t=\lambda_tD_t$, and by the foreign private agents $S_tF_t^g=(1-\lambda_t)D_t$ where $0\leq\lambda_t\leq 1$. Then dividing by $P_t\bar{Y}$ the budget constraint binding governmnet in real and as percenrtage of GDP can be written as

$$\frac{\lambda_{t+1}d_{t+1}}{R_{h,t}} + \frac{(1-\lambda_{t+1})d_{t+1}}{R^*_{h,t}} + \frac{\bar{Y}\phi^g}{2R^*_{h,t}}[(1-\lambda_{t+1})d_{t+1} - \bar{d}]^2 = \frac{\lambda_t d_t}{\pi_t} + \frac{Q_t}{Q_{t-1}\pi^*_t}(1-\lambda_t)d_t + \frac{P_{h,t}}{P_t}g_t - \tau^c_t\frac{C_t}{\bar{Y}} - \tau^n_t w_t\frac{N_t}{\bar{Y}} - \tau^l_t \tag{2.39}$$

2.3.4 Fiscal Policy and Monetary Policy Rules

The analysis is specifically focused on fiscal rules that incorporate easily observable macroeconomic indicators, which offer insights into the ongoing economic situation of the economy. The fiscal policy tools, specifically, government expenditure as share of output,g_t and consumption tax, labor tax and tump-sum taxes $\tau^c_t, \tau^n_t, \tau^l_t$ are adjusted as per the contemporaneous output gap, $(y^h_t - y)$, stated as under

$$\hat{g}_t = -\gamma^g_y(y_t - y) \tag{2.40}$$

$$\tilde{\tau}^c_t = -\gamma^c_y(y_t - y) \tag{2.41}$$

$$\tilde{\tau}^n_t = -\gamma^n_y(y_t - y) \tag{2.42}$$

$$\tilde{\tau}^l_t = -\gamma^l_y(y_t - y) \tag{2.43}$$

This essay further incorporates monetary policy as defined by the Taylor rule, stating that domestic interest rates should consistently react to domestic production and inflation.

$$R_{h,t} = (\frac{\pi_{h,t}}{\pi^*_h})^{\Phi^\pi}(\frac{Y_t}{\bar{Y}})^{\Phi^Y} \tag{2.44}$$

In the given context,$\bar{\pi}_h$ denotes the domestic inflation target and $\bar{Y}$ is steady state domestic output. Parameters Φ^Y and Φ^π illustrate the central bank's preferences about output gap and domestic inflation, respectively while determining the monetary policy rules. Since the primary objective of the central bank is stability of the price level therefore, the parameter Φ^π should be higher than Φ^Y . Following the Taylor rule, the central bank has the authority to adjust monetary policy in line with changing economic circumstances, directing the economy towards its targeted inflation and output goals. The monetary policy rule affirms that the central bank sets nominal interest rates based on deviations of inflation from its steady-state position and discrepancies between output and the steady-state output.

2.3.5 Market Clearing Conditions

The market clearing equation states that domestically produced good (j) equals the sum of domestic consumption and foreign consumption of good (j) plus public consumption of the good (j) defined as under

$$Y_{h,t}(j) = C_{h,t}(j) + C^*_{h,t}(j) + G_{h,t}(j) \tag{2.45}$$

The demand by domestic consumers for good (j) can be defined as follows:

$$C_{h,t}(j) = (1-\alpha)\left(\frac{P_{h,t}(j)}{P_{h,t}}\right)^{-\epsilon}(\frac{P_{h,t}}{P_t})^{-\eta}C_t \tag{2.46}$$

Furthermore, the demand for domestically produced good (j) in home country in country (i) is expressed as under

$$C^*_{h,t}(j) = \alpha\left(\frac{P_{h,t}(j)}{P_{h,t}}\right)^{-\epsilon}\left(\frac{P^*_{h,t}}{P^*_t}\right)^{-\eta}C^*_t \tag{2.47}$$

The government consumption of the good "j" is as under

$$G_{h,t}(j) = \left(\frac{P_{h,t}(j)}{P_{h,t}}\right)^{-\epsilon} G_t \tag{2.48}$$

As a result, the ultimate expression for the final equation could be stated as:

$$Y_{h,t}(j) = \left(\frac{P_{h,t}(j)}{P_{h,t}}\right)^{-\epsilon} \left[(1-\alpha)(\frac{P_{h,t}}{P_t})^{-\eta} C_t + \alpha \left(\frac{P_{h,t}}{S_t P_t^*}\right)^{-\eta} C_t^* + G_t\right] \tag{2.49}$$

The definition of aggregate demand is given as

$$Y_t = \left[\int_0^1 Y_t(j)^{\frac{\epsilon-1}{\epsilon}} dj\right]^{\frac{\epsilon}{\epsilon-1}} \tag{2.50}$$

by injecting the above stated equation in overall output statement

$$Y_t = (1-\alpha)(\frac{P_{h,t}}{P_t})^{-\eta} C_t + \alpha \left(\frac{P_t}{S_t P_t^*} \frac{P_{h,t}}{P_t}\right)^{-\eta} C_t^* + G_{h,t} \tag{2.51}$$

$$Y_t = (\frac{P_{h,t}}{P_t})^{-\eta} \left[(1-\alpha) C_t + \alpha \left(\frac{S_t P_t^*}{P_t}\right)^{\eta} C_t^*\right] + G_{h,t} \tag{2.52}$$

$$Y_t = (\frac{P_{h,t}}{P_t})^{-\eta} \left[(1-\alpha) C_t + \alpha Q_t^{\eta} C_t^*\right] + G_{h,t} \tag{2.53}$$

In particular, this small open economy model implies that the relative small size of home economy does not have any influence over fixation of the world price level and interest rate. Furthermore, foreign economy is composed as an aggregate economy and its equilibrium conditions are exogenous with respect to the domestic small economy. Foreign market clearing is defined as $Y_t^* = C_t^*$ (Gali and Monacelli, 2005; Faia and Monacelli, 2007). Here H_t^i denotes the mutual terms of trade between the domestic economy and foreign country (i) and $H_{i,t}$ denotes the effective terms of trade of country (i). The first order log-linear approximation around the steady state level can be derived subject to the statement that $\int_0^1 \mathrm{H}_t^i di = 0$,

$$\frac{1}{1-\bar{g}}\hat{Y}_t - \frac{1}{1-\bar{g}}\tilde{g}_t = (1-\alpha)\hat{C}_t + \alpha\hat{C}_t^* + \eta\alpha(2-\alpha)\hat{H}_t \tag{2.54}$$

The Net Foreign Asset position is a significant state variable, particularly in presence of incomplete markets, as it influences the consumption-saving decision by affecting the debt-elastic risk premium (Motyovszki, 2020). The real net foreign assets condition is derived by aggregating the household budget constraint, firm profit condition, government budget constraint, and market clearing condition, explained as under:

$$Q_s\frac{f_{s+1}}{R_{h,t}^*} + \phi_{t+1}^h - Q_s\frac{f_s}{\pi_s^*} - \frac{(1-\lambda_{t+1})d_{t+1}}{R_{h,t}^*} - \phi_{t+1}^g + \frac{Q_s}{Q_{s-1}}\frac{(1-\lambda_t)d_t}{\pi_s^*} + = \frac{Y_t}{\bar{Y}} - \frac{C_t}{\bar{Y}} - \frac{P_{h,t}}{P_t}g_t \tag{2.55}$$

2.3.6 Marginal cost, inflation, the real exchange rate and terms of trade

The derivation of real marginal cost based on the gaps between output and consumption as well as between home and international prices is defined as under:

$$\hat{M}C_t = \hat{W}_t - \hat{p}_{h,t} \tag{2.56}$$

$$\hat{M}C_t = (\hat{W}_t - p_t) + (p_t - \hat{p}_{h,t})$$

$$\hat{M}C_t = \varphi\hat{N}_t + \sigma\hat{C}_t + \frac{\tilde{\tau}_t^c}{1+\bar{\tau}^c} + \frac{\tilde{\tau}_t^n}{1-\bar{\tau}^n} + \alpha\hat{H}_t$$

$$\begin{aligned}\hat{M}C_t = \varphi\hat{Y}_t + \sigma\left(\frac{\hat{Y}_t}{(1-\bar{g})(1-\alpha)} - \frac{\alpha}{1-\alpha}\hat{C}_t^* - \frac{\eta\alpha(2-\alpha)}{(1-\alpha)}\hat{H}_t - \frac{\tilde{g}_t}{(1-\bar{g})(1-\alpha)}\right) + \frac{\tilde{\tau}_t^c}{1+\bar{\tau}^c} \\ + \frac{\tilde{\tau}_t^n}{1-\bar{\tau}^n} + \alpha\hat{H}_t\end{aligned} \tag{2.57}$$

$$\hat{M}C_t = \left(\varphi + \frac{\sigma}{(1-\bar{g})(1-\alpha)}\right)\hat{Y}_t - \frac{\sigma\alpha}{1-\alpha}\hat{C}_t^* - \left(\frac{\sigma\eta\alpha(2-\alpha)}{(1-\alpha)} - \alpha\right)\hat{H}_t - \frac{\sigma}{(1-\bar{g})(1-\alpha)}\tilde{g}_t + \frac{\tilde{\tau}_t^c}{1+\bar{\tau}^c} + \frac{\tilde{\tau}_t^n}{1-\bar{\tau}^n} \tag{2.58}$$

In the last term, the expressions are used that $Y_t = N_t$ and $p_t - \hat{p}_{h,t} = \alpha H_t$, where $P_{h,t} = [\int_0^1 P_{h,t}(j)^{1-\epsilon}dj]^{\frac{1}{1-\epsilon}}$ is the price index of the goods produced in the domestic market, and $P_{f,t} = [\int_0^1 P_{f,t}(j)^{1-\epsilon}dj]^{\frac{1}{1-\epsilon}}$ is the price index for the goods imported fron foreign country(expressed in domestic currency units. The composite pric eindex can be defined as $P_t = [(1-\alpha)P_{h,t}^{1-\eta} + (\alpha)P_{f,t}^{1-\eta}]^{\frac{1}{1-\eta}}$. The effective terms of trade between the domestic output and imports as $H_t = \frac{P_{f,t}}{P_{h,t}}$ is the price of foreign goods in terms of home goods. The effective terms of trade are defined as: $H_t = \frac{P_{f,t}}{P_{h,t}}$=$(\int_0^1 H_{i,t}^{1-\gamma}di)^{\frac{1}{1-\gamma}}$ approach first order condition by the log-linear expression stated as $H_t = \int_0^1 H_{i,t}di$. The log-linearization of the price level around steady state level subject to the PPP condition $P_{h,t} = P_{f,t}$ is as: $P_t = (1-\alpha)P_{h,t} + (\alpha)P_{f,t}$ that can also be further elaborated as $P_t = P_{h,t} + \alpha h_t$, where $\hat{H}_t = P_{f,t} - P_{h,t}$ is the log effective terms of trade, that is price of foreign goods in terms of foreign goods when $\gamma = 1$ and $\eta = 1$ respectively. Domestic inflation, characterized by the rate of change in domestic prices and Consumer Price Index (CPI) inflation, can be defined as:

$$\Pi_t = \Pi_{h,t} + \alpha\Delta H_t \tag{2.59}$$

The equation highlights that the discrepancy between domestic inflation and composite inflation is proportionate to the variation in the terms of trade, with the coefficient of proportionality determined by the level of openness. It is further assumed that law of one price holds for all individual domestic and foreign goods at all times, implying that $P_{h,t}(j) = S_t P_{h,t}^*(j)$ for all $i, j \in [0, 1]$

where S_t is the effective nominal exchange rate and $P^*_{h,t}(j)$ is the price of foreign goods in terms of foreign currency.

Since $P_{f,t} = (\int_0^1 P_{i,t}^{1-\chi} di)^{\frac{1}{1-\chi}}$ is the price index for the imported goods from all the foreign economies, using this definition and and log-linearization around the steady state level the following impressions are obtained

$$P_{f,t} = \int_0^1 (s_{i,t} + P_{i,t})di = s_t + P^*_t \tag{2.60}$$

where $s_t = \int_0^1 s_{i,t}di$ is the (log) nominal effective exchange rate concluding all the foreign economies (i), $P^i_{i,t} = \int_0^1 P^i_{i,t}(j)di$ is the (log) domestic price index for country i (expressed in terms of its currency), and $P*_t = \int_0^1 P^i_{i,t}di$ is the (log) world price index. Combining the previous result with the definition of the terms of trade the following equations are derived

$$\hat{H}_t = P^*_{f,t} - P_{h,t} \tag{2.61}$$

$$\hat{H}_t = s_t + P^*_t - P^*_{h,t} \tag{2.62}$$

The bilateral real exchange rate $Q_{i,t} = \frac{(S_{i,t}P^*_t)}{P_t}$ is explained as the ratio of the two countries'CPIs, defined in domestic currency. Let $Q_t = \int_0^1 Q_{i,t}di$ be the effective real exchange rate, the assocciation between the terms of trade and the real exchange rate can be explained as

$$\hat{Q}_t = \int_0^1 (S_{i,t} + P^i_t - P_t)di \tag{2.63}$$

$$\hat{Q}_t = \hat{H}_t + P_{h,t} - P_t \tag{2.64}$$

$$\hat{Q}_t = (1 - \alpha)\hat{H}_t \tag{2.65}$$

2.3.7 Linearized model

When considering a general inflation target, the linearized model equations simplify to:

$$\pi_{h,t} = \kappa_{mc} \sum_{s=0}^{T} (\omega\beta)^s E_t((\varphi + \frac{\sigma}{(1-\bar{g})(1-\alpha)})\hat{Y}_{t+s} - \frac{\sigma\alpha}{1-\alpha}\hat{C}^*_{t+s} - (\frac{\sigma\eta\alpha(2-\alpha)}{(1-\alpha)} - \alpha)\hat{H}_{t+s}$$
$$-\frac{\sigma}{(1-\bar{g})(1-\alpha)}\tilde{g}_{t+s} + \frac{\tilde{\tau}^c_{t+s}}{1+\bar{\tau}^c} + \frac{\tilde{\tau}^n_{t+s}}{1-\bar{\tau}^n}) + \frac{(1-\omega)}{\omega}\sum_{s=1}^{T}(\omega\beta)^s E^j_t \pi_{h,t+s} \tag{2.66}$$

$$\hat{d}_{t+1} = \frac{1}{\beta}\tilde{d}_t + \bar{\lambda}\bar{d}(\hat{R}_{h,t} - \frac{1}{\beta}\hat{\pi}_t) + (1-\bar{\lambda})\bar{d}(\hat{R}^*_{h,t} - \frac{1}{\beta}\hat{\pi}^*_t) + \frac{(1-\bar{\lambda})\bar{d}}{\beta}((1-\alpha)(\hat{H}_t - \hat{H}_{t-1}))$$
$$+\frac{1}{\beta}\hat{g}_t - \frac{\bar{g}\alpha}{\beta}\hat{H}_t - \frac{1}{\beta}\hat{\tau}^l_t -$$
$$\frac{(1-\bar{g})}{\beta}(\bar{\tau}^c\left(\frac{\hat{Y}_t}{(1-\bar{g})(1-\alpha)} - \frac{\alpha}{1-\alpha}\hat{C}^*_t - \frac{\eta\alpha(2-\alpha)}{(1-\alpha)}\hat{H}_t - \frac{\tilde{g}_t}{(1-\bar{g})(1-\alpha)}\right) + \tilde{\tau}^c_t)$$
$$-\frac{\bar{w}}{\beta}(\bar{\tau}^n((\varphi + \frac{\sigma}{(1-\bar{g})(1-\alpha)})\hat{Y}_t - \frac{\sigma\alpha}{1-\alpha}\hat{C}^*_t - \frac{\sigma\eta\alpha(2-\alpha)}{(1-\alpha)}\hat{H}_t - \frac{\sigma\tilde{g}_t}{(1-\bar{g})(1-\alpha)}$$
$$+\frac{\tilde{\tau}^c_s}{1+\bar{\tau}^c} + \frac{\tilde{\tau}^n_s}{1-\bar{\tau}^n} + \hat{Y}_t) + \tilde{\tau}^n_t) \tag{2.67}$$

$$(1-\nu_y)\hat{Y}_t = \frac{1}{\rho}\hat{b}_t + \frac{1}{\rho}\hat{f}_t + \tilde{g}_t + \alpha(1-\bar{g})\hat{C}^*_t + \eta\alpha(2-\alpha)(1-\bar{g})\hat{H}_t + \frac{\bar{f}}{\rho}\sum_{s=0}^{T}\beta^s(\beta E_t\hat{R}^*_{h,t+s} -$$
$$E_t\hat{\pi}^*_{t+s}) + \nu_y\sum_{s=1}^{T}\beta^s E_t\hat{Y}_{t+s} + \nu_g\sum_{s=0}^{T}\beta^s E_t\tilde{g}_{t+s} + \nu_h\sum_{s=0}^{T}\beta^s E_t\hat{H}_{t+s} + \nu_{c^*}\sum_{s=0}^{T}\beta^s E_t\hat{C}^*_{t+s} + \nu_{\tau^c_1}\tilde{\tau}^c_t +$$
$$\nu_{\tau^c_2}\sum_{s=1}^{T}\beta^s\tilde{\tau}^c_{t+s} - \frac{\mu}{\rho}\sum_{s=1}^{T}\beta^s\sum_{j=1}^{s}(E_t\hat{R}_{t+j} - E_t\hat{\pi}_{t+j+1}) - \frac{\beta^{T+1}}{(1-\beta)}\frac{\mu_b}{\rho\sigma}\sum_{j=0}^{T-1}(E_t\hat{R}_{t+j} - E_t\hat{\pi}_{t+j+1}) -$$
$$+\frac{\beta^{T+1}}{(1-\beta)}\frac{\mu_b}{\rho\sigma}\hat{R}_{t+T}\nu^n_\tau\sum_{s=0}^{T}\beta^s\tilde{\tau}^n_{t+s} - \frac{\bar{\tau}^l}{\rho\bar{Y}}\sum_{s=0}^{T}E_t\hat{\tau}^l_{t+s} + \frac{\bar{b}}{\rho}\sum_{s=0}^{T}\beta^s(\beta E_t\hat{R}_{t+s} - E_t\hat{\pi}_{t+s}) \tag{2.68}$$

While the coefficients are explained in Appendix.

$$s_t^g - s^g = -\gamma_y^g (y_t - y) \tag{2.69}$$

$$\tau_t^c - \tau^c = -\gamma_y^c (y_t - y) \tag{2.70}$$

$$\tau_t^n - \tau^n = -\gamma_y^n (y_t - y) \tag{2.71}$$

$$\tau_t^l - \tau^l = -\gamma_y^l (y_t - y) \tag{2.72}$$

$$\hat{R}_{h,t} = \Phi^\pi \hat{\pi}_t + \Phi^Y \hat{Y}_t \tag{2.73}$$

2.4 Expectations

Infinite planning horizon stipulates that agents have information of all the states and variables and they possess the ability to solve their dynamic programming problems for infinite periods. In this essay, the New Keynesian model is based on the assumption that the agents make inter-temporal decisions and develop expectations in a forward looking manner. This concept of bounded rationality approaches optimal decision making as their cognitive limitations and planning horizons admit. It is assumed that both households and firms engage in sophisticated forecasting and develop fully-state contingent plans within their finite planning horizons and follow the model equations efficiently. However, an important assumption underlying the finite horizon approach is that agents are boundedly rational when it comes to considering the continuation values of their plans over the infinite planning horizon. As a result, their behavior becomes less sophisticated when it extends beyond their finite planning horizons.

In this essay, it is assumed that in finite planning horizon agents start to formulate expectations about the end period of their planning horizon and while doing this they consider the model equations of period t+T. However, the aggregate demand and inflation equations, in this model contain finite sums up to T periods onwards. Indeed, when the model equations are projected forward by T periods expressions involving expectations about periods t+T+1 up to t+T+T arise. These terms capture the agents' expectations regarding economic indicator variables that lie beyond their planning periods. Agents make predictions and decisions depending on the knowledge that is accessible to them within the finite planning horizon. As a result, expectations about variables beyond their planning horizon introduce an element of uncertainty and can impact their decision-making process. However the agents assume that model will merge to steady state in the periods beyond their planning horizon.

The assumed behavioural framework of the model implies that agents first make expectations about end period t+T in their planning horizon with regard to state variables and then solve the model backward. When they move towards the formation of model equations for the period t+T-1, agents in the model follow a process where they use the already solved equations for period t+T as their expectations for period t+T. Subsequently, they solve the model equations in respect of the state variables of period t+T-1. Due to this iteration agents solve the model for overall expectations within their planning horizon, using the current happening state variables of period t as input. By incorporating their expectations based on the already solved equations and using the available information, agents can make optimal decisions and adjust their plans accordingly during their entire planning horizon.

The accurate description of expectations formation mechanism of the model and deviation of model-based expectations from the optimal expectations depend on the model persistence and agents' planning horizon. It is believed that the model will eventually converge to a steady state when there is a lengthy planning horizon in relation to the persistence of the economy. This implies that over time, agents in the model will have access to more information and their expectations will become more accurate and rational. As a result, the model can provide a fully rational expectation solution, where agents' forecasts align with the true underlying dynamics of the economy. The coincidence to a steady state in the long run facilitates a more precise representation of the behavior of economic variables and facilitates the analysis of long-term dynamics and outcomes.

However, If the shocks impacting the economy have effects that persist beyond the planning horizon then finite planning horizon model provides biased results.The biasness mentioned emerges due to the fact that as agents approach the conclusion of their planning horizon; they tend to overlook the impact that their expectations about periods beyond their horizon will have on the actual outcomes of these variables. This limited consideration of future expectations can introduce a bias in their decision-making process, as they may not fully account for the potential changes and uncertainties that can arise in the economic environment beyond their planning horizon. This bias can affect their optimal choices and the accuracy of their forecasts, particularly when it comes to variables that are influenced by longer-term factors or events. In case of shorter planning horizons, expectation bias can arise about all periods within their horizon that will affect the decision-making ability of the agents and their economic decisions can be differ than that rational decisions.

The finite horizon model offers efficient estimates by capturing the persistence observed in economic variables. This ability to explain persistence is rooted in the behavioral assumptions made about agents' beliefs regarding the continuation values of their plans over an infinite planning horizon. The model recognizes that agents' learning processes and the consideration of their value functions contribute to endogenous persistence in the economy. Moreover, the shorter planning horizons in the finite horizon model result in a reduced degree of forward-looking behavior compared to models with longer planning horizons. This emphasizes the importance of short-term dynamics and the learning process of agents in shaping economic outcomes. Overall, the finite horizon model provides a framework that effectively incorporates these behavioral aspects, allowing for a better understanding of persistence and dynamics in economic variables.

2.4.1 Finite Horizon Expectations

Since optimal decision making requires taking account and processing of all information upto infinity. As these elements are missing in shorter planning horizons that leads to forecast error and limited ability to make optimal decisions. In that instance of a longer planning horizon such as T=100 employing and processing of this information over 100 periods model equations will provide economic forecasts that are quite close to fully rational and optimal expectations benchmark. Alternatively in the matter of a planning horizon of T=20, agents have the forecasting ability to forecast for the next 20 periods only. Nevertheless, when shaping expectations for periods beyond 20, they lack the cognitive capacity to predict the impact on variables in period 20, which will be contingent on expectations formulated in period 20 regarding subsequent periods. Ultimately, the forecasts are biased and not fully optimal as the households overestimate or underestimate the influence of policy instruments on the economic variables.

2.4.2 Calibration to Pakistan's Economy

In this section, the parameter values of the model are caliberated as per the existing theoretical and empirical literature in DSGE framework for Pakistan. In this essay one period corresponds to one quarter. The planning horizons in this illustrations are referred by two cases, T=20 to show finite planning planning horizon and T=100 to show long planning horizons. It is interesting to mention that behaviour of the agents for the period T=100 is same as that of T=10000 and T=10000000 and it is also referred that the behaviour of the agents in the long planning horizon as T=100 is same as that of very long planning horizon or infinite planning horizon of T=10000000. Table 1 in Appendix A presents the parameters of model equations. Based on these parameter values, the model is calibrated with fiscal policy rules specifications. The quarterly discount factor β is adjusted equal to 0.95 (Haidar et al., 2008) and the value of degree of trade openness α is 0.20 following (Ahmed et al., 2017). The parameters of inverse elasticity of intertemporal substitution in consumption σ and domestic-foreign substitution elasticity η are 0.84, 1.01 respectively (Haidar et al., 2008) and inverse elasticity of labour supply φ is 0.98 (Ahmed et al., 2017). The Calvo parameter, which determines the degree of price stickiness, holds significant importance in analyzing the implications of fiscal policy. The smaller value of Calvo parameter indicates more flexible prices and a small impact of monetary policy on output. The Calvo value of price stickiness is 0.904 in Satti et al (2007) that shows high value of price stickiness, while Ahmed et al., 2017 confined the price stickiness parameter to 0.5. However in this study the Calvo parameter equal to 0.7 is used following Tufail and Ahmed, 2022.

The chosen parametric values for the monetary policy reaction function offer a credible depiction of Pakistan's monetary policy framework, where the parameter for inflation coefficient Φ_π is 1.05 and output growth coefficient Φ_y is 0.25 following Ahmad et al (2016). This also implies that policy maker in Pakistan are more concerned about growth objectives as compared to that of other developing economies. The steady state government expenditure as share of GDP is set at 0.2, steady state consumption tax rate is 0.17 and steady state labour tax rate is 0.05 following Ahmed et al. (2016), while the assumed lump-sum tax rate is 0.08. These specifications lead to steady state debt to GDP ratio 0.92. The parameters ϕ^h and ϕ^g describing adjustment costs with respect to changes in private and public foreign assets respectively are both set to 0.22 following Ahmed et al. (2017). Finally, λ, the fraction of total public debt possessed by domestic agents is set at 0.50, this average value is per the empirical data of Pakistan.

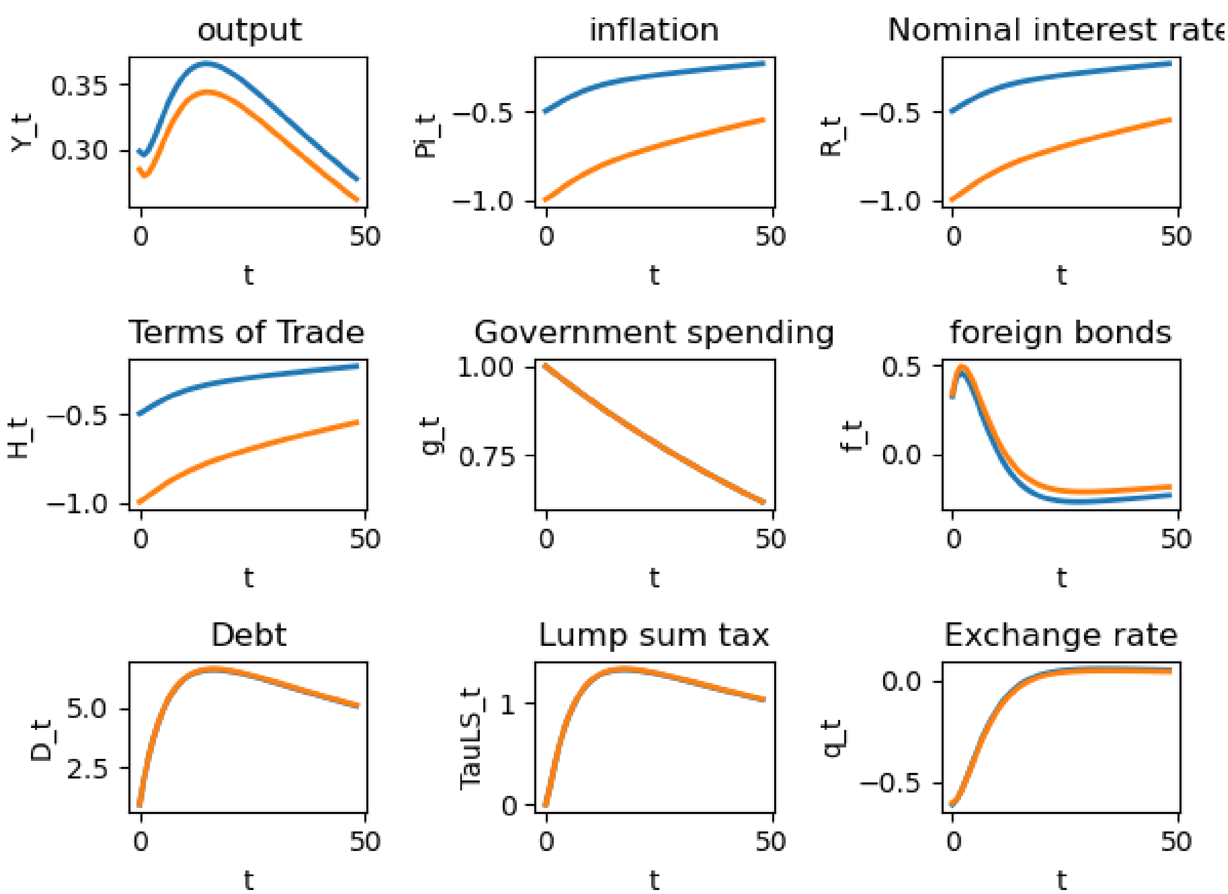
2.5 Impulse Responses

The implications of fiscal policy on macro-economic indicators are examined by the response of various factors to government expenditure shocks, consumption tax shocks and labor tax shocks. The impact of these shocks is depicted in three figures: Figure 2.1 illustrates the effects of increased government spending, Figure 2.2 displays the consequences of an increase in consumption tax, and Figure 2.3 displays the outcomes of a rise in labor tax. Each figure represents the responses over two planning horizons: T=20 and T=100, with the blue curves representing the former and the orange curves representing the latter.

2.5.1 Government Spending Shock

The consistent government spending increase serves to boost economic activity. This is largely attributed to the allocation of public funds to infrastructure development and public investments. The improvements in public investment activities play a crucial role in stimulating economic activity and shaping overall growth. The expansion in output reaches its peak in the 15th quarter, however remain positive and above steady state level in the whole forecasting period. The increase in public expenditure and the expanded availability of goods and services resulting from the available excessive production capacity leads to decrease in domestic inflation and a decline in interest rates, with both remaining below the steady state for the whole forecasting period. The expanded avail-

Figure 2.1: Impulse response for a positive government expenditure shock. The blue curves defines the scenario of short planning periods (T=20) and the orange curves defines the scenario of long planning periods (T=100)



ability of goods and services resulting from the increased output subsequently leads to decrease in domestic inflation (Surjaningsih et al., 2012). Additionally, the expansion of public expenditure can also result in a decline in interest rates further contributing to the decline in marginal cost and inflation. The decline in inflation might be due to increased expenditures in infrastructure and public development projects and the improved distribution of goods and services. Furthermore, in the baseline calibration, a high degree of Calvo price stickiness indicating price rigidity has been assumed. This high level of price stickiness implies that a rise in government expenditures aspires to a decline in both inflation and interest rates. This also reflects the active role of the central bank to offset the potentially inflationary effects of fiscal policy. The findings of essay are that acceleration of government expenditure leads to expansion of output and fall in inflation and interest rate, are in conformity with the findings of Mountford and Uhlig, 2002; Fatas and Mihov, 2003; Zubairy, 2014. Monacelli and Perotti (2007) and Ravn et al.,(2007) found that the increase in government spending, which leads to a positive effect on aggregate demand, causes a decrease in the domestic interest rate. This, in turn, lowers the cost of domestic output and contributes to the depreciation of the real exchange rate.

Due to a positive shock in government expenditure, both the real exchange rate and terms of trade decline. On the one hand, lower domestic inflation increases foreign demand for local exports. On the other hand, the appreciation of the local currency makes exports more expensive, reducing their competitiveness. However, the overall impact suggests that the boost in export demand outweighs the negative effects of currency appreciation, leading to a positive effect on output. Meanwhile, the decline in real exchange rate makes the exports cheaper for the foreign buyers. Ultimately, in a country like Pakistan, which heavily depends on importing raw materials, this situation can lead to balance of payments difficulties. The rising import costs may widen the trade deficit, increasing external borrowing needs. Over time, this could put downward pressure on the currency, leading to depreciation and a growing debt burden.

The study by Mehboob et al., 2006 for Pakistan examined that one percent increase in government expenditure become cause of depreciation of the real exchange rate by approximately 0.93 percent. Empirical studies by (Monacelli and Perotti, 2010; Kim and Roubini, 2008; Corsetti and Muller, 2006; Enders et al., 2011) have also confirmed that in the economies with flexible exchange rates, expansion of government spending coincides with depreciation of the real domestic currency. Easterly and Hebbel, 1993 has aslo examined that the attempts to reduce budget deficits in Pakistan through reduction of public investment, results in appreciation of the real exchange rate. This occurs due to the discouraging impact of diminishing public investment on domestic output. This result is in conformity with the results derived from this essay that by increasing government expenditures, real exchange rate decreases.

The drop in domestic interest rates encourages domestic households to keep more international assets. This reflects the inclination of domestic households to hold foreign assets. However, after a delay of 8 periods the foreign bond holdings start to decline. Eventually, they become negative, indicating a rise in foreign private debt.The results of this essay further indicate that the increment in government spending is accompanied by a rise in the collective debt level, that consists upon domestic debt and foreign debt. The increase in debt is primarily attributed to the practice of deficit financing, which involves borrowing to fund public expenditure initiatives. Additionally, as indicated above that the surge in public expenditures and the subsequent increase in demand for imported machinery and raw materials exert negative pressure on the current account balance and contribute to the escalation of the public debt level. Alberola et al. 2021 also found that if investors perceive that future fiscal surpluses do not provide full backing to the debt, the magnification of public spending can result in a depreciation of real exchange rate and further increase in debt.

