

# STATE-DEPENDENT GOVERNMENT SPENDING MULTIPLIER: EVIDENCE FROM PAKISTAN



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OF DEVELOPMENT  
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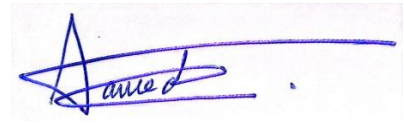
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I, Ms. Ayesha Javeed, hereby declare that the MPhil thesis titled "State-Dependent Government Spending Multiplier: Evidence from Pakistan" is my original work and has not been submitted previously by me for the award of any degree at the Pakistan Institute of Development Economics or any other institution, either in Pakistan or abroad.

I understand that if, at any stage, even after the award of the degree, this declaration is found to be false, the university reserves the right to withdraw my MPhil degree.



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## **Dedicated**

To my dearest mother

***Ms. Bushra Parveen Warraich***

Whose unwavering love, endless sacrifices, and steadfast support have been the cornerstone of my life and learning. Her strength, wisdom, and constant encouragement have guided me through every obstacle and milestone. This thesis is a humble tribute to her unconditional belief in me and the enduring inspiration she continues to provide.

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Ms. Ayesha Javeed

## **Abstract**

This research investigates whether Pakistan's fiscal multipliers are higher during periods of economic slack than during periods of non-slack. By using the Local Projection Method (LPM), we estimate how real GDP and inflation change in response to a government spending shock while distinguishing between states using high and low unemployment rates. Fiscal expansions are found to have limited and temporary effects on output, with multipliers remaining very small and consistently below unity across all degrees of economic slack. In contrast, their inflationary effects are more lasting and persistent. These findings support the idea that Pakistan's fiscal stimulus is less effective in enhancing output growth in any state of the economy. This suggests that increased government spending during expansionary periods tends to crowd out private investment due to the dominant role of the public sector in the economy. As well as increasing the fiscal stimulus, causes inflation to fuel. Therefore, strengthening the private sector is essential, as sustainable economic growth cannot rely solely on government stimulus.

### **Keywords:**

Fiscal Policy, Local Projection Method, Non-Linear Model, Smooth Transition Function

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## LIST OF ABBREVIATIONS

<b>ADF</b>	Augmented Dickey-Fuller
<b>AIC</b>	Akaike Information Criterion
<b>BISP</b>	Benazir Income Support Program
<b>DSGE</b>	Dynamic Stochastic General Equilibrium
<b>F(Z)</b>	Logistic Function
<b>FPE</b>	Final Prediction Error
<b>GDP</b>	Gross domestic product
<b>G<sub>t</sub></b>	Total Government Spending
<b>HQIC</b>	Hannan-Quinn Information Criterion
<b>IMF</b>	International Monetary Fund
<b>LL</b>	Log Likelihood
<b>LPM</b>	Local Projection Method
<b>LR Stats</b>	Likelihood Ratio Statistic
<b>MPC</b>	Marginal Propensity to Consume
<b>MPI</b>	Marginal Propensity to Import
<b>MRSM</b>	Markov Regime Switching Model
<b>OLS</b>	Ordinary Least Squares
<b>P-Value</b>	Probability Value
<b>PVAR</b>	Panel Vector Auto-Regressive
<b>SBIC</b>	Schwarz Bayesian Information Criterion
<b>STF</b>	Smooth Transition Function

<b>SVAR</b>	Structural Vector Auto-Regressive Model
<b>T</b>	Taxes
<b>VAR</b>	Vector Auto-Regressive Model
<b>Y</b>	Output
<b>ZLB</b>	Zero Lower Bound
<b><math>\Pi</math></b>	Inflation

# CHAPTER 1

## INTRODUCTION

### 1.1 Background of the Study

An active fiscal policy in economic stability has been the center of attention for economists and policymakers since the great depression of 1930 and the aftermath of Keynesian doctrines that support an active government role. Many economists support the role of government to keep the economy on track by promoting growth and development through regulating markets, and public goods provision (Gigineishvili et al., 2023 & Shaukat et al., 2023) while a vast majority of economists oppose the government's active role in the economy, favoring the principle of invisible hand by classical school of thought arguing that public sector interventions cause inefficiencies, and resource misallocation (Raashid et al., 2020). Empirically, the results for government spending multiplier are ambiguous, yet the recent development on state-dependent multipliers often showed fiscal multipliers below unity (Raashid et al., 2020; Ramey & Zubairy, 2018). The reason behind such a low fiscal multiplier can be theoretical as well as methodological, e.g., less information asymmetry and various definitions of the state of the economy by economists. If the multipliers are this low, research suggests that rises in government purchases do not stimulate private activity, and fiscal consolidations that involve reducing government purchases are unlikely to cause much harm to the private sector. It also indicates that expansionary fiscal policies could raise public debt without generating enough economic growth. The public finances sustainability may be affected since the debt-to-GDP ratio might increase faster than expected. Since the global recession of 2008, the literature has focused on state-dependent multipliers, and policy effectiveness is intuitively dependent on various factors, i.e., unemployment rate, business cycle variations, exogenous shocks, and other macroeconomic variables working along policy variables.

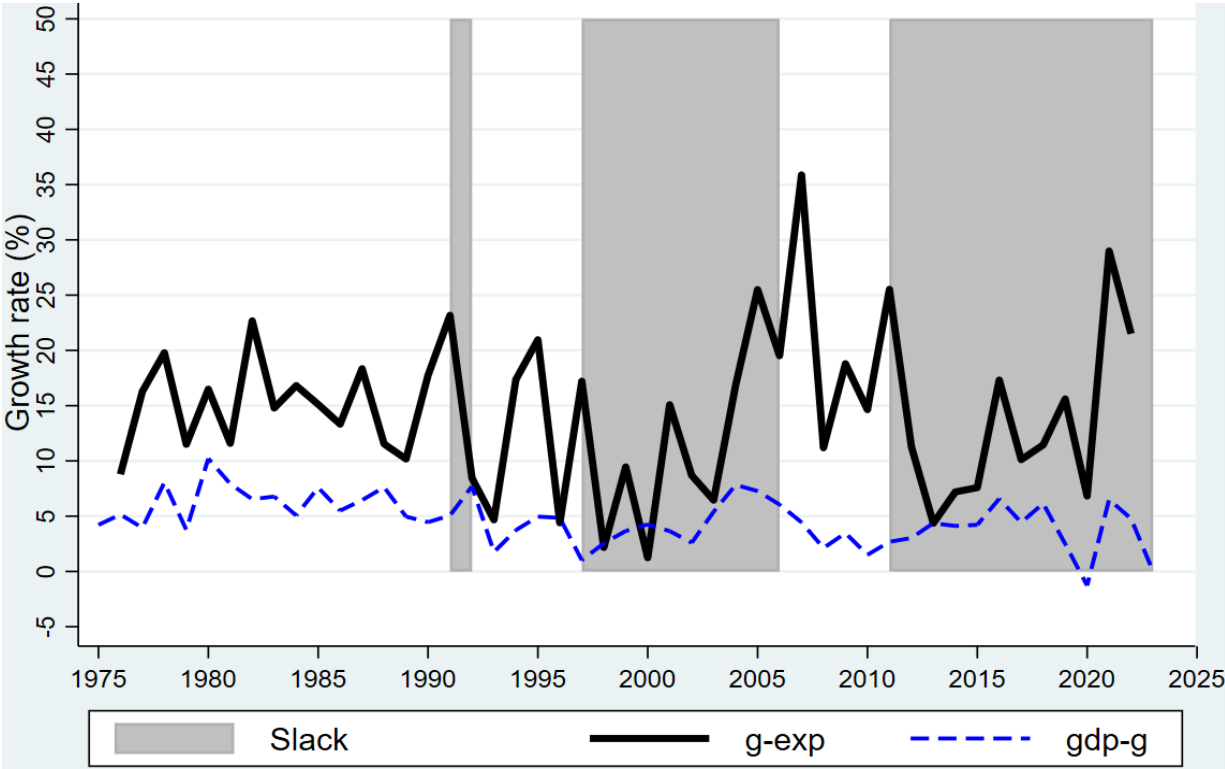
The Keynesian theory states that fiscal policy is significantly more effective during economic recessions than during periods of expansion, suggesting whenever there is economic slack the multiplier would be high<sup>1</sup>. However, if the economy is operating in a non-slack period and near

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<sup>1</sup> The slack period can be defined as the period when the unemployment rate of the economy is higher from a certain threshold.

the stage of full employment, then more government spending may squeeze private investment, resulting in a reduced multiplier. Thus, Keynesian models forecast that the multipliers are state-dependent and nonlinear, and results vary along with the state of the economy. Many studies recently supported a higher government spending multiplier during the recession in the economy in line with these Keynesian models (Auerbach & Gorodnichenko, 2011; Fazzari et al., 2014). Some studies also found effective fiscal policy responses in cases with a zero lower bound compared to the normal situation of the economy (Serio et al., 2020; Klein & Winkler, 2021).

**Figure 1.1: Growth in Government Spending and GDP in Slack & Non-Slack Periods**



Source: Ministry of Finance

Figure 1.1 shows the trend of growth in government expenditures (g-exp) and GDP (gdp-g) in slack and non-slack episodes for Pakistan. The blue dashed line presents the pattern of GDP growth, while the black solid line shows the pattern of growth in government spending. The gray shaded area presents the slack period of the economy, where the unemployment rate is above the average unemployment rate of 5.3, whereas the unshaded area presents the non-slack period. Movements in both variables are asymmetric in the sense that in some periods when the

expenditures increase, the GDP also accelerates almost to the same extent, but a few periods highlight that growth in expenditures is not stimulating GDP growth. This shows that the multiplier effect is state-dependent (non-linear) instead of linear, so the study will use non-linear models for the analysis. Observing both variables, particularly in slack episodes (gray shaded area), presents asymmetric behavior in each episode of slack. For instance, in the first episode of slack, expenditure growth is declining but GDP growth is increasing in the second episode of the slack period when GDP growth is increasing, expenditure growth is declining, but afterward, when expenditure growth is increasing, GDP growth is declining, indicating the asymmetric behavior of both variables. Similarly, the third episode of slack shows a similar trend where sometimes both variables move in the same direction, but sometimes they move in opposite directions.

Understanding how fiscal multipliers vary with the state of the economy is crucial for Pakistan's policy design. If multipliers are larger during high-unemployment periods, timely government spending can stimulate growth without crowding out private investment. Conversely, in non-slack phases, additional spending may raise interest rates or inflation and be less effective. By identifying these state-dependent dynamics, this study provides actionable guidance on when fiscal stimulus is growth-enhancing and when it risks aggravating fiscal or inflationary pressures, a question that remains unsettled in the context of developing economies such as Pakistan.

## **1.2 Research Problem**

The current fiscal condition of Pakistan's economy can be seen by having an idea about the fiscal imbalances of the economy. In Pakistan, total Revenue collection is Rs. 9.78 trillion, while total expenditures are Rs. 13.68 trillion, as per Pakistan's Economic Survey 23-24 (Ministry of Finance, 2023). So the fiscal deficit was recorded at Rs. 3.9 trillion, which is 3.7% of GDP (Ministry of Finance, 2023). To fill the gap between expenditure and revenue, the government borrows money from both domestic and foreign sources to pay the fiscal imbalance. Pakistan's overall public debt, according to the survey, is Rs. 67.525 trillion rupees, of which Rs. 43.43 trillion is domestic and Rs. 24.09 trillion is foreign (Ministry of Finance, 2023). Therefore, it is crucial to analyze whether or not this government expenditure has a multiplier impact on the economy particularly in times of economic downturn in term of unemployment. To do this, the study will use data from 1975-2023 for the Pakistan economy to examine multipliers in different states of the economy. The standard economic theory, which states that the government spending multiplier is bigger during

economic recessions and lower during economic expansions, will be empirically tested in this research, but with a modification in the definition of slack by taking the unemployment rate as a measure of slack. The slack, which is determined by the unemployment rate, will determine the multiplier in the two states of the economy: states with high and low unemployment rates.

### **1.3 Research Gaps and Contributions**

Literature on the estimation of government spending multipliers in the case of Pakistan has ambiguous results. Shaukat et al. (2023) used a simple OLS regression model to investigate whether government spending boosts economic growth in Pakistan when recessions hit, using yearly time series data from 1982-2020, and results proved that a 1% increase in government expenditure results in a 2.2 unit increase in GDP. To study the nonlinear effect of fiscal policy, Malik (2020) employed TVAR using annual data from 1974-2017 and found that the value of the fiscal multiplier in the recession is 0.31, whereas in the expansion it is 0.081, indicating that the government spending has a higher multiplier in times of economic downturn, or recession. Gul (2022) investigated the impact of government spending on output/GDP by having military spending as an instrument using annual data from 1971-2019, employing OLS and 2SLS methods, and the results show that the short-run multiplier is 1.19. On the other side, Raashid et al. (2020) show that Pakistan has a low fiscal spending multiplier, estimated to be 0.54 after a year, 0.29 after five, and 0.18 after one decade, using annual data from 1999-2019 and quarterly data from 2002Q2-2019Q4 by employing a DSGE model. Similarly Ali (2018) used business cycle states, recession, and expansion to study the effect of fiscal expansion on GDP using annual data from 1980-2015.

Following Ramey & Zubairy (2018); Fazzari et al., (2014), this study will use the unemployment rate as a measure of economic slack (not recession). There's also the use of other measures i.e. output gap and debt to GDP ratio for measuring slack. However, the output gap can be measured by the difference of actual and potential GDP which requires assumptions about potential GDP and leads to variation in results. While debt to GDP ratio is mostly used to assess fiscal sustainability and debt burden instead of economic slack. So the unemployment rate is a better indicator of slack for the following reasons:

- **Direct Impact on Labor Market:** Unemployment directly reflects labor market conditions, so it is a pretty straightforward indicator of economic slack. Government spending increases the aggregate demand that can reduce unemployment.
- **The unemployment rate as a measure of underutilized resources:** Since it indicates the percentage of the labor force actively seeking employment but unable to find any job, it fits perfectly within the parameters of economic slack as it is a clear indication of idle resources.
- **Timing of unemployment:** The unemployment rate is often low during expansions and relatively high during recessions so it is a much better indication of the status of the economy.

The state in this study implies that when the economy is below the threshold of the unemployment rate, which is 5.3, there's a non-slack period, and when the economy is above the threshold of the unemployment rate, there's a slack state in the economy. Secondly, most of the literature evaluating state-dependent effects employed either simple OLS or VAR methodologies, which have either no or a limited application for non-linear models. To counter this issue, this study uses the local projection method of Jordà (2005) to calculate the state-dependent multipliers. Thirdly, all studies employed annual time series data to determine the multiplier impact. One challenge with using annual data frequency in a state-dependent analysis is the issue of small sample bias. When the data is divided between two states using a binary approach, often a limited number of observations are left for the slack period, resulting in econometric issues related to small sample size. This study will address this issue by employing two methodologies.

- **Interpolation method:** A statistical method called interpolation is used to estimate values within a dataset in situations where data points are missing or where higher-frequency information from lower-frequency observations is needed. Interpolation will be utilized to transform annual data into quarterly values.
- **Building a logistic function:** In econometric analysis, particularly when time-varying parameters or regime-dependent analysis are involved, small sample sizes might result in estimates that are biased for the following reasons:
  - a) The lack of observations restricts the capacity to accurately quantify the regime impacts.

- b) Discrete regime-switching models could escalate the issue of small sample bias by dividing data into expansion and recession.

Auerbach & Gorodnichenko (2012) propose a logistic function that provides a more continuous and fluid regime shift rather than a classification of regimes. This will lessen the biases associated with sample size.

#### **1.4 Significance of the Study**

This research will contribute to the growing literature on state-dependent fiscal multipliers by investigating whether the fiscal expenditure multipliers in Pakistan's economy differ based on the amount of economic slack as measured by the unemployment rate. This study aims to use yearly data for the Pakistan economy to study the multiplier in different states, as well as making yearly data into quarterly data, along with building a logistic function to do the sensitivity analysis and robustness checking. Secondly, this research defines a slack economy as, “the economy in which the unemployment rate exceeds a certain level by taking an average of the unemployment rate as the threshold”. For sensitivity analysis and robustness checks, the study also intends to use some of the other alternative variables, such as real GDP itself, real per capita GDP, and industrial production, using two datasets (quarterly and annual). Lastly, our research will deal with the key methodological issue that arose in earlier studies using simple linear models for calculating multipliers. This study will calculate the multiplier using both linear and non-linear (state-dependent) models and will show how the results vary for both models.