2.5.2 Consumption Tax and Labor Tax Shock

The impact of a consumption tax shock on economic indicators are depicted in Figure 2.2. The analysis reveals that the increase in consumption tax has a detrimental effect on aggregate demand resulting in a decrease in output. Throughout the entire forecast period, domestic output experiences a decline and remains below its optimal level. The imposition of a high consumption tax results in an adverse wealth effect, leading to a decrease in consumer spending and lower output in countries that rely on consumption-driven growth, such as Pakistan.

The results of this essay further indicates that rising taxes contribute to elevated production costs, exerting upward pressure on the domestic inflation. Additionally, the tax increase expedites to an elevation in interest rates, which also remains above its steady state level. This scenario depicts that within the context of an active monetary policy, the central bank of Pakistan responds more actively by raising interest rates to counteract the inflationary pressure. Consequently, in the result of consumption tax hike all the economic forces including price hike and interest rate increase combines to slow down the pace of economic growth and results in decline in aggregate output. Shahid et al., 2016 examined that fiscal shock in the form of higher taxes causes a decline in output in Pakistan. This happens because higher taxes introduce inflationary pressure in the economy and discourage productive activities.

According to Cebi (2012), a tax increase signifies a contractionary fiscal policy, which should be complemented by an expansionary monetary policy to counterbalance the negative effects of the contractionary fiscal policy. However, the central bank of Pakistan opts to increase interest rates despite the higher tax rates. This propagates that both the fiscal and monetary policy makers are implementing contractionary policies, which subsequently impact the macroeconomic conditions of the country, as highlighted in Shahid et al. (2016). Furthermore, it is analyzed that for the productive implementation of tax hike policy, the central bank should refrain from raising interest rates when the government generates revenue through taxes. The analysis of the impact of tax shock over the government debt explains that in response to a positive tax shock, government borrowing experiences a decline and stays below its steady state level. Furthermore, due to increase in revenue there is decline in foreign assets holding by the domestic households (decline in private foreign debt) and decline in aggregate debt burden. The decline in government debt is mainly attributed to the rise in government revenues from taxation.

Typically, when domestic inflation increases, it results in exports becoming more expensive, leading to a deterioration of a country's terms of trade. However, this study explores an alternative scenario where a rise in domestic inflation can actually improves home country's terms of trade. This occurs when the increase in inflation originates the domestic currency to depreciate, thereby making exports more competitive and favorably impacting the terms of trade. As the depreciation of domestic currency can make exports discounted, which can increase the demand of exports and improve the terms of trade. However, the real exchange rate increase (nominal exchange rate decline) also describes decline in the trade competitiveness of the reporting country (Hyder and Mehboob, 2005). Nevertheless, in this context, the high cost of exports, facilitated by the terms of trade channel, counteracts the impact of the depreciation of the local currency. As a result, a negative effect on output is observed.

Additionally, the analysis conducted in this essay reveals a strong correlation between interest rate, inflation, and exchange rate. The tax hike leads to rise in inflation and interest rate, while implementing higher interest rate attract foreign investment which strengthens local currency rates.

Figure 2.2: Impulse response for a positive consumption tax shock. The blue curves defines the scenario of short planning periods (T=20) and the orange curves defines the scenario of long planning periods (T=100)

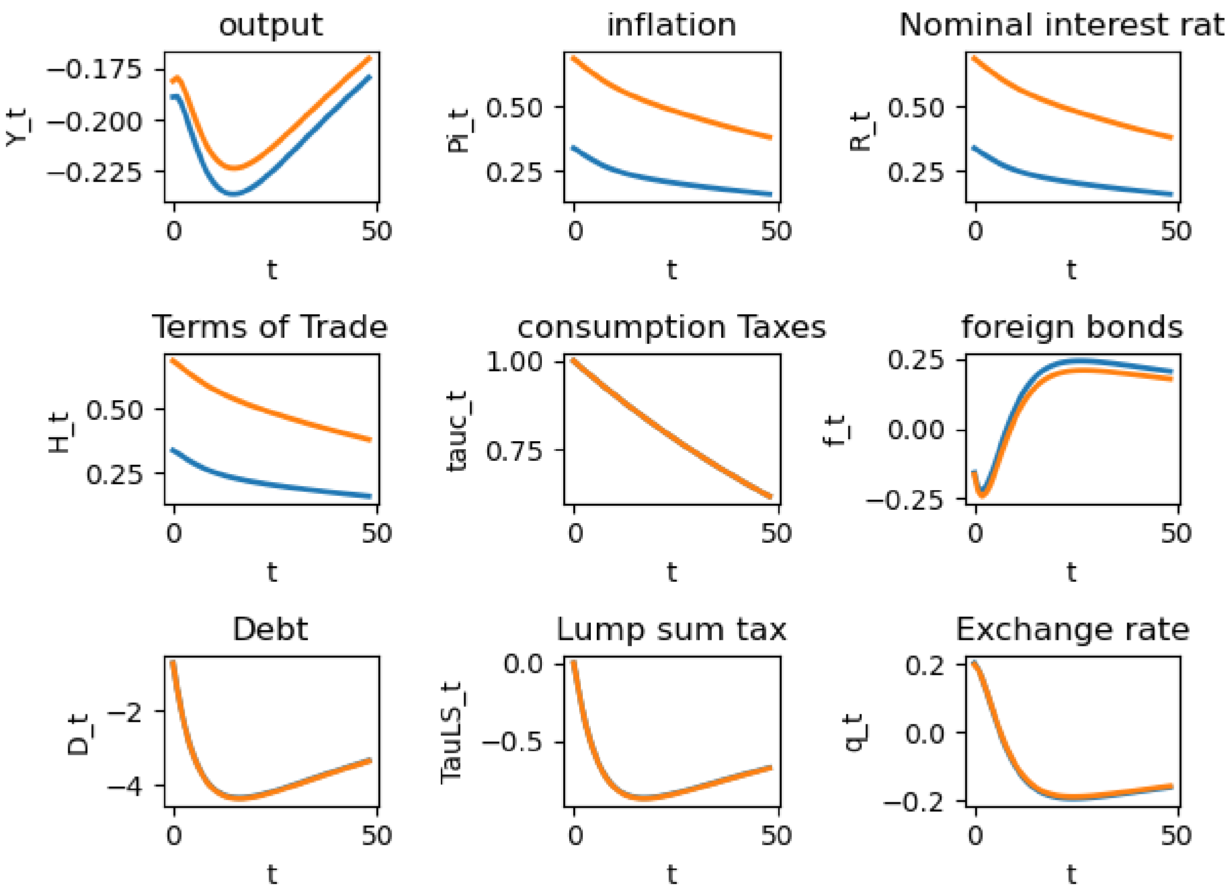
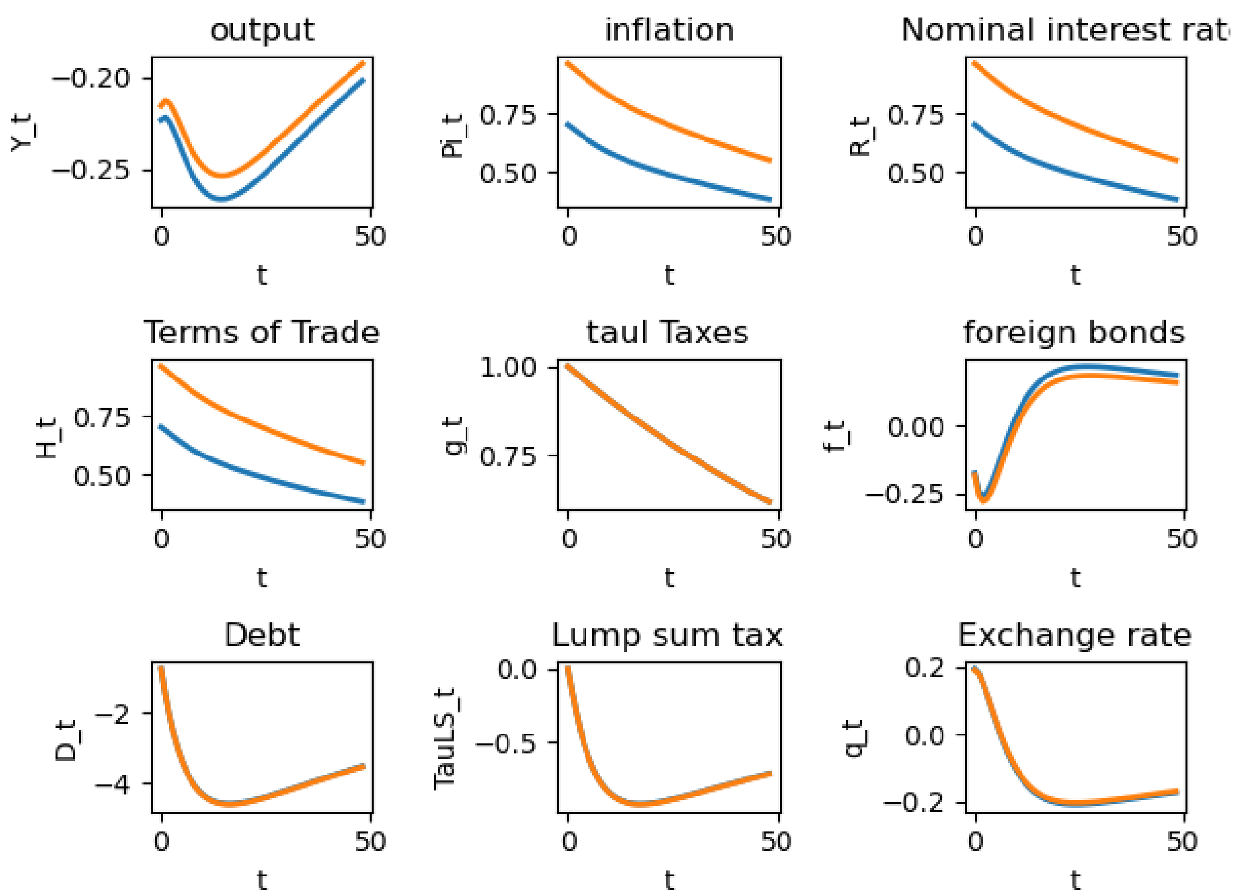


Figure 2.3: Impulse response for a positive labour tax shock. The blue curves defines the scenario of short planning periods (T=20) and the orange curves defines the scenario of long planning periods (T=100)



Nevertheless, prolonged periods of excessively high interest rates can lead to inflationary pressures and ultimately devaluing the currency.

The outcomes of this research align with the findings of Sims (1992) and Grilli and Roubini (1998), which shed light on the depreciation of the domestic currency. According to these studies, a positive change or innovation in interest rates can lead to an exchange rate puzzle. This describes that when interest rates increase, it results in a higher debt service burden for the fiscal authority, subsequently raising inflationary expectations. As a consequence, the local currency weakens and depreciates and negatively affects the economic condition of the country.

According to Figure 2.3, when the labor tax rate increases, there is a corresponding decrease in output. This is attributed to a detrimental impact on wealth, resulting in a decline in consumption and a decrease in labor due to the lower return on labor. Additionally, the labor tax rate increase affects the labor supply resulting in a decrease in the return on capital. As a consequence, the economic activities and output experiences a decline. The decline in economic activities reduces the supply of goods and became cause of increase in inflation and interest rate. Here the same behaviour is seen that was depicted earlier in the case of rise in consumption taxes, however the impulse response in case of labour tax rise shows more intense impact.

The impulse response analysis of fiscal policy shocks reveal that the spending-based adjustment has stimulating impact on economic growth in both the short run and long run, however tax-based adjustment has the tendency to reduce economic growth (Hussain et al., 2021). Honda, 2020 discovered that the impact of discretionary fiscal policy on the economy is offset in emerging nations by exchange rate swings. As under flexible exchange rate regimes, this inflationary pressure results in a decline in exports and thus initial impact of the fiscal stimulus would be nullified. Javed et al., 2016 examined the historical data of Pakistan and concluded that appreciation of exchange rate negatively affects the external competitiveness of the country. Along with negative effects on tradable sector, overvalued exchange rates are interlinked with shrink economic activity, lower investment and savings and decreasing labor productivity.

The analysis of fiscal policy shocks also implies that households with shorter planning horizons (T=20) fails to properly ascertain the economic conditions. Accordingly, they overestimate or underestimate the influence of fiscal policy instruments on output. As in the matter of a positive shock to government spending, agents overestimate the positive impact of shock on the aggregate demand and this leads to higher level of output in the short run. This also explains the effectiveness of positive government expenditure shock in stimulation of economic growth. Furthermore, agents expect that due to increase in government expenditure and resulting rise in aggregate demand, there will be decline in interest rate and inflation. But, while making such assumptions they overestimate the ultimate decline in prices and inflation, or in other words they expect a lower path for inflation and interest rate. Ultimately, agents increase consumption and investment expenditures and over time the cumulative effect of increased consumption and investment expenditures by agents, in the presence of bounded rational expectations, leads to a higher positive output trajectory compared to scenarios with longer planning horizons. Furthermore, the expectation of persistent decline in domestic inflation and the resulting underestimation of decline in terms of trade will have positive impact on export growth and output.

The description of consumption tax and labour tax increase in figure 2.2 and 2.3 respectively show that overestimation of the economic conditions by the bounded rational agents in the finite planning horizon results in a lower path for output than that of infinite planning horizon. The consumption tax hike leads to rise in inflation and interest rate, however the agents overestimate this rise and decrease consumption and investment expenditures. Furthermore, the agents also overestimate the foreign bonds accumulation denominated in foreign currency. As due to overestimation of the decline in domestic interest rate they increase the accumulation of foreign bonds (foreign private debt), that leads to further decline in output than that of longer planning horizon.

The results of this essay suggest a strong preference for bounded rationality of agents. Fiscal policy is more effective due to bounded rationality and less Ricardian behaviour of the agents. It is further implied thta the formation of future expectations is not consistently rational, or it might be rational over the long term, but individuals may not promptly act upon them in the short term. Hohberger et al., 2024 also examined the existence of the myopic behaviour of the agents for the US data and the ultimate effectiveness of fiscal policy and insignificant impact of monetary policy due to a deanchoring of expectations.

The theoretical model used in the essay is based on micro foundation of the economy and the model equations are estimated by calibrating the economic literature related to Pakistan. To assess the robustness of the model, various values of the parameters are employed. The qualitative results of the model are robust to different values of the parameters. For example, for selected different values of the Calvo parameter in the firm's optimality problem and found that the main qualitative results of the model remain same for different values of Calvo price parameter, however it is also reported that as price stickiness increases, the impact of fiscal policy shock becomes milder over output. Different values of labour elasticity parameter elaborate that main behaviour of the economic indicators do not change with this. However, due to increase in values labour elasticity the impact over output decreases (increases) for the positive government expenditure shock (positive tax shock). This further implies the behaviour of the agents that in case of positive government expenditure increase they prefer leisure over work, while in case of increases in tax rates they increase their working hours. It can be included from this analysis that the quantitative results of the model are robust to different sets of parameters.

2.6 Conclusion

Fiscal policy is essential for addressing macroeconomic imbalances and achieving full growth potential. This essay primarily focuses on analyzing the effects of fiscal policy within the context of Pakistan economy. The theoretical framework is based on New Keynesian modeling approach, considering a small open economy, providing an expanded analysis of the fiscal policy implications. Additionally, the model assumes that agents have finite planning horizons and exhibit bounded rationality.

This study finds that the government expenditure shock has a positive impact on aggregate demand and output in both the short and long run. The results further reveal that because of a positive government expenditure shock, inflation and interest rates experience a decline. The tax hike, like other developing countries negatively affects the purchasing power of the households and results in decline in aggregate demand and output. However, due to tax hike there is found cost-push inflation and interest rate increase, further suppressing investment and economic activities. The analysis further reveals that the ultimate impact of fiscal policy shocks on economic activities is largely shaped by the expectations and perceptions of economic agents regarding economic policies. The results of this essay implies bounded rationality of the agents, provided that agents tend to either overestimate or underestimate the influence of fiscal policy indicators.

The findings of this essay are more aligned with the empirical literature on Pakistan's economy and emphasize that policymakers should prioritize infrastructure development, public services, and social welfare to boost short-term demand while fostering long-term economic stability. On the other side, the negative effects of tax hikes on aggregate demand, household purchasing power, and economic activity highlight the importance of maintaining a balanced approach to taxation and carefully assessing the timing and magnitude of tax increases. The findings of the study suggest that fiscal policy makers in Pakistan should monitor inflationary pressures carefully, particularly in the context of cost-push inflation from tax hikes, and adjust fiscal policies accordingly to avoid inflation spirals. Policymakers should work to build trust in fiscal decisions and ensure that agents' expectations are aligned with long-term fiscal objectives, minimizing uncertainty and enhancing the effectiveness of policy measures.

The theoretical framework of this essay is built on the assumption of homogeneous agents. Future research can advance this foundation by investigating how heterogeneity in agents' expectations influences the effectiveness of fiscal policies. Furthermore, exploring the dynamic interaction between fiscal and monetary policies within the context of bounded rationality offers a compelling direction for further study, potentially uncovering deeper insights into policy outcomes.

Appendix

2.A steady state

We shall calculate the small open economy model's steady state conditions in this study. From the consumption euler conditions it is stated as under

$$\bar{R} = \bar{R}^* = \frac{1}{\beta} \tag{2.74}$$

The production function at the steady state level defines

$$\bar{N} = \bar{Y} \tag{2.75}$$

Market clearing condition for output and domestic consumption at the steady is derived by equation (52), respectively

$$\bar{Y} = \bar{C} + \bar{Y}\bar{g} \tag{2.76}$$

Evaluating the optimal output level

$$\bar{m}c = \frac{\epsilon - 1}{\epsilon} \tag{2.77}$$

When we substitute the labor and consumption steady state levels into the steady state description of the optimal labor/consumption trade-off, we obtain the following result.

$$\bar{w} = \bar{m}c = \frac{(1-\bar{g})^{\sigma}(1+\bar{\tau}^{c})\bar{Y}^{\varphi+\sigma}}{(1-\bar{\tau}^{n})} = \frac{\epsilon - 1}{\epsilon} \tag{2.78}$$

The aggregate output at the steady state level is described as

$$\bar{Y} = \left(\frac{\bar{m}c(1-\bar{\tau}^{n})}{(1-\bar{g})^{\sigma}(1+\bar{\tau}^{c})}\right)^{\frac{1}{\varphi+\sigma}} \tag{2.79}$$

Steady state government budget constraint is expressed as under

$$\bar{d} = \frac{1}{1-\beta}\left(\bar{\tau}^{n}\bar{w} + \bar{\tau}^{l} + \bar{\tau}^{c} - \bar{g}(1+\bar{\tau}^{c})\right) \tag{2.80}$$

Steady state profits are expressed as

$$\frac{\bar{\Xi}}{\bar{Y}} = \frac{1}{\epsilon} \tag{2.81}$$

2.B Derivation of Households Value Function

The households' utility maximization assumes that they are concerned with maximizing their utility both within the planning horizon and at the conclusion of the planning period, considering their wealth. To approximate this, a value function is used, consistent with a future stationary equilibrium when there are no shocks in the economy. In this approximation, all variables, except for the household's own consumption, bond possessions, and private foreign asset holdings, are at their steady state. At the steady state, it's also assumed that there are no adjustment costs related to private foreign asset holdings. Considering the households' assumptions about the end of the finite planning horizon, the utility maximization is expressed as under:

$$V(\tilde{B},\tilde{F}) = u(C) + \beta V(\tilde{B}',\tilde{F}') \tag{2.82}$$

subject to

$$\beta(\bar{Y}\tilde{B}' + \bar{Y}\tilde{F}') \leq \left[\bar{x} + \bar{Y}\tilde{B} + \bar{Y}\tilde{F} - (1+\bar{\tau}^c)C\right] \tag{2.83}$$

within the budget constraint, $\bar{X}$, comprises of labor income, profits and taxes at the steady state position. In order to calculate the value function, we experiment value function iteration. We start with:$V^0(\tilde{B},\tilde{F}) = 0$. In the first period, the optimal consumption is dictated by the household's budget constraint. This constraint takes into account the available income and wealth of the household and sets the limit on their consumption choices. By considering their budget constraint, households can determine the optimal level of consumption that maximizes their utility while respecting their financial constraints, by assuming $\tilde{F}' = \tilde{B}' = 0$

$$C = \frac{1}{1+\bar{\tau}^c}\left(\bar{X} + \bar{Y}\tilde{B} + \bar{Y}\tilde{F}\right) \tag{2.84}$$

Optimal consumption produces an optimized value

$$V^1(\tilde{B},\tilde{F}) = u\left[\frac{1}{1+\bar{\tau}^c}(\bar{X} + \bar{Y}\tilde{B} + \bar{Y}\tilde{F})\right] \tag{2.85}$$

In next maximization of the households in iteration 1, the value function is updated to reflect the updated information and variables. Using the value function, the household's utility maximization is described as under

$$V(\tilde{B},\tilde{F}) = u(C) + \beta u\frac{1}{1+\bar{\tau}^c}(\bar{X} + \bar{Y}\tilde{B}' + \bar{Y}\tilde{F}') \tag{2.86}$$

subject to

$$\beta(\bar{Y}\tilde{B}' + \bar{Y}\tilde{F}') \leq \bar{X} + \bar{Y}\tilde{B} + \bar{Y}\tilde{F} - (1 + \bar{\tau}^c)C \tag{2.87}$$

Injecting the budget constraint into the value function, the value function shows up as under

$$V(\tilde{B}, \tilde{F}) = u(C) + \beta u \left[\frac{\bar{X}}{1 + \bar{\tau}^c} + \frac{1}{\beta(1 + \bar{\tau}^c)} \left[\check{X} + \bar{Y}\tilde{B} + \bar{Y}\tilde{F} - (1 + \bar{\tau}^c)C \right] \right. \tag{2.88}$$

From the F.O.C. of the maximization problem above and by monotonicity of the utility function, it is stated that

$$C = \frac{\bar{X}}{1 + \bar{\tau}^c} + \frac{1}{(1 + \beta)(1 + \bar{\tau}^c)} \left(\bar{Y}\tilde{B} + \bar{Y}\tilde{F} \right) \tag{2.89}$$

and the optimal decision for $\tilde{B}'$, $\tilde{F}'$ is as under

$$(\bar{Y}\tilde{B}' + \bar{Y}\tilde{F}') = \frac{1}{(1 + \beta)} \left(\bar{Y}\tilde{B} + \bar{Y}\tilde{F} \right) \tag{2.90}$$

The optimization of value function in iteration 2 is derived as follows, taking into account the updated variables, constraints, and information:

$$V^2(\tilde{B}, \tilde{F}) = u(C) + \beta u \left(\frac{1}{1 + \bar{\tau}^c} (\bar{X} + \bar{Y}\tilde{B}' + \bar{Y}\tilde{F}') \right) \tag{2.91}$$

Plugging the optimal consumption and optimal choice for the assets, we get value function for the iteration 2

$$V^2(\tilde{B}, \tilde{F}) = (1 + \beta) u \left[\frac{\bar{X}}{1 + \bar{\tau}^c} + \frac{1}{(1 + \beta)(1 + \bar{\tau}^c)} \left(\bar{Y}\tilde{B} + \bar{Y}\tilde{F} \right) \right] \tag{2.92}$$

Continuing this iteration process till infinity, we reach the limiting function for the optimal consumption decision, which is given by:

$$C = \frac{\bar{X}}{1+\bar{\tau}^c} + \frac{1-\beta}{(1+\bar{\tau}^c)}\left(\bar{Y}\tilde{B} + \bar{Y}\tilde{F}\right) \tag{2.93}$$

and the optimal decision for $\tilde{B}'$, $\tilde{F}'$ is as under

$$(\bar{Y}\tilde{B}' + \bar{Y}\tilde{F}') = (1-\beta)(\bar{Y}\tilde{B} + \bar{Y}\tilde{F}) \tag{2.94}$$

The particular form of the value function is established as

$$V(\tilde{B}, \tilde{F}) = (1-\beta)^{-1} u\left[\frac{\bar{X}}{1+\bar{\tau}^c} + \frac{1-\beta}{1+\bar{\tau}^c}\left(\bar{Y}\tilde{B} + \bar{Y}\tilde{F}\right)\right] \tag{2.95}$$

2.C Log-linearized model

The following is an expression for the log-linearized conditions for the household's utility maximization issue and the financial restrictions.

$$\sigma\hat{C}_s + \varphi\hat{N}_s = \hat{w}_s - \frac{\tilde{\tau}^c_s}{1+\bar{\tau}^c} - \frac{\tilde{\tau}^n_s}{1-\bar{\tau}^n} \tag{2.96}$$

$$\hat{C}_s = \hat{C}_{s+1} - \frac{1}{\sigma}(\hat{R}_{h,s} - \hat{\pi}_{s+1} - \frac{\tilde{\tau}^c_{s+1} - \tilde{\tau}^c_s}{1+\bar{\tau}^c}) \tag{2.97}$$

$$\hat{C}_s = \hat{C}_{s+1} - \frac{1}{\sigma}\left(\hat{R}^*_{h,s} - \hat{\pi}^*_{s+1} + \hat{Q}_{s+1} - \hat{Q}_s - \frac{\tilde{\tau}^c_{s+1} - \tilde{\tau}^c_s}{1+\bar{\tau}^c_s}\right) + \phi^h\frac{\bar{Y}}{\sigma}(\bar{f}\hat{Q}_s + \tilde{f}_{s+1}) \tag{2.98}$$

Equationg both the optimal conditions for domestic and foreign bond holdings for λ_s

$$\hat{R}_{h,s} - \hat{\pi}_{s+1} = (\hat{R}^*_{h,s} - \hat{\pi}^*_{s+1} + \hat{Q}_{s+1} - \hat{Q}_s) - \phi^h\bar{Y}(\bar{f}\hat{Q}_s + \tilde{f}_{s+1}) \tag{2.99}$$

$$\tilde{b}_{t+T+1} + \tilde{f}_{t+T+1} = \frac{(1-\bar{g})(1+\bar{\tau}^c)}{1-\beta}\hat{C}_{t+T} + \frac{(1-\bar{g})}{\sigma(1-\beta)}\tilde{\tau}^c_{t+T} + \frac{(1-\bar{g})(1+\bar{\tau}^c)}{\sigma(1-\beta)}\hat{R}_{h,t+T} \quad (2.100)$$

$$\hat{R}_{h,t+T} = \hat{R}^*_{h,t+T} - Q_{t+T} - \phi^h \frac{\bar{Y}}{\bar{R}^*_h}(\bar{f}\hat{Q}_{t+T} + \tilde{f}_{t+T+1}) \quad (2.101)$$

$$\begin{aligned}\tilde{b}_{s+1} + \tilde{f}_{s+1} &= \frac{1}{\beta}\tilde{b}_t + \frac{1}{\beta}\tilde{f}_t + \bar{f}(\hat{R}^*_{h,s} - \frac{1}{\beta}E_t\pi^*_s) + \bar{b}(\hat{R}_s - \frac{1}{\beta}E_t\hat{\pi}_s) - \bar{f}(\hat{Q}_s - \frac{1}{\beta}\hat{Q}_s) \\ -\frac{(1-\bar{g})}{\beta}&((1+\bar{\tau}^c)\hat{C}_s + E_t\tilde{\tau}^c_s) - \frac{\bar{w}}{\beta}E_t\tilde{\tau}^n_s + \frac{\bar{w}}{\beta}(1-\bar{\tau}^n)(E_t\hat{w}_s + \hat{N}_s) + \frac{\bar{\Xi}}{\bar{Y}\beta}E_t\hat{\Xi}_s - \frac{1}{\beta}E_t\tilde{\tau}^l_s\end{aligned} \quad (2.102)$$

Iterating the log-linearized budget constraints from period $(t+T)$ backward andd multiplying both sides by β^{T+1} gives

$$\begin{aligned}\beta^{T+1}(\tilde{b}_{T+t+1} + \tilde{f}_{T+t+1}) &= \tilde{b}_t + \tilde{f}_t + \bar{f}\sum_{s=0}^{T}\beta^s(\beta E_t\hat{R}^*_{h,t+s} - E_t\hat{\pi}^*_{t+s}) + \bar{b}\sum_{s=0}^{T}\beta^s(\beta E_t\hat{R}_{t+s} - E_t\hat{\pi}_{t+s}) \\ -\bar{f}\sum_{s=0}^{T}\beta^s(\beta E_t\hat{Q}_{t+s} - E_t\hat{Q}_{t+s}) &- (1-\bar{g})\sum_{s=0}^{T}\beta^s((1+\bar{\tau}^c)E_t\hat{C}_{t+s} + E_t\tilde{\tau}^c_{t+s}) - \bar{w}\sum_{s=0}^{T}\beta^s E_t\tilde{\tau}^n_{t+s} \\ +\bar{w}(1-\bar{\tau}^n)\sum_{s=0}^{T}\beta^s(E_t\hat{w}_{t+s} &+ E_t\hat{N}_{t+s}) + \frac{\bar{\Xi}}{\bar{Y}}\sum_{s=0}^{T}\beta^s E_t\hat{\Xi}_{t+s} - \sum_{s=0}^{T}\beta^s E_t\tilde{\tau}^l_{t+s}\end{aligned} \quad (2.103)$$

By plugging in $(\tilde{b}_{T+t+1} + \tilde{f}_{T+t+1})$ and labor from $\varphi\hat{N}_s$

$$\begin{aligned}\beta^{T+1}\left(\frac{\mu_b}{1-\beta}\hat{C}_{t+T} + \frac{(1-\bar{g})}{\sigma(1-\beta)}\tilde{\tau}^c_{t+T} + \frac{\mu_b}{\sigma(1-\beta)}\hat{R}_{t+T}\right) = \tilde{b}_t + \tilde{f}_t + \bar{f}\sum_{s=0}^{T}\beta^s(\beta E_t\hat{R}^*_{h,t+s} - \\ E_t\hat{\pi}^*_{t+s}) + \bar{b}\sum_{s=0}^{T}\beta^s(\beta E_t\hat{R}_{t+s} - E_t\hat{\pi}_{t+s}) - \bar{f}\sum_{s=0}^{T}\beta^s(\beta E_t\hat{Q}_{t+s} - E_t\hat{Q}_{t+s}) \\ -(1-\bar{g})\sum_{s=0}^{T}\beta^s((1+\bar{\tau}^c)E_t\hat{C}_{t+s} + E_t\tilde{\tau}^c_{t+s}) - \bar{w}\sum_{s=0}^{T}\beta^s E_t\tilde{\tau}^n_{t+s} \\ +\bar{w}(1-\bar{\tau}^n)\sum_{s=0}^{T}\beta^s(E_t\hat{w}_{t+s} + \frac{1}{\varphi}\left(\hat{w}_{t+s} - \frac{\tilde{\tau}^c_{t+s}}{(1+\bar{\tau}^c)} - \frac{\tilde{\tau}^n_{t+s}}{(1-\bar{\tau}^n)} - \sigma\hat{C}_{t+s}\right)) \\ +\frac{\bar{\Xi}}{\bar{Y}}\sum_{s=0}^{T}\beta^s E_t\hat{\Xi}_{t+s} - \sum_{s=0}^{T}\beta^s E_t\tilde{\tau}^l_{t+s}\end{aligned} \tag{2.104}$$

Next we employ the Euler equation to exchange for future consumption. Iterating the Euler equation gives

$$\hat{C}_{t+s} = \hat{C}_t + \sum_{j=0}^{s-1}\frac{1}{\sigma}\left(E_t\hat{R}_{t+j} - E_t\hat{\pi}_{t+j+1}\right) - \frac{1}{\sigma}\left(\frac{\tilde{\tau}^c_{t+s} - \tilde{\tau}^c_t}{1+\bar{\tau}^c}\right) \tag{2.105}$$

Rearranging the equation and exchanging for future consumption gives

$$\begin{aligned}
&\beta^{T+1}\frac{\mu_b}{1-\beta}\left(\hat{C}_t+\sum_{j=0}^{T-1}\frac{1}{\sigma}(E_t\hat{R}_{t+j}-E_t\hat{\pi}_{t+j+1})-\frac{1}{\sigma}(\frac{\tilde{\tau}^c_{t+T}-\tilde{\tau}^c_t}{1+\bar{\tau}^c})\right)+\beta^{T+1}\frac{(1-\bar{g})}{\sigma(1-\beta)}\tilde{\tau}^c_{t+T}\\
&+\beta^{T+1}\frac{\mu_b}{\sigma(1-\beta)}\hat{R}_{t+T}=\tilde{b}_t+\tilde{f}_t+\bar{f}\sum_{s=0}^{T}\beta^s(\beta E_t\hat{R}^*_{h,t+s}-E_t\hat{\pi}^*_{t+s})+\bar{b}\sum_{s=0}^{T}\beta^s(\beta E_t\hat{R}_{t+s}-E_t\hat{\pi}_{t+s})\\
&-\bar{f}\sum_{s=0}^{T}\beta^s(\beta E_t\hat{Q}_{t+s}-E_t\hat{Q}_{t+s})-\bar{w}\sum_{s=0}^{T}\beta^sE_t\tilde{\tau}^n_{t+s}\\
&-(1-\bar{g})\sum_{s=1}^{T}\beta^s((1+\bar{\tau}^c)\left(\hat{C}_t+\sum_{j=0}^{s-1}\frac{1}{\sigma}(E_t\hat{R}_{t+j}-E_t\hat{\pi}_{t+j+1})-\frac{1}{\sigma}(\frac{\tilde{\tau}^c_{t+s}-\tilde{\tau}^c_t}{1+\bar{\tau}^c})\right)\\
&-(1-\bar{g})\sum_{s=0}^{T}\beta^sE_t\tilde{\tau}^c_{t+s})+\bar{w}(1-\bar{\tau}^n)\sum_{s=0}^{T}\beta^s(E_t\hat{w}_{t+s}+\frac{1}{\varphi}\left(\hat{w}_{t+s}-\frac{\tilde{\tau}^c_{t+s}}{(1+\bar{\tau}^c)}-\frac{\tilde{\tau}^n_{t+s}}{(1-\bar{\tau}^n)}-\sigma\right.\\
&(\hat{C}_t+\sum_{j=0}^{s-1}\frac{1}{\sigma}(E_t\hat{R}_{t+j}-E_t\hat{\pi}_{t+j+1})-\frac{1}{\sigma}(\frac{\tilde{\tau}^c_{t+s}-\tilde{\tau}^c_t}{1+\bar{\tau}^c})))+\frac{\bar{\Xi}}{\bar{Y}}\sum_{s=0}^{T}\beta^sE_t\hat{\Xi}_{t+s}-\sum_{s=0}^{T}\beta^sE_t\tilde{\tau}^l_{t+s}
\end{aligned} \tag{2.106}$$

Taking contemporaneous consumption to the right side of the equation derives the current consumption choice of the consumer

$$\begin{aligned}
&\left[\frac{u_b\beta^{T+1}}{1-\beta}+\left((1-\bar{g})(1+\bar{\tau}^c)+\frac{\bar{w}\sigma(1-\bar{\tau}^n)}{\varphi}\right)\frac{(1-\beta^{T+1})}{1-\beta}\right]\hat{C}_t=\tilde{b}_t+\tilde{f}_t\\
&+\bar{f}\sum_{s=0}^{T}\beta^s(\beta E_t\hat{R}^*_{h,t+s}-E_t\hat{\pi}^*_{t+s})+\bar{b}\sum_{s=0}^{T}\beta^s(\beta E_t\hat{R}_{t+s}-E_t\hat{\pi}_{t+s})-\bar{f}\sum_{s=0}^{T}\beta^s(\beta E_t\hat{Q}_{t+s}-E_t\hat{Q}_{t+s})\\
&-(1-\bar{g})\sum_{s=0}^{T}\beta^s(E_t\tilde{\tau}^c_{t+s})+\bar{w}(1-\bar{\tau}^n)\sum_{s=0}^{T}\beta^s\left((1+\frac{1}{\varphi})(E_t\hat{w}_{t+s}-\frac{\tilde{\tau}^n_{t+s}}{(1-\bar{\tau}^n)})-\frac{\tilde{\tau}^c_{t+s}}{\varphi(1+\bar{\tau}^c)}\right)\\
&-\left((1-\bar{g})(1+\bar{\tau}^c)+\frac{\sigma\bar{w}(1-\bar{\tau}^n)}{\varphi}\right)\frac{1}{\sigma}\sum_{s=1}^{T}\beta^s\sum_{j=0}^{s-1}(E_t\hat{R}_{t+j}-E_t\hat{\pi}_{t+j+1})\\
&+\left((1-\bar{g})(1+\bar{\tau}^c)+\frac{\sigma\bar{w}(1-\bar{\tau}^n)}{\varphi}\right)\frac{1}{\sigma}\sum_{s=1}^{T}\beta^s(\frac{\tilde{\tau}^c_{t+s}-\tilde{\tau}^c_t}{1+\bar{\tau}^c})-\beta^{T+1}\frac{\mu_b}{\sigma(1-\beta)}\sum_{j=0}^{T-1}(E_t\hat{R}_{t+j}-E_t\hat{\pi}_{t+j+1})\\
&-\beta^{T+1}\frac{\mu_b}{\sigma(1-\beta)}\frac{\tilde{\tau}^c_t}{(1+\bar{\tau}^c)}-\beta^{T+1}\frac{\mu_b}{\sigma(1-\beta)}\hat{R}_{t+T}+\frac{\bar{\Xi}}{\bar{Y}}\sum_{s=0}^{T}\beta^sE_t\hat{\Xi}_{t+s}-\sum_{s=0}^{T}\beta^sE_t\tilde{\tau}^l_{t+s}
\end{aligned} \tag{2.107}$$

By aggregating the previously mentioned equation over all households, we obtain an expression for aggregate consumption that solely depends on aggregate expectations regarding aggregate variables.