#### **1.5 Research Questions**

Our study will mainly address the following research questions:

- Whether the government spending multiplier is state-dependent, particularly high during periods of slack?
- Whether there is any significant difference if the impulse responses are calculated by linear and non-linear models?
- How does a change in multiplier calculation affect the estimates calculated in previous studies?

## **1.6 Research Hypotheses**

**H1:** Government spending multipliers are large in periods of economic slack (in periods of high unemployment state).

**H2:** The government spending multiplier estimated from a linear model is significantly different from that estimated by non-linear models.

## **1.7 Objectives of Study**

### **Objective 1: Govt. Spending Multiplier Depending on the State of the Economy**

The primary goal of this research is to determine whether the government spending multiplier may differ based on the state of the economy. Our Objective is to investigate the multiplier during the high-unemployment state and during the low-unemployment state of the economy. So the study aims to figure out whether the multipliers are larger or not in periods of economic slack.

### **Objective 2: Comparison of the linear and non-linear (state-dependent) models of multiplier**

The study aims to assess the government spending multiplier through the application of two distinct models, as the linear model is not an appropriate approach for determining the multiplier in different states of the economy so we will use both models in the study. These models are:

- The linear model: By holding all other economic variables constant, it will investigate the multiplier effect. According to this model, the multiplier is independent of the state of the economy.
- The nonlinear model (state-dependent): To represent the behavior of the multiplier in various economic states, it will make use of the economic slack variable, which is quantified by the unemployment rate, to find out the multiplier in low and high unemployment states.

### **Objective 3: Difference in the calculation of multiplier by changing the calculation method**

The objective of the study is to find out whether the results of calculating the multiplier vary from the previous studies if we employ the local projection method (LPM) of Jordà (2005) to calculate the multiplier which is the most appropriate and flexible method to capture non-linearity.

#### **Objective 4: Cross-check the results by doing a sensitivity analysis**

Our objective is to find out whether the results are changing by changing the frequency of data and by using different alternative variables for GDP to check the robustness of the results.

#### **1.8 Policy Context**

Looking at the previous decade, there has been a sharp increase in government spending despite tight financial conditions, fiscal imbalances, budget deficits, and increasing amounts of public debt in the economy. Policymakers should know when government spending should be increased to be used as a policy tool and how various economic situations, like the high unemployment rate can lessen the effectiveness of the policy. So this research will address the following key aspects.

- **Effectiveness of Fiscal Policy:** The study will address the ongoing debate on the effectiveness of fiscal policy, specifically after 2008, to critically analyze the role of fiscal policy in times of economic slowdown on the GDP growth or revival of the economy.
- **State-dependent multiplier:** The study will investigate whether the multiplier is state dependent, which means it varies depending on the amount of economic slack (high unemployment)? Further, the study aims to empirically test the multipliers for the time of recession and expansion as measured by slack, to find out whether the multiplier is high during the slack period.
- **Future policy Implications:** The purpose of this research is to provide support to policymakers, particularly when preparing government spending plans during times of slack. They should must comprehend how the multiplier operates under various economic circumstances to allocate resources to stimulate the economy efficiently and prevent adding to the national debt. The results of this study will have an impact on choices regarding the fiscal stimulus plan, particularly during an economic downturn. Thus, in terms of the significance of fiscal policy in the economic downturn, this research will scientifically offer evidence that either validates or denies the conventional economic theory regarding stimulus packages in an economic downturn.

## **1.9 Organization of the Study**

The study proceeds in the following order. Chapter 1 discuss the introduction, chapter 2 have a literature review, and chapter 3 discussed the econometrics methodology and data collection. Chapter 4 focused on the estimations and interpretation of these results along robustness check. Chapter 5 consists of policy recommendations and conclusion.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Introduction

Since the great depression of 1930, there has always been a debate on the size of the government spending multiplier in different states (recession, expansion) of the economy to study the effectiveness of fiscal policy. According to the economic theory proposed by Keynesian, an increase in investment, net government spending, or private consumption expenditures will increase GDP overall by an amount greater than the increase itself due to the multiplier effect on the economy. Thus, the concept of “multiplier states that the GDP as a whole will rise by more than 10 units when expenditure rises by 10 units”.

By studying the role of fiscal policy from history it's worth noticing that the unemployment rate stayed in the double digits during the 1930s depression until 1941, when the government started to invest heavily in the war effort. Economists viewed this positive impact of military expenditures on job creation and economic activity as obvious proof of the effectiveness of Keynes's fiscal policy. However, the ongoing increase in unemployment and inflation in the 1960s highlighted that the Keynes fiscal approach was failing. Consequently, monetary policy became the primary focus of countercyclical policy instead of fiscal policy. As a result of the Fed's failure to prevent a severe recession at the end of 2007, several economists argued for fiscal stimulus to revive the economy. So again, the focus shifts from monetary policy to fiscal policy as an effective tool to mitigate recession (Feldstein, 2009). For macroeconomic forecasting and policymaking to be effective, an understanding of fiscal multipliers is still essential in the present time. Batini et al., (2014) shows that fiscal multipliers, which quantify the effect of fiscal policy on the economy, are essential instruments for macroeconomic forecasting and policy formulation. Although multipliers are usually positive, they are usually small, but there is some evidence that they could be negative in specific situations (Mahfouz et al., 2002). Given that scenario it's important to empirically test whether government spending is having a multiplier effect on the economy which may vary depending on the states of the economy.

### **2.1.1 Basic Keynesian Theory of Fiscal Multipliers**

The Keynesian theory regarding fiscal multiplier states that government expenditure can boost economic growth, especially in recessions. Charles et al., (2015) & Michailat, (2014) reported high fiscal multipliers during recessions. Gordon & Krenn (2010) calculated that during the Great Depression, the government spending multiplier was 1.80 in the absence of capacity constraints and 0.88 in their presence. As unemployment increases from 5% to 8%, the multiplier doubles, according to a model created by (Michailat, 2014). One possible explanation for this phenomenon is the pro-cyclical character of capitalist savings patterns (Charles et al., 2015). McGee (2014) stated that the theory of multiplier to explain economic reality have been conflicting. It's interesting to note that Bastiat (1848) addressed a related idea before Keynes did in the 1840s. These findings support an argument against austerity policies during economic downturns, which imply that stimulus programs may be more successful during recessions (Charles et al., 2015).

### **2.1.2 Transition from Linear to Non-Linear Multiplier**

Recently, many researchers have figured out that fiscal multipliers depend on the level of economic activity because they are nonlinear by nature. Fazzari et al., (2014) stated that government expenditure multipliers are higher in slack economies (estimates approach 1.6 in low utilization regimes). The study of López-Vera et al., (2018) indicates that a negative output gap in Colombia results in a greater tax revenue multiplier and expenditure. Alexandra et al., (2017) showed that the amount of debt is a critical determinant of the efficacy of fiscal policy because tax-based debt consolidations lose their effectiveness when debt levels are high, whereas spending reductions help to stabilize debt. Numerous findings of the above-mentioned studies that indicate fiscal multipliers vary with business cycles, particularly during downturns. Additionally, there is compelling evidence that the initial debt levels and fiscal shocks (tax versus expenditure) are important predictors of the consequences of fiscal policy, highlighting the importance of taking these aspects into account by considering their non-linear nature before policy making.

## **2.2 Methodological Evolution to Estimate Fiscal Multipliers**

It has been shown that estimation methods for calculation of fiscal multipliers, which gauge how changes in fiscal policy affect economic production, have changed dramatically over time. Particularly, these methods are shaped by the need to improve the theoretical frameworks, obtain

newly created data, or overcome past econometric challenges. The most common and basic approach for estimating multiplier is the use of OLS. Numerous studies have estimated the fiscal consequences in Pakistan using the Ordinary Least Squares (OLS) approach. To examine the effects of policy, a small macro-econometric model was created using OLS and annual data from FY73-FY06 (Hanif et al., 2011). Faridi et al., (2013) used simple OLS model and found that revenue decentralization has no positive effect on employment. Then the literature turned from OLS to dynamic structural vector auto-regression (SVAR) models to study the effects of fiscal multipliers. The study Sharif & Nawaz (2024) examines how fiscal policy affects Pakistan's macroeconomic circumstances using the structural Vector Auto-regression (SVAR) model and found the result that although tax shocks have negligible effects, government spending shocks have a favorable impact on output along with raising inflation and debt ratios. Similarly, Shafique et al., (2020) also used SVAR in the study and results indicate that while expenditure shocks continuously raise taxes and government spending, tax shocks have erratic short-term effects on spending. Additionally, they point out that increased output improves tax revenue, which helps with managing debt and the deficit.

Then researchers found new techniques like the DSGE model and regime-switching models for the study of fiscal policy. Recent studies examine macroeconomic fluctuations and policy consequences using regime-switching DSGE models. Liu et al., (2010) make the case for an effective regime-switching DSGE model estimate methodology in order to pinpoint the major shocks causing macroeconomic volatility. A general formulation of endogenous and threshold-based regime-switching models is presented by Albertini & Moyen (2020), who also developed an effective numerical solution technique. Regime changes in DSGE models become extremely important in the research in order to understand the intricate economic dynamics and policy implications. To estimate and analyze such models, they offer a variety of methodological approaches, leading to a deeper comprehension of the effects of macroeconomic policies and variations across multiple regimes.

After this, the literature turns toward local projection methods, for the flexibility of this method. Inoue et al., (2024) presented time-varying local projection models that took into account the unpredictability of economic data and applied them to fiscal policy shocks, based on recent research that used local projection methods to analyze the consequences of fiscal policy. These

methods could estimate impulse responses in a flexible way, but they make certain assumptions about the dynamics of the data.

**Table 2.1: Evolution of Methodologies Regarding Fiscal Multiplier in Literature**

<b>Study</b>	<b>Methodology</b>	<b>Results</b>	<b>Time Span</b>
Shaikh et al., (2015)	<b>Ordinary Least Square (OLS)</b>	In Pakistan, the consumption multiplier is predicted to be 5.587, while the marginal propensity to consume is 0.821.	1985-2011
Shaheen (2012)	<b>Structural vector autoregressive model (SVAR)</b>	Backed by cumulative output multipliers, which show that in five years, output has increased by 70%, but the multiplier value is still less than one.	1965-2009
Raashid et al., (2020)	<b>Dynamic stochastic general equilibrium (DSGE)</b>	With estimates of 0.54, 0.29, and 0.18 after 1, 5, and 10 years, respectively, Pakistan's fiscal multiplier is low.	1972-2019
Ali & Ahmad (2020)	<b>Markov Regime Switching Model (MRSB)</b>	One-unit shock to government spending has a multiplier effect on the output of the economy when it is in a low growth regime around 0.65 throughout the first quarter. The fifth period Eventually drops to 0.50, the multiplier gradually declines over time.	1972-2018
Ramey & Zubairy (2018)	<b>Local Projection Method (LPM)</b>	Regardless of the degree of economic slack, an estimate of multipliers is below unity.	1890-2013

Quantile regression approaches were used for local projections by Linnemann & Winkler (2016), who reported nonlinear impacts of government expenditure shocks on output and unemployment. For example, they found that low quantiles in the conditional output distribution had higher output effects. Using local predictions, Haan & Wiese (2020) examined how labor and product market reforms affected economic development while accounting for endo-geneity and fiscal policy stance. They also discovered that the current state of fiscal policy affects how reforms affect growth.

### **2.3 Evidence on State-Dependent Fiscal Multipliers**

State-dependent fiscal multipliers indicate that the multiplier effect is non-linear, as the multiplier can vary based on the variation in the economy's business cycle, so it depends on the state of the economy whether the economy is in the expansionary state or recessionary state. So in this section, the study will focus on the global, developing, and South Asian economies literature regarding state-dependent fiscal multipliers with empirical support for the idea.

#### **2.3.1 Global Studies**

The impact of government expenditure multipliers on the economy has been studied in various research studies. Contrary to prior forecasts that multipliers would be higher during recessions, Ramey & Zubairy (2018) found no evidence that multipliers vary depending on economic slack. Regarding the zero lower bound (ZLB), their findings were inconsistent; certain specifications pointed to greater multipliers, but these were not statistically significant. Larger multipliers during recessions were reported by Auerbach & Gorodnichenko (2011), supporting the theory of state-dependent fiscal impacts. But Klein & Winkler (2021) presented strong evidence that ZLB occurrences have far greater multipliers (around 1.5), highlighting the fact that this variation is not caused by economic slack. The study of Ghassibe & Zanetti (2022) creates a general analytical theory of fiscal multipliers that are dependent on the state for a variety of tax and spending measures. Firstly, the study Ghassibe & Zanetti (2022) highlights that Multipliers linked to fiscal instruments that increase aggregate demand, including government expenditure and consumption tax reductions, are pro-cyclical during supply-driven fluctuations and countercyclical during demand-driven fluctuations. Secondly, multipliers related to initiatives that increase aggregate supply, like lowering taxes on sales and household labor income are pro-cyclical during periods of demand-driven variations and countercyclical during periods of supply-driven fluctuations.

### **2.3.2 Studies on South Asia and Developing Economies**

Fiscal multipliers in developing nations have been the subject of recent studies, emphasizing South Asia. Hayat & Qadeer (2016) found that in several South Asian countries, government spending stimulates GDP growth during recessions more than during expansions. For the four South Asian nations including Bangladesh, India, Pakistan, and Sri Lanka, they use the panel vector autoregressive (PVAR) technique using data from 1982 to 2014. Hayat & Qadeer (2016) indicates that government investment multipliers were found to be more important than consumption multipliers in South Asian nations. Beyer & Milivojevic (2019) highlight that the majority of South Asian nations have pro-cyclical fiscal policies, meaning that government spending is rising at a rate that is disproportionate to growth in GDP. Capital expenditures are the primary factor influencing public spending's impact on economic activity; the government's overall spending multiplier is positive and considerable (Beyer & Milivojevic, 2019). Huidrom et al., (2016) highlight that when public debt and deficit levels are low, multipliers are larger. Hlaváček et al., (2021), found that nonlinear models also show asymmetry in the GDP response to shocks to government expenditure, with stronger fiscal multiplier during recovery periods compared to recessions in developing countries. These findings highlight the necessity of taking economic cycles and fiscal circumstances into account when creating fiscal plans in developing nations.

### **2.3.3 Empirical Studies on Multiplier in Pakistan**

Naveed et al., (2011) evaluates the effects of the four-sector open-market multiplier model, as applied to Pakistan's economy. The Keynes multiplier (K) for the economy of Pakistan is 0.84 on average. This figure is determined by using a regression approach to the data and using the Keynes multiplier model to determine the multiplier (K) for each year. Shaukat et al., (2023) highlights that government spending boosts economic growth in Pakistan and fiscal policy expansion can be utilized to increase the country's economy when recessions hit, by using the OLS regression model taking GDP as the dependent variable and the independent variables are (govt. spending, inflation, and GDP per capita). On the contrary using the DSGE model with real and nominal frictions to assess fiscal policy transmission the study of Raashid et al., (2020) states that Pakistan's fiscal spending multiplier is small, settling at 0.54 after a year, 0.29 after five years, and 0.18 after ten. The study discovered evidence of varying fiscal policy effects across regimes, in the business cycle states especially in two scenarios of recession and boom, the findings indicate that revenue-side

policies perform better during a boom while expenditure-side policies perform significantly better during a recession. The study employed a Markov regime-switching Vector Autoregressive (MSVAR) model (Rehman A., 2018).