2.D Linearized firm equations

$$\hat{p}_{h,t}(j) - \hat{p}_{h,t} = (1-\omega\beta)E_t^j \sum_{s=0}^{T}(\hat{m}c_{t+s} + \hat{p}_{h,t+s} - \hat{p}_{h,t}) + (\omega\beta)^{T+1}E_t^j(\hat{p}_{h,t+T} - \hat{p}_{h,t}) \tag{2.108}$$

Stipulated in the form of inflation expectations as

$$\hat{p}_{h,t}(j) - \hat{p}_{h,t} = (1-\omega\beta)\left[\hat{m}c_t + E_t^j \sum_{s=1}^{T}(\hat{m}c_{t+s} + \sum_{\tau=1}^{s}\pi_{h,t+\tau})\right] + (\omega\beta)^{T+1}E_t^j \sum_{\tau=1}^{T}\pi_{h,t+\tau} \tag{2.109}$$

The general price level is given as

$$P_{h,t} = \left[\omega P_{h,t-1}^{1-\epsilon} + (1-\omega)\int_0^1 P_{h,t}(j)^{1-\epsilon}\right]^{\frac{1}{1-\epsilon}} \tag{2.110}$$

Log-linearizing the general price equation

$$\hat{p}_{h,t} = \omega\hat{p}_{h,t-1} + (1-\omega)\int_0^1 \hat{p}_{h,t}(j)dj \tag{2.111}$$

from which it follows that

$$\pi_{h,t} = \frac{1-\omega}{\omega}\left(\int_0^1 \hat{p}_{h,t}(j)dj - \hat{p}_{h,t}\right) \tag{2.112}$$

Aggregating the aggregate price level and plugging in the above equation

$$\pi_{h,t} = \frac{(1-\omega)(1-\omega\beta)}{\omega}\left[\left(\hat{m}c_t + \sum_{s=1}^{T}(\omega\beta)^s E_t^j(\hat{m}c_{t+s} + \sum_{\tau=1}^{T}(\omega\beta)^s \sum_{\tau=1}^{s}\pi_{h,t+\tau})\right) + \frac{(\omega\beta)^{T+1}}{1-\omega\beta}E_t^j \sum_{\tau=1}^{T}\pi_{h,t+\tau}\right. \tag{2.113}$$

Writing the Double sum as a geometric series and combing with the final term we can rewrite this as

$$\pi_{h,t} = \kappa_{mc} \sum_{s=0}^{T} (\omega\beta)^s E_t^j \hat{m}c_{t+s} + \frac{(1-\omega)}{\omega} \sum_{s=1}^{T} (\omega\beta)^s E_t^j \pi_{h,t+s} \tag{2.114}$$

$$\kappa_{mc} = \frac{(1-\omega)(1-\omega\beta)}{\omega} \tag{2.115}$$

2.E Final model

The log-linearized government budget constraint is given as under:

$$\begin{aligned} \hat{d}_{t+1} = \frac{1}{\beta}\tilde{d}_t + \frac{\bar{\lambda}\bar{d}}{\beta}(\hat{\lambda}_t - \hat{\pi}_t) + \frac{(1-\bar{\lambda})\bar{d}}{\beta}(\hat{Q}_t - \hat{Q}_{t-1} - \hat{\pi}_t^* - \hat{\lambda}_t) - \bar{\lambda}\bar{d}(\hat{\lambda}_{t+1} - \hat{R}_{h,t}) \\ +(1-\bar{\lambda})\bar{d}(\hat{\lambda}_{t+1} + \hat{R}_{h,t}^*) + \frac{1}{\beta}\hat{g}_t - \frac{\bar{g}\alpha}{\beta}\hat{H}_t - \frac{(1-\bar{g})}{\beta}(\bar{\tau}^c\hat{C}_t + \tilde{\tau}_t^c) - \frac{\bar{w}}{\beta}(\bar{\tau}^n(\hat{w}_t + \hat{N}_t) + \tilde{\tau}_t^n) - \frac{1}{\beta}\hat{\tau}_t^l \end{aligned} \tag{2.116}$$

The log linearized net foreign assets and monetary policy equations are given as

$$\begin{aligned} \beta\tilde{f}_{t+1} - \tilde{f}_t - \beta(1-\bar{\lambda})\tilde{d}_{t+1} + (1-\bar{\lambda})\tilde{d}_t + \bar{f}(\hat{\pi}_t^* - \beta R_{h,t}^*) - \bar{f}(\hat{Q}_t - \beta\hat{Q}_t) + (1-\bar{\lambda})\bar{d}(\beta\hat{\lambda}_{t+1} - \hat{\lambda}_t) \\ +\bar{d}(1-\bar{\lambda})(\beta R_{h,t}^* - \hat{\pi}_t^*) + \bar{d}(1-\bar{\lambda})(\hat{Q}_t - \hat{Q}_{t-1}) = \frac{\alpha}{1-\alpha}\tilde{g}_t - \frac{\alpha}{1-\alpha}\hat{Y}_t + \frac{\alpha(1-\bar{g})}{1-\alpha}\hat{C}_t^* + \\ (\frac{\alpha\eta(2-\alpha)(1-\bar{g})}{1-\alpha} + \alpha\bar{g})\hat{H}_t \end{aligned} \tag{2.117}$$

$$\hat{R}_{h,t} = \Phi^{\pi}\hat{\pi}_t + \Phi^{Y}\hat{Y}_t \tag{2.118}$$

The aggregate labour is given as under

$$N_t = \int_0^1 N_t(j) = \int_0^1 Y_t(j) = Y_t \tag{2.119}$$

Log-linearizing this equation and capturing aggregate wages and marginal costs equations

$$\hat{m}c_t = \varphi\hat{N}_t + \sigma\hat{C}_t + \frac{\tilde{\tau}^t}{1-\bar{\tau}_t^c} + \frac{\tilde{\tau}_t^n}{1-\bar{\tau}_t^n} + \alpha\hat{H}_t \tag{2.120}$$

$$\hat{m}c_t = \left(\varphi + \frac{\sigma}{(1-\bar{g})(1-\alpha)}\right)\hat{Y}_t - \frac{\sigma\alpha}{1-\alpha}\hat{C}_t^* - \left(\frac{\sigma\eta\alpha(2-\alpha)}{(1-\alpha)} - \alpha\right)\hat{H}_t - \frac{\sigma}{(1-\bar{g})(1-\alpha)}\tilde{g}_t + \frac{\tilde{\tau}_t^c}{1+\bar{\tau}^c} + \frac{\tilde{\tau}_t^n}{1-\bar{\tau}^n} \tag{2.121}$$

the log-linearized market clearing condition is described as under

$$\frac{1}{1-\bar{g}}\hat{Y}_t - \frac{1}{1-\bar{g}}\tilde{g}_t = (1-\alpha)\hat{C}_t + \alpha\hat{C}_t^* + \eta\alpha(2-\alpha)\hat{H}_t \tag{2.122}$$

Using (123) in (108) results in an expression for aggregate output.

$$\begin{aligned}\hat{Y}_t = {} & \frac{1}{\rho}\tilde{b}_t + \frac{1}{\rho}\tilde{f}_t + \frac{\bar{b}}{\rho}\sum_{s=0}^{T}\beta^s(\beta E_t\hat{R}_{t+s} - E_t\hat{\pi}_{t+s}) + \frac{\bar{f}}{\rho}\sum_{s=0}^{T}\beta^s(\beta E_t\hat{R}_{h,t+s}^* - E_t\hat{\pi}_{t+s}^*) \\ & - \frac{\bar{f}}{\rho}\sum_{s=0}^{T}\beta^s(\beta E_t\hat{Q}_{t+s} - E_t\hat{Q}_{t+s}) + \delta\sum_{s=0}^{T}\beta^s\left(((1-\bar{\tau}^n)E_t\hat{w}_{t+s} - \tilde{\tau}_{t+s}^n)\right) \\ & - \frac{1}{\rho}\mu\sum_{s=1}^{T}\beta^s\sum_{j=0}^{s-1}(E_t\hat{R}_{t+j} - E_t\hat{\pi}_{t+j+1}) \\ & - \frac{\beta^{T+1}}{(1-\beta)}\frac{\mu_b}{\rho\sigma}\sum_{j=0}^{T-1}(E_t\hat{R}_{t+j} - E_t\hat{\pi}_{t+j+1}) - \frac{\beta^{T+1}}{(1-\beta)}\frac{\mu_b}{\rho\sigma}\hat{R}_{t+T} - \frac{\mu_c}{\rho}\tilde{\tau}_t^c - \frac{(1-\bar{g})}{\rho}(1-\frac{1}{\sigma})\sum_{s=1}^{T}\tilde{\tau}_{t+s}^c \\ & + \frac{\bar{\Xi}}{\bar{Y}\rho}\sum_{s=0}^{T}\beta^s E_t\hat{\Xi}_{t+s} - \frac{1}{\rho}E_t\tilde{\tau}_{t+s}^l + \alpha(1-\bar{g})\hat{C}_t^* + \eta\alpha(2-\alpha)(1-\bar{g})\hat{H}_t + \tilde{g}_t\end{aligned} \tag{2.123}$$

where

$$\rho = \frac{1}{(1-\bar{g})(1-\alpha)}\left[\frac{u_b\beta^{T+1}}{1-\beta} + \left((1-\bar{g})(1+\bar{\tau}^c) + \frac{\bar{w}\sigma(1-\bar{\tau}^n)}{\varphi}\right)\frac{(1-\beta^{T+1})}{1-\beta}\right] \tag{2.124}$$

$$\delta = \frac{\bar{w}}{\rho}(1 + \frac{1}{\varphi}) \tag{2.125}$$

$$\mu = \left(\frac{\bar{w}}{\varphi}(1 - \bar{\tau}^n) + \frac{(1 - \bar{g})(1 + \bar{\tau}^c)}{\sigma} \right) \tag{2.126}$$

$$\mu_c = \left[(1 - \bar{g}) + \left(\frac{(1 - \bar{\tau}^n)}{(1 + \bar{\tau}^c)} \frac{\bar{w}}{\varphi} \right) \frac{1 - \beta^{T+1}}{1 - \beta} + \frac{\beta(1 - \bar{g})}{\sigma(1 - \beta)} \right] \tag{2.127}$$

$$\mu_b = (1 - \bar{g})(1 + \bar{\tau}^c) \tag{2.128}$$

Further, we log-linearize the profits of firm (j)

$$\Xi_{h,s}(j) = \frac{1}{1 - \bar{m}c}(p_{h,t}(j) - p_{h,t}) + \hat{Y}_t(j) - \frac{\bar{m}c}{1 - \bar{m}c}\hat{m}c_t \tag{2.129}$$

The accumulated profits are defined as

$$\Xi_{h,s} = \hat{Y}_t - (\epsilon - 1)\hat{m}c_t \tag{2.130}$$

Assuming that agents possess knowledge of the relationships between aggregate variables as stated above, they can substitute their expectations regarding wages and profits using equations (122) and (130) respectively. This substitution formulates a system of equations that, along with a specification of monetary and fiscal policy, fully describes the model. By solving this system of equations, a comprehensive understanding of the dynamics and interactions within the model is gained.

$$\pi_{h,t} = \kappa_{mc}\sum_{s=0}^{T}(\omega\beta)^s E_t((\varphi + \frac{\sigma}{(1-\bar{g})(1-\alpha)})\hat{Y}_{t+s} - \frac{\sigma\alpha}{1-\alpha}\hat{C}^*_{t+s} - (\frac{\sigma\eta\alpha(2-\alpha)}{(1-\alpha)} - \alpha)\hat{H}_{t+s}$$
$$-\frac{\sigma}{(1-\bar{g})(1-\alpha)}\tilde{g}_{t+s} + \frac{\tilde{\tau}^c_{t+s}}{1+\bar{\tau}^c} + \frac{\tilde{\tau}^n_{t+s}}{1-\bar{\tau}^n}) + \frac{(1-\omega)}{\omega}\sum_{s=1}^{T}(\omega\beta)^s E^j_t \pi_{h,t+s} \tag{2.131}$$

As per equation (2.131), government spending, consumption, labor tax, and output directly impact inflation through equation (2.122). The Phillips curve slope coefficient κ_{mc} represents the sensitivity of domestic inflation to changes in real marginal cost.

$$\hat{d}_{t+1} = \frac{1}{\beta}\tilde{d}_t + \bar{\lambda}\bar{d}(\hat{R}_{h,t} - \frac{1}{\beta}\hat{\pi}_t) + (1-\bar{\lambda})\bar{d}(\hat{R}^*_{h,t} - \frac{1}{\beta}\hat{\pi}^*_t) + \frac{(1-\bar{\lambda})\bar{d}}{\beta}((1-\alpha)(\hat{H}_t - \hat{H}_{t-1}))$$
$$+\frac{1}{\beta}\hat{g}_t - \frac{\bar{g}\alpha}{\beta}\hat{H}_t - \frac{1}{\beta}\hat{\tau}^l_t -$$
$$\frac{(1-\bar{g})}{\beta}(\bar{\tau}^c\left(\frac{\hat{Y}_t}{(1-\bar{g})(1-\alpha)} - \frac{\alpha}{1-\alpha}\hat{C}^*_t - \frac{\eta\alpha(2-\alpha)}{(1-\alpha)}\hat{H}_t - \frac{\tilde{g}_t}{(1-\bar{g})(1-\alpha)}\right) + \tilde{\tau}^c_t)$$
$$-\frac{\bar{w}}{\beta}(\bar{\tau}^n((\varphi + \frac{\sigma}{(1-\bar{g})(1-\alpha)})\hat{Y}_t - \frac{\sigma\alpha}{1-\alpha}\hat{C}^*_t - \frac{\sigma\eta\alpha(2-\alpha)}{(1-\alpha)}\hat{H}_t - \frac{\sigma\tilde{g}_t}{(1-\bar{g})(1-\alpha)}$$
$$+\frac{\tilde{\tau}^c_s}{1+\bar{\tau}^c} + \frac{\tilde{\tau}^n_s}{1-\bar{\tau}^n} + \hat{Y}_t) + \tilde{\tau}^n_t) \tag{2.132}$$

$$(1-\nu_y)\hat{Y}_t = \frac{1}{\rho}\hat{b}_t + \frac{1}{\rho}\hat{f}_t + \tilde{g}_t + \alpha(1-\bar{g})\hat{C}^*_t + \eta\alpha(2-\alpha)(1-\bar{g})\hat{H}_t + \frac{\bar{f}}{\rho}\sum_{s=0}^{T}\beta^s(\beta E_t\hat{R}^*_{h,t+s} - E_t\hat{\pi}^*_{t+s})$$
$$+\nu_y\sum_{s=1}^{T}\beta^s E_t\hat{Y}_{t+s} + \nu_g\sum_{s=0}^{T}\beta^s E_t\tilde{g}_{t+s} + \nu_h\sum_{s=0}^{T}\beta^s E_t\hat{H}_{t+s} + \nu_{c^*}\sum_{s=0}^{T}\beta^s E_t\hat{C}^*_{t+s} + \nu_{\tau^c_1}\tilde{\tau}^c_t + \nu_{\tau^c_2}\sum_{s=1}^{T}\beta^s\tilde{\tau}^c_{t+s}$$
$$-\frac{\mu}{\rho}\sum_{s=1}^{T}\beta^s\sum_{j=1}^{s}(E_t\hat{R}_{t+j} - E_t\hat{\pi}_{t+j+1}) - \frac{\beta^{T+1}}{(1-\beta)}\frac{\mu_b}{\rho\sigma}\sum_{j=0}^{T-1}(E_t\hat{R}_{t+j} - E_t\hat{\pi}_{t+j+1}) - \frac{\beta^{T+1}}{(1-\beta)}\frac{\mu_b}{\rho\sigma}\hat{R}_{t+T}$$
$$+\nu^n_\tau\sum_{s=0}^{T}\beta^s\tilde{\tau}^n_{t+s} - \frac{\bar{\tau}^l}{\rho\bar{Y}}\sum_{s=0}^{T}E_t\hat{\tau}^l_{t+s} + \frac{\bar{b}}{\rho}\sum_{s=0}^{T}\beta^s(\beta E_t\hat{R}_{t+s} - E_t\hat{\pi}_{t+s}) \tag{2.133}$$

Table 2.E.1: List of calibrated Parameters

Parameters	Description	Calibration	Source
α	Degree of trade openness	0.2	Ahmad et al., 2017
β	Discount factor	0.95	Haider et al.,2008
σ	inverse elasticity of intertemporal substitution in consumption	0.84	Haider et al., 2008
φ	the inverse elasticity of labour supply	0.98	Ahmad et al., 2017
Ω	Calvo price stickiness	0.7	Munir et al., 2022
Φ_π	Interest rate reaction to inflation coefficient	1.05	Ahmad et al., 2016
Φ_Y	Interest rate reaction to Output coefficient	0.25	Ahmad et al., 2016
$\bar{g}$	Steady state fiscal spending to GDP ratio	0.2	Ahmad et al., 2016
τ_c	steady state taxes on consumption	0.17	Ahmad et al., 2016
τ_n	steady state taxes on labor	0.05	Ahmad et al., 2016

$$\nu_y = \frac{1}{\rho\epsilon} + \left(\delta(1-\bar{\tau}^n) - \frac{\epsilon-1}{\rho\epsilon}\right)(\varphi + \frac{\sigma}{(1-\bar{g})(1-\alpha)}) \tag{2.134}$$

$$\nu_g = \frac{\sigma}{(1-\bar{g})(1-\alpha)}\left(\frac{\epsilon-1}{\rho\epsilon} - \delta(1-\bar{\tau}^n)\right) \tag{2.135}$$

$$\nu_{c^*} = \frac{\alpha\sigma}{(1-\alpha)}\left(\frac{\epsilon-1}{\rho\epsilon} - \delta(1-\bar{\tau}^n)\right) \tag{2.136}$$

$$\nu_h = \frac{\bar{f}}{\rho}(1-\alpha)(1-\beta) - \frac{\alpha(\epsilon-1)}{\rho\epsilon} + \frac{\sigma\eta\alpha(2-\alpha)}{(1-\alpha)}\left(\frac{\epsilon-1}{\rho\epsilon} - \delta(1-\bar{\tau}^n)\right) \tag{2.137}$$

$$\nu_{\tau_1^c} = \delta\frac{1-\bar{\tau}^n}{1+\bar{\tau}^c} - \frac{\mu_c}{\rho} - \frac{\epsilon-1}{\rho\epsilon(1+\bar{\tau}^c)} \tag{2.138}$$

$$\nu_{\tau_2^c} = \delta\frac{1-\bar{\tau}^n}{1+\bar{\tau}^c} - \frac{\epsilon-1}{\rho\epsilon(1+\bar{\tau}^c)} - \frac{1-\bar{g}}{\rho}(1-\frac{1}{\sigma}) \tag{2.139}$$

$$\nu_\tau^n = -\frac{\epsilon-1}{\rho\epsilon(1-\bar{\tau}^n)} \tag{2.140}$$

Chapter 3

Impact of Fiscal Stimulus in Expectations Driven Liquidity Trap

3.1 Introduction

The economic recession of 2007 manifested by depressed aggregate economic activity, low inflation and zero lower bound (ZLB) interest rate led the world into new wave of liquidity trap. Liquidity trap is defined as the economic scenario where interest rate and inflation are jammed at the lower bound and cannot fall further (Tamanyu, 2021); and the minimum level of inflation and interest rate explain the inability of monetary policy to sustain the economic conditions (Bagaria, 2012; Arifovic et al. 2018). Moreover, in this scenario of uncertainty people prefer to hoard money instead of spending or investing it. This situation indicates that in presence of liquidity trap and monetary policy failure, the absence of strong policy intervention would push the economy into a deflationary trap and deep recession (Benhabib et al., 2014; Bullard, 2010). Ultimately, the advent of fiscal policy intervention as a stabilization tool is inevitable for the revival of the economy and mitigation of recessions (Christiano et al., 2009; Andersen, 2005).

The conventional monetary policy tools such as lowering interest rates fails to stimulate the economic activities because nominal interest rates are already close to zero, and further reductions may have limited impact on stimulating spending and investment. However, the fiscal stimulus operating through decline in taxes or increase in public spending can increases the household's after-tax wealth and stimulate aggregate demand (Benhabib et al., 2001), and up to a certain point this can also enhance welfare (Woodford, 2011; Blanchard et al., 2019). Studies have also analyzed that expanded supply policies as tax cuts can be counterproductive by increasing deflationary pressures (Eggertesson, 2011). The policy makers also have concerns regarding the long run impact of fiscal stimulus, precisely when tax hikes are eventually required to service the debt or debt sustainability (Coenen et al., 2012). Nevertheless, there is a consensus that during a liquidity trap, fiscal policy can assist in stimulating demand and contribute to an overall boost in economic activity.

Due to dynamic transmission mechanism and involvement of longer policy lags in execution of fiscal policy the private agents form anticipations about expected fiscal plans even before implementation (Blanchard and Perotti, 2002). Furthermore, public expectations affect agents' decision-making and ultimate impact of economic policies (Gali, 2008; Sims, 2009; Zhao, 2017) and determination of government-spending multipliers (Monacelli and Perotti 2008; Leeper, 2009). However, the majority of macroeconomic studies are based on rational expectations models. The orthodox macroeconomic modeling is further dominated by the paradigm of homogeneous expectations that all agents share the same information and have same expectations. In effect, the economic agents possess heterogeneous expectations due to unavailability and costs of acquiring and processing information (Honkaphoja 1995). The evolution of state of the economy determines heterogeneity in expectations of the agents that in turn affects their behaviour and the resulting equilibrium evolution of the economy (Mankiv et al, 2003). Several studies in the economic literature, such as those conducted by Berardi (2007), Branch and McGough (2009), De Grauwe (2010), and Jang and Sacht (2022), have examined macroeconomic models incorporating heterogeneous expectations. Lustenhouver, 2020 and Lima et al., 2023 examined that fiscal policy is beneficial in stabilization of economy and in mitigation of liquidity trap when agents hold time-varying heterogeneous expectations about inflation and output.

There are different causes and scenarios of liquidity trap. A fundamental liquidity trap may occur when an economic shock leads to the short-term rate of interest binding and large fall in output (Mertens and Ravn, 2010). The deflationary equilibrium emerged by the de-anchoring of the expectations of the agents is defined as expectations driven liquidity trap (Benhabib et al., 2001). Specifically, in fundamental liquidity trap the economic down turn is aroused due to some economic shock and in the expectations driven liquidity trap the expectations of the agents are the main instrument in spread of economic depression. However, the expectations of the agents play an important role in intensifying any form of liquidity trap.

The primary aim of this essay is to enhance the economic literature by demonstrating that fiscal policy plays a vital role in stabilization of the economy and mitigation of liquidity trap, with reference to the Pakistan economy. The theoretical framework employed in this essay following Lustenhouver, 2020 to examine the influence of fiscal policy in a liquidity trap scenario, featuring heterogeneous expectations and bounded rationality. Bounded rationality is introduced by assuming that agents are facing a finite horizon following Woodford, 2018. The assumptions of heterogeneous expectations assume that agents have unequal access to information, leading to divergence in expectations. Furthermore, agents are presumed to have limited cognitive resources to process available information and use different models or methods to predict future variables and market segmentation. More specifically, it is assumed that some of these agents adopt a backward-looking approach, while the remaining fraction of agents formulate forward looking perspective on economic conditions. The backward-looking agents rely on past and current data to make decisions about the future. Their expectations are grounded in historical trends and patterns. In contrast, forward-looking agents anticipate future conditions based on their understanding of current and anticipated developments. They may incorporate forecasts, policy changes, and potential economic shocks into their expectations. The coexistence of these two types of agents introduces heterogeneity in how expectations are formed, which can affect the outcomes of economic models.

Following Lustenhouver, 2020 the analysis in this essay is constructed upon three scenarios of liquidity trap. The first scenario is built upon conventional fundamentals-driven liquidity trap, characterized by rational expectations among all agents. In this first scenario, a persistent fundamental shock leads to liquidity trap. Second, in expectations driven liquidity trap, a singular non-persistent shock hits the expectations of backward-looking agents and pushes the economy into liquidity trap. The expectations driven liquidity trap further portrays heterogeneous expectations scenario where some of these agents adopt a backward-looking approach, while the remaining fraction of agents takes forward looking perspective on economic conditions. The third scenario of a mixed liquidity trap defines a fundamental shock, incorporating a fraction of backward-looking agents. Benhabib et al., 2014 and Mertens and Ravn, 2014 conducted the analysis of preference driven liquidity trap but with infinite horizon and homogenous expectation. Lustenhouwer, 2018 studied this scenario with fragments of forward and backward-looking agents, a concept closely discussed by Gasteiger, 2014, 2017 and Branch and McGough, 2009. The economic literature has seen substantial studies on the subjects of liquidity traps and heterogeneous expectations. However, in the context of Pakistan, this analysis makes a significant contribution by specifically examining the concepts of liquidity traps and heterogeneous expectations within the framework of the Pakistan economy.

Khalid et al., 2007 studied the fiscal transmission mechanism for Pakistan through three indicators of fiscal policy i.e. budget deficit, government expenditure and taxes and concluded that fiscal policy in Pakistan is based on backward looking expectations and contemporaneous but not forward looking at all. The governance issues of Pakistan like political instability and institutional weaknesses significantly affect its fiscal policy outcomes. Political uncertainty and poor governance create a lack of consistent fiscal policy direction and undermines efforts to reduce fiscal deficits and delay stimulus measures when they are most needed. Pakistan's narrow tax base, reliance on indirect taxation, and low tax-to-GDP ratio limit the government's capacity to fund fiscal expansion. Furthermore, reliance on external and domestic borrowing to finance deficits constrains fiscal flexibility, especially in liquidity traps where public spending is crucial to stimulate demand. Fiscal discipline and well-coordinated fiscal policies can improve fiscal policy outcomes and better navigate liquidity traps and economic crises. The analysis of fiscal plans in this essay facilitates a comprehensive understanding of the effectiveness of fiscal instruments. The issue of liquidity trap is either hardly addressed in Pakistan or is specifically studied with reference to monetary policy. So, this study will also contribute in the fiscal literature of Pakistan by analyzing the efficacy of fiscal policy at zero lower bound.

The findings of this essay affirm in check with Hommes et al., 2019 that in absence of fiscal intervention, a fundamental-driven liquidity trap leads the economy into a deflationary spiral, and an expectations-driven liquidity trap pushes the economy into prolonged periods of recession. Since, implementing fiscal stimulus at zero lower bound (ZLB) effectively prevents unstable deflationary and recessionary patterns and ensures a gradual transition towards the desired equilibrium (Hommes, 2018). However, fiscal intervention in the shape of rise in government spending and consumption tax cut prevents deflationary spirals in all scenarios of liquidity trap. An increase in government spending and consumption tax cut stimulates both output and inflation, providing a potential solution to exit the liquidity trap. However, labour tax cut fails to stimulate the economic conditions and even pushes the economy into deflationary spirals in all scenarios of liquidity trap. The results of this essay are in accordance with the results obtained in earlier research by Benhabib et al., 2014; Honkapohja and Evans, 2009 and Lustenhouwer, 2020.

The remainder of this essay is structured as follows: in section 2, a review of pertinent literature will be provided, while section 3 will delve into the theoretical framework of the essay. Section 4 provides description of different scenarios of liquidity traps and duration of liquidity traps under situations of fiscal stimulus and without fiscal stimulus. Section 5 deals with the investigation of effectiveness of different indicators of fiscal policy and Section 6 concludes.

3.2 Literatire review

Fiscal policy played a pivotal role in stabilizing economic systems during the global financial crisis of the 1930s. However, it subsequently lost prominence to monetary policy, which became the primary instrument for mitigating economic fluctuations. The global financial crisis of 2008 marked a resurgence in the recognition of discretionary fiscal policy as a critical macroeconomic tool. Fiscal literature provides diverse evidence on the usefulness of fiscal stimulus during the economic crisis. The Keynesian school of thought as well as Joseph Stiglitz and Paul Krugman propagated the view that the wave of fiscal consolidation would aggravate the recession so fiscal policy interventions are inevitable. Moreover, the financial crisis exposed the limitations of relying on near-zero interest rates and highlighted the fragile prospects for economic recovery. This underscored the realization that interest rate policy would no longer be a viable tool for macroeconomic stabilization (Weberpals, 1997). In their study, Blanchard and Perotti, 2002 discovered that government expenditure shocks tend to have a modest yet positive impact on output, whereas tax shocks have a depressive impact over the economic activities. The study conducted by Beetsma and Giuliodori, 2011 similarly corroborated the findings that government spending exerts a small yet positive influence on output in European Union countries.

Empirical studies conducted during economic crises have indicated that fiscal adjustment decisions must be carefully coordinated considering the response function of monetary policy (Bagaria, 2012). Romer and Bernstein, 2009 analyzed the American Recovery and Reinvestment Act of 2009 and raised doubts about the advantages of tax cuts. However, they further discussed that the government spending multiplier is expected to be substantial, especially in the presence of near-ZLB. The fiscal stimulus plans implemented in both the euro area and the US were found to be effective in mitigating the magnitude and duration of the economic downturn, as highlighted by Sabri et al., 2016. However, in order to maximize the effectiveness of these stimulus plans, it is crucial to complement them with accommodative monetary policy, as emphasized by Brusselen, 2009 and Coenen et al., 2012.