#### **2.4 Determinants of State-Dependent Fiscal Multipliers**

The factors influencing state-dependent fiscal multipliers are the focus. Since stimulus programs that cause demand shocks are more effective in a demand-led recession and those that cause supply shocks are more effective in a supply-driven one, Ghassibe & Zanetti (2022) establish that multiplier cyclicity is dependent on the source of economic shocks. Aursland et al., (2020) found that during recessions, bigger multipliers can be produced by both downward nominal wage rigidity and zero lower bound. Fiscal multipliers are higher during economic downturns, fixed exchange rates, smaller debt burdens, and democratic governance, as shown by (Woldu & Szakálné Kanó, 2023). Additionally, focusing on cash-strapped businesses and consumers should be prioritized. Cacciatore & Traum (2022), for example, demonstrated that fiscal multipliers, as measured by import shares, government debt financing, or currencies of export invoicing, and these fiscal multipliers may be more important in more open economies. Policymakers can learn from these findings on successful budgetary interventions in various scenarios. Figure 3 shows the main determinants of the fiscal multiplier.

#### **2.5 Summary of Key Findings**

Few pieces of research favoring state-dependent effects (Auerbach & Gorodnichenko, 2011; Klein & Winkler, 2021; Shaukat et al., 2023) and others found contrary evidence (Raashid et al., 2020; Ramey & Zubairy, 2018), these contradictory findings highlight the ongoing debate in the literature about the link between economic conditions and fiscal multipliers particularly by considering that the dynamics of every country may vary so the results might vary for different countries.

#### **2.6 Novelty/ Gap in Literature**

Some researchers have estimated the non-linear multiplier for Pakistan's economy but they all used the recession and expansion to define the state of the economy and GDP as measure of slack Malik (2020); Ali (2018) instead of unemployment, and almost all studies in the literature either used simple OLS, SVAR, regime-switching or DSG model for their study. But as the local projection method is an appropriate and easy method to capture non-linearity, which has not been used yet in

Pakistan's literature, this study aims to add in literature in methodological perspective. Utilizing Ramey & Zubairy (2018) our analysis will consider the effect of government spending during a high unemployment state to find out whether it has a high multiplier effect during the period of high unemployment. To take a starting point, the Keynesian model suggests that during a recession, government expenditure is a more effective way to boost output and get the economy back on track, this study will empirically test the hypothesis. Additionally, we will demonstrate that some issues arise when calculating multipliers for the Pakistani economy using the existing literature regarding the concept of cumulative multipliers and log vs level debate. Consequently, we will employ a novel technique for computing multipliers the "cumulative multiplier" that hasn't been applied in Pakistani literature before by using it for both linear and non-linear models.

So the novelty of the research is in three aspects: firstly, we will use the new definition of the slack state, which is measured by the unemployment rate, to calculate the multiplier for Pakistan's economy, which has not been used in Pakistan's literature yet. Secondly, the study will use the econometric technique of Jordà (2005) by using the local projection method, which is an addition to the growing literature regarding fiscal multipliers to capture non-linearity in a better manner. Thirdly, this study will address the issue of small sample bias by converting data frequency from annual to quarterly terms, along with building a logistic function. Lastly, the study will also focus on sensitivity analysis, by changing the threshold of the unemployment rate, as well as comparing the results of two methodologies (LPM and regime switching).

Moreover, by covering data up to 2023, the analysis captures the fiscal dynamics of the post-COVID period when governments worldwide, including Pakistan, relied heavily on fiscal stimulus to sustain growth. This makes the findings particularly relevant for contemporary policy debates on pandemic-era recovery and future crisis response.

## **2.7 Analytical Methods**

This study examines the theory that changes in government expenditure have varying multipliers for different economic states by relying on the conventional economics concept of fiscal multiplier.

### 2.7.1 Theoretical Foundation

In macroeconomic theory, the fiscal multiplier is a key component that illustrates the relationship between changes in government spending or taxation and the following impacts on output or national income. Numerous theoretical developments have been made over time, all of which have improved the comprehension of how fiscal policy affects economic activity. Multiplier varies according to different economic theories and models. These theories are given below.

- **General Theory of Keynes (1936):** Keynes laid the groundwork for multipliers and fiscal policy. Despite acknowledging that economic reactions to policy changes may vary depending on the situation, his groundbreaking work was not specifically nonlinear. The theory states that the final increase in income will be multiple times of the initial injection.

$$\Delta Y = \Delta G \times \frac{1}{1 - MPC(1 - T) + MPI}$$

- **Modigliani (1944) and Patinkin (1956):** These two economists coined the term "liquidity trap," which refers to the idea that monetary policy exhibits non-linear effects because it is ineffective at zero interest rates.
- **Fiscal Policy and the Multiplier (1960s–1970s):** Tobin and other scholars, including Franco Modigliani and Robert Solow, discussed the impact of fiscal policy in greater detail, highlighting the possibility of non-linearity.
- **New Classical and Ricardian equivalence (1962s):** It states that forward-looking consumers will not increase their consumption when the government increases its spending by taking debt, as they know they have future tax obligations to fulfill so it will neutralize the increase in government spending due to future tax obligations, and the multiplier in the long run will be zero.
- **New Keynesian Economics (1980s–1990s):** This school based a lot of its theories on the idea that wages are stiff and prices are sticky, which resulted in non-linear reactions to the implemented policies.
- **Asymmetry in Fiscal Multiplier:** It indicates the effect of fiscal policy on economic growth varies depending on the state of the economy.

## CHAPTER 3

### DATA AND METHODOLOGY

#### 3.1 Introduction

This chapter explains the methodology employed, its specifications, and the data used in our study. The primary goal of this study is to analyze the potential nonlinear effects of the fiscal multiplier on output and other macroeconomic variables like inflation. Section 3.2 covers the details of the methodology, and Section 3.3 gives details about the reason for choosing this methodology as well as the variables and data used in this study. Further sections 3.4 and 3.5 have details on the models estimated for annual and quarterly data using both shocks (total and development spending).

#### 3.2 Research Methodology

The study mainly used a quantitative approach by employing the econometric technique of Jordà (2005) called the local projection method, to explore the multiplier effect of government expenditures, especially in slack and non-slack periods, by using the study of Ramey & Zubairy (2018).

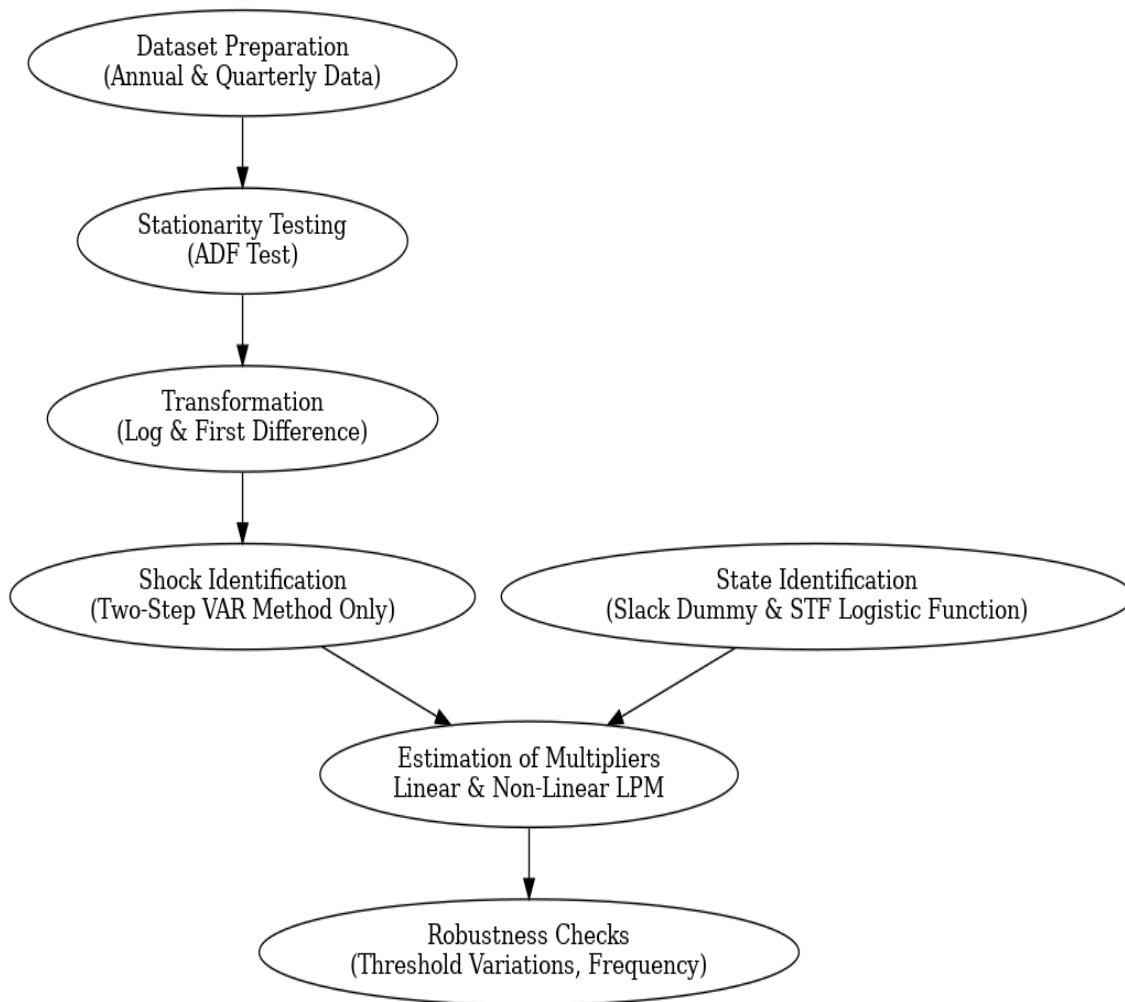
- **State Identification:** The study used the unemployment rate to identify the state of the economy. For this purpose, the study aims to take the average of the unemployment rate, which is 5.3, as a threshold. Periods where the unemployment rate is below 5.3 are non-slack periods (20 years), whereas periods where the unemployment rate is above 5.3 are periods of economic slack (29 years).