Brendon et al., 2019 found that small increases in government expenditure at ZLB will always make recessionary equilibria more severe, but sufficiently large fiscal expansion can eliminate the recessionary equilibrium. On the other hand, an alternative approach known as a ”fiscal switching rule” has been suggested, which involves automatically initiating fiscal stimulus through increased government expenditures when inflation or expected inflation is low. This approach is considered equally effective in stimulating the economy (Benhabib et al., 2014). Eggertsson, 2011 conducted an analysis focusing on policy implications at the zero lower bound and concluded that reducing taxes on labor or capital tends to have a contractionary effect. However, the virtue of temporarily increasing government expenditure is more pronounced in such circumstances compared to normal conditions. Additionally, other types of tax cuts, such as reductions in sales taxes and investment tax credits, as emphasized by Feldstein, 2002 during Japan's "Great Recession," have been found to be highly effective.

Ilzetzki et al., 2011 found that Countries that have less trade restrictions or holds systems of flexible exchange rates are more likely to experience a positive impact of government consumption on economic activity. Conversely, highly-indebted countries may face significant negative effects when implementing fiscal expansion measures. However, in the economies of the Eurozone, fiscal expansion has resulted in a larger fiscal multiplier during prolonged periods of liquidity trap. This is primarily due to the expansion of domestic demand triggered by lower real interest rates and depreciation of the terms of trade (Blanchard et al. 2017). Bloch and Fournier, 2018 identified that the countries that adopt a counter-cyclical fiscal stance generally tend to have a public spending structure that is more conducive to inclusive growth. However, during the economic recession of 2008, the ability of public finances to support inclusive growth significantly deteriorated in countries that were severely affected by the crisis. Moreover, it has been observed that the government expenditure multiplier nearly doubles when the economy reaches the zero lower bound. However, the impact of government debt on the value of multipliers is significant, often rendering these policies less effective (Cogan et al.,2010; Christiano et al., 2011).

The execution of fiscal policies is characterized with legislative and implementation lags. When fiscal policy changes are announced, they trigger immediate anticipation effects owing to the wealth effects stemming from the expected future tax adjustments. Subsequently, these effects are followed by additional and more sustained impacts driven by changes in expected future wages and interest rates (Mitra et al., 2013). Additionally, a money-financed fiscal stimulus has a positive impact on output. However, if there is a significant delay in implementing the stimulus, the effect on output may be weak or even negative. Moreover, the effects on output tend to be more unstable compared to a debt-financed fiscal stimulus (Tsuruga and Wake, 2019). Expectations play a definite role in modern macro-economic theory by influencing current choices of firms and households, that in turn affect overall current and future economic activities (Woodford, 2005; Gali, 2008; Sims, 2009). Anticipated and unanticipated "shocks" to economic fundamentals affect the economy's information flows and agents' expectations (Leeper et al., 2013), and increase the pace of economic fluctuations or even short period flow equilibrium (Collard, 1983). An experimental study based on adaptive learning conducted by Hommes et al. 2018 examined that pessimistic expectations lead to deflationary spirals, and fiscal stimulus play effective role in avoiding expectations driven liquidity trap. Furthermore, the fiscal stimulus also has potential to accelerate the speed of convergence to the targeted equilibrium with fiscal multipliers larger than one at the ZLB.

Krugman, 1998 analyzed the liquidity trap situation of Japan to gauge the chances of occurrence of liquidity trap in the wake of recent financial crisis, and concluded, that end of depression, seems to depend on inflation expectations instead of that of temporary fiscal stimulus. However, the strategy of fiscal expansion would work over an extended period. However, Mertens and Ravn (2014) consolidated that in the state of confidence driven liquidity trap the fiscal stimulus can lead to deflationary effects and becomes ineffective, while tax cut can prove inflationary with expansionary effects. Expectations are more influential when fundamentalist economic conditions improve faster following the crisis, where past realized inflation and output values are used to form expectations about future economic conditions. Anticipated fiscal policy facilitate economic recovery, furthermore, if minimum lags are involved in the execution of expenditures, it will help to reverse expectations in the direction toward the steady state (Arifovic, 2014). Although the role of expectations in driving liquidity traps and recovery is well-documented, however, the mechanisms through which fiscal policies influence heterogeneous expectations remain inadequately addressed.

At the outset of the liquidity trap, optimal amount of government spending is negatively affected by the outstanding government debt level, and resultingly future monetary policy proves helpful in prompting the private sector expectations to reduce the fall in output and inflation (Burgert, 2013). However, active monetary policy solution can be the optimal decision when the central bank conforms a generalized Taylor (1993) rule and observes the heterogeneous nature of private sector expectations. However, the active fiscal policy can operate well when the share of agents with rational expectations is less and within the empirically relevant range (Gasteiger, 2017). Furthermore, during economic crisis the behaviour of private sector is influenced by the size and persistence of the fiscal impulse and the composition of fiscal policy measures (Giavazzi and Pagano,1996). On the other hand, the boundedly rational behavior of agents introduces an interesting dynamic where current tax cuts and transfers have an unusually stimulating effect. This is because agents exhibit partial myopia and are unable to perfectly anticipate future taxes, leading to a heightened response to present fiscal measures (Gabaix, 2018).

Benigno and Fornaro, 2015, 2017 analyzed the interplay between low productivity growth and low aggregate demand, referred to as ”Stagnation Traps.” In this scenario, expectations of low future income diminish aggregate demand, leading to a persistent liquidity trap. To address this situation, aggressive policy measures are necessary to trigger a shift in agents’ expectations regarding future growth. Eggertsson, 2008 examined the recovery regime of the United States from the Great Depression and attributed it to a crucial shift in expectations from a ”contractionary” outlook to an ”expansionary” one. The change in expectations played a substantial role in fostering economic recovery during that period. Nakata and Schmidt, 2022 studied the implications of liquidity trap driven by a decline in agents’ confidence and implied no effective policy implications in case of inflation targeting with even decline in welfare in case of stabilization through government spending. Evans and Honkapohja, 2016 developed an analysis if economic agents make forecasts using adaptive learning under the ZLB constraint. During a period of depression, an early and substantial temporary increase in government expenditure can effectively hold the economy from spiraling into deflation and stagnation. Even if expectations have already adapted to the stagnation trap, a significant temporary fiscal stimulus has the potential to rescue the economy and lift it out of the stagnant state. Government spending shocks are not necessarily correlated with persistent increase in debt-to-GDP ratios.

According to Arifovic et al., 2018 agents in the economy hold a pessimistic view regarding the central bank's capacity to effectively combat deflation. This perception gives rise to a stochastically stable environment where deflation and stagnation persist, particularly under the mechanism of social learning. Elton et al. (2018) conducted an estimation and found that a behavioral model incorporating short-horizon forecasters aligns better with the observed data. This is primarily attributed to the model's ability to capture the diverse expectations of consumers. On the other hand, long-horizon predictors demonstrate a notably weak predictive ability, highlighting the significance of considering the heterogeneity of forecasters' time horizons in capturing the dynamics of the data. Smit, 2023 conducted an empirical study for a monetary union by developing a New Keynesian model where agents form expectations as per non-fundamental factors, that are associated with the implications of fiscal policy. This study further examined that fiscal policy is highly effective in stimulating output due to its impact over the consumer sentiments.

Huang, 2019 estimated fiscal multipliers in normal times and in liquidity trap and concluded that government expenditures are above unity(moderately) in the liquidity traps and below unity in normal times. The study also examined that impact of fiscal stimulus to bring the economy out of recession is quite modest with maximum reduction in the average ZLB duration of 2 years, so in deep recession along with fiscal stimulus other combatory measures should also be used. However, Tamanyu, 2021 employed New Keynesian model with heterogeneous agents and found that a tax rule responding to inflation can prevent the economy from falling down into liquidity trap driven by expectations, by persuading the economic agents to increase labour supply when the inflation rate decreases.

Lima et al., 2023 found that counter cyclical fiscal policy is effective in mitigating liquidity trap when agents possess time-varying heterogeneous strategies to form inflation and output expectations, when fiscal policy is designed in accordance with a comprehensive policy rule. The study further emphasized that fiscal policy has definite impact over stabilization of output and inflation directly through aggregate demand formation and indirectly through management of heterogenous expectations.

Khalid et al., 2007 estimated that for the case of Pakistan government expenditure are anti-cyclical in recessions however they have insignificant impact in booms, while tax policy is pro-cyclical in both states of depression and boom. Goemans 2023 studied the economic situations in the Euro area countries and estimated that in the times of economic uncertainty, government investment and government consumption escalation has larger impression on output than in normal times. Kocherlakota, 2022 studied fiscal policy stabilization heterogeneous agent New Keynesian (HANK) model and found that in existence of high debt fiscal policy shock is quite effective to stabilize either inflation or output. However, in this situation monetary policy fails to stabilize output and inflation at all. The studies recognize variability in fiscal multipliers across economic contexts however, there is limited understanding of how structural differences, such as labor market dynamics or financial systems, influence these outcomes. Piergallini, 2021 studied the finite horizon model and a ZLB liquidity trap and found that debt targeting rules increase chances of self-fulfilling liquidity trap as it will increases the austerity expectations of the agents. Furthermore, implementing sustainable fiscal policies such as well-balanced tax cuts or increased transfers in response to disinflationary trends can effectively navigate liquidity traps and promote inflation, thereby assisting in the mitigation of such traps.

The literature review in this section seeks to address the research gaps by investigating the differential impacts of fiscal policies under varying macroeconomic conditions, such as liquidity traps and periods of high debt; exploring the dynamic interplay between fiscal interventions and expectations, with a focus on behavioral heterogeneity among economic agents and proposing a framework for optimizing fiscal policy design in conjunction with monetary measures to enhance macroeconomic stability. The interaction between fiscal and monetary policies, particularly in high-debt economies, remains underexplored. The potential for active monetary policies to complement or substitute fiscal interventions needs further empirical validation.

3.3 Model

The model is based on Keyensian Economic Framework. There is a continuum of household $i \in [0, 1]$ who gains utility from consumption and leisure and a continuum of firms $j \in [0, 1]$ who are determined to maximize their profits. In the economic model being described, there are two distinct kinds of households and firms. The first fraction of agents α formulate their expectations in a backward-looking mode. The second fraction of agents $1 - \alpha$, formulate their expectations in a forward-looking mode. In addition, the model utilizes both monetary and fiscal policy tools to impact the economy.

3.3.1 Households

The model focuses on households' planning for a limited number of future periods. Nevertheless, households also consider their wealth at the conclusion of their planning period (T+1 periods). Their primary objective is to boost their expected discounted utility throughout their planning periods (T), while adhering to a standard consumer budget constraint. According to Woodford, 2019 and Lustenhouwer and Mavromatis,2017 the objective function of households consists upon utilities $U(.)$, which capture the satisfaction derived from consumption and labour during the periods within their planning horizon. Additionally, there is an additional term involving a value function $V(.)$ that increases due to increases in the end of the planning horizon wealth. The household utility function can be expressed as follows:

$$E_t^i \sum_{s=t}^{t+T} \beta^{s-t} \xi_s u(C_s^i, H_s^i) + \beta^{T+1} V \left(\frac{B_{t+T+1}^i}{P_{t+T}} \right) \tag{3.1}$$

subject to

$$(1+\tau_\tau^c) P_\tau C_\tau^i + \frac{B_{\tau+1}^i}{(1+i_\tau)} \leq (1-\tau_\tau^l) W_\tau N_\tau + B_s^i + P_\tau LS_\tau + \Xi_\tau \tag{3.2}$$

where $\tau = t, t+1, ...t+T$

where H_t^i is households working hours and C_t^i is households consumption index. B_t^i are niminal bond holdings by the households at the start of their planning period t. $\beta \in [0,1]$ is the inter-temporal discount factor that describes the time preference, while E_t^i is the type-specific expectation operator of households at time t. Nominal interest rate is defined as i_τ. $\Xi_{h,s}$ are real dividends received by domestic firms that are uni-formally distributed among the households. Furthermore τ_τ^c and τ_τ^l are consumption tax and labour tax rates respectively and LS_τ denotes lump sum tax. Moreover, the value function stipulated at the end of planning horizon is defined as

$$V(x) = (1-\beta)^{-1} u \left[\frac{1}{1-\sigma} \left(\frac{\Lambda}{1+\bar{\tau}^c} + \frac{1-\beta}{1+\bar{\tau}^c} \frac{x}{\bar{\pi}} \right)^{1-\sigma} \right] \tag{3.3}$$

where $\Lambda = (1-\bar{\tau}^l)\bar{w}\bar{H} + \bar{\Xi}$ is the steady state net income. The value function and the respective constraint is given as under

$$V(x) = max_c U(C, \bar{H}) + \beta V(x') \tag{3.4}$$

subject to:

$$x' = \frac{\bar{\pi}}{\beta} \left[(1-\bar{\tau}^l)\bar{w}\bar{H} + \bar{\Xi} - \bar{L}S - (1+\bar{\tau}^c)C \right] \tag{3.5}$$

In line with Woodford (2018), the formulation of the value function assumes that wages, working hours, price level, interest rates, taxes and profits are at equilibrium. Consequently, the only variables that change within the optimization of the value function are consumption and debt. An additional assumption is made that agents lack the sophistication to anticipate how their decisions regarding consumption after the planning horizon would impact variables such as hours worked, wages, inflation, interest rates, and profits. The assumption is made that households adhere to the Constant Relative Risk Aversion (CRRA) function for both consumption and labor, implying that

$$U(C_s, N_s) = \frac{(C_s^i)^{1-\sigma}}{1-\sigma} - \frac{(H_s^i)^{1+\eta}}{1+\eta} \tag{3.6}$$

Where σ and η are the inter-temporal substitution elasticity and labor-leisure choice elasticity, respectively. The optimization condition with respect to consumption, labor and bonds respectively are given as under:

$$\xi_\tau (C_\tau^i)^{-\sigma} = \lambda_\tau^i (1+\tau_\tau^c) \tag{3.7}$$

$$(C_\tau^i)^\sigma (H_\tau^i)^\eta = \frac{1-\tau_\tau^l}{1+\tau_\tau^c} w_\tau \tag{3.8}$$

$$\lambda_\tau^i = \beta \tilde{E}_\tau^i \frac{(1+i_\tau)\lambda_{\tau+1}^i}{\pi_{\tau+1}^i} \tag{3.9}$$

$$\lambda_{t+T}^i = \frac{\beta(1+i_{t+T})}{\bar{\pi}(1+\bar{\tau}^c)} \left[\frac{\Lambda}{(1+\bar{\tau}^c)} + \frac{1-\beta}{1+\bar{\tau}^c \bar{\pi}} \left(\frac{B_{t+T+1}}{P_{t+T}} \right)^{-\sigma} \right] \tag{3.10}$$

Equation (3.7) is the consumption optimality condition and Equation (3.8) is the optimal condition for work hours, stating that the optimal labor-leisure choice stipulates that the marginal rate of substitution between consumption and working hours equals the real wage. While, equation (3.9) is the optimal equation for governing purchases of bonds. The real bond holdings are introduced in the model, scaled by steady state output ($b_t = \frac{B_t}{P_{t-1}\bar{Y}}$). Plugging this equation in equation (3.10) and (3.3)

$$\lambda_{t+T}^i = \frac{\beta(1+i_{t+T})}{\bar{\pi}(1+\bar{\tau}^c)} \left[\frac{\Lambda}{(1+\bar{\tau}^c)} + \frac{1-\beta}{1+\bar{\tau}^c} \left(\frac{\bar{Y} b_{t+T+1}}{\bar{\pi}} \right)^{-\sigma} \right] \tag{3.11}$$

and

$$(1+\tau_\tau^c) C_\tau^i + \bar{Y} \frac{\bar{Y} b_{\tau+1}}{1+i_\tau} \leq (1-\tau_\tau^l) w_s H_s^i + \bar{Y} \frac{b_\tau^i}{\pi_\tau} - LS_\tau + \Xi_\tau \tag{3.12}$$

3.3.2 Firms

There is a continuation of firms $j \ln [0,1]$ operating in the monopolistic competition while while the firms set their prices as per Calvo (1983) price adjustment, where in each period $(1-\omega)$ fraction of the firms that are selected randomly to adjust prices optimally. It is further assumed that firms are operated by the same households that are stated in the above section. Thus, firm owners utilize the same prediction heuristic as households for anticipation in each period. The objective of each firm is to maximize its profit by leveraging variations in prices and using the following linear technology function

$$Y_t(j) = H_t(j) \tag{3.13}$$

It is assumed about the firms that the producers are short sighted as they formulate expectation sbaout future marginal cost and price of their goods until T periods only. However, just like the households, they are concerned about their likelihood and state of profits upon termination of their planning horizon. Hence, firms that have the ability to adjust their prices strive to boost the discounted value of their profits over the planning periods (T) periods, taking into account the anticipated value of their state at the conclusion of the planning horizon. The profit function of these firms can be expressed as follows:

$$\tilde{E}_t^j \left(\sum_{s=0}^{T} (\omega\beta)^s \lambda_{t+s}^j \left[(\frac{p_t(j)}{P_{t+s}})^{1-\theta} Y_{t+s} - (\frac{p_t(j)}{P_{t+s}})^{-\theta} mc_{t+s} Y_{t+s} \right] + \omega^{T+1\beta} \tilde{V}(\frac{p_t(j)}{P_{t+T}}) \right) \tag{3.14}$$

where λ_{t+s}^j is the is lagrange multiplier associated with the household that runs firrm "j". Following Woodford (2018), the value function is characterized as a function of the relative price, representing the future utility-based continuation value of actual profits.

$$\tilde{V}(r) = \frac{1}{1-\omega\beta\bar{\pi}^{\theta-1}} \bar{\lambda} (\frac{r}{\bar{\pi}})^{1-\theta} \bar{Y} - \frac{1}{1-\omega\beta\bar{\pi}^{\theta-1}} \bar{\lambda} (\frac{r}{\bar{\pi}})^{1-\theta} \bar{Y} \bar{m}c \tag{3.15}$$

$$\begin{aligned} \tilde{E}_t^j \sum_{s=0}^{T} (\omega\beta)^s \frac{\lambda_{t+s}^j}{P_{t+s}} Y_{t+s} \left[(1-\theta)(\frac{p_t(j)}{P_{t+s}})^{-\theta} + \theta (\frac{p_t(j)}{P_{t+s}})^{-1-\theta} mc_{t+s} \right] + \omega^{T+1} \beta^{T+1} \frac{\bar{\lambda}}{\bar{\pi} P_{t+T}} \bar{Y} \\ \left[\frac{1-\theta}{1-\omega\beta\bar{\pi}^{\theta-1}} (\frac{p_t(j)}{\bar{\pi} P_{t+T}})^{-\theta} + \frac{\theta \bar{m}c}{1-\omega\beta\bar{\pi}^{\theta}} (\frac{p_t(j)}{\bar{\pi} P_{t+T}})^{-1-\theta} \right] = 0 \end{aligned} \tag{3.16}$$

3.3.3 Government Budget Constraint

The government issues bonds B_{t+1} levies τ_t^l labour tax, τ_t^c consumption taxes, and LS_tlump sum taxes, to finance government expenditure. The governmnet budget constraint is given as

$$\frac{B_{t+1}}{1+i_t} = B_t + P_t G_t - \tau_t^c P_t C_t - \tau_t^l W_t H_t - P_t LS_t \tag{3.17}$$

$b_t = \int B_t di$ is the aggregate bonds holdings, $H_t = \int H_t di$ aggregate labour. Dividing by $\bar{Y} P_t$ yields

$$\frac{B_{t+1}}{1+i_t} = \frac{b_t}{\pi_t} + g_t - \frac{\tau_t^c C_t}{\bar{Y}} - \frac{\tau_t^l w_t H_t}{\bar{Y}} - \frac{LS_t}{\bar{Y}} \tag{3.18}$$

where $b_t = \frac{B_t}{P_{t-1}\bar{Y}}$ and $g_t = \frac{G_t}{\bar{Y}}$ are debt-to-GDP ratio and Government spending to GDP ratio respectively.

Market clearing condition is stated as under

$$Y_t = C_t + G_t = C_t + \bar{Y} g_t \tag{3.19}$$

It is assumed in the model g_t, τ_t^l and τ_t^c ccan be adjusted at the government's discretion to alleviate liquidity traps. Government uses lump sum taxes LS_t to stabilize debt. The Taylor rule defines monetary policy, stipulating that the domestic interest rate systematically adjusts in response to domestic inflation and output.

$$1 + i_t = max\left(1, (1+i_t)\frac{\pi_t}{\bar{\pi}}^{\Phi_1}(\frac{Y_t}{\bar{Y}})^{\Phi_2}\right) \tag{3.20}$$

where $\bar{\pi}_t$ is the target inflation rate which is assumed to coincide with steady state domestic inflation. While Y_t is output level and $\bar{Y}$ is steady state domestic output. Parameters Φ_1 and Φ_2 show the central bank preferences about domestic inflation and output gap respectively.

3.4 Fiscal policy effectiveness in a liquidity trap

3.4.1 Expectations

This research presupposes the existence of two types of agents, namely those with a backward-looking perspective and those with a forward-looking perspective. The Forward-looking agents possess rational expectations while backward-looking agents make their economic decisions based on the most recent observation of all economic variables, considering it as the most reliable information set available. The backward looking agents assess the ongoing economic affairs and future evolution of economic conditions by placing more importance on recent observations and less emphasis on earlier ones. Furthermore, they anticipate that the economy will not remain in its current state for an extended period but instead perceive a movement towards the optimal equilibrium in the future.

The backward looking agents formulate expectations for instance regarding government spending as under

$$E_t^b \tilde{g}_{t+s} = \rho^{s+1} \tilde{g}_{t-1} \tag{3.21}$$

This particular expectation pattern is referred to as adaptive expectations. Backward-looking agents apply the same approach when formulating their expectations regarding macroeconomic variables.

It is further assumed in the study that inflation and output expectations of backward-looking agents are prone to shock, ϵ_t, and this shock affect the expectation patterns of all agents equally. After integrating shocks, the inflation and output expectations of all agents with a backward-looking perspective undergo the following transformation

$$E_t^b \hat{Y}_{t+s} = \rho^{s+1}(\hat{Y}_{t-1} + \hat{\epsilon}_t), \tag{3.22}$$

$$E_t^b \hat{\pi}_{t+s} = \rho^{s+1}(\hat{\pi}_{t-1} + \hat{\epsilon}_t) \tag{3.23}$$

3.4.2 Liquidity trap

The foundation of the model lies in the acknowledgment that the economy comprises of two sorts of agents, namely backward-looking agents and forward-looking agents. This diverse composition of agents gives rise to various scenarios where the liquidity trap can be driven by fundamental shock, expectations driven shock, or a combination of both.

Under the scenario of fundamental liquidity trap it is assumed that all agents are forward-looking and possess rational expectations. In Equation 3.1, the variable ξ_t represents an exogenous persistent shock to preferences. In contrast, liquidity traps driven by expectations can occur when there is a substantial proportion of backward-looking agents in the economic system. Furthermore, it is assumed that the agents experience a negative shock to their expectations and this shock is also non-persistent. Such liquidity trap is introduced in the form of ϵ_t in equations (3.22) and (3.23). In case of mixed liquidity trap, the initial decline in expectations can be attributed to a single, non-persistent shock to fundamental factors. The economy may endure a protracted fundamental shock, and some of the players inside it may be backward-looking, which can result in mixed liquidity traps. In such cases, the persistent fundamental shock leads to the emergence of a liquidity trap that spans multiple periods. However, the intensity and time span of the liquidity trap are exacerbated by the pessimistic expectations of backward-looking agents.

3.4.3 Parametrization

In this model, the parameter values of the model have been taken from the prevailing theoretical and empirical literature for Pakistan. In this context, one period corresponds to one quarter. The finite horizon in the model corresponds to a horizon at T=4. The quarterly discount factor β is set to 0.99, inverse elasticity of labour supply η is 1.12 following (Ahmed et al., 2017), estimate of inverse elasticity of intertemporal substitution in consumption σ is 1 (Haidar et al., 2008).

The value of price stickiness Calvo parameter is set as 0.7 following Tufail and Ahmed, 2022. The parametric values for the monetary policy reaction function defined Φ_π is 1.5 and output growth coefficient Φ_y is 0.25 folowing (Haidar et al., 2008). The steady state fiscal variables are determined based on historical averages in Pakistan, adhering to the following specifications: government expenditure as a percentage of GDP is set at 0.2, the consumption tax steady state value is confined to 0.17, and the labour tax steady state value is 0.05 as per the findings of Ahmed et al.,2016.

3.4.4 Durations of liquidity trap

In this section, the relative effectiveness of fiscal policy indicators is assessed to mitigate liquidity trap. This analysis is done by assessing the time span of liquidity trap and presence of deflationary spiral. The analysis consists upon the cases where the planning horizon of the agents is finite as T=4 and the economy is affected by persistent fundamental shock as well as non-persistent shocks to expectations. To investigate the impression of fiscal policy on the time scale of fundamental driven liquidity trap, expectations driven liquidity trap and mixed liquidity trap, the first scenario demonstrates no fiscal stimulus in figure 3.4.1 and then the impact of government expenditure rise, labour tax cut and consumption tax cut have been discussed in figure 3.4.2, 3.4.3, and 3.4.4 respectively.

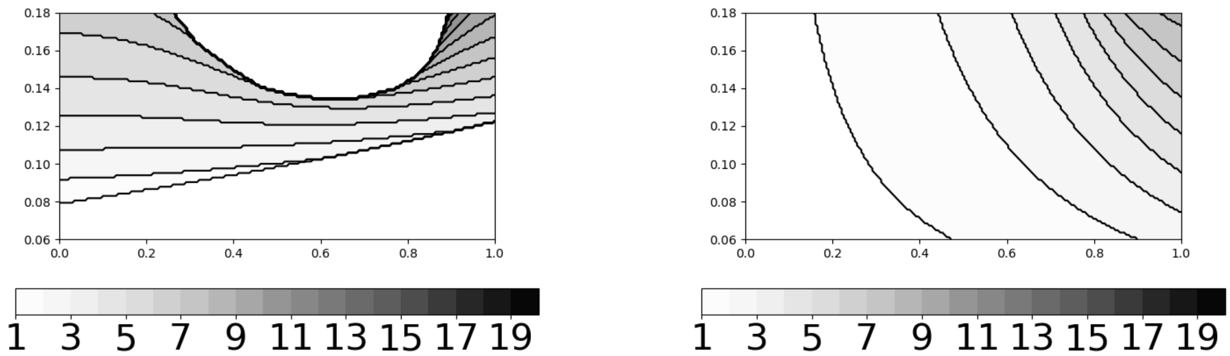
Figure 3.4.1 panel (a), illustrates the time span of the fundamental-driven liquidity trap when planning horizon consists of 4 periods (T=4). The horizontal axis represents the fragment of backward-looking agents, while the vertical axis represents the magnitude of preference shock (in absolute value). The figure illustrates that when the shock size is very small the zero lower bound is not binding and there is no indication of liquidity trap. However, as the shock size as well as the portion of backward-looking agents increase (towards the right side of the panel), the duration of the liquidity traps becomes longer, as indicated by the color of the plots. The inner section of the graph symbolizes mixed liquidity traps. It signifies that when there is a considerable proportion of backward-looking agents, coupled with a substantial shock size, a deflationary spiral ensues, as denoted by the white area at the peak of the panel. In such situations, the economy fails to recover from this crisis.

The examination of the duration of liquidity traps reveals that in all three types of liquidity traps, a higher proportion of backward-looking agents corresponds to deflationary spirals. This occurs when there is low inflation and low output and backward-looking agents anticipate a considerable decline in macro-economic indicators in the future. This pessimistic outlook perpetuates a continuous decrease in inflation and output in subsequent periods, creating a downward spiral where inflation and output continue to decline progressively.

Panel (b) of Figure 3.4.1 corresponds to the scenario when there is a negative shock affects the inflation and output expectations of the agents. Inside the figure, darker shades of gray represent longer spans of liquidity traps. In that instance of expectations-driven liquidity traps, the presence of a small fragments of backward-looking agents does not result in a liquidity trap even in presence of larger shock size. However, as the portion of backward-looking agents increases, liquidity traps start to emerge. Accordingly, expectations-driven liquidity traps persist for short run but do not escalate into a deflationary spiral.

Figure 3.4.2 examines the time scale of the liquidity trap in presence of an expansion in government spending. Panel (a) demonstrates that in presence of fundamental shock, a rise in government expenditures. proves to be highly effective, promptly resolving the liquidity trap. On the other hand, Panel (b) pertains to the matter of an expectations-driven liquidity trap. It shows that with small segments of backward-looking agents the economic system does not experience liquidity trap. This indicates that fiscal policy is highly effective in mitigating even expectations-driven liquidity traps. This underlines the fact that in this scenario, the liquidity trap problem rapidly disappears when the stimulus plan is put in place.

In Panel (a) of Figure 3.4.3, the duration of a liquidity trap is depicted when a labor tax is implemented. The graph illustrates that even with a small shock and a small proportion of backward-looking agents, the presence of a fundamental-driven liquidity trap results in longer periods of trap, as indicated by the darker shades on the graph. Furthermore, when the percentage of agents who are looking backward rises, the economy experiences a deflationary cycle, making labor tax reductions inefficient at boosting the economy. In Panel (b) of Figure 3.4.3, it is evident that the introduction of a labor tax cut in the economy prevents liquidity traps from occurring for small proportions of backward-looking agents. However, as the proportion of backward-looking agents increases, prolonged liquidity traps emerge, leading to deflationary spirals similar to those observed in Panel (a). Nonetheless, it is worth noting that the duration of the deflationary spiral is shorter in the case of an expectations-driven liquidity trap. The completely white areas in the figures symbolize these deflationary spirals. This observation highlights that labor tax cuts fail to



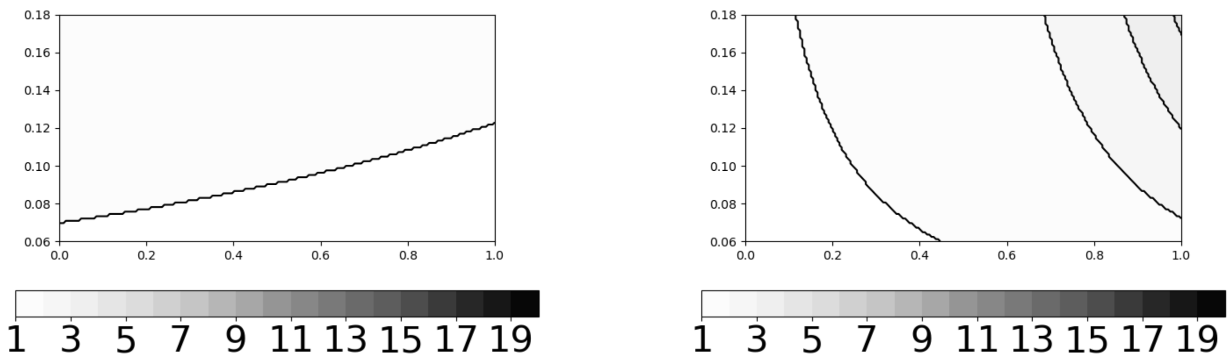
(a) (b)

Figure 3.4.1: Duration of liquidity traps in presence of finite planning horizon (T = 4). Panel (a) depicts both fundamentals-driven and mixed liquidity traps, while Panel (b) depicts expectations-driven liquidity traps.

improve economic conditions when a liquidity trap is present. Instead, when the proportion of backward-looking agents is further increased, an irreversible deflationary spiral occurs, resulting in a state from which the economy cannot recover. In Figure 3.4.4, Panel (a) demonstrates the effectiveness of a consumption tax in mitigating fundamental driven liquidity traps. Panel 4(b) indicates that in case of non-persistent driven liquidity trap and implementing a consumption tax cut resolves the issue of liquidity traps in the initial period of its implementation. Liquidity traps don't even last longer when dealing with higher proportions of agents that look backward. This suggests that the introduction of a consumption tax cut effectively addresses the challenges posed by liquidity traps, allowing for a swift resolution and preventing prolonged periods of trap.

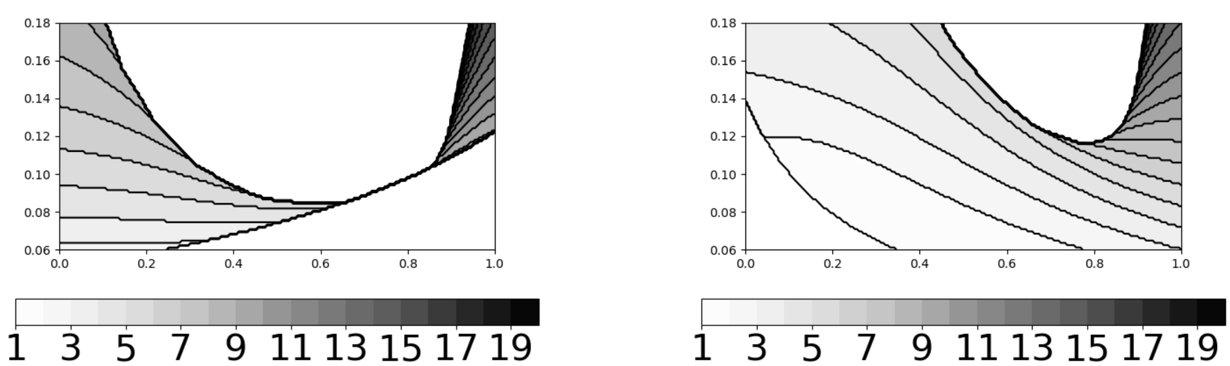
3.5 Impulse response function

Impulse response functions are a valuable tool in econometrics for understanding how economic variables respond over time to a fiscal shock in the system. This analysis is helpful to analyze the impact of fiscal policy instruments in the finite and very long planning horizons.



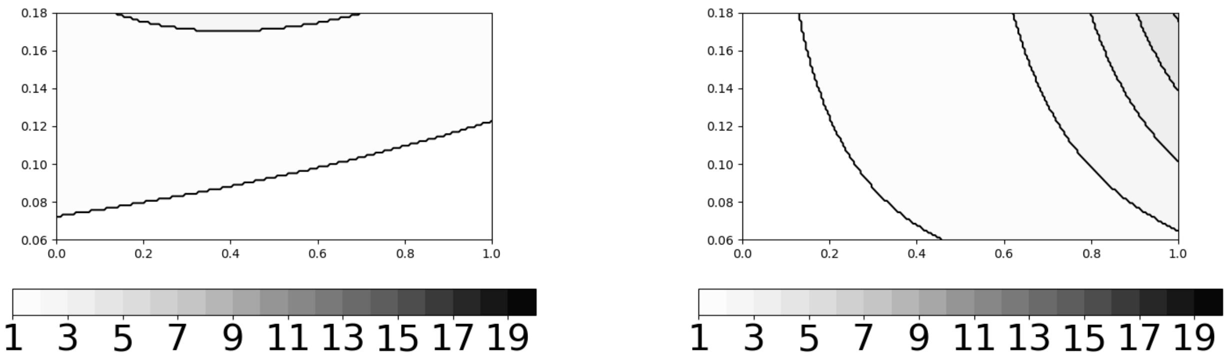
(a) (b)

Figure 3.4.2: Duration of liquidity traps in presence of finite planning horizon (T = 4). Panel (a) depicts both fundamentals-driven and mixed liquidity traps, while Panel (b) depicts expectations-driven liquidity traps in case of government spending increases



(a) (b)

Figure 3.4.3: Duration of liquidity traps in presence of finite planning horizon (T = 4). Panel (a) depicts both fundamentals-driven and mixed liquidity traps, while Panel (b) depicts expectations-driven liquidity traps in case of labour tax cut



(a) (b)

Figure 3.4.4: Duration of liquidity traps in presence of finite planning horizon (T = 4). Panel (a) depicts both fundamentals-driven and mixed liquidity traps, while Panel (b) depicts expectations-driven liquidity traps in case of consumption tax cut

3.5.1 Ineffectiveness of labour tax

The impact of labour tax cut when the existing proportion of backward-looking agents is 25 percent in the economy has been analyzed in the figure 3.5.1. The orange curves depict the impact of labour tax cut on the economic indicators while the blue curves represent the scenario of no fiscal stimulus. The analysis of liquidity trap duration discussed above in section (3.4.4) has already indicated that labour tax is ineffective to mitigate liquidity trap and even ends the economy into deflationary spiral. The impact of labour tax cut proves useless in both fundamental driven liquidity trap and expectations driven liquidity trap.

The analysis is expanded by estimating the impulse response functions to evaluate how a labor tax cut affects various other macroeconomic indicators. First examining the blue curves, it is revealed that in absence of fiscal stimulus, negative preference shock becomes the cause of decline in output. Furthermore, the decline in overall economic activities became cause of decline in labour demand, wage rate and inflation. The sharpest decline in output, inflation, wages and consumption is till the first period after the negative preference shock hits the economy. Afterwards the economy starts to recover and approach steady state without any stimulus.

The orange curves describe the situation when after the shock the labour tax stimulus is introduced after the outbreak of expectations driven liquidity trap. Here the situation describes that after the labour tax cut the nominal income from work goes up as the labour get more money for each working hour. Thus the agents increase the labour supply and the real wage declines. Lower real wages became cause of decline in marginal cost and puts deflationary pressure. Accordingly, it is examined that fiscal stimulus in the shape of labour tax cut incites further decline in wages and inflation. This lower pressure on inflation drive the higher real interest rate and decline in aggregate demand and consumption. Our results for labour tax cut are in line with Bagis, 2017 and Lustenhouwer, 2020. The study by Eggertsson, 2011 found similar results in case of labour tax cut and described that a labor tax cut is expansionary during normal times, however, it becomes contractionary in a liquidity trap. This shows that the impact of labour tax cut on inflation and output depends on the relevant labour supply and wage indicators. Finally, the impact of labour tax cut on the economic activities reveals that the labour tax cut fails to simulate the economic activities and revive the economy from the circle of liquidity trap.

The decreasing trend in wages and consumption is also attributed to the pessimistic expectations of the backward-looking agents towards inflation and output. Here the forward-looking agents expect that in future there will be further decline in output and prices and increase in real interest rate, so they limit their consumption and investment expenditures even before the implementation of fiscal stimulus. This pessimistic anticipation of the agents crates further declining trend for output and prices. Thus in expectations driven liquidity trap, the forward-looking as well as backward-looking agents anticipate further decline in output and inflation in future and this expectations dynamic pushes the economy in deflationary spiral.

3.5.2 Effectiveness of government expenditure and consumption tax

In this section, the efficacy of fiscal policy is examined when government expenditure increase and consumption tax cut are introduced in the liquidity trap. The case is analyzed when agents are equally segmented into backward looking agents and forward looking agents. The orange and green curves depict the influence of government expenditure shock and consumption tax shock respectively on the economic indicators. The blue curves represent the scenario of no fiscal stimulus.

In figure 3.5.2 the curves of no fiscal stimulus (blue curves) states that when the economy is stuck in the liquidity trap and no fiscal intervention is introduced then the economy will take almost 10 periods to revive back to normal automatically. It is noteworthy that in Figure 3.5.1, the economy reached the steady state level more quickly when there was no fiscal stimulus compared to the scenario depicted in Figure 3.5.2 without fiscal stimulus. This discrepancy can be attributed to the larger proportion of backward-looking agents in Figure 3.5.2. The increased presence of backward-looking agents implies that future expectations are influenced by past economic trends. Consequently, economic activities struggle to stabilize, resulting in a prolonged recovery period in the absence of fiscal stimulus.

In figure 3.5.2, the decline in inflation in the period 2 is high as compared to the inflation decline situation in figure 3.5.1. This is owing to the larger proportion of backward-looking agents who keeping in view the declining trend of inflation in the last period, formulate expectations of further decline in inflation. This situation paved the way for fiscal intervention in the economy that reduce the duration of liquidity trap considerably and increase output and inflation.

The orange curves depict that after outbreak of negative expectations shock the government

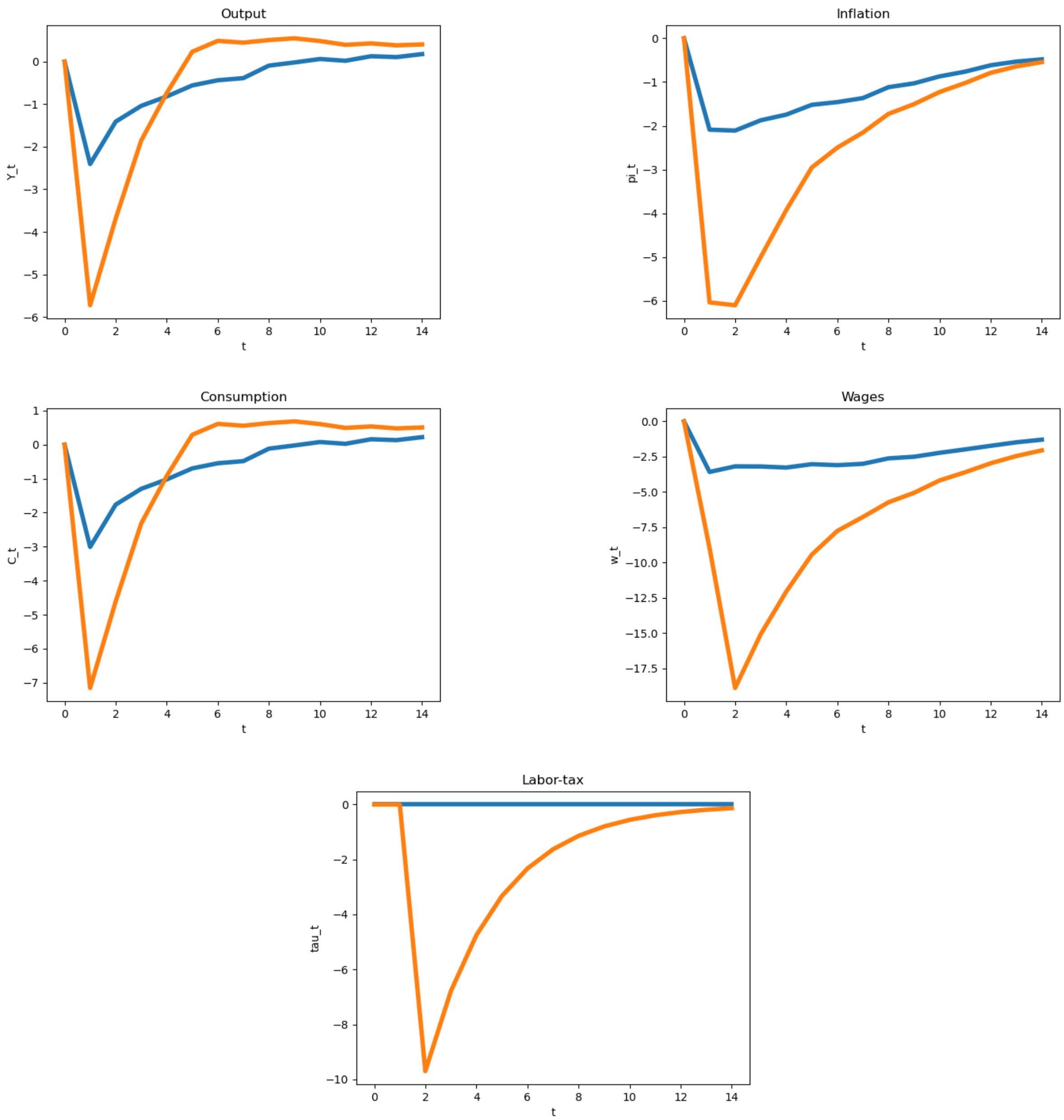


Figure 3.5.1: Mixed liquidity trap for $T = 4$, $\xi = 0.08$ and 25 percent backward-looking agents. The orange curves shows fiscal stimulus in the form of labour tax cuts while blue curves represents the case of no fiscal stimulus.

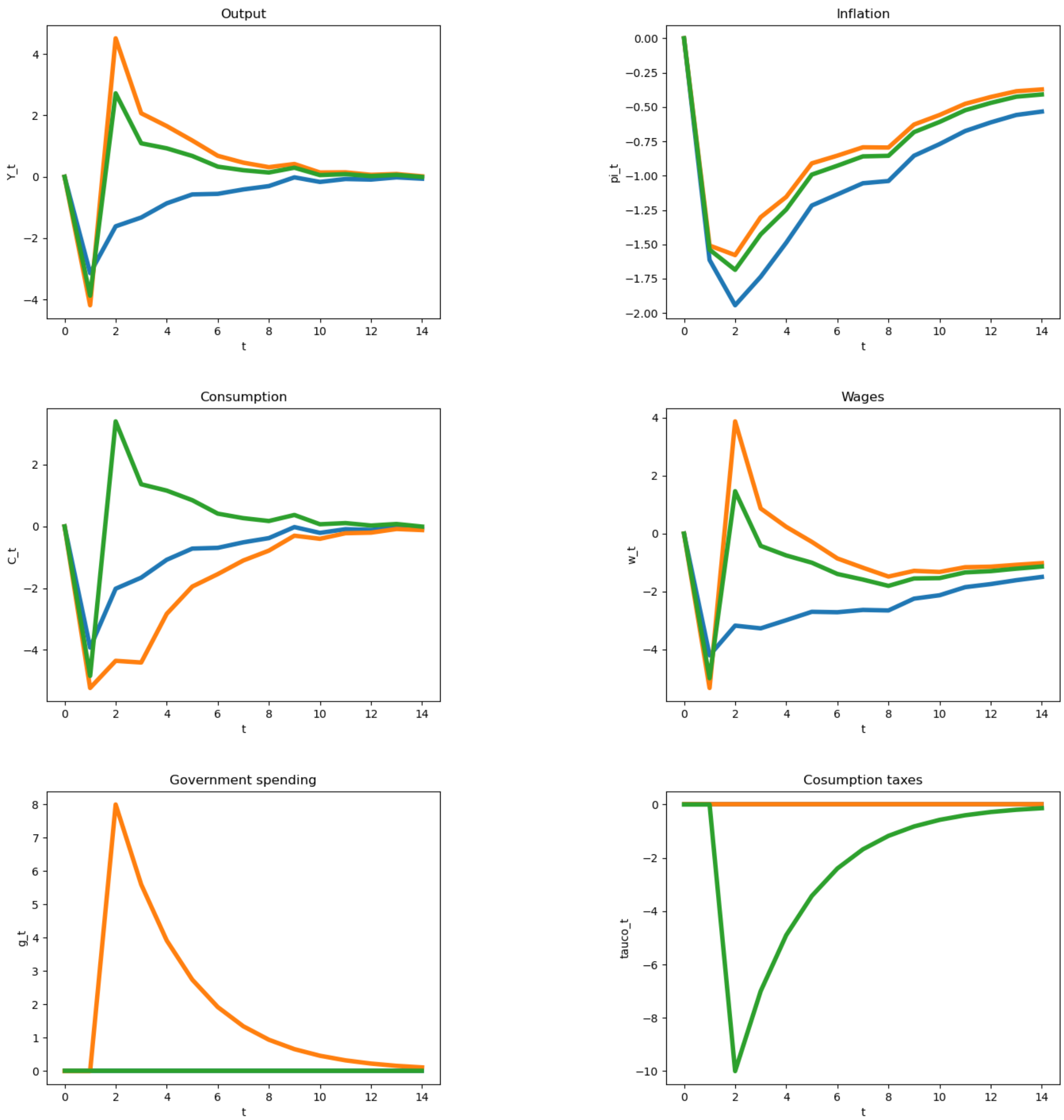


Figure 3.5.2: Mixed liquidity trap for $T = 4$, $\xi 1 = 0.08$ and 50 percent backward-looking agents. The orange and green curves represent fiscal stimulus in the form of government expenditure and consumption tax respectively, while blue curves represents the case of no fiscal stimulus

spending stimulus is introduced after one period. Increase in government spending raises output level significantly. The rise in output is also supported by the positive government spending multiplier, later discussed in Section 5. Woodford, 2011; Erceg and Lind´e, 2014 and Lustenhouwer, 2020 estimated that the positive impact of rise in government expenditure is due to the large fiscal multiplier in liquidity trap. Due to expansion in government spending and resulting aggregate demand, there is rise in labour demand and vivid rise in wages. The agents anticipate rise in taxes to compensate for this fiscal expansion, so they increase labour supply to smooth lifetime consumption. Accordingly, negative wealth effect on consumption is found that pushes the consumption to decline in result of rise in government expenditure, however this fall in consumption is less than that of in case of no fiscal stimulus. Our findings of rise in government expenditure are are in line with Bonam et al., 2020 and Eggertsson, 2011. The decline in prices and involvement of long periods for inflation to reach steady state, is due to the pessimistic behaviour of the higher proportion of backward-looking agents in the considered simulation.

The green curves depict the consumption tax cut when interest rate is binding. This consumption tax cut stimulates aggregate demand and output that ultimately leads to rise in labour demand and wages and resulting increase in inflation. The impact of labour tax cut is positive and mainly it plays its role by stimulating the consumption expenditures of the agents. However, still the positive impact of consumption tax cut on output is less than that of government expenditure rise. This result further confirms that in Pakistan economy the impact of positive government expenditure surpasses all other fiscal policy indicators in the situation of liquidity trap.

3.5.3 Fiscal Multipliers

In this section, the usefulness of fiscal stimulus is examined during a liquidity trap taking into account diverse expectations among agents. Our approach to estimating multipliers during a liquidity trap aligns with Lustenhouwer, 2020. The fiscal multipliers are calculated for varying proportions of backward-looking agents, considering both persistent fundamental-driven liquidity traps and non-persistent expectations-driven liquidity traps. To ensure comparability, the multipliers are calculated based on a marginal change in the fiscal instrument that does not influence the time span of the liquidity trap. Following the methods of Bi et al., 2013 and Mountford and Uhlig, 2009 the multipliers are computed as under

$$\Gamma_{t+k} = \sum_{j=0}^{k} \left(\Pi_{i=0}^{j} r_{t+i}^{-1}\right) \left(Y_{t+j}^{s} - Y_{t+j}^{ns}\right) / \sum_{j=0}^{k} \left(\Pi_{i=0}^{j} r_{t+i}^{-1}\right) \left(x_{t+j}^{s} - x_{t+j}^{ns}\right) \tag{3.24}$$

where r_t is the interest rate, and x_t denotes the type-specific fiscal stimulus defining as $x_t = G_t$ in scenario of government spending increases, $x_t = \tau_t^c \bar{C}$ in matter of consumption tax cuts, and $x_t = \tau_t^l w \bar{H}$ in situation of labor tax cuts. Y_t^s and x_t^s indicate values taken when there is fiscal stimulus and Y_t^{ns} and x_t^{ns} indicate values that would have appeared in the absence of fiscal stimulus.

Table 3.5.1 corresponds to the details of the multipliers when T=4 with the shock size=0.08 and when the agents are facing fundamental driven liquidity trap, while table 2 corresponds to the details of the multipliers when T=4 with the shock size=0.11 in presence of expectations driven liquidity trap. The results of multipliers in both cases describe that government expenditure increase is effective tool to increase output and inflation in the presence of liquidity trap, indicating that values of multipliers are close to one in Pakistan. The impact of consumption tax cut is also effective; however, the values of consumption tax multipliers are less than that of government expenditures

Table 3.5.1: T=4 and persistent negative fundamental shock (of size 0.08)

Frac. BL agents	Govt. spending	Consumption tax	Labour tax
0	0.81	-0.57	-0.17
0.25	0.71	-0.50	-0.16
0.5	0.77	-0.54	-0.12
0.75	0.81	-0.57	-0.08
0.875	0.82	-0.58	-0.07
1	0.84	-0.59	-0.06

Table 3.5.2: T=4 and non-persistent negative fundamental shock (of size 0.11)

Frac. BL agents	Govt. spending	Consumption tax	Labour tax
0	0.64	-0.45	-0.19
0.25	0.71	-0.50	-0.16
0.5	0.74	-0.54	-0.08
0.75	0.78	-0.57	-0.06
0.875	0.80	-0.70	-0.02
1	0.99	-0.71	-0.01

(in absolute value). The rise of output in Figure 3.5.1 also imply that in case of Pakistan increase in government expenditure is more simulative. The multipliers for labor taxes indicate that labour tax cut fails to increase output and inflation as impact multipliers are approximately zero. The labor tax multipliers have negligible impact on output and inflation in both scenarios of expectations-driven as well as mixed liquidity traps. The values of government spending multipliers in case of Pakistan are close to one, however Huang and Vu, 2019 estimated fiscal multipliers in liquidity trap and in normal times for US economy and found that the values of government expenditure multipliers are greater than unity over in both normal times and in liquidity trap. Ramay and Zubairay, 2014 estimated for the US economy and found no evidence that multipliers are greater at liquidity trap.

The analysis of the government expenditure and consumption tax multipliers enforce that as the portion of backward-looking agents increases, the multiplier values increase. This result is inline with Lustenhouwer, 2020. This describes that initially due to increase in government expenditure and decline in consumption tax there is impact increase in output and inflation. The fiscal stimulus will elevate the expectations of backward-looking agents in the subsequent period, thereby boosting aggregate demand to counteract the effects of a liquidity trap through a feedback mechanism. The higher the proportion of backward-looking agents in the economy, the higher will be the increase in output in later periods. Forward-looking agents possess rational expectations so they anticipate this trend in advance and became more optimistic by now at the initiation of the liquidity trap.

This essay analyzes the effectiveness of fiscal policy within the context of a liquidity trap, employing a deliberately simplified general equilibrium model focused on Pakistan. To enhance analytical manageability, the assumption that prices are rigid is employed to depict a more typical and realistic scenario involves price stickiness. Notably, heightened price stability can have destabilizing effects in a liquidity trap, as highlighted by Eggertsson (2010). The incorporation of price stickiness provides valuable insights, expanding the applicability of the results. Moreover, the stability of the liquidity trap under a finite planning horizon seems resilient to changes in parameters. The results of the model are robust regarding the signs of the IRFs of the model's variables, due to changes in the monetary policy parameters. The results of this essay further indicate that the positive government expenditure stimulus is a robust feature of the optimum for this model. This is because increases in government spending not only influence private consumption but also impact the inflation trajectory, thereby fostering price stability.

3.6 Conclusion

Fiscal policy plays a vital role in revitalizing the economy and mitigating the adverse effects of a prolonged economic downturn and liquidity trap. By stimulating overall economic activity, it can also promote aggregate investment through increased public investment and the crowding in of private investment. In addition, well-designed fiscal policies can enhance consumer and business confidence, fostering investment and aggregate demand.

This essay is formulated to assess the efficacy of fiscal stimulus within the framework of an expectations-driven liquidity trap. The theoretical framework of the essay is based on the New Keynesian model under bounded rationality and heterogeneous expectations, where fraction of the agents is backward looking and the rest is forward looking. The dynamics of the economy are predominantly influenced by the behavior of backward-looking agents, as they anticipate a continuation of the negative trends in output and inflation in the future. The pessimistic behavior of the backward-looking agents pushes the economy into deflationary spirals. This research will contribute significantly to the fiscal literature in Pakistan by assessing the effectiveness of fiscal policy in the context of a liquidity trap.

This study validates that increasing government expenditure and implementing decline in consumption tax are more beneficial strategies for revitalizing the economy, boosting output, and increasing price level during a liquidity trap. However, the positively significant influence of positive government expenditure shock on the economy is more than that of consumption tax cut. The reduction in labor taxes proves inadequate in boosting output and inflation, and may even worsen the likelihood of an economic deflationary spiral. Furthermore, the study provides evidence that in the scenario of a fundamental-driven liquidity trap, there is a higher likelihood of the economy falling into deflationary spirals. Conversely, the intensity of expectations-driven liquidity trap is lower, indicating a reduced likelihood of the economy entering into deflationary spirals. Moreover, the analysis of expectations in the study affirms the validation of trust in the future trajectory of the economic system regarding the efficacy of fiscal stimulus (Michail et al., 2017).

The main context of this essay is based on the assumption of heterogeneous expectations, specifying that agents form expectations about future outcomes differently based on their unique information, preferences, and behavioral biases. However, empirical validation of models with heterogeneous expectations is difficult due to limited data on individual agents' expectations and decision-making processes. Assumptions about the distribution of expectations might oversimplify real-world behaviors. Alternative formulations for future research work may employ Agent Based Modeling with interactions among heterogeneous agents with distinct rules for forming expectations. Furthermore, the models incorporating cognitive biases, differing risk tolerances, or agents grouped into regimes (e.g., optimists vs. pessimists), can provide insights into expectation heterogeneity.

A liquidity trap occurs when monetary policy becomes ineffective in stimulating the economy. Institutional inefficiencies, such as weak financial systems and delays in implementing fiscal stimulus measures, can exacerbate economic downturns and hinder stabilization efforts. To address a liquidity trap, it is crucial to establish consistent policy directions that foster certainty and confidence among economic agents, thereby encouraging private investment. Effective coordination between monetary and fiscal authorities is essential to achieve coherent and impactful policy outcomes. To address recession and liquidity traps, government authorities in Pakistan should implement targeted fiscal policy measures, such as direct cash transfers, tax rebates, and specific development and infrastructure programs. Collaboration between the central bank and the government is also essential to align policy objectives, combining monetary policy initiatives with fiscal stimulus to achieve maximum economic impact. Furthermore, in the context of heterogeneous expectations, policymakers must recognize the diversity in expectations and take them into account when formulating economic policies.

Appendix

3.A steady state

Here we estimate steady state conditions of the non-linear model assuming that preference shock is constant $\xi = 1$ at the steady state level. Derived from the consumption Euler conditions, it establishes that in the steady state

$$\frac{1+\bar{i}}{\bar{\pi}} = \frac{1}{\beta} \tag{3.25}$$

The production function at the steady state level defines

$$\bar{H} = \bar{s}\bar{Y} \tag{3.26}$$

The market clearing condition for output and domestic consumption at the steady state level is given as

$$\bar{C} = \bar{Y}(1-\bar{g}) \tag{3.27}$$

When injecting steady-state labor and consumption equations into the steady-state labor/consumption trade-off, we obtain the following results.

$$\bar{w} = \bar{m}c = \frac{(1-\bar{g})^{\sigma}(1+\bar{\tau}^{c})s^{\eta}\bar{Y}^{\eta+\sigma}}{(1-\bar{\tau}^{l})} \tag{3.28}$$

Then the aggregate output level at equilibrium is defined as

$$\bar{Y} = \left(\frac{\bar{m}c(1-\bar{\tau}^{l})}{s^{\eta}(1-\bar{g})^{\sigma}(1+\bar{\tau}^{c})}\right)^{\frac{1}{\eta+\sigma}} \tag{3.29}$$

The relative optimal price level at the equilibrium is as under:

$$\bar{d} = \left(\frac{1-\omega\bar{\pi}^{\theta-1}}{1-\omega}\right)^{\frac{1}{1-\theta}} \tag{3.30}$$

while the price dispersion is given as

$$\bar{s} = \frac{1-\omega}{1-\omega\bar{\pi}^{\theta-1}}\bar{d}^{-\theta} \tag{3.31}$$

The government budget constraint at optimal equilibrium level is as under

$$\frac{\beta\bar{b}}{\bar{\pi}} = (1+\bar{\tau}^{c})\bar{g} - \bar{\tau}^{l}\bar{s}\bar{w} - \bar{\tau}^{c} - \frac{\bar{L}S}{\bar{Y}} + \frac{\bar{b}}{\bar{\pi}} \tag{3.32}$$

Steady state profit is described as under

$$\bar{\Xi} = (1-\bar{w}\bar{s})\bar{Y} \tag{3.33}$$

3.B Log-linearized model

Log-linearized household equilibrium conditions can be expressed as follows

$$\eta\hat{H}^{i}_{\tau} = \hat{w}_{\tau} - \sigma\hat{C}^{i}_{\tau} - \frac{\tilde{\tau}^{c}_{\tau}}{1+\bar{\tau}^{c}} - \frac{\tilde{\tau}^{l}_{\tau}}{1-\bar{\tau}^{l}} \tag{3.34}$$

$$\hat{C}^i_\tau = \hat{C}^i_{\tau+1} - \frac{1}{\sigma}\left(\hat{i}_\tau - \hat{\pi}_{\tau+1} - \frac{\tau^c_{\tau+1} - \tilde{\tau}^c_\tau}{1+\bar{\tau}^c} + \xi_{\tau+1} - \xi_\tau\right) \tag{3.35}$$

$$\tilde{b}_{t+T+1} = \frac{\mu_b}{1-\beta}\hat{C}^i_{t+T} + \frac{\mu_b}{\sigma(1-\beta)}\frac{\tilde{\tau}^c_{t+T}}{1+\bar{\tau}^c} - \frac{\mu_b}{\sigma(1-\beta)}i_{t+T} - \frac{\mu_b}{\sigma(1-\beta)}\xi_{t+T} \tag{3.36}$$

$$\begin{aligned}\tilde{b}_{\tau+1} = \frac{1}{\beta}\tilde{b}^i_\tau + +\bar{b}(\hat{i}_\tau - \frac{1}{\beta}E_t\hat{\pi}_\tau) - \frac{(1-\bar{g})\bar{\pi}}{\beta}((1+\bar{\tau}^c)\hat{C}^i_\tau + \tilde{\tau}^c_\tau) + \\ \frac{\bar{w}\bar{s}\bar{\pi}}{\beta}(1-\bar{\tau}^l)((E_t\hat{w}_\tau + \hat{H}_\tau) - \tilde{\tau}^l_\tau) + \frac{\bar{\Xi}\bar{\pi}}{\bar{Y}\beta}E_t\hat{\Xi}_\tau - \frac{\bar{LS}\bar{\pi}}{\bar{Y}\beta}E_t\hat{LS}_\tau\end{aligned} \tag{3.37}$$

where $\mu_b = (1-\bar{g})(1+\bar{\tau}^c)\bar{\pi}$ Iterating the log-linearized budget constraints T periods and using the first order conditions of the households, we derive the following equation that describe the household's optimal condition for consumption in the period t

$$\begin{aligned}\left[\frac{u_b\beta^{T+1}}{1-\beta} + \left((1-\bar{g})(1+\bar{\tau}^c) + \frac{\bar{w}\bar{s}\sigma(1-\bar{\tau}^l)}{\eta}\right)\bar{\pi}\frac{(1-\beta^{T+1})}{1-\beta}\right]\hat{C}^i_t = \tilde{b}^i_t + \\ \bar{b}\sum_{s=0}^{T}\beta^s(\beta E^i_t\hat{i}_{t+s} - E^i_t\hat{\pi}_{t+s}) - (1-\bar{g})\bar{\pi}\sum_{s=0}^{T}\beta^s(E^i_t\tilde{\tau}^c_{t+s}) + \bar{w}\bar{s}\bar{\pi}(1-\bar{\tau}^l) \\ \sum_{s=0}^{T}\beta^s\left((1+\frac{1}{\eta})(E^i_t\hat{w}_{t+s} - \frac{E^i_t\tilde{\tau}^l_{t+s}}{(1-\bar{\tau}^l)}) - \frac{E^i_t\tilde{\tau}^c_{t+s}}{\eta(1+\bar{\tau}^c)}\right) - \left((1-\bar{g})(1+\bar{\tau}^c) + \frac{\sigma\bar{w}\bar{s}(1-\bar{\tau}^l)}{\eta}\right)\bar{\pi} \\ \frac{1}{\sigma}\sum_{s=1}^{T}\beta^s\sum_{j=0}^{s-1}(E^i_t\hat{i}_{t+j} - E^i_t\hat{\pi}_{t+j+1}) + \left((1-\bar{g})(1+\bar{\tau}^c) + \frac{\sigma\bar{w}\bar{s}(1-\bar{\tau}^l)}{\eta}\right)\bar{\pi}\frac{1}{\sigma}\sum_{s=1}^{T}\beta^s(\frac{E^i_t\tilde{\tau}^c_{t+s} - E^i_t\tilde{\tau}^c_t}{1+\bar{\tau}^c} \\ +E^i_t\xi_{t+s} - E^i_t\xi_t) - \beta^{T+1}\frac{\mu_b}{\sigma(1-\beta)}\sum_{j=0}^{T-1}(E^i_t\hat{i}_{t+j} - E^i_t\hat{\pi}_{t+j+1}) - \frac{\beta^{T+1}\mu_b}{\sigma(1-\beta)}\frac{\tilde{\tau}^c_t}{(1+\bar{\tau}^c)} \\ -\frac{\beta^{T+1}\mu_b}{\sigma(1-\beta)}\hat{E}^i_t i_{t+T} + \frac{\bar{\Xi}\bar{pi}}{\bar{Y}}\sum_{s=0}^{T}\beta^s E^i_t\hat{\Xi}_{t+s} - \frac{\bar{LS}}{\bar{Y}}\sum_{s=0}^{T}\beta^s E^i_t\hat{LS}_{t+s} + -\frac{\beta^{T+1}\mu_b}{\sigma(1-\beta)}\xi_t\end{aligned} \tag{3.38}$$

By summing up this equation across all households, it is possible to derive an expression for aggregate consumption that relies solely on the aggregate expectations of aggregate variables.

$$
\begin{aligned}
&\left[\frac{u_b\beta^{T+1}}{1-\beta}+\left((1-\bar{g})(1+\bar{\tau}^c)+\frac{\bar{w}\bar{s}\sigma(1-\bar{\tau}^l)}{\eta}\right)\bar{\pi}\frac{(1-\beta^{T+1})}{1-\beta}\right]\hat{C}_t=\tilde{b}_t^i+\\
&\bar{b}\sum_{s=0}^{T}\beta^s(\beta\bar{E}_t\hat{i}_{t+s}-\bar{E}_t\hat{\pi}_{t+s})-(1-\bar{g})\bar{\pi}\sum_{s=0}^{T}\beta^s(\bar{E}_t\tilde{\tau}^c_{t+s})+\bar{w}\bar{s}\bar{\pi}(1-\bar{\tau}^l)\\
&\sum_{s=0}^{T}\beta^s\left((1+\frac{1}{\eta})(\bar{E}_t\hat{w}_{t+s}-\frac{\bar{E}_t\tilde{\tau}^l_{t+s}}{(1-\bar{\tau}^l)})-\frac{\bar{E}_t\tilde{\tau}^c_{t+s}}{\eta(1+\bar{\tau}^c)}\right)-\left((1-\bar{g})(1+\bar{\tau}^c)+\frac{\sigma\bar{w}\bar{s}(1-\bar{\tau}^l)}{\eta}\right)\bar{\pi}\\
&\frac{1}{\sigma}\sum_{s=1}^{T}\beta^s\sum_{j=0}^{s-1}(\bar{E}_t\hat{i}_{t+j}-\bar{E}_t\hat{\pi}_{t+j+1})+\left((1-\bar{g})(1+\bar{\tau}^c)+\frac{\sigma\bar{w}\bar{s}(1-\bar{\tau}^l)}{\eta}\right)\bar{\pi}\frac{1}{\sigma}\sum_{s=1}^{T}\beta^s(\frac{\bar{E}_t\tilde{\tau}^c_{t+s}-\bar{E}_t\tilde{\tau}^c_t}{1+\bar{\tau}^c}\\
&+\bar{E}_t\xi_{t+s}-\bar{E}_t\xi_t)-\beta^{T+1}\frac{\mu_b}{\sigma(1-\beta)}\sum_{j=0}^{T-1}(\bar{E}_t\hat{i}_{t+j}-\bar{E}_t\hat{\pi}_{t+j+1})-\frac{\beta^{T+1}\mu_b}{\sigma(1-\beta)}\frac{\tilde{\tau}^c_t}{(1+\bar{\tau}^c)}\\
&-\frac{\beta^{T+1}\mu_b}{\sigma(1-\beta)}\bar{E}_t i_{t+T}+\frac{\bar{\Xi}\bar{pi}}{\bar{Y}}\sum_{s=0}^{T}\beta^s\bar{E}_t\hat{\Xi}_{t+s}-\frac{\bar{LS}}{\bar{Y}}\sum_{s=0}^{T}\beta^s\bar{E}_t\hat{L}S_{t+s}+\frac{\beta^{T+1}\mu_b}{\sigma(1-\beta)}\xi_t
\end{aligned}
\tag{3.39}
$$