For the robustness checks of the results, the study aims to take different thresholds of unemployment, as well as by changing the frequency of data. For this purpose, two datasets are constructed:

- 1) Annual series with a smooth transition function (STF) to mitigate small-sample bias in non-linear models.
- 2) A simulated quarterly series obtained by linear interpolation of annual data, to mitigate the issue of small sample bias.

After constructing these two datasets, the next step is to get the shock series for both quarterly and annual datasets using two-step shock identification method from total spending, current spending, and development spending variables. The final step after getting shocks is to find out the multiplier using the local projection method for both data sets. The detail of each step is given below.

**Figure 3.1: Methodological Framework: Step-by-Step Flowchart**



### 3.2.1 Endogeneity Considerations

A key econometric concern in fiscal multiplier estimation is the potential endogeneity of government spending: higher spending may be a reaction to slow growth or rising unemployment rather than an exogenous shock. To mitigate this bias, we adopt a two-step identification strategy where VAR-based residuals represent exogenous spending shocks orthogonal to past economic conditions. This approach, following Ramey & Zubairy (2018), helps isolate innovations in

spending that are not driven by contemporaneous macroeconomic developments, thereby reducing the risk of upwardly biased multiplier estimates.

While the two-step identification strategy mitigates contemporaneous endogeneity to some extent, the possibility of remaining bias due to omitted variables or mis-specification cannot be completely ruled out. Future studies could incorporate external instruments, such as military spending or narrative approaches, to further strengthen exogeneity assumptions.

### 3.3 Annual Data with a Smooth Transition Function

A binary dummy variable is used to divide the annual sample into slack and non-slack periods. However, out of 49 total observations, only 29 fall into the slack regime and 20 into the non-slack regime. This raises concerns about small-sample bias in the nonlinear estimation, as the sample size for one regime is below the commonly recommended threshold of 30 observations for a normal distribution. This issue is addressed by modeling the state indicator (unemployment rate) as a continuous logistic function of the lagged standardized unemployment series using Auerbach & Gorodnichenko (2012). For standardizing the unemployment series;

$$Z_t = \frac{U_t - \text{avg}(U)}{\sigma_u} \dots\dots\dots (1)$$

Where  $\text{avg}(U)$  and  $\sigma_u$  are the mean and standard deviation of the unemployment rate. Then generated a series of lags of the standardized  $Z_t$  as  $Z_{t-1}$  to prevent any contemporaneous feedback from policy acts into the state of the economy. Then applied the formula for building a logistic function on the  $Z_{t-1}$  series.

$$F(Z_t) = \frac{\exp(-\gamma z_{t-1})}{1 + \exp(-\gamma z_{t-1})} \quad \text{where } \gamma > 0 \text{ and } 0 < F_t < 1 \dots\dots\dots (2)$$

In equation 2,

- $Z_{t-1}$  = lagged value of the standardized unemployment series
- $F(Z_t)$  = Effect of spending shock when the economy is in non-slack (low unemployment)
- $1-F(Z_t)$  = Effect of spending shock when the economy is in slack (high unemployment).
- $\gamma$  = smoothness parameter, which determines the sharpness of the transition that occurs in slack and non-slack economies.

### 3.4 Quarterly data using the Linear interpolation method

To examine the impulse responses of output and inflation to the government spending shock while mitigating small-sample biases, the study aimed to convert low-frequency (annual) data into high-frequency (quarterly) data. The annual data is converted into a quarterly frequency to increase the number of observations, as the limited number of yearly data points is not sufficient to meet the assumptions of normal distribution. This adjustment is necessary to reduce small-sample bias and improve the reliability of the statistical analysis, particularly for nonlinear estimation techniques that are sensitive to sample size and distributional properties.

There are several disaggregation methods that can be used to convert yearly data into quarterly series in time series analysis when only annual data is available, but higher-frequency data (quarterly) is required for empirical research. These include the Chow-Lin approach, the Fernandez method, the Denton method (either proportional or additive), and simple interpolation techniques like linear, quadratic, or cubic interpolation (Abberger et al., 2023)<sup>2</sup>. The more sophisticated Denton and Chow-Lin approaches use comparable linear high-frequency indicators to drive the distribution, making them suitable when auxiliary information is available. Linear interpolation is a practical and obvious choice when there are no reliable quarterly indicators or when it is preferred to preserve the overall annual trend without adding arbitrary assumptions. The method used in this study is linear interpolation because it makes it simple to distribute annual data evenly among quarters, preserves time series continuity, and guards against biases that more complex model-based disaggregation techniques can introduce. This method works well in situations when there are no known seasonal patterns and the underlying economic variable changes gradually over time. The quarterly frequency data is constructed using the equation given below.

$$X_{t,q}^Q = X_{t-1}^A + \frac{q}{4} (X_t^A - X_{t-1}^A), \quad q = 1,2,3,4 \dots\dots\dots (3)$$

Where;

- $X_t^A$  = The value of the variable X in year t (annual data).
- $X_{t,q}^Q$  = The estimated value of variable X in quarter q of year t (quarterly data).

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<sup>2</sup> The study of Abberger et al., (2023) compares algorithms including Chow-Lin, Fernandez, Denton, and cubic spline interpolation for imputing monthly values from quarterly business cycle data.

- Q = quarter number (1,2,4 or 4).
- $X_{t-1}^A$  = The value of variable X in the previous year.

After converting the annual data into quarterly frequency, we created a binary variable to define the slack state of the economy using the unemployment series. This study utilizes the long-run average of the unemployment series as a threshold level, where the economy is defined as being in a slack state when it is above the average unemployment rate (5.3%). On the other hand, the non-slack period is defined as where the unemployment rate is below 5.3%. Where  $avg(U)$  is the long-run average (5.3) of the unemployment rate.

$$D_t^Q = \begin{cases} 1, & \text{if } U_t^q \geq avg(U) = 5.3 \\ 0, & \text{Otherwise} \end{cases}$$

### **3.5 Identification of Shocks using the Two-Step Method**

Following Calvo (1983), this study utilizes the two-step approach to find the exogenous component of the government spending variable<sup>3</sup>. This procedure is employed on both yearly and quarterly data. The initial step is to estimate a VAR in first differences for each spending category, along with significant controls. Then, each VAR equation's fitted residuals are applied as structural shocks. But before estimating the VAR for getting residuals, the study checked the stationarity of variables at the level, then took the natural log of the required variables and again checked the stationarity.

#### **➤ Preliminary stationarity testing**

The unit root test was used to check for stationarity in each series before estimating the VAR and calculating spending-shock residuals. The only difference between the methodology for quarterly and annual data was the lag length. We estimate the augmented Dickey–Fuller regression for each initial series (real GDP, total expenditure, etc.).

#### **Log transformation and ADF testing:**

The natural logarithm was used to normalize the strictly positive level series in order to stabilize variance and interpret elasticities. Then the study uses the ADF test to check the stationarity of the series using following equation.