3.C Firms

The optimizing condition of the firms is given as

$$
\begin{aligned}
&\frac{p_t(j)}{P_{t+s}}\left[\tilde{E}_t^j\sum_{s=0}^{T}\frac{\xi_{t+s}}{1+\tau^c_{t+s}}(C^j_{t+s})^{-\sigma}(\frac{P_{t+s}}{P_t})^{-\theta-1}Y_{t+s}+\frac{(\omega\beta)^{T+1}}{1-\omega\beta\bar{\pi}^{\theta-1}}\bar{\lambda}\bar{Y}(\frac{\bar{\pi}P_{t+T}}{P_t})^{\theta-1}\right]\\
&=\frac{\theta}{\theta-1}\left[\tilde{E}_t^j\sum_{s=0}^{T}\frac{\xi_{t+s}}{1+\tau^c_{t+s}}(C^j_{t+s})^{-\sigma}(\frac{P_{t+s}}{P_t})^{\theta}Y_{t+s}mc_{t+s}+\frac{(\omega\beta)^{T+1}}{1-\omega\beta\bar{\pi}^{\theta-1}}\bar{\lambda}\bar{Y}\bar{m}c(\frac{\bar{\pi}P_{t+T}}{P_t})^{\theta}\right]
\end{aligned}
\tag{3.40}
$$

let $d_t(j)=\frac{p_t(j)}{P_t}$ and then rewrite the equation in context of inflation as

$$
\begin{aligned}
&d_t(j)\left[\tilde{E}_t^j\sum_{s=0}^{T}\frac{\xi_{t+s}}{1+\tau^c_{t+s}}(C^j_{t+s})^{-\sigma}(\prod_{j=1}^{s}\pi_{t+j})^{-\theta-1}Y_{t+s}+\frac{(\omega\beta)^{T+1}}{1-\omega\beta\bar{\pi}^{\theta-1}}\bar{\lambda}\bar{Y}(\prod_{j=1}^{T}\pi_{t+j})^{\theta-1}\right]\\
&=\frac{\theta}{\theta-1}\left[\tilde{E}_t^j\sum_{s=0}^{T}\frac{\xi_{t+s}}{1+\tau^c_{t+s}}(C^j_{t+s})^{-\sigma}(\prod_{j=1}^{s}\pi_{t+j})^{\theta}Y_{t+s}mc_{t+s}+\frac{(\omega\beta)^{T+1}}{1-\omega\beta\bar{\pi}^{\theta-1}}\bar{\lambda}\bar{Y}\bar{m}c(\prod_{j=1}^{T}\pi_{t+j})^{\theta}\right]
\end{aligned}
\tag{3.41}
$$

log-linearizing the equation

$$\hat{d}_t(j) = \tilde{E}_t^j \sum_{s=0}^{T} ((1-c_1)(c_1)^s - (1-c_2)(c_2)^s)(\hat{Y}_{t+s} - \sigma \hat{C}_{t+s} - \frac{\tilde{\tau}^c_{t+s}}{1+\bar{\tau}^c} + \hat{\xi}_{t+s}) + \tilde{E}_t^j \sum_{s=0}^{T} (1-c_1)(c_1)^s \hat{m}c_{t+s} + \tilde{E}_t^j \sum_{s=1}^{T} (\theta(c_1)^s - (\theta-1)(c_2)^s)\hat{\pi}_{t+s} \tag{3.42}$$

where

$$c_1 = \omega\beta\bar{\pi}^{\theta} \tag{3.43}$$

$$c_2 = \omega\beta\bar{\pi}^{\theta-1} \tag{3.44}$$

Aggregating equation (38)

$$\int_0^1 \hat{d}_t(j) = \bar{E}_t \sum_{s=0}^{T} ((1-c_1)(c_1)^s - (1-c_2)(c_2)^s)(\hat{Y}_{t+s} - \sigma \hat{C}_{t+s} - \frac{\tilde{\tau}^c_{t+s}}{1+\bar{\tau}^c} + \hat{\xi}_{t+s}) + \bar{E}_t \sum_{s=0}^{T} (1-c_1)(c_1)^s \hat{m}c_{t+s} + \bar{E}_t \sum_{s=1}^{T} (\theta(c_1)^s - (\theta-1)(c_2)^s)\hat{\pi}_{t+s} \tag{3.45}$$

The general price level is given as

$$P_t = \left[\omega P_{t-1}^{1-\theta} + (1-\omega)\int_0^1 P_t(j)^{1-\theta}\right]^{\frac{1}{1-\theta}} \tag{3.46}$$

from which it follows that

$$\hat{\pi}_t = \frac{1-\omega\bar{\pi}^{\theta-1}}{\omega\bar{\pi}^{\theta-1}} \int_0^1 \hat{d}_t(j)^{1-\theta} dj \tag{3.47}$$

plugging in equation (41)

$$\hat{\pi}_t = \frac{1-\omega\bar{\pi}^{\theta-1}}{\omega\bar{\pi}^{\theta-1}}(\bar{E}_t\sum_{s=0}^{T}((1-c_1)(c_1)^s-(1-c_2)(c_2)^s)(\hat{Y}_{t+s}-\sigma\hat{C}_{t+s}-\frac{\tilde{\tau}^c_{t+s}}{1+\bar{\tau}^c}+\hat{\xi}_{t+s})+$$
$$\bar{E}_t\sum_{s=0}^{T}(1-c_1)(c_1)^s\hat{m}c_{t+s}+\bar{E}_t\sum_{s=1}^{T}(\theta(c_1)^s-(\theta-1)(c_2)^s)\hat{\pi}_{t+s}) \tag{3.48}$$

3.D Final model

Log-linearized government budget constraint is presented as follows:

$$\tilde{b}_{t+1} = \frac{1}{\beta}\tilde{b}_t + \bar{b}(\hat{i}_t - \frac{1}{\beta}\hat{\pi}_t) - \frac{\bar{w}\bar{s}\bar{\pi}}{\beta}(\bar{\tau}^l(\hat{w}_t+\hat{H}_t)+\tilde{\tau}^l_t) - \frac{\bar{\pi}\bar{LS}}{\beta}\hat{LS}_t + \frac{\bar{\pi}}{\beta}\hat{g}_t - \frac{(1-\bar{g})\bar{\pi}}{\beta}(\bar{\tau}^c\hat{C}_t+\tilde{\tau}^c_t) \tag{3.49}$$

The aggregate labour is given as under

$$H_t = \int_0^1 H_t(j)dj = \int_0^1 Y_t(j)dj = s_tY_t \tag{3.50}$$

where $s_t = \int_0^1(\frac{P_t(j)}{P_t})dj$ is the equation describing price dispersion in the economy. The linearized aggregate wages and marginal costs yields the following expression:

$$\hat{m}c_t = \eta\hat{H}_t + \sigma\hat{C}_t + \frac{\tilde{\tau}^t}{1-\bar{\tau}^c_t} + \frac{\tilde{\tau}^l_t}{1-\bar{\tau}^l_t} \tag{3.51}$$

$$\hat{m}c_t = \left(\eta + \frac{\sigma}{(1-\bar{g})}\right)\hat{Y}_t - \frac{\sigma}{(1-\bar{g})}\tilde{g}_t + \frac{\tilde{\tau}^c_t}{1+\bar{\tau}^c} + \frac{\tilde{\tau}^l_t}{1-\bar{\tau}^l} + \eta\hat{s}_t \tag{3.52}$$

The equation for aggregate profits is as under

$$\Xi_t = \hat{Y}_t - \frac{\bar{s}\bar{w}}{1-\bar{s}\bar{w}}(\hat{m}c_t + \hat{s}_t) \tag{3.53}$$

The log-linearized market clearing condition and aggregate output equation aspectivelyre given as under re

$$\hat{Y}_t = \tilde{g}_t + (1-\bar{g})\hat{C}_t \tag{3.54}$$

$$\begin{aligned}\hat{Y}_t = \frac{1}{\rho}\tilde{b}_t + \frac{\bar{b}}{\rho}\sum_{s=0}^{T}\beta^s(\beta\bar{E}_t\hat{i}_{t+s} - \bar{E}_t\hat{\pi}_{t+s}) + \delta\sum_{s=0}^{T}\beta^s\left(((1-\bar{\tau}^l)\bar{E}_t\hat{w}_{t+s} - \tilde{\tau}^l_{t+s})\right) \\ -\mu\sum_{s=1}^{T}\beta^s\sum_{j=0}^{s-1}(\bar{E}_t\hat{i}_{t+j} - \bar{E}_t\hat{\pi}_{t+j+1}) - \frac{\beta^{T+1}}{(1-\beta)}\frac{\mu_b}{\rho\sigma}\sum_{j=0}^{T-1}(\bar{E}_t\hat{i}_{t+j} - E_t\hat{\pi}_{t+j+1}) - \frac{\beta^{T+1}}{(1-\beta)}\frac{\mu_b}{\rho\sigma}\hat{i}_{t+T} - \frac{\mu_c}{\rho}\tilde{\tau}^c_t \\ -\frac{\bar{\pi}(1-\bar{g})}{\rho}(1-\frac{1}{\sigma})\sum_{s=1}^{T}\tilde{\tau}^c_{t+s} + \frac{(1-\bar{w}\bar{s})\bar{\pi}}{\bar{Y}\rho}\sum_{s=0}^{T}\beta^s\bar{E}_t\hat{\Xi}_{t+s} - \frac{\bar{LS}\bar{\pi}}{\bar{Y}\rho}\bar{E}_t\hat{LS}_{t+s} \\ +\mu_\xi\xi_t - \mu\sum_{s=0}^{T}\beta^s\bar{E}_t\xi_{t+s} + \tilde{g}_t\end{aligned} \tag{3.55}$$

where

$$\rho = \frac{1}{(1-\bar{g})}\left[\frac{u_b\beta^{T+1}}{1-\beta} + \left((1-\bar{g})(1+\bar{\tau}^c) + \frac{\bar{s}\bar{\pi}\bar{w}\bar{s}\sigma(1-\bar{\tau}^l)}{\eta}\right)\bar{\pi}\frac{(1-\beta^{T+1})}{1-\beta}\right] \tag{3.56}$$

$$\delta = \frac{\bar{w}\bar{s}\bar{\pi}}{\rho}(1+\frac{1}{\eta}) \tag{3.57}$$

$$\mu = \frac{\bar{\pi}}{\rho}\left(\frac{\bar{w}\bar{s}}{\eta}(1-\bar{\tau}^l) + \frac{(1-\bar{g})(1+\bar{\tau}^c)}{\sigma}\right) \tag{3.58}$$

$$\mu_\xi = \frac{\bar{\pi}}{\rho}\left(\frac{\beta-\beta^{T+1}}{1-\beta}\frac{\bar{w}\bar{s}}{\eta}(1-\bar{\tau}^l) + \frac{(1-\bar{g})(1+\bar{\tau}^c)\beta}{\sigma(1-\beta)}\right) \tag{3.59}$$

$$\mu_c = \frac{\bar{\pi}}{\rho}\left[(1-\bar{g}) + \left(\frac{(1-\bar{\tau}^l)}{(1+\bar{\tau}^c)}\frac{\bar{w}\bar{s}}{\eta}\right)\frac{\beta-\beta^{T+1}}{1-\beta} + \frac{\beta(1-\bar{g})}{\sigma(1-\beta)}\right] \tag{3.60}$$

$$\mu_b = (1-\bar{g})(1+\bar{\tau}^c) \tag{3.61}$$

It is assumed that agents are cognizant of the aforementioned connections among aggregate variables, which persist in every period, then the expectations concerning wages and profits can be substituted. This leads to the following set of equations, which, when integrated with a specification of monetary and fiscal policy, as well as price dispersion, completely defines the model.

$$\begin{aligned}\pi_t = \bar{E}_t \sum_{s=0}^{T}(\kappa_{y1}(c_1)^s + \kappa_{y2}(c_2)^)\hat{Y}_{t+s} + \kappa_g \bar{E}_t \sum_{s=0}^{T}(c_2)^s \tilde{\tau}^i_{t+s} + \kappa_s \bar{E}_t \sum_{s=0}^{T}(c_1)^s \hat{s}_{t+s} + \\ \kappa_c \bar{E}_t \sum_{s=0}^{T}(c_2)^s \tilde{\tau}^c_{t+s} + \kappa_\tau \bar{E}_t \sum_{s=0}^{T}(c_1)^s \tilde{\tau}^l_{t+s} + bar E_t \sum_{s=1}^{T}(\kappa_{\tau 1})^s \tilde{\tau}^l_{t+s} + \\ \kappa_{\tau 2})^s (c_2)^s \hat{\pi}_{t+s} + E_t \sum_{s=0}^{T}(\kappa_{\xi 1}(c_1)^s + \kappa_{\xi 2}(c_2)^)\hat{\xi}_{t+s}\end{aligned} \tag{3.62}$$

$$\begin{aligned}\tilde{b}_{t+1} = \frac{1}{\beta}\tilde{b}_t + \bar{b}(\hat{i}_t - \frac{1}{\beta}\hat{\pi}_t) - \frac{\bar{\pi}\bar{LS}}{\bar{Y}\beta}\hat{LS}_t + \frac{\bar{\pi}}{\beta}\hat{g}_t - \frac{(1-\bar{g})\bar{\pi}}{\beta}\tilde{\tau}^c_t - \frac{\bar{\pi}}{\beta}\bar{\tau}^c(\hat{Y} - \tilde{g}_t) \\ \frac{\bar{w}\bar{s}\bar{\pi}}{\beta}\left[\bar{\tau}_l\left((1+\eta+\frac{\sigma}{1-\bar{g}})\hat{Y}_t - \frac{\sigma}{1-\bar{g}}\tilde{g}_t + \frac{\tau^c_t}{1+\bar{\tau}^c} + \frac{\tau^l_t}{1-\bar{\tau}^l} + (1+\eta)\hat{s}_t\right) + \tilde{\tau}^l_t\right]\end{aligned} \tag{3.63}$$

$$\begin{aligned}(1-\nu_y)\hat{Y}_t = \frac{1}{\rho}\hat{b}_t + \tilde{g}_t + \nu_y \sum_{s=1}^{T}\beta^s \bar{E}_t \hat{Y}_{t+s} + \nu_s \sum_{j=0}^{T}\beta^j \bar{E}_t \hat{s}_{t+j} - \mu \sum_{s=1}^{T}\beta^s(\bar{E}_t \hat{i}_{t+j-1} - \bar{E}_t \hat{\pi}_{t+j}) \\ + \frac{\bar{b}}{\rho}\sum_{s=0}^{T}\beta^s(\beta \bar{E}_t \hat{i}_{t+s} - E_t \hat{\pi}_{t+s}) - \frac{\beta^{T+1}}{(1-\beta)}\frac{\mu_b}{\rho\sigma}\sum_{j=0}^{T-1}(\bar{E}_t \hat{i}_{t+j} - \bar{E}_t \hat{\pi}_{t+j+1}) - \frac{\beta^{T+1}}{(1-\beta)}\frac{\mu_b}{\rho\sigma}\bar{E}_t \hat{i}_{t+T} \\ - \frac{\bar{LS}\bar{\pi}}{\bar{y}\rho}\sum_{s=0}^{T}\beta^s \bar{E}_t \hat{LS}_{t+s} + \mu_\xi \xi_t - \mu \sum_{s=1}^{T}\beta^s \bar{E}_t \xi_{t+s} + \nu_{c1}\tilde{\tau}^c_t + \nu_{c2}\sum_{s=1}^{T}\beta^s \bar{E}_t \tilde{\tau}^c_{t+s}\end{aligned} \tag{3.64}$$

$$\nu_y = \frac{1}{\rho\theta} + \left(\delta(1-\bar{\tau}^l) - \frac{\theta-1}{\rho\theta}\right)(\eta + \frac{\sigma}{(1-\bar{g})}) \tag{3.65}$$

$$\nu_g = \frac{\sigma}{(1-\bar{g})}\left(\frac{\theta-1}{\rho\theta} - \delta(1-\bar{\tau}^l)\right) \tag{3.66}$$

$$\nu_{\tau_1^c} = \delta\frac{1-\bar{\tau}^l}{1+\bar{\tau}^c} - \frac{\mu_c}{\rho} - \frac{\theta-1}{\rho\theta(1+\bar{\tau}^c)} \tag{3.67}$$

$$\nu_{\tau_2^c} = \delta\frac{1-\bar{\tau}^l}{1+\bar{\tau}^c} - \frac{\theta-1}{\rho\theta(1+\bar{\tau}^c)} - \frac{1-\bar{g}}{\rho}(1-\frac{1}{\sigma}) \tag{3.68}$$

$$\nu_\tau^l = -\frac{\theta-1}{\rho\theta(1-\bar{\tau}^l)} \tag{3.69}$$

Chapter 4

Fiscal Policy Effectiveness in Pakistan: Insights from a SVAR

4.1 Introduction

Fiscal policy is considered an integral part of the government policy to enhance growth and ensure economic stability. Fiscal policy is projected to stimulate aggregate demand through debt-financed increase in government spending and tax cuts (Foster, 2009). However, the opponents of fiscal policy reason that considerable budget deficit and public debt in wake of economic crisis will further distort the fiscal imbalances and limit the effectiveness of fiscal policy (Badurina et al. 2012; Nickel and Tudyka 2014). In developing countries, it is observed that a high level of debt tends to hinder economic growth. This becomes especially apparent when these countries implement fiscal expansionary measures financed through borrowing, potentially resulting in an increase in the output gap. In addition, the relationship between public debt and fiscal balance in Pakistan like other developing countries also exhibits an inverse correlation that adversely impacts fiscal sustainability and economic growth.

Fiscal policy is based on allocation of government expenditure and imposition of taxes to stimulate the economic activities. The impact of fiscal policy hinges on various factors including economic conditions, the scale of the fiscal stimulus, and the timing of policy interventions. The New Keynesian literature advocates for active fiscal policy during severe recessions to boost output, even if it leads to higher inflation and crowding out private economic activity. In contrast, the Neo-Classical School argues that debt-financed expansionary fiscal policies lead to increased interest rates, subsequently reducing output and inflation. Nevertheless, economic literature emphasizes that the effectiveness of economic stabilization through increased expenditures or reduced taxes is influenced by a country's debt dynamics.

Government expenditure and taxation play a pivotal role in managing debt while on the other hand debt also influence the government expenditure and revenue determination. Fiscal shock has the tendency to put a constraint on the future path of government spending and taxes due to the binding intertemporal budget constraint. Extensive research has been conducted to examine the impact of fiscal policy shocks on macroeconomic variables through the utilization of Structural Vector Autoregression (SVAR) Models (Fatas and Mihov 2001; Caldara and Kamps 2008; Giordano et al. 2007; Claus et al. 2006). However, the standard fiscal SVAR models do not keep track of debt dynamics while evaluating fiscal shocks. Ultimately, such models miss the reaction of taxes and public spending to debt to GDP ratio. This limitation implies that a significant portion of fiscal VAR studies are based on models that may be potentially mis-specified. These models lack feedback from the debt level to the variables involved in the intertemporal budget constraint (Favero and Giavazzi 2007). The primary goal of this essay is to fill this gap and examine the influence of fiscal policy on macroeconomic conditions in Pakistan considering the debt dynamics in the Pakistan.

Fiscal policy in Pakistan is the critical component of country's economic framework, aimed at managing government revenue, expenditures, and debt. It serves as a key instrument for achieving macroeconomic goals, including economic growth, price stability, income redistribution, and maintaining external balance. However, the historical trajectory of fiscal policy in Pakistan reveals a pattern of persistent fiscal deficits, high public debt, low revenue generation. Limited fiscal space, low generation of revenues, high non-development expenditures and more expenditure than taxes result in negative fiscal balance. Furthermore, reliance on borrowing to finance deficits has fueled inflationary pressures and disproportionately burdening low-income households.

In this context, the adoption of the Fiscal Responsibility and Debt Limitation Act, 2005 aimed to instill financial discipline and enhance fiscal management within the country was a milestone towards fiscal sustainability. This legislation-imposed limits on the debt-to-GDP ratio, with a cap set at 60 percent of GDP and established stringent standards for fiscal transparency (Qasim et al., 2012; Khalid et al., 2007). The implementation of this Act for prudent Public Debt Management remained absent throughout the period. The debt-to-GDP also remained higher than the 60 percent limit envisaged in the Act. (SBP Annual Report, 2019-20). Despite these endeavors, Pakistan's fiscal framework is characterized by a rise in current expenditures, an inequitable tax system lacking progressivity and a limited tax base, leading to a substantial budget deficit (Pasha, 2014). Fiscal stimulus plans in Pakistan rely heavily on domestic and external borrowings, leading to a further deterioration of the fiscal sustainability through debt accumulation and high debt servicing (Yasin, 2001). The intertwined issues of debt accumulation and fiscal sustainability highlight the broader concerns of economic strategy and fiscal management (Hasan, 1999; Hussain et al., 2022).

The analysis of fiscal policy in Pakistan indicates that fiscal stimulus plans were heavily reliant on domestic and external borrowings, leading to a further deterioration of the fiscal sustainability through debt accumulation and high debt servicing (Yasin, 2001). The intertwined issues of debt accumulation and fiscal sustainability also highlight the broader concerns of economic strategy and fiscal management in Pakistan (Hasan, 1999; Hussain et al., 2022). Furthermore, since Pakistan has to spend a major portion of revenues on debt servicing, therefore, government revenue and expenditure play a crucial role in adjusting debt and vice versa (Aslam 2001; Chandia and Javid 2013). Moreover, empirical studies have also demonstrated that higher levels of public debt have resulted in lower levels of economic growth in subsequent years, both in developed and developing countries (Reinhart and Rogoff 2010; Ilzetzki 2011).

Fiscal policy has positive impact over propagation of economic activities and economic growth in Pakistan (Ahmad and Malik, 2017; Shahbaz et al., 2012; Javaid et al., 2009). However, debt management is the pre-requisite for fiscal sustainability (Khan and Qayyum, 2007). There is found extensive literature in Pakistan over the impact of fiscal policy on economic indicators, however this paper upgrades the literature by incorporating debt dynamics in the fiscal policy analysis. The empirical studies conducted by Khalid and Satti, 2016; Ahmad and Malik, 2017 investigated fiscal policy effects in Pakistan using VAR model. However, these studies did not add the debt feedback in the analysis. Javaid and Arif, 2009 conducted the fiscal policy analysis for Pakistan along with the debt-to-GDP ratio implications. However, the study too lacks the requisite debt feedback analysis. This essay fills this gap by conducting the fiscal policy analysis encompassing the debt feedback analysis.

The primary goal of this essay is to perform an empirical examination of the effectiveness of fiscal policy on economic conditions in Pakistan. The impression of fiscal policy shocks on macroeconomic variables has been extensively studied using the structural vector autoregressive (SVAR) approach (Fatas and Mihov, 2001: Giordano et al., 2007; Caldara and Kamps, 2008; Claus et al., 2006). However, the conventional fiscal SVAR models fail to incorporate the dynamics of debt and the corresponding adjustments in taxes and spending as the debt ratio changes over time

(Cherif and Hasanov, 2012; Parkyn and Vehbi, 2013). Ultimately, such models miss the reaction of taxes and public spending to debt to GDP ratio. This limitation implies that a significant portion of fiscal VAR studies are based on models that may be potentially mis-specified and further lack feedback from the debt level to the variables involved in the government intertemporal budget constraint. Following Favero and Giavazzi (2007), this study seeks to address these limitations by employing a modified five-equation structural VAR model along with a debt feedback equation, specifically tailored for Pakistan. The empirical model used in this essay offers a more comprehensive framework by enhancing the model developed by Blanchard and Perotti (2002) with additional variables such as the cost of debt servicing and inflation. The inclusion of government's intertemporal budget constraint as an identity further enhance the analytical scope of this study and provides valuable insights about the influence of fiscal policy over the economic activity in Pakistan.

This paper empirically examines the effectiveness of fiscal policy in Pakistan and confirms that increase in government expenditure leads to expansion of the aggregate demand and have significant impact on output. However, the impact of tax rise curtails aggregate demand and leads to decline in output. The increase in government expenditure further becomes cause of rise in inflation in the short run and it becomes insignificant in the medium to long run. However, the impact of tax shock on inflation is majorly insignificant. This study also implies that both tools of fiscal policy fail to have any significant impact over the debt interest payments. The results also confirm the reliance over the debt to support fiscal policy in Pakistan and the insignificant impact of revenue collection on the debt management. This paper further confirms that debt has profound implications over the ultimate effects of fiscal policy on Pakistan's economy. A well-managed fiscal policy is crucial for fiscal balance and materializing economic growth potential. Furthermore, Pakistan's economic conditions seem more conducive to the adoption of expansionary fiscal policies. The effectiveness of fiscal policy depends on debt dynamics and revenue generation, as fiscal policy tools are heavily influenced by them. Therefore, fiscal policy in Pakistan should be managed and implemented in a responsible way including through increased revenue collection, control spending, and prioritize debt management.

The structure of this essay is as: Section 2 illustrates the evidence from the available economic literature on the subject area. In Section 3, the methodology developed by Favero and Giavazzi (2007) and data description have been described. Section 4 describes the identification technique designed by Blanchard and Perotti (2002). Section 5 and section 6 summarizes the findings and concludes with some policy implications respectively.

4.2 Literature Review

The empirical literature provides varied evidence regarding the ultimate effects of fiscal policy on the stimulation of economic activities. New Keynesian literature advocates for significant role of fiscal policy in stimulation of economic activities and aggregate demand. On the other hand, the Neo-Classical School of thought argues that debt-financed expansionary fiscal policy raises interest rates, leading to a decrease in output. However, it is widely acknowledged in economic literature that fiscal policy indicators, both directly and indirectly, are influenced by the debt dynamics of a country.

Blanchard and Perotti (2002) utilized institutional information pertaining to fiscal policy instruments and the timing of tax collection to spot out exogenous shocks. They observed that the occurrence of unexpected shocks prevents fiscal policy from responding within four quarters. According to their findings, raising taxes had a negative impact on productivity while increasing government spending had a beneficial one. Additionally, they observed that a simultaneous escalation of both government spending and taxes had a significant negative impact on private investment. Erceg et al. (2014) estimated that the temporary increase in government expenditure have more stimulating effects in the recession than under normal conditions. However, in the case of brief liquidity traps, the positive multiplier values decline rapidly with increased government spending levels. However, (Ilzetzki, 2011) found that reducing taxes has an enhancing impact on productivity in emerging economies.

The effects of governmental expenditure shocks are mostly determined by public debt levels and the scope of the fiscal policy framework. Leeper et al. (2010) examined the impact of debt-financed fiscal shocks and found that they can lead to long-lasting dynamics. Ilzetzki et al., (2010, 2013) estimated that efforts to stabilize economic situations in heavily indebted countries are largely futile, yielding multipliers with zero or even negative values in the long run. Cherif and Hasanov (2012) adopted the methodology used by Favero and Giavazzi (2007) to analyze the impact of macroeconomic shocks on the dynamics of U.S. public debt. They found that after an austerity shock, the debt ratio initially decreases but eventually reverts back to its pre-shock trajectory. This suggests that while austerity measures may initially incite decline in the debt ratio, the long-term effect is limited, as the debt-to-GDP ratio tends to return to its previous trend.

Afonso and Sousa (2009) investigated the effect of government expenditure and tax shocks on macroeconomic variables and indicated that a government expenditure shock had a detrimental impact on GDP, resulting in a decrease in both private consumption and private investment. Additionally, they observed that this shock result in a rise in the price level and at the expense of debt refinancing. Conversely, a revenue shock had a negative impact on GDP, accompanied by a decline in the price level. The analysis conducted by Fotiou, 2020 revealed that in the midst of high debt, increase in taxes leads to higher debt-to-GDP ratio. Conversely, a reduction in public expenditure has minimum impact on economic activity but exerts a balancing impact on debt. In general, a substantial government debt diminishes the effectiveness of fiscal policy tools in the stabilization of economic activities. However, neglecting the consideration of debt dynamics in fiscal policy analysis might have led to an overestimation of fiscal multipliers.

Public debt exerts a negative impact on both short-term and long-term output and investment. The empirical research conducted by (Akram, 2011) found that debt servicing has a significantly negative correlation with per capita GDP in Pakistan. Moreover, this finding challenges the notion of a ”crowding out effect,” which suggests that increase in government borrowing induces reduction in private investment. Small et al. (2019) assessed that when faced with elevated levels of debt, the adjustment in fiscal policy tools tend to rely on revenue-based measures. Moreover, countries also postpone tax increments until the debt reaches a relatively significant level, possibly influenced by political concerns or the distorting impacts of tax raises.

Using SVAR technique, Javid and Arif (2009) calculated the effect of fiscal policy on macroeconomic indices in Pakistan. The study indicated that rise in government expenditure had a negative impact on consumption and output. Additionally, in response to expansionary fiscal spending, interest rates tended to increase. In terms of funding public spending programs, they noted that utilizing debt as a financing method resulted in a short-term reduction in the debt-to-GDP ratio. Nevertheless, over the long term, a stabilization effect occurs leading to an increase in the debt-to-GDP ratio. These findings highlight the complex relationship between fiscal policy, macroeconomic indicators, and the impression of debt in the context of Pakistan. Rahaman and Gonzalez (2021) used the SVAR framework to investigate the macroeconomic consequences of fiscal shocks in Bangladesh. The analysis uncovered that a government spending shock positively influences both investment and consumption. However, when it came to a tax increase shock, they found that there was a decline in output and consumption, while investment remained relatively unaffected. Dungey and Fry (2009) revealed that tax shock and debt shocks have an intensive impact over the economic indicators compared to government expenditure shocks.

Padda and Akram (2009, 2010) and Padda et al. (2022) conducted the empirical studies for Pakistan using SVAR and indicated that a government spending shock has a positive influence on output, whereas a positive tax shock exerts a negative impact on output, spending, and inflation. Moreover, the effect of a tax shock is not constant, while expenditures consistently affect economic growth. However, Ali and Ahmad, 2010 found an adverse long-term correlation between the fiscal deficit and economic growth in Pakistan. They further explained that negative and significant coefficient of fiscal deficit implies the implications of expansionary fiscal contraction, where fiscal expansionary programs, which are often unproductive, act as a constraint on economic growth. In another study, Ismail and Hussain (2012) estimated the effects of government spending on employment, inflation and output in Pakistan and concluded that in Pakistan economic activity fails to affect development or current expenditures. Ultimately, government spending remained insignificant for macroeconomic variables, so there should be strict cost and benefit analysis of debt financed public spending programs. Lahouel et al. (2023) used SVAR methodology to estimate fiscal multipliers and found in agreement of the other prevailing studies that the fiscal multipliers are moderate. The study further found that government investment multipliers are larger than government consumption multipliers as government expenditure multipliers causes considerable crowding out effects.

Shahid et al. (2016) performed an investigation on the interconnectedness of fiscal and monetary policies in Pakistan. Their findings revealed that inflation is influenced by fiscal policy shocks, including government spending, revenue, and borrowing shocks. The study also emphasized the effect of monetary policy on fiscal policy and the significance of maintaining fiscal discipline in Pakistan. However, Soharwardi et al. (2022) found that fiscal policy affects Pakistan's economic growth positively, but monetary policy is more powerful in this respect. This study further suggested that promoting the monetary policy would provide base for economic growth through maintenance of inflationary rates, interest rates, and lending rates.

Hayat et al. (2017) conducted the study to examine the dynamic effects of fiscal shocks on the economic conditions in both developed and developing nations. The study examined that shock in public spending has positive impact on key macroeconomic activities and fiscal policy is an important tool to control inflation, interest rate and public debt. In his study, (Kakar, 2011) highlighted that fiscal policy serves as an important tool for long-run phenomena rather than short-run effects in Pakistan. Government spending can stimulate economic development in the short run, however, this approach may come at the expense of inflation and have implications for the overall process of economic growth. In contrast, Riaz and Munir (2016) conducted a study exploring the connection between fiscal policy and macroeconomic stability in South Asian countries. Their findings revealed that automatic stabilizers and discretionary fiscal policy have an undermining impact on the economy, resulting in a decline in economic growth for developing economies. Hussain et al. (2022) conducted the research to empirically assess the effect of both size and configuration of fiscal adjustment on Pakistan's debt-to-GDP ratio. This study measured that the contraction in debt-to-GDP ratio in the foregoing year of fiscal adjustment is positively linked with the cumulative variation in cyclically adjusted primary balance. However, the diminution of debt-to-GDP ratio in the foregoing years of fiscal adjustment is negatively linked with real debt decline.

Teles and Mossoulini (2014) demonstrated in the study that debt-to- GDP ratio negatively affect the propagation of economic activities. As due to government indebtedness, a major proportion of public savings are used for the debt servicing leaving less amount for public spending. However, Kamiguchi and Tamai (2023) examined that debt financed public investment can improve growth in presence of dynamically inefficient economy and sufficiently high productive public capital. The study further suggested that economies with dynamic resource inefficiency choose debt financing of public investment. However, an efficient economy with low productive public capital prefers balanced budget. Turan and Iyidogan (2023) confirmed that public debt does not have significant impact over economic growth rate. Furthermore, public investment and private credit is negatively influenced when the public debt exceeds the threshold level.

Eminidou and Zachariadis (2023) estimated the association of public debt and fiscal policy for the euro countries. The study further confirmed that positive government expenditure shock positively affects output and consumption in the high debt economies with quite different results in the low debt economies. (Hawitibo, 2023) examined the role of monetary and fiscal policies over the macroeconomic conditions in Ethiopia. The study further elaborated that positive government expenditure shock has an expansionary impact on output while impact of tax shock is contractionary. Furthermore, fiscal policy shocks have statistically significant impact over inflation. Ragot and Grand (2023) indicated that the public debt dynamics depend on the persistence of positive government expenditure shock as the public debt increases (decreases) when the persistence of the public spending shock is low (high).

4.3 Fiscal SVAR with Debt Feedback

SVAR models are widely used for policy analysis and for obtaining stylized facts about economic theory. This methodology is used to analyze the underlying structural relationships among the variables and to identify and estimate the structural shocks that drive changes in the variables. SVAR model assumes that the relationships among variables are linear and all the variables are stationary, meaning that their statistical properties do not change over time. It is further assumed that the variance of the error term is constant over time and the residuals from the model should not exhibit autocorrelation. SVAR allows for the modeling of dynamic interactions between variables, and provide a flexible framework for analyzing the joint behavior of multiple time series variables in a system. This methodology is often used for policy analysis and forecasting, as this analysis provides the impact of policy changes on the entire system. Furthermore, SVAR captures the uncertainty inherent in economic systems by incorporating shocks that represent unobservable disturbances.

The choice between SVAR and other time series techniques depends on the specific objectives of the analysis, the nature of the data, and the assumptions inherent in each method. Alternative approaches like DSGE models, Panel VARs, and VECMs each have their merits, the SVAR framework's ability to explicitly identify structural shocks and analyze contemporaneous relationships makes it superior in contexts where causal dynamics and short-term interactions are the focus. Panel models are more appropriate when dealing with panel data involving multiple cross-sectional units observed over time however the primary goal of this essay is to examine the influence of fiscal shocks on macroeconomic variables using the time series data. VECM requires the presence of cointegrating relationships among variables. If this assumption is invalid, the model's results are misleading. In contrast, SVAR does not rely on this restrictive assumption. VECM does not inherently provide a mechanism to disentangle structural shocks, which is often crucial for economic policy analysis. SVAR, through imposed restrictions, allows for more nuanced structural interpretation. The reduced-form SVAR model with k lags is defined as:

$$Y_t = \sum_{i=1}^{k} C_i Y_{t-1} + U_t \tag{4.1}$$

The Vector Y_t contains endogenous variables as government expenditure, output, taxes, interest rate and inflation. C_i is the coefficient matrix and U_t is the vector of reduced form residuals representing the unexpected movement in the components of Y_t. The vector of residuals are assumed to have nonzero cross correlations. Equation (4.1) does not incorporate the debt-to-GDP ratio. This suggests that the influence of debt dynamics will be included into the corresponding vector of residuals along with other exogenous shocks. Accordingly, the resulting correlation between dependent variables and error terms will produce biased estimates. Therefore, it is imperative to consider that taxes, government spending, real GDP growth, inflation and the interest rate are connected by the inter-temporal budget constraint. This assumption further revolves around the idea that fiscal authorities need to prioritize debt stabilization and fiscal responsibility. Considering this transformation, the equation (4.1) is replaced by (4.22) Following Favero and Giavazzi (2007), debt feedback has been incorporated into the SVAR analysis assuming that fiscal shock in period t will influence the future trajectory of tax and government expenditure as a means to maintain inter-temporal budget constraint. Hence, it is crucial to recognize that government spending, taxes, inflation, real GDP growth, inflation, and the interest rate are interlinked through the inter-temporal budget constraint. This assumption further revolves around the idea that fiscal authorities needs to prioritize debt stabilization and fiscal responsibility. Considering this transformation, the equation (4.1) is replaced by (4.2)

$$Y_t = \sum_{i=1}^{k} C_i Y_{t-1} + \sum_{i=1}^{l} \rho d_{t-1} + U_t \tag{4.2}$$

where d_{t-i} are vectors representing debt feedback to endogenous variables in Y_t. The relationship between government spending, taxes, inflation, output and the interest rate is described by a debt identity. This debt identity governs the evolution of the debt ratio over time given as under:

$$d_t = \frac{(1+i_t)d_{t-i}}{(1+\pi_t)(1+y_t)} + \frac{exp(g_t) - exp(t_t)}{exp(y_t)} \tag{4.3}$$

In the debt feedback identity (4.3) d_t is the debt to GDP ratio, i is the average cost of debt financing, y_t is real GDP growth rate and π_t is the inflation rate. Debt identity portrays that the evolution of debt to GDP ratio depends on two factors. The first element symbolizes the preceding debt amount, which is then multiplied by the fraction of the actual interest rate and the reciprocal of the growth rate. This value explains the the impact of interest rate channel on the debt dynamics. The second part explains the impact of primary fiscal deficit on the debt to GDP ratio. This debt identity further infers that if interest rate surges higher than the output growth rate, then fiscal balance should be in surplus to keep the inter-temporal budget constraint constant (Parkyn and Vehbi 2013). However, as indicated by the second part of the identity, the reduction in expenditures directly affects the primary balance, resulting in an improvement and reduction of the debt ratio. A negative primary balance indicates that the government is borrowing not only to service its debt but also to finance a portion of its non-interest expenditures. The persistence of a negative primary balance can push a country into a debt trap, posing significant challenges in managing its debt burden. Consequently, whether the debt increases or decreases depends on the interplay between these factors, and the ultimate outcome is determined by the dominating synergy.

The system of equations is defined by equations (4.2) and (4.3). However, only equation (4.2) is necessary for estimating the model's parameters. Equation (4.3) is essential for tracking the dynamics of debt and calculating impulse responses.

4.3.1 SVAR Identification of Restrictions

The SVAR model formulated for this study comprises of five equations. The reduced form residuals in equation (4.2) are interconnected and not entirely exogenous. To overcome this issue, the identification method developed by Blanchard and Perotti (2002) is used. The identification method relies on recognizing the presence of decision lags in implementation of fiscal policy and utilizing institutional knowledge regarding the automatic elasticity of fiscal variables. Identification scheme is used by utilizing the observed reduced form residuals and imposing limitations on the system in order to attain identification and retrieve the uncorrelated structural shocks. The identification restrictions help to identify structural shocks to government expenditure (g) and taxes (t) by employing restrictions on A and B matrices in the AB model described as under:

$$Au_t = Be_t \tag{4.4}$$

where A is a n×n matrix of occurring correlations among variables and B is a n×n matrix that admit some shocks to influence directly multiple endogenous variable, u_t is the vector of reduced form error with variance-covariance matrix, and e_t is the vector of structural shocks e_t^t, e^g and non-structural shocks e_t^y, e_t^p, e_t^i. Using the specification given in (Perotti, 2005) the five variables empirical model is described as follows:

$$\begin{bmatrix} 1 & 0 & \alpha_y^g & \alpha_p^g & \alpha_i^g \\ 0 & 1 & \alpha_y^t & \alpha_p^t & \alpha_i^t \\ \alpha_3^1 & \alpha_3^2 & 1 & 0 & 0 \\ \alpha_4^1 & \alpha_4^2 & \alpha_4^3 & 1 & 0 \\ \alpha_5^1 & \alpha_5^2 & \alpha_5^3 & \alpha_5^4 & 0 \end{bmatrix} \begin{bmatrix} \mu_t^g \\ \mu_t^t \\ \mu_t^y \\ \mu_t^p \\ \mu_t \end{bmatrix} = \begin{bmatrix} b_{11} & b_{12} & 0 & 0 & 0 \\ b_{21} & b_{22} & 0 & 0 & 0 \\ 0 & 0 & b_{33} & 0 & 0 \\ 0 & 0 & 0 & b_{44} & 0 \\ 0 & 0 & 0 & 0 & b_{55} \end{bmatrix} \begin{bmatrix} e_t^g \\ e_t^t \\ e_t^y \\ e_t^p \\ e_t^i \end{bmatrix}$$

Each row in the system of equations described above establishes a correlation between the error terms and the structural shocks. However, it is important to note that the system of equations, as it stands, lacks identification. To address this issue, certain restrictions are imposed to achieve identification.

One key observation is that the debt-to-GDP ratio functions as an identity and does not contribute to the identification of structural shocks. Therefore, its inclusion in the system of equations does not impact the identification process. Here e_t^y,e_t^p, e_t^i are not fiscal policy shocks so they does not contain any structural interpretation, and e_t^g and e_t^t are the government expenditure shock and tax shock respectively, with the assumption of cov (e_t^t, e_t^g=0). Clearly, e_t^t and e_t^g are associated with the reduced form error terms hence they cannot be estimated by an OLS estimation and need exogenous information for estimation. Following Blanchard and Perotti (2002) α_y^g, α_p^g, α_i^g, α_y^t, α_p^t and α_i^t are pointed out employing some external information, so there are left only 15 parameters to be estimated. The model is just-identified as the condition of equal number of parameters to be estimated and elements in the variance-covariance matrix of the SVAR model is fulfilled. The non-fiscal shocks e_t^y, e_t^p, e_t^i are acquired by imposing a recursive scheme on the bottom three rows of A and B matrices. However, this assumption does not influence the identification of structural shocks.

In accordance with Blanchard's identification approach, the elasticities of government expenditure and tax with respect to output, inflation and interest rate will be identified using the external information. The output elasticity of tax is set to $\alpha_y^t = 0.96$ and price elasticity of tax is $\alpha_p^t = 0.71$ following (Bilquees, 2004) and Shaheen and Turner (2010). It is further assumed that the inflation elasticity with respect to government expenditure is $\alpha_p^g = -0.5$. (Perotti, 2005) reasons that the governmnet expenditure over wages is fixed over a quarter. Therefore, nominal wages has no reaction to the existing changes in inflation and this depicts that in real terms govt wages decreases if inflation increases. Following Blanchard and Perotti(2005) and Claus et al. (2006) the output elasticity of government expenditure is adjusted to $\alpha_y^g = 0$ assuming that government spending are not influenced by the contemporaneous change in output. Furthermore, it is assumed that the elasticities of these two variables, with respect to changes in interest rates, are equal to zero i.e. α_i^g=0 and $\alpha_i^t = 0$. Finally, following (Perotti, 2005) and Shaheen and Turner (2010) it is assumed that $b_{12} = 0$ because government decisions about public expenditures are taken ahead of decisions about taxes. Impact of this assumption on the results is minimal as they are not sensitive to it. In this concluding step, it becomes viable to estimate the structural fiscal shocks and generate the corresponding impulse response.

The pattern of variables as per the used identification strategy is established as per the theoretical understanding of how fiscal shocks impact the system in a specific sequence. The chosen order is as follows: government expenditure, taxes, output, inflation, and debt servicing. This ordering reflects the assumption that shocks originating from fiscal indicators propagate through the system, influencing the subsequent macroeconomic indicators. Specifically, the influence of fiscal shocks on output is considered to be direct, as government expenditure and taxes directly affect aggregate demand. This assumption aligns with the principles of Keynesian theory, which posits that changes in aggregate demand can lead to corresponding changes in output.

Additionally, in accordance with the Keynesian theory, variations in aggregate demand may also contribute to inflationary pressures. Therefore, it is expected that changes in fiscal indicators could potentially influence inflation. Moreover, it is anticipated that the interest rate on debt would respond to changes in inflation, as inflation can affect the cost of debt servicing. By following this ordering of variables, the identification strategy aims to capture the dynamic relationships and inter-dependencies among fiscal indicators, output, inflation, and debt servicing, based on the underlying economic theory.

4.3.2 Data and Estimation

Quarterly data spanning over the period 2001Q1-2021Q4 has been used. The data for log Government expenditures, log taxes and log real GDP are seasonally adjusted due to their tendency to follow a distinct quarterly pattern. Furthermore, to hold on to the parsimoniousness of the model the definition of average debt servicing rate (by dividing interest payments on public debt by the public debt at time t–1) as in Favero and Giavazzi (2007) and Cherif and Hasanov (2012) has been used. Since quarterly GDP data for Pakistan is not available, the works of Kemal and Arby (2005), (Arby, 2008), and Hanif et al. (2013) has been used to construct the necessary GDP time series data. Quarterly data for fiscal policy indicators is obtained from Ministry of Finance website (Pakistan Fiscal Operations) and Pakistan Economic Survey (Various Issues). The description of variables along with summary statistics is at Appendix A.

Before proceeding with SVAR estimation, it is essential to ensure that the data is stationary. Nevertheless, upon conducting the Augmented Dickey-Fuller (ADF) unit root test, it becomes evident that all variable series contain a unit root. This implies that all the series are non-stationary at levels. However, due to the highly oscillating pattern, created due to the first difference data series we opt to conduct our analysis using the level data series. The primary objective of this SVAR analysis is to elucidate the relationship between fiscal policy variables rather than quantifying the magnitude of the shock's impact between the variables (Surjaningsih et al., 2012). Moreover, Canova (2007) and Sims et al. (1990) asserted that the VAR model yields consistent outcomes even when applied to non-stationary data.

4.4 Empirical Results

4.4.1 Stability of debt trends

Debt dynamics are influenced by the macroeconomic variables incorporated into the equation 4.3. Figure 4.4.1 describes the debt-to-GDP ratio along with the simulated debt-to-GDP ratio. The actual debt series is in close coordination with the simulated debt series, stipulating the accuracy of debt dynamics equation 4.3, This also confirms the stability of macroeconomic variables with debt series for the data of Pakistan. However, the graph in figure 4.4.1 shows small differences in the data series. These differences are due to many reasons. For instance, limited availability of fiscal policy indicators' data at the quarterly pattern. Furthermore, the quarterly GDP and debt-to-GDP ratio series are also not available. Besides, in Pakistan, similar to many other developing countries, a substantial portion of economic activities occurs within the informal sector. Additionally, a significant fraction of revenues is generated from non-tax sources, thereby contributing to data limitations. Favero and Giavazzi (2007) also indicated that such difference is due to presence of seigniorage too.

The identity equation (4.3) depicts the dynamics of public debt that comprises of two components. The first component involves the previous level of public debt, which is multiplied by the ratio of the debt service rate to the inverse of the growth rate and inflation. This factor captures the impact of these economic factors on the debt level. The second component reflects the primary balance as a proportion of GDP, which is estimated by considering the difference between revenues and non-interest expenditures. When government expenditures decline, it leads to a negative output effect. Given a certain past debt value and interest payment rate, this negative effect con-

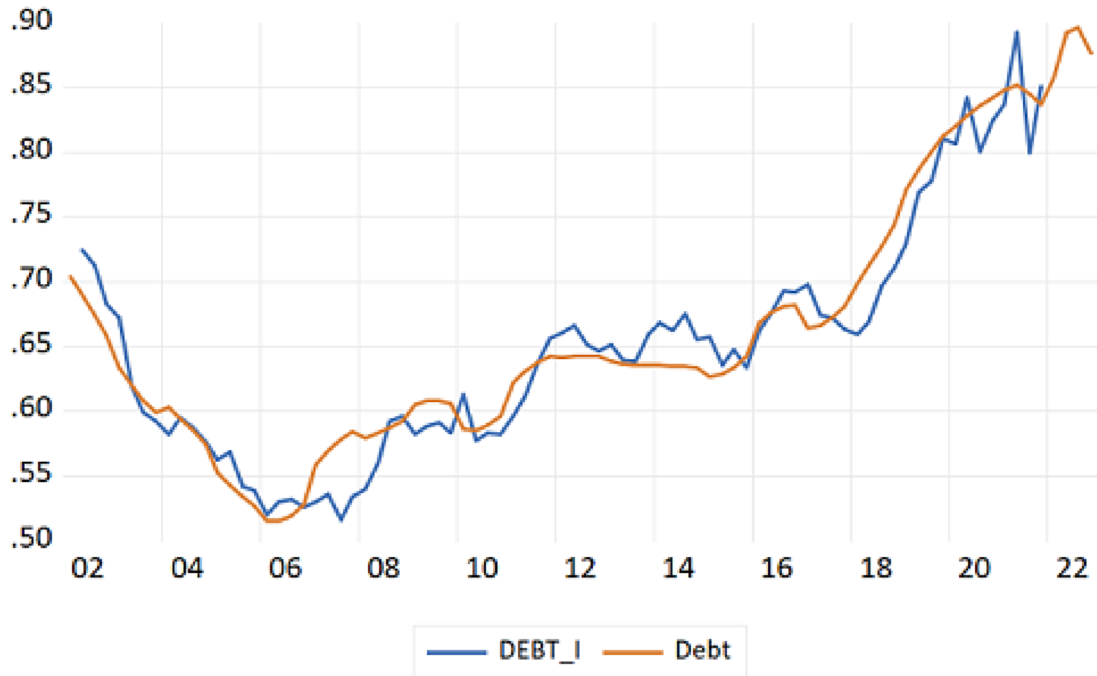


Figure 4.4.1: Consistency of debt series: Actual debt to GDP ratio (Debt) and simulated debt to GDP ratio $(Debt_I)$. Quarterly data are observed at quarterly frequency from 2001 onwards at the X-axis and the debt to GDP ratio at the Y-axis

tributes to an expansion in the debt ratio. However, as indicated by the second part of the identity, the reduction in expenditures directly affects the primary balance, resulting in an improvement and reduction of the debt ratio. Consequently, whether the debt increases or decreases depends on the interplay between these factors, and the ultimate outcome is determined by the dominating synergy. A negative primary balance indicates that the government is borrowing not only to service its debt but also to cover some of its non-interest expenses. The consistency of a negative primary balance can push an economy into a debt trap posing significant challenges in managing its debt burden.

4.4.2 Fiscal shocks and government debt feedback

The inclusion of debt feedback in VAR models introduces asymmetry and non-linearity distinguishing them from linear VAR models. This indicates that fiscal shocks of the same magnitude will not result in identical behavior, but only with an opposite sign (Stanova, 2015). Debt feedback often depends on thresholds or conditions, such as the level of debt relative to GDP or specific economic triggers. Furthermore, fiscal policies have different implications in presence of high or low debt levels and this conditional dependency creates asymmetric dynamics, as the system responds differently in high-debt and low-debt scenarios. Linear VAR models assume constant relationships between variables, represented by linear equations. However, with debt feedback effects, like worsening fiscal balances due to higher debt servicing costs, create loops that cannot be captured by linear models. Therefore, non-linearity allows the model to capture more complex economic dynamics, such as tipping points or regime switches. The non-linearity and asymmetry further imply that the effects of fiscal policy are not proportional and depend on the initial conditions. This concept is critical for policymakers, as it suggests that optimal fiscal responses must account for the economic context and debt dynamics.

Table 4.4.1 presents the estimated coefficients for the first and second lags of debt feedback d_t in all endogenous variable equations. The condition that the two coefficients should be of equal magnitude and opposite sign is maintained. This finding aligns with the work of Favero and Giavazzi (2007), Cherif and Hasanov (2012), and Yusuf and Segan (2019). This implies that when the debt ratio increases, it has a certain effect on other variables (e.g., GDP, interest rates, inflation, etc.). Conversely, when the debt ratio decreases, the effect is of the same magnitude but in the opposite direction. This condition ensures that the lagged change in the debt ratio is a critical predictor, meaning that its past fluctuations strongly influence the current state of these variables. The coefficient on the lagged change in the debt ratio serves as a measure of the discrepancy between the actual primary surplus and the surplus required to balance the dynamics of the debt. Its scale indicates that this discrepancy acts as an error correction mechanism in the fiscal reaction function. The aggregate impact of lagged debt levels on government expenditure implies that government spending increases when thelagged change in the debt ratio is negative. However, most of the fiscal policy indicators exhibit insignificant responsiveness to changes in the debt ratio. This also explains that fiscal policy in Pakistan is not designed to stabilize the debt to GDP ratio.

Debt	Expenditure	Tax	GDP	Inflation	Debt Servicing
d_{t-1}	0.124	-1.397	0.091	0.397	0.036
$st.er$	(1.58352)	(0.93110)	(0.18891)	(0.20165)	(0.04049)
d_{t-2}	-0.082	1.329	-0.133	-0.391	-0.038
$st.er$	(1.53757)	(0.90408)	(0.18343)	(0.19580)	(0.03931)
Sum	0.042	-0.068	-.042	0.006	0.002

Table 4.4.1: Debt feedback (standard errors in parenthesis)

4.4.3 Impulse Response Functions (IRFs)

This section deals with the empirical results pertaining to the impact of government expenditure and tax shocks on the dependent variables through impulse response functions. IRFs are crucial tools in analyzing Vector Autoregressive (VAR) models. They trace the effect of a one-unit shock to one variable on the current and future values of all variables in the system. IRFs quantify how long the effects of a shock last (persistence) and whether the impact increases, decreases, or oscillates over time. IRFs help evaluate the effects of policy interventions on economic variables like GDP, inflation, or interest rates, further specifying that fiscal interventions must consider the state of the economy and debt levels to avoid adverse long-term effects.

The impulse responses demonstrate the sensitivity of these endogenous variables to shocks in the error term of the fiscal policy indicators. The process of estimating the model is relatively straightforward. However, the presence of an intertemporal budget constraint introduces a distinct computation method for the impulse response, deviating from the approach used in standard VAR models. Given that equation (4.3) encompasses all the estimated variables from equation (4.2) and contains no parameters, it does not require estimation. To calculate the impulse response, the debt at each time period in equation (4.3) is derived from the macro variables obtained from equation (4.2) and subsequently reintegrated into equation (4.2). The impulse responses have been estimated following the methodology defined in Favero and Giavazzi (2007) given as under:

1. To produce a baseline simulation for all the model variables, equation (4.2) is solved dynamically forward by setting all shocks to zero for the forecast horizon,

2. In the second step, an alternative simulation is conducted for all the model variables and the desired structural shock is set to one for the first period of the simulation while keeping all other shocks at zero. Then, the model is solved dynamically forward for the periods covering the forecast horizon,

3. To generate impulse response, the difference between the baseline simulation and the alternative simulation as explained in the above steps is derived.

4. Compute confidence intervals using bootstrap methodology

In the analysis of impulse response function, baseline simulations serve as reference points for understanding the impact of individual shocks. When all the shocks are set to zero, the model operates solely based on its intrinsic dynamics (e.g., lagged relationships among variables) without any external shock. Adding a specific shock in the scenario simulation allows us to clearly observe how the system responds relative to the baseline. Furthermore, setting other shocks to zero ensures that the analysis focuses purely on the dynamics of the shock under consideration, eliminating confounding influences. A residual-based bootstrap methodology is applied with replications to estimate the standard errors and confidence intervals for the impulse response functions. The following steps are used for bootstrapping: saving the residuals from the estimated VAR and then iterating the following steps: a) re-sample from the saved residuals and generate a set of observation b) estimate the VAR and identify structural shocks, c) compute impulse responses going through the steps described above, d) go back to step 1. By going thorugh 1,000 iterations the process of bootstrapped distributions for impulse responses and compute confidence intervals is completed.

The choice of selecting two-year lags for VAR model estimation is determined based on the Akaike Information Criteria (AIC), which is a widely used criterion for model selection. In addition, following Favero and Giavazzi (2007), it is argued that including two lags of the debt ratio (d_{t-1} and d_{t-2}) in the SVAR model is essential for examining the co-integrating connection between the primary deficit and the deficit required to stabilize the debt level. By including these lagged variables, the VAR model can better capture the long-term relationship between the primary deficit and debt stabilization. Figures 4.4.2 and 4.4.3 represent the impulse responses obtained from government expenditure shock and tax shock respectively. In each figure the left-hand panels refer to analysis without considering debt feedback and right side refers to the analysis with debt feedback. Within each column of the graphs, the impulse responses are displayed from top to bottom, showing the responses of government expenditure, taxes, output, inflation, and the average cost of debt service.

4.4.4 Government Spending Shock

Figure 4.4.2 depicts the impulse response of the endogenous variables to a positive government spending shock. Due to the government spending shock, the change in government spending is positive and persistent for the forecasting period. This consistency of government spending shock aligns with the typical findings observed in most of the fiscal VAR studies by Parkyn and Vehbi 2013 and Blanchard andPerotti 2002. The impact of increase in government expenditure over taxes remains positive and significant for the whole forecasting period, reaching its peak by the third quarter. Blanchard and Perotti (2002) similarly concluded that positive government expenditure shock influences taxes positively. A positive government expenditure shock tends to influence taxes positively either directly (tax hikes to fund spending) or indirectly (economic growth boosting tax revenues automatically). The exact impact depends on how the spending is financed and the government's fiscal strategy.

The consistent government spending increase serves to boost output. This is largely attributed to the allocation of public funds to infrastructure development and public investments. Government spending shocks stimulate aggregate demand, which drives short-term increases in output through increased spending on public goods. Higher incomes boost consumption, further amplifying aggregate demand through a multiplier effect. In the short term, government spending can improve economic sentiment and encourage private investment, especially if the economy is operating below potential. Government spending, particularly on capital investments, enhances productivity and contribute to short-term economic growth. The result also confirms that positive government expenditure shock can be used to stabilize Pakistan economy. (Aschauer 1989), Parkyn and Vehbi (2013) and Munir and Riaz (2019) also found that a rise in total government expenditure corresponds to a proportional increase in GDP.

At the outset, the positive shock to government expenditure yields a positive impact on prices, leading to a gradual acceleration in inflation due to increased demand pressures. However, after 4th quarter inflation declines and remains insignificant for the whole forecasting period. The study conducted by Marcellino (2002) for the Euro Countries also found small and insignificant impact of positive government spending shock on inflation in Germany, Italy and Spain in the short term. In the short term, government spending shocks can lead to increased production and utilization of existing resources and as production expands to meet demand, firms may initially raise prices (demand-pull inflation). However, after the fourth quarter, capacity constraints may ease as investments improve supply chains or businesses adapt, reducing inflationary pressures. On the demand side, the initial rounds of government spending may generate significant increases in aggregate demand, fueling inflation. Over time, the marginal impact of additional government spending diminishes as resources are reallocated and demand returns to sustainable levels, reducing inflationary pressures.

The impact over the average cost of debt servicing is positive due till 8th period in the model without debt feedback. However, in the model with debt dynamics the effect on the average cost of debt payments is negative. The finding in the model with debt dynamics follows the results reported by Favero and Giavazzi (2007) for the United States, wherein an unexpected decline in interest rate payments follows an increase in government expenditure. They argued that while a government expenditure shock immediately boosts the debt stock, its impact on actual interest payments is delayed. Consequently, although public debt rises, interest payments initially remain stable, leading to a short-term decrease in the implied interest rate payments. However, when the debt feedback is not included in the model, it portray that the surge in government expenditure leads to a rise in the interest payments. This is because the increase in government expenditure has a positive impact on output and tax revenue, that ultimately leads to an increase in interest payments. This result is a confirmation of Afonso and Souza (2012).

The impact of government expenditure shock in the models with debt feedback and without debt feedback describes that the overall behaviour of the variables show similar initial dynamics, however, the inclusion of debt feedback has profound implications for macroeconomic stability. In the model with debt feedback, the effects of a government spending shock on output become somewhat smaller as reported in Afonso and Souza, 2012. Debt feedback mechanisms influence the trajectory of fiscal and economic variables by creating predictable responses to changes in the debt-to-GDP ratio. These mechanisms act as constraints that guide the system toward more stable or sustainable paths. When debt feedback is incorporated, fiscal policies such as tax increases or spending cuts are modeled as responses to rising debt levels. These predictable adjustments reduce uncertainty about the future path of fiscal variables, leading to narrower confidence intervals for economic variables. Conversely, the absence of debt feedback mechanisms leads to wider confidence intervals for key variables, exaggerating perceived uncertainty and reducing the reliability of model-based forecasts and this divergence widens over time as debt accumulates (Haug et al., 2013).

Debt dynamics are central to understanding the nonlinear behavior of fiscal systems. The relationship between fiscal shocks, debt accumulation, and macroeconomic outcomes often deviates from linearity, as increasing debt levels can amplify or dampen the effects of fiscal shocks depending on the economic context. Debt dynamics introduce significant nonlinearities and amplify fiscal shocks, as demonstrated by studies like Stanova (2015) and Haug et al. (2013). These effects are especially pronounced in high-debt environments, where feedback loops and threshold effects create disproportionate responses to fiscal shocks. Recognizing and addressing these dynamics is crucial for ensuring fiscal sustainability and macroeconomic stability.

4.4.5 Government Revenue Shock

Figure 4.4.3 shows the impact of positive tax shock on the endogenous variables without debt feedback (left side) and with debt feedback (right side). The empirical results show that in response to positive tax shock, the impact over taxes is positive and persistent but less significant compared to the expenditure shock.

In the aftermath of a tax shock, government spending shows fluctuations reaching its highest point after the second quarter and becoming negative after the fifth quarter. The impact over the government expenditure is also mostly insignificant. The positive tax shock further fails to stimulate the economy and the impact of tax shock on output is majorly negative and insignificant. This finding aligns with empirical evidence from developing countries, where increases in taxes have been shown to diminish household purchasing power, leading to a suppression of aggregate demand and output. This also demonstrates that tax shock fails to positively influence public spending and output in Pakistan. This result is in line with the findings of Blanchard and Perotti (2002) and Parkyn and Vehbi (2013). This result further corroborates the analysis by Ilzetzki (2011), suggesting that the notion of tax policy effectively stimulating output in developing economies may not be highly accurate.

The response of prices due to positive tax shock tends to be negative. The negative and insignificant impact of tax increase on inflation becomes the cause of passive economic activities and further decline in output. The impact of tax shock on the debt interest payments is negative and insignificant in the model without debt feedback. However, in the model with debt feedback

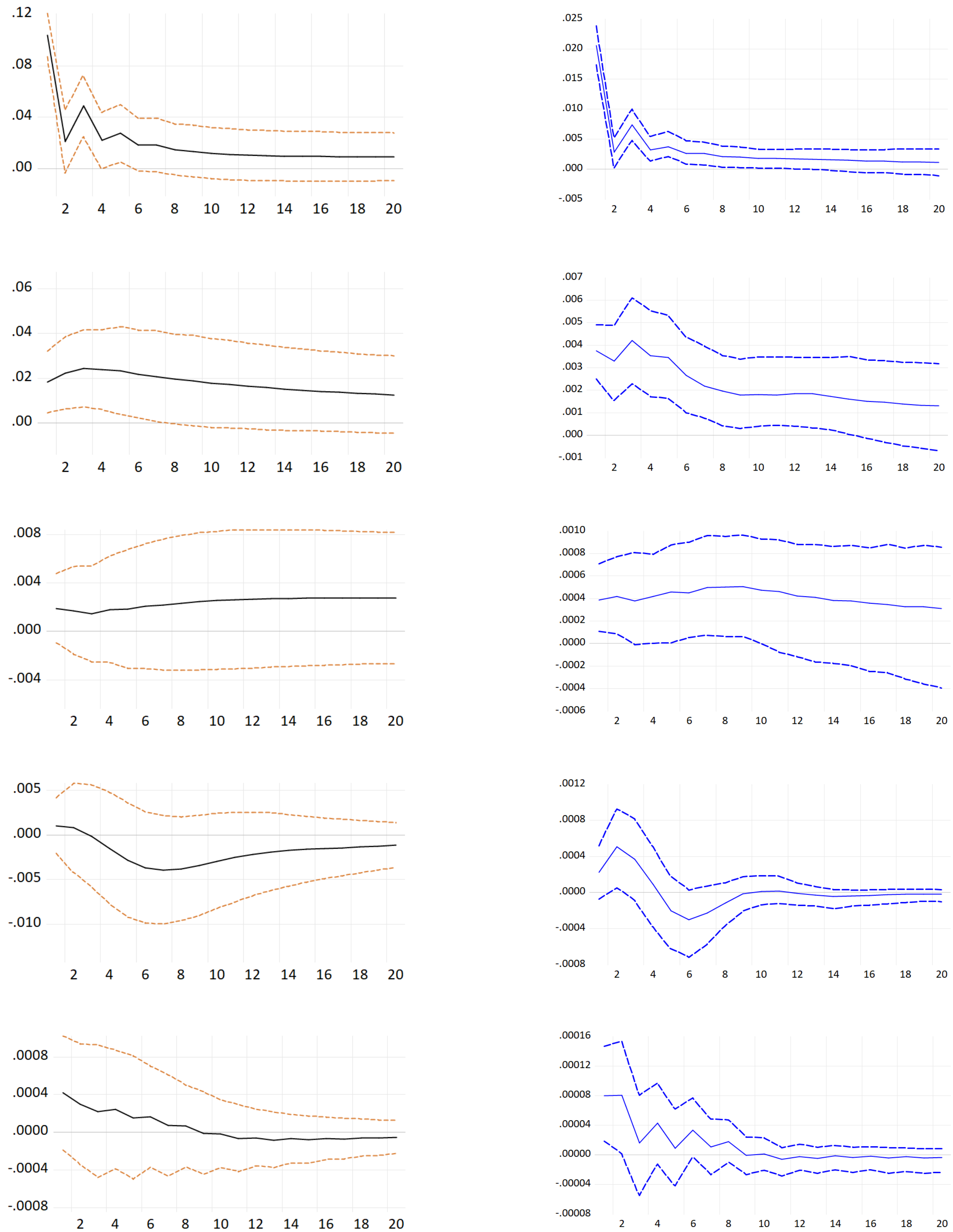


Figure 4.4.2: Fiscal shocks identified from a SVAR and in model without debt feedback (left) and with debt feedback (right). Both columns show response to shocks in government expenditure. The responses reported along the rows refer, respectively, to the effects on government spending, taxes, output, inflation and interest spending.