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<sup>3</sup> See the study of Zakir & Malik (2013) who derived monetary policy shock by using Calvo method.

$$\Delta y_t = \alpha + \beta t + \rho y_{t-1} + \sum_{i=1}^l \beta_i \Delta y_{t-i} + \varepsilon_t \dots (4)$$

Where;

- $\Delta y_t$  = first difference of the series.
- $\alpha$  = intercept/ drift.
- $\beta t$  = deterministic time trend.
- $\rho y_{t-1}$  = test for unit root in levels.
- $\sum_{i=1}^l \beta_i \Delta y_{t-i}$  = lagged differences to absorb serial correlation.
- $\varepsilon_t$  = error term/ residual.

**Hypothesis testing:**

- $H_0: \rho = 0$ , series has a unit root; non-stationary.
- $H_0: \rho < 0$ , series has a unit root; non-stationary.

**Decision rule:**

- If p-value  $\leq 0.05$ , reject  $H_0$ , the series is stationary.
- If p-value  $> 0.05$ , accept  $H_0$ , the series is non-stationary.

**3.5.1 Step 1: Specification for VAR**

Let  $X_t$  be the first difference of the log-series of the corresponding spending category for each spending series (Total, current, and development), and let  $Z_t$  be a vector of the first differences of the control variables (e.g., GDP growth and tax-revenue growth). The expression for the p-lag VAR is:

$$X_t = \alpha_0 + \sum_{i=1}^p \alpha_{1i} X_{t-i} + \sum_{i=1}^p \beta_i Z_{t-i} + \mu_t \dots (5)$$

$$\text{In equation 5, } Z_t = \gamma_0 + \sum_{i=1}^p \Gamma_i \begin{bmatrix} X_{t-i} \\ Z_{t-i} \end{bmatrix} + v_t \dots (6)$$

Where in equation 5,  $X_t$  is one of:

- $\Delta \ln (G_t)$  = Change in Total government spending.
- $\Delta \ln (G_t^{cur})$  = Change in current government spending.
- $\Delta \ln (G_t^{dev})$  = Change in Development spending.
- $Z_t = \Delta \ln (Y_t), \Delta \ln (Tax_t)$ .
- $\mu_t$  = Reduced form residual in the spending equation.

- $P$  = The lag-order  $p$  is chosen based on AIC, SC, HQ, LR criteria (in quarterly data  $p=4$ , in annual data  $p=1$ ).

### 3.5.2 Step 2: Extraction of Exogenous Spending Shocks

To get the structural spending shock in period  $t$ , the study simply used residuals from the equation of the VAR model (eq. 4). Exogenous changes in all spending categories are reflected in  $\mu_t$  since it is orthogonal to the past values of  $x$  and  $z$ .

- $\varepsilon_t^{total} = \mu_t^{total}$  = Two-step identified shock form total govt. expenditures.
- $\varepsilon_t^{current} = \mu_t^{current}$  = Two-step identified shock form current expenditures.
- $\varepsilon_t^{development} = \mu_t^{development}$  = Two-step identified shock form development expenditures.

By relying on these reduced form residuals using VAR;

- We avoid imposing identification assumptions or contemporaneous restrictions that go beyond lag exclusivity.
- By construction, the shocks  $\varepsilon_t$  are serially uncorrelated and mean-zero.
- Our state-dependent multiplier model (Section 3.5) uses these innovations directly to evaluate the difference between the effects of fiscal shocks under slack and non-slack conditions.

## 3.6 Estimating Fiscal Multiplier using Local Projection Method (LPM)

After the two-stage shock identification technique has identified the overall, development, and current government expenditure shocks, the next step is to estimate the state-dependent fiscal multipliers. The Local Projection Method (LPM), created by Jordà (2005), is used in this study to achieve this goal. It allows for the direct estimation of impulse responses and is particularly suitable in circumstances where non-linearity or state dependencies are common.

### 3.6.1 Linear model of LPM

In the first stage, the multiplier is computed using the linear LPM specification, which adds the anticipated shocks and does not include state interaction. For the Linear model, the equation of LPM is as follows:

$$X_{t+h} = \alpha_h + \Psi_h(L)Z_{t-1} + \beta_h shock_t^G + \varepsilon_{t+h} \quad h=0,1,2, \dots (7)$$

Where;

- $X_{t+h}$  = Dependent, outcome Variables (real GDP, industrial production, per capita real GDP, inflation at horizon h).
- $shock_t$  = Identified government spending shock (total, current or development expenditure shocks).
- $Z_{t-1}$  = Vector of control Variables (lag of dependent, outcome variables).
- $\Psi_h(L)$  = Polynomial in the lag operator.
- $\beta_h$  = Estimated linear multiplier at horizon h.

### 3.6.2 Non-Linear Model of LPM (State Dependent)

To capture the state-dependence of multipliers, that is, the differences in the response to spending shocks during slack and non-slack periods, interacting shocks and controls with the state variable are introduced to the LPM model. In the case of yearly data, we could not use a slack dummy variable to distinguish between slack and non-slack periods, as dividing the limited number of observations into two states (0 and 1) would lead to small-sample bias. According to the rule of thumb, at least 30 observations are needed in each state to ensure the normality assumption is satisfied. To address this issue and to avoid abrupt parameter changes, we employed a logistic transition function to smoothly capture changes between regimes. However, for quarterly data, since there are sufficient observations in both slack and non-slack states, we used a binary slack dummy to define the state of the economy.

#### Approach 1: Using Slack Dummy

$$X_{t+h} = I_{t-1} [\alpha_{A,h} + \Psi_{A,h}(L)Z_{t-1} + \beta_{A,h} shock_t^G] + (1 - I_{t-1})[\alpha_{B,h} + \Psi_{B,h}(L)Z_{t-1} + \beta_{B,h} shock_t^G] + \varepsilon_{t+h} \dots (8)$$

Where;

- $I_{t-1}$  = Dummy indicator for slack state (1 if slack, 0 if non-slack).
- $\beta_{A,h}, \beta_{B,h}$  = Multipliers in slack and non-slack states respectively.

#### Approach 2: Using Logistic Transition Function

In accordance with Auerbach & Gorodnichenko (2012), the state is employed as a logistic function in this study to handle small sample bias and smooth regime transition. For yearly data, the study will estimate non-linearity using the logistic function estimated using equation 2.

$$X_{t+h} = F(Z_{t-1}) [\alpha_{A,h} + \Psi_{A,h}(L)Z_{t-1} + \beta_{A,h} shock_t^G] + (1 - F(Z_{t-1}))[\alpha_{B,h} + \Psi_{B,h}(L)Z_{t-1} + \beta_{B,h} shock_t^G] + \varepsilon_{t+h} \dots (9)$$

Where;

- $F(Z_{t-1})$  = Smooth transition function (estimated using eq. 2) capturing the probability of being in slack and non-slack state.
- $\beta_{A,h}, \beta_{B,h}$  = Multipliers in slack and non-slack states respectively.

### 3.7 Robustness Check

The robustness of the estimated multipliers is examined by:

- a) Using alternative variables for the dependent variable (i.e, Industrial production, real GDP, real GDP per capita) to check the consistency of results.
- b) Estimating the models on a quarterly and annual basis.
- c) Using two distinct shocks, the total and development shock.
- d) Changing the threshold of the unemployment rate for baseline estimates.

Each of these processes guarantees that the results are independent of data frequency or particular outcome variable for GDP.

### 3.8 Reasons for choosing LPM

We have a few reasons behind the rationale of choosing LPM, which are given below.

- **Flexibility in Estimation:** For different time horizons, local projections make it simpler to estimate impulse response functions. In contrast to VAR, which imposed structure and underlying assumptions about the data-generating process, local projections are flexible and less likely to contain errors in model misspecification.
- **Handling Nonlinearity:** Creating impulse response functions in nonlinear models is a challenging task. Without imposing the strict structure of functions, local projections overcome the issue by enabling a comparatively simple framework to be more adaptable to changes in economic conditions.
- **Sensitivity to Assumptions:** A large number of previous findings showing significant multipliers during recessions are based on assumptions that are most likely not representative of the real procedures used to generate the data. Ramey & Zubairy (2018)

eliminate biases that may have existed in earlier research by employing local forecasts to provide estimates that are more in line with the observed economic behavior.