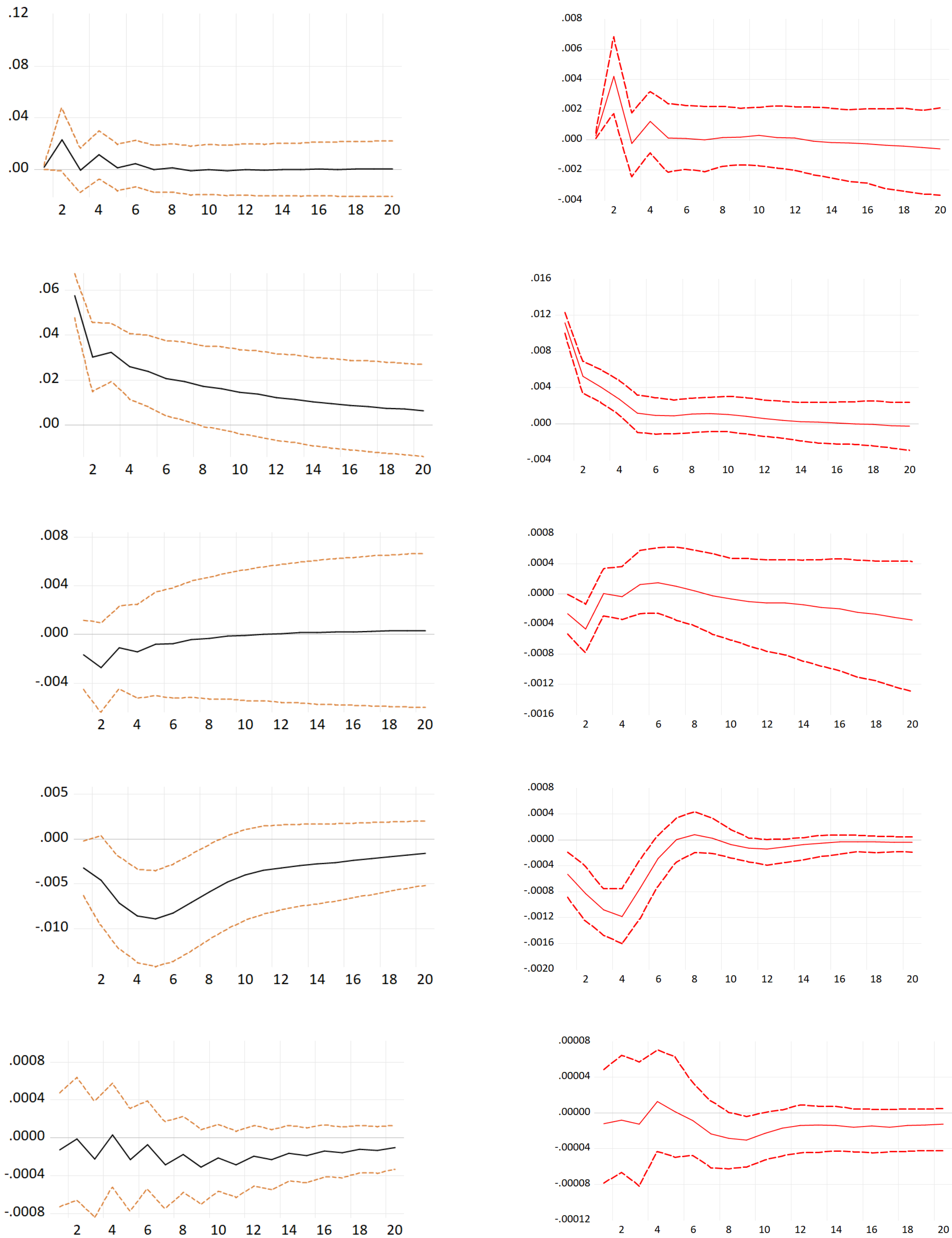


Figure 4.4.3: Fiscal shocks identified from a SVAR and in model without debt feedback (left) and with debt feedback (right). Both columns show response to shocks in taxes. The repurposes reported along the rows refer, respectively, to the effects on government spending, taxes, output, inflation and interest spending

the impact of positive tax shock over interest payments is positive. The impact over inflation and interest rate confirms that price level and long-term interest rates fail to respond to fiscal shocks, as indicated by Afonso and Souza (2012). The insignificant impression of fiscal policy shocks over the debt servicing portrays the insignificant tax revenue collection and high initial conditions of debt in Pakistan.

The presence of debt feedback highlights the need for caution in designing fiscal and monetary policies. Policymakers must consider not only the immediate effects of shocks but also their interactions with debt trajectories to ensure sustainable economic outcomes. Furthermore, policies need to account for the endogeneity of debt and its effects on macroeconomic stability. The magnitude of responses to shocks is often amplified due to the feedback loop between debt accumulation and economic variables (e.g., interest rates, output, or fiscal policy). However, without debt feedback, the responses are generally smaller since the model assumes no reinforcing mechanism. Confidence intervals around the response paths are wider in the model without debt feedback, reflecting greater uncertainty due to the potential for nonlinear interactions. This uncertainty complicates forecasting and policy planning. However, in the model with debt feedback, confidence intervals are generally narrower because the dynamics are more predictable and stable.

4.4.6 Forecast Error Variance Decomposition Analysis

The analysis of Forecast Error Variance Decomposition (FEVDs) over 10 quarters for government expenditure is displayed in Table 2(a). The Variance Decomposition analysis explains that major variation in the government expenditure shock is explained by its own lags. With the passage of time, this effect of lagged values of government expenditure decreases however even after the 10 periods it remains quite a large amount at 77.09 percent. Lagged effects in government spending highlight the complex interplay between fiscal inertia referring to the tendency of government budgets to change slowly over time due to established processes, political constraints, and bureaucratic hurdles, program implementation delays, and economic dynamics. The persistence of these lagged effects underscores the importance of aligning fiscal policy with long-term economic objectives.

Output is also effective in explanation of major variation in government expenditure. The impact of output in explanation of variation is persistent over the longer planning horizon that reaches 16.04 percent over a period of 10 quarters. It proves that government seems to have impact over manipulating aggregate demand in Pakistan. The growing role of output in explaining expenditure variation underscores the interconnectedness of fiscal policy and economic dynamics. By reinforcing the fiscal multiplier effect, this relationship highlights the importance of adaptive fiscal policies that respond effectively to economic conditions. The variation in government expenditure explained by taxes increases gradually. This dynamic underscore the critical role of fiscal policy in moderating the economic effects of tax changes and highlights the importance of considering expenditure responses when designing tax policies. The relationship between tax shocks and government expenditure is a key area of inquiry in public finance and macroeconomics and involves that changes in tax revenues (tax shocks) influence government spending and the broader fiscal framework. The results further explain that the variation explained by inflation and interest rate is negligible and decreases gradually. Inflation and interest rates contribute negligibly to fiscal stabilization in Pakistan due to its narrow tax base, high debt burden, supply-driven inflation, and weak institutional frameworks**.** Addressing these structural issues is essential for improving fiscal policy effectiveness.

The results of FEDVs over a 10-quarter horizon for tax shocks are reported in Table 2(b). Most of the variation in taxes is explained by itself. Government expenditure explains major variation in taxes and it also increases over time. The contribution of output in explanation of variation of taxes has increased from 0.84 percent in the 4th quarter to 9.26 in the 10th quarter and it is also consistent over time. The explanation of variation in taxes by debt interest payments ranges between 1.26 percent in 4th quarter to 2.11 percent in the 10th quarter. Hover the role of inflation in explaining the variation in interest rate is negligible.

Table 4.4.2: Variance Decomposition-Government expenditure

Period	S.E.	Govt. Exp	Tax	GDP	Inflation	Interest rate
1	0.105901	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.111125	94.75613	4.593578	0.247565	0.145496	0.257235
3	0.123017	93.56737	3.799955	1.730266	0.194229	0.708180
4	0.126879	90.80526	5.019740	3.293718	0.194917	0.686361
5	0.131933	88.47653	4.859818	5.128310	0.434677	1.100664
6	0.135398	85.74155	5.171443	7.566555	0.475297	1.045152
7	0.138832	83.33579	5.089512	9.719160	0.605651	1.249887
8	0.142036	80.65350	5.125726	12.43114	0.594722	1.194906
9	0.144941	78.36840	5.050035	14.70551	0.605718	1.270340
10	0.147940	75.88808	5.029967	17.27984	0.581411	1.220696

Table 4.4.3: Variance Decomposition-Taxes

Period	S.E.	Govt. Exp	Tax	GDP	Inflation	Interest rate
1	0.062269	9.360086	90.63991	0.000000	0.000000	0.000000
2	0.073721	15.97547	83.29337	0.128108	0.594545	0.008515
3	0.084656	19.23431	78.44199	0.439638	0.486613	1.397454
4	0.091656	22.64344	74.72335	0.857207	0.458471	1.317532
5	0.098129	24.47813	70.95877	2.032563	0.464582	2.065953
6	0.102890	26.11808	68.28858	3.137222	0.468969	1.987148
7	0.107751	26.85440	65.39968	4.863824	0.593628	2.288467
8	0.111664	27.52596	63.23356	6.413223	0.626477	2.200777
9	0.115723	27.72638	60.96624	8.321084	0.684094	2.302201
10	0.119205	27.93559	59.11725	10.05094	0.678678	2.217538

4.5 Conclusion and Policy Implications

This essay explores the impact of fiscal policy on macroeconomic indicators, with specific attention to tracking the evolution of debt dynamics. The analysis of how public debt and debt feedback affect the implications of fiscal policy is a relatively new and unexplored area in the literature in Pakistan. This paper provides a substantial contribution to the recent economic literature in Pakistan by estimating the impact of fiscal policy shocks on economic indicators while incorporating debt feedback. Failing to account for debt feedback in fiscal policy analysis can result in inaccurately estimated dynamic effects of fiscal policy.

The results of this essay highlight a positive impact of government expenditure on output, while the effect of government revenue on output is negative and lacks statistical significance. The impact of government expenditure shock on inflation becomes negative and insignificant after 4 quarters while tax shock fails to affect inflation in Pakistan. The model included the average cost of debt servicing, which have important implications in the context of debt dynamics. The findings of the study reveal a noteworthy and consistent rise in the average cost of debt servicing in response to government spending shocks. However, in the case of tax shocks, the impact on the average cost of debt servicing is negative and lacks statistical significance.

This essay's findings underscore the importance of analyzing debt dynamics to assess the potential impact of fiscal policy instruments on the escalating debt burden in developing countries. Additionally, this research reaffirms the need of a policy coordination between monetary and fiscal authorities for the essential fiscal sustainability. It highlights the necessity for clear and well-defined stabilization objectives in collaboration with the fiscal authorities. The practice of excessive borrowing to support pro-cyclical fiscal expansions can have a direct impact on inflation. Consequently, the monetary authority may need to adopt a contractionary stance to maintain inflation within acceptable limits. Accordingly, policy coordination is the requisite ingredient for stability of economy and smooth economic growth.

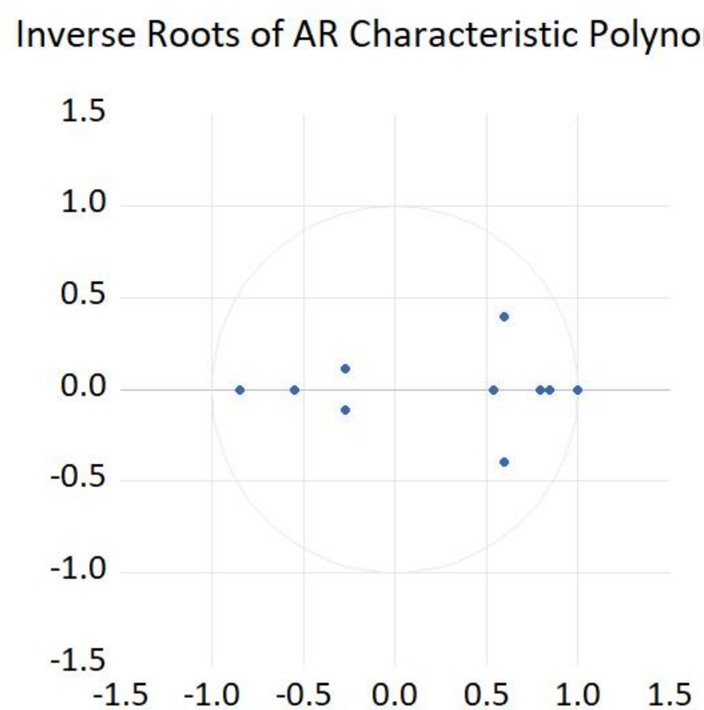
For Pakistan, it is clear that the average cost of financing public debt consistently exceeds the growth rate of real GDP. This underscores the importance of incorporating the debt level into the model when analyzing fiscal shocks. These findings underscore the importance for developing countries to carefully assess their government debt situation before implementing fiscal stimulus programs. It highlights the need for thorough scrutiny and evaluation of the potential impact on debt dynamics and the associated risks before embarking on such programs. This cautious approach is crucial to ensure sustainable fiscal policies and avoid potential adverse consequences in the long run. Moreover, there should be coordination between fiscal and monetary policies to maintain a consistent policy mix, complemented by an effective public debt management program (Togo, 2007).

The results indicate that positive government expenditure shock have the potential to stimulate the economic growth. The negative and insignificant impact of taxes on output also imply that revenue generation fails to be effectively channelized into productive spending that stimulates the economy. Although the influence of government revenue on output is insignificant, fiscal policy should be designed in a well-balanced way. Since effective revenue collection is essential to sponsor increase in government expenditures and to mitigate the reliance of the government on public debt.

Appendix

Table 4..1: Definition of Variables

Variables	Definition
GDP	GDP is defined as the sum of all goods and services produced in a country within a year. Quarterly GDP data is constructed by using the studies of Kemal and Arby (2005), Arby (2008) and Hanif et al. (2013).
Government Expenditure	Government expenditure are defined as the sum of public consumption and public investment.
Taxes	Total government tax revenue
Interest Payments	Average debt servicing is derived by dividing interest payments on public debt by the public debt at time (t – 1), as in Favero and Giavazzi (2007) and Cherif and Hasanov (2012).
Debt-GDP ratio	Debt to GDP ratio defines public debt as percentage share of GDP.
Inflation	Inflation is the rate of increase in prices of goods and services. This is Measured by the difference in prices at period t and (t-1).



Statistics	Debt	Interest Payments	Govt. exp	Taxes	GDP	Inflation
Mean	0.65545	0.016754	13.65469	13.03141	14.59213	0.078866
Median	0.635963	0.016697	13.81012	13.10924	14.60155	0.078483
Maximum	0.856937	0.025585	15.30989	14.40637	14.98076	0.219280
Minimum	0.515112	0.009010	12.18989	11.57225	14.14727	0.016239
Std. Dev.	0.088235	0.003666	0.861182	0.829944	0.257227	0.040643
Skewness	0.779445	0.047990	-0.222532	-0.123989	-0.210961	1.141586
Kurtosis	2.927403	2.301327	1.900889	1.679068	1.918969	5.134062
Jarque-Bera	8.523939	1.740746	4.921443	6.322241	4.713257	34.18483
Probability	0.014095	0.418795	0.085373	0.042378	0.094739	0.000000
Sum	55.05840	1.407294	1146.994	1094.639	1225.739	6.624762
Sum Sq. Dev.	0.646186	0.001116	61.55565	57.17094	5.491747	0.137106

Table 4..2: **Summary statistics for the variables**
In the table GDP stands for Gross domestic product, Interest Pay: for the average interest payments, Govt.exp: Government expenditure and Debt stands for debt-to-GDP ratio. Inflation is a rate, debt-to-GDP ratio and interest payments are in percentage while GDP, taxes and government expenditure are in log.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	642.10	NA	2.38e-14	-17.18	-16.71	-16.99
1	918.53	492.2	2.43e-17	-24.06	-22.81	-23.56
2	978.14	97.99*	9.57e-18*	-25.01*	-22.97*	-24.20*
3	993.12	22.56	1.30e-17	-24.74	-21.91	-23.61
4	1014.9	29.91	1.51e-17	-24.65	-21.04	-23.21
5	1040.4	31.38	1.64e-17	-24.66	-20.27	-22.91
6	1058.4	19.78	2.29e-17	-24.47	-19.30	-22.41
7	1087.4	27.82	2.54e-17	-24.58	-18.62	-22.21

Table 4..3: **VAR Lag Order Selection Criteria**
Note: * indicates lag order selected by the criterion.
LR: sequential modified LR test statistic (each test at 5FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Chapter 5

Conclusion and Policy Analysis

The thesis is structured around three essays that explore the effectiveness of fiscal policy across different dimensions. The first essay is constructed in the scenario of small open economy; second essay is based on the liquidly trap analysis and third essay centers on the empirical analysis of fiscal policy effectiveness in Pakistan. This thesis also creates a novelty by analyzing the economic scenarios in the first and second essays within the framework of a finite planning horizon and bounded rationality, specifically in the context of Pakistan. The primary finding of this thesis reveals positive government expenditure shock booms the economic conditions in Pakistan. Conversely, an increase in taxes is associated with adverse effects on both output and the standard of living for the population.

The analysis of fiscal policy indicators in the first essay indicates that increase in government expenditure has a positive impact over aggregate demand and output in short run as well as long run. Furthermore, the positive influence of positive government expenditure shock results in a decline in inflation and interest rate. The tax increase, akin to its impact in other developing countries, adversely affects the purchasing power of households, leading to a reduction in both aggregate demand and output. Additionally, the tax hike contributes to cost-push inflation and an elevation in interest rates. These factors, in turn, exacerbate the suppression of investment and economic activities. The examination of fiscal policy under bounded rationality has affirmed that the expectations held by economic agents play a crucial role in determining the ultimate impact of fiscal policy on economic activities. Given cognitive limitations and bounded rationality, economic agents tend to either overestimate or underestimate the implications of fiscal policy. Ultimately, it further demonstrates that the implications of fiscal policy are shaped by the bounded rationality of economic agents along with other economic indicators.

The second essay of the thesis is constructed on the innovative concept of liquidity trap with reference to Pakistan. In a liquidity trap, monetary policy becomes ineffective in revitalizing and stabilizing the economy. Consequently, fiscal policy assumes a primary role as a tool for stabilization. Fiscal policy, through the tools of government spending increase and tax cuts, have the potential to bolster aggregate demand and economic activities. The topic of expectations driven liquidity trap is examined under the assumptions bounded rationality and heterogenous expectations. The second essay confirms based on the economic indicators of Pakistan that, in the context of a liquidity trap, reducing consumer taxes and raising government spending are the more advantageous approaches for stimulating the economy. The fiscal policy tools of rise in government expenditure and consumption tax cut effectively increase production and prices. Conversely, a decrease in labor taxes does not increase production or inflation and can instead make the possibility of an economic deflationary cycle worse. Moreover, this study will make a significant contribution to the fiscal literature of Pakistan by evaluating the effectiveness of fiscal policy within the framework of a liquidity trap and bounded rationality.

The third essay of the thesis investigates the influence of fiscal policy on macroeconomic indicators in Pakistan, with a focus on monitoring the country's debt dynamics. The exploration of debt feedback during the analysis of fiscal policy implications is a significant contribution in the economic literature of Pakistan. The results of this essay identify that impact of government expenditure shock has positive impact on output. However, the impact of government expenditure shock has negative impact on inflation. Tax shock has negative impact over output and it fails to influence inflation. It is further analyzed that cost of debt servicing increases in response to government spending shock. Conversely, in instances of tax shocks, the effect on the average cost of debt servicing is negative and insignificance.

This thesis provides diversified and interesting analysis of fiscal policy implications over the economic conditions in Pakistan. In all three essays, the results consistently align, despite addressing entirely different scenarios. This thesis affirms that a positive government expenditure shock has a beneficial impact on economic conditions in Pakistan, while tax policies appear to have a negative effect. Considering these implications, it is concluded that an increase in government expenditure should take precedence in the formulation of fiscal policy. Moreover, the economic landscape of Pakistan seems more conducive to fiscal expansionary policies.

5.1 Policy Analysis

Fiscal policy primarily revolves around the government's actions related to taxation, spending, and borrowing. It encompasses various significant aspects such as determining the appropriate size and role of the state, promoting economic growth, creation of employment opportunities, social development, and equal distribution of income and economic benefits. A well-managed fiscal policy is crucial for preventing fiscal balances in the overall economy and materializing its full growth potential. Pakistan experienced significant macroeconomic imbalances during the 1990s, primarily due to excessive imbalance between government expenditure and revenues. Ultimately, this large fiscal deficit and lack of fiscal discipline led to unsustainable levels of public debt, which had adverse effects on the country's macroeconomic landscape.

The impact of fiscal policy on output volatility is primarily influenced by the structural characteristics of the fiscal regime. These structural features encompass the size of the public sector, as well as the composition of public spending and tax revenue (Debrun and Kapoor, 2010). The overall effect of fiscal policy on the economy is also shaped by factors such as the methods of debt financing, the expenditure and tax powers of fiscal authorities, and the composition of fiscal policy measures.The economic situation of Pakistan is always characterised with high non-development expenditures, low development expenditures, fiscal deficit and resulting rise in public debt burden. The empirical trends about the fiscal indicators in the figure 5.1.1 indicates that the government spending always remain high than the government revenue in Pakistan. Over the period government expenditure remained higher than taxes and this resulted in negative fiscal balance.

The supply side effects of fiscal policy are manifested through the wealth effect and the choices made by households regarding labor and leisure (Baxter and King, 1993). In each of the three essays, a consistent observation emerges that regardless of the circumstances, the rise in government spending exerts a favourable influence on output growth in Pakistan. The main drivers of economic growth are consumption, investment and net exports. Notably, consumption plays a substantial role in driving economic growth in nearly every economy, followed by investment and net exports. Pakistan's economic growth is historically categorized as consumption-led growth (Economic Survey of Pakistan, 2022-23). During the Fiscal Year 2022-23 aggregate consumption as a percentage of GDP was 25 percent while aggregate investment was 15 percent of GDP. Over

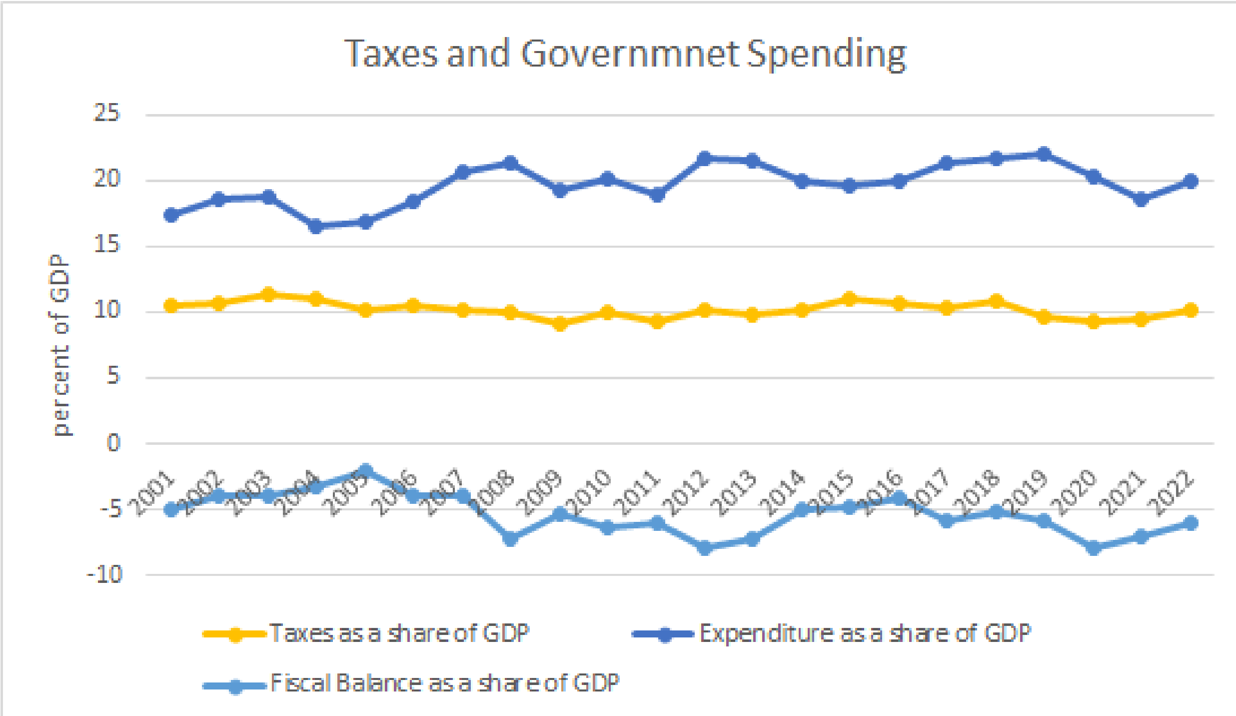
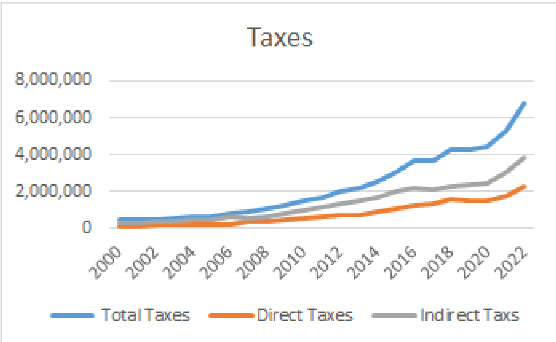


Figure 5.1.1: Source: Economic Survey of Pakistan (various issues)

the past decade, the investment rate as a percentage of GDP remained stagnant at 14 to 15 percent, while the consumption rate as a percentage of GDP increased from 86 percent to 99.6 percent (Economic Survey of Pakistan, 2022-23). This phenomenon is evident while discussing consumption in the second essay that even during a recession, economic agents enhance their consumption expenditures in response to an increase in government spending. This outcome suggests that Pakistan's economy thrives on consumption led growth. Given these implications, the conclusion is drawn that prioritizing an increase in government expenditure is advisable in the formulation of fiscal policy. Furthermore, the economic context of Pakistan appears to be more favorable for the implementation of expansionary fiscal policies.

The tax structure plays a role in influencing the supply side of the economy by impacting households' decisions regarding labor supply and firms' decisions concerning business financing,



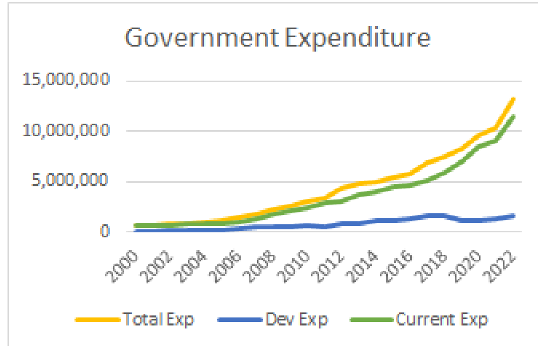


Figure 5.1.2: Source: Economic Survey of Pakistan (various issues)

among other factors. Direct and indirect tax levels have distinct transmission mechanisms that affect decision-making by economic agents. The tax system in Pakistan is characterized with many issues including lack of enforcement, narrow tax base, exemptions/concessions, widespread tax evasion and low tax-to-GDP ratio. The analysis articulated in this thesis validates the claim that a rise in tax rates imposes a burden on economic agents, resulting in adverse effects on economic growth in Pakistan. This scrutiny further underscores the inherent challenges within Pakistan's tax framework. On one hand, taxation proves insufficient in generating necessary revenues, leading to the government's dependence on debt. On the other hand, the reliance on indirect taxes diminishes the purchasing power of households and producers, thereby constraining overall economic growth.The description of increasing fiscal deficit is further explained by the increasing proportion of non-development expenditures (current expenditures) and the decline in development expenditures (Figure 5.1.2).

Debt dynamics elucidate the changes in the debt-to-GDP ratio over time. The effectiveness of fiscal policy is contingent on the debt dynamics as the fiscal policy tools are closely affected by the debt dynamics. This analysis is majorly needed in the countries like Pakistan where the debt to

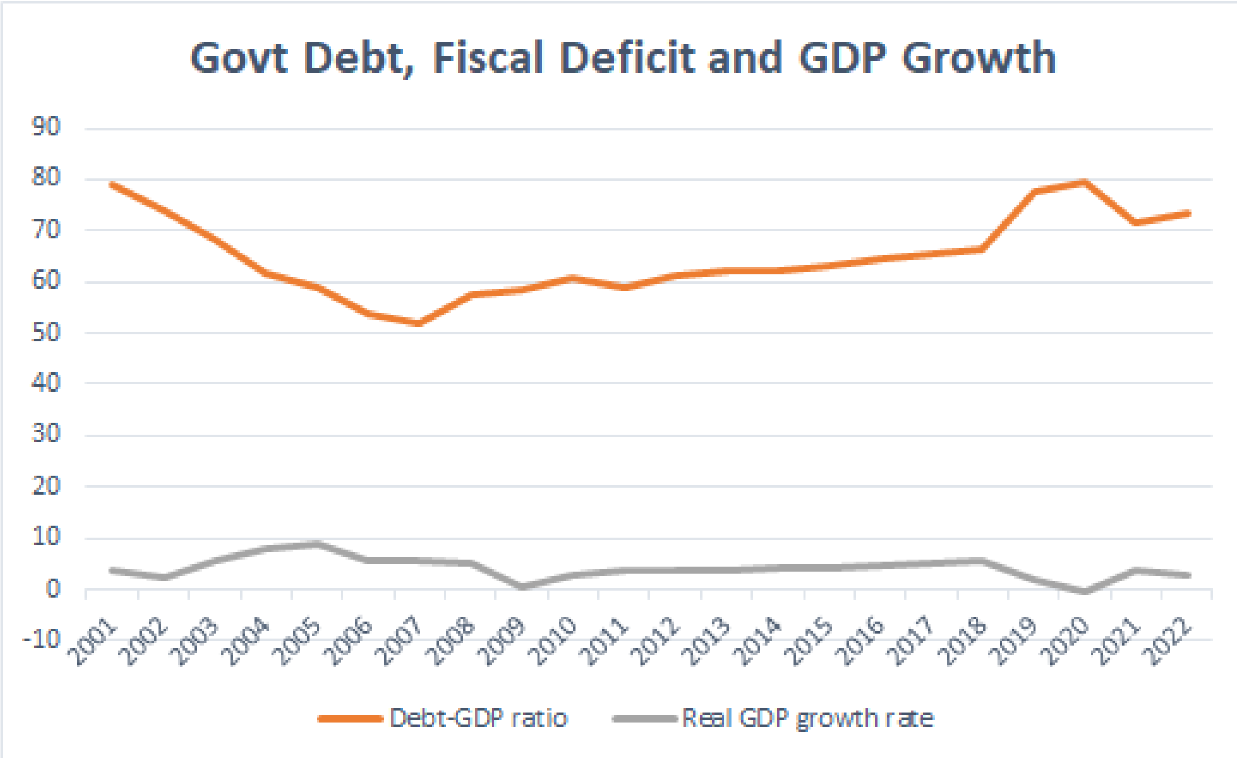


Figure 5.1.3: Source: Economic Survey of Pakistan (various issues)

GDP is higher than the GDP growth rate as indicated in figure 5.1.3. Both domestic and external debt have contributed to the overall debt burden. External debt is denominated in foreign currencies and is subject to exchange rate risks. The servicing of public debt, including interest payments and principal repayments, has significant implications for the government's budget. The importance of public debt in the successful execution of fiscal policy plans has been thoroughly elucidated across all three chapters. The first essay reveals that the devaluation of the domestic currency and the resulting implications for servicing foreign debt have adverse effects on the substance of fiscal policy. Conversely, the third essay demonstrates that the dynamics of debt exert a significant impact on both the development and execution of fiscal policy in Pakistan.

As discussed in the previous chapters, the lower tax to GDP ratio and the fiscal deficit increases the reliance on the public debt. The increasing trend in the debt-to-GDP ratio also implies that the Fiscal Responsibility and Debt Limitation Act, 2005 (FRDLA) has a negligible impact, that was aimed to limit the debt to GDP upto 60 percent. Fiscal policy and debt situation in Pakistan are closely correlated, as is the case in many other countries. This correlation determines the government's decisions regarding taxation, government spending, and budgetary management and level of government borrowing and the associated debt burden. The empirical analysis conducted in the third essay in Pakistan defines that it is needed for the government to implement responsible fiscal policies, including measures to increase revenue collection, control spending, and prioritize debt management. The implementation of the Fiscal Responsibility Act and Debt Limitation Act, 2005 can have significant implications for fiscal sustainability, debt management, and transparency in Pakistan. However, effective implementation, enforcement, and continuous monitoring are vital to ensure that the intended objectives are achieved and the country's fiscal position is strengthened. Addressing these issues requires comprehensive tax reforms, including simplifying tax laws, widening the tax base, improving tax administration, promoting a culture of tax compliance, and enhancing transparency and accountability in the system.

Chapter 6

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