### 3.9 Data and Variables

The data used in the study spans from 1975–2023. The study used annual and quarterly data for Pakistan’s economy, as the rationale for using these two datasets is already explained earlier in the methodology section. Table 3.1 presents the variables used in the study, including their definitions, time span, data sources, and the formulas applied for their construction.

*Table 3.1: Description of Variables*

Indicator	Abbreviations	Formula of Measurement	Time Span	Source
GDP at Current Prices (Rs. Million)	<b>gdp_curr</b>	Nominal GDP = $\sum(\text{Price of Goods and Services in Current Year} \times \text{Quantity of Goods and Services in Current Year})$	1975-2023	WDI
GDP Deflator Index	<b>gdp_defl</b>	GDP deflator = $(\text{Nominal GDP} / \text{Real GDP}) \times 100$	1975-2023	WDI
Real GDP (Million PKR)	<b>gdp_real</b>	Real GDP = $(\text{Nominal GDP} / \text{GDP deflator}) \times 100$	1975-2023	Own Calculation
Real GDP Per Capita	<b>real_gdp_per_capita</b>	GDP per capita = $\text{Real GDP} / \text{Population}$	1975-2023	Own Calculation
Industrial Production	<b>ind_prod</b>	Measured as index of industrial output	1980-2021	IMF
Total Expenditures (Rs. Million)	<b>tot_exp</b>	Total expenditures = current + development	1975-2023	Finance Ministry
Current Expenditures (Rs. Million)	<b>cur_exp</b>	Spending on interest payments, wages, pension and subsidies.	1975-2023	Finance Ministry
Development Expenditures (Rs. Million)	<b>dev_exp</b>	Spending on investment in infrastructure, health, education	1975-2023	Finance Ministry
Unemployment rate	<b>un_rate</b>	Unemployment Rate = $(\text{Number of Unemployed} / \text{Labor force}) \times 100$	1975-2023	WDI
Population (Million)	<b>pop_mil</b>	Total residents of a country	1975-2023	WDI
Inflation, consumer prices (annual %)	<b>inflation</b>	Inflation = $(\text{CPI}_t - \text{CPI}_{t-1} / \text{CPI}_{t-1}) \times 100$	1975-2023	WDI
Tax Revenues (Rs. Million)	<b>tax_rev</b>	Total tax collection by govt.	1975-2023	Finance Ministry

Smooth transition function, using $F(Z)$	<b>stf</b>	$STF= 1-F(Z_{t-1})$	1975-2023	Own Calculation
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### 3.10 Conclusion

The data sources, variable generation, and empirical methods used to estimate Pakistan's state-dependent government expenditure multipliers have all been illustrated in this chapter. The research ensures robustness in capturing fiscal dynamics by using both annual and interpolated quarterly data, as well as slack-state indicators and a smooth transition function to adjust for potential non-linearities. A two-step VAR methodology is used to identify government expenditure shocks, and the local projection approach (LPM) is used to estimate the multipliers under both linear and state-dependent constraints. The chapter also covered the addition of appropriate control variables, stationarity checks, and robustness checks, which laid a solid foundation for the empirical work in the next chapter.

## CHAPTER 4

### RESULTS AND DISCUSSION

This chapter examines the empirical findings from the quarterly and annual data used to calculate state-dependent government spending multipliers in Pakistan. Using the two-step technique to shock identification, both linear and non-linear Local Projection Model (LPM) estimations are carried out. These results have been categorized into four groups for each dataset: descriptive analysis, testing stationarity, shock identification, and estimations based on local projections.

#### 4.1 Results for Annual Data

This section shows the projected results using the initial yearly data from 1975 to 2023. Even though high-frequency data (such as quarterly) typically better captures short-term trends. For the sake of robustness and comparability, this section will analyze the results using the original yearly series, even though a quarterly series is constructed using interpolation techniques for increasing frequency. It will discuss the state identification, shock identification, and final results of the local projection method for linear and non-linear models.

##### 4.1.1 State Identification, $F(Z)$

In the annual dataset (1975-2023), the unemployment rate is initially used as a direct measure of economic slack to identify the state variable in the model. Applying a threshold of 5.3, based on the mean unemployment rate, results in 29 observations classified as ‘slack’ (i.e., high unemployment) and 20 as ‘non-slack’ (i.e., low unemployment), which is shown in Table 4.1.

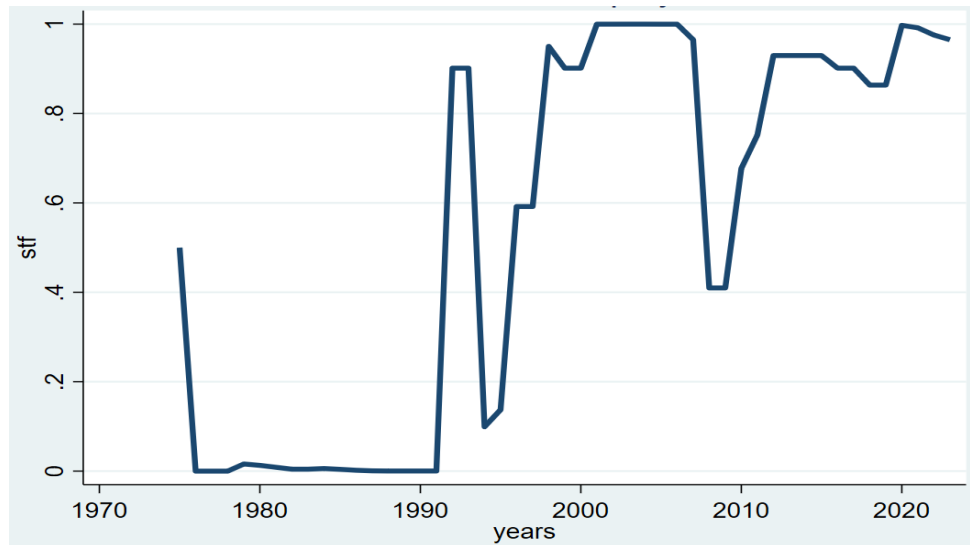
*Table 4.1: Frequency of slack and non-slack episodes*

State	Frequency	Percentage
Non-slack (0)	20	40.82 %
Slack (1)	29	59.18%
Total	49	100.00%

This uneven distribution raises concerns regarding small sample bias, particularly in the non-slack regime. To address this limitation by using Auerbach & Gorodnichenko (2012) method a smooth transition function  $F(Z)$  based on a logistic transformation is constructed and used as the state variable for annual data analysis. This approach allows for a more continuous and flexible

representation of economic conditions, as shown below in Figure 4.1, thereby mitigating potential biases arising from binary classification.

**Figure 4.1: Smooth Transition Function  $F(Z)$  for State Identification**



The smooth transition series of the unemployment rate is shown in Figure 4.1. It is constructed to distinguish between distinct economic conditions, such as slack and non-slack periods. The smooth transition model reflects smooth changes in economic conditions by using continuous weights ranging from 0 to 1 in place of a dichotomous categorization with a set cutoff point. This method allows for a more accurate modeling of the growth of the economy between states and avoids abrupt changes. In state-dependent models, the smoothed series is particularly useful since it allows for the estimation of dynamic responses to shocks without the need for a rigid cut-off.

#### **4.1.2 Two-Step Shock Identification**

It is necessary to ensure the stationarity of the variables before getting the exogenous shocks using the two-step method. In this context ADF test is applied on both the level and log-transformed first-differenced variables. The variables where log transformation is required, such as GDP, spending, and revenue, are log-transformed. Table 4.2 shows the stationarity testing of series at level and after 1<sup>st</sup> difference of variables using the Augmented Dickey Fuller test (ADF) test. As all the p-values are greater than 0.05 and all test statistics are below the corresponding critical values (1%, 5%, 10%) thus the ADF results show that all of the variables are non-stationary at level confirming that all of the variables have unit roots and require differencing to become stationary. After differencing of log-transformed variables, the stationarity is then rechecked by

reapplying the ADF test to these first-differenced series. As all the p-values are less than 0.05 thus the ADF results show that all of the variables are stationary at 1<sup>st</sup> difference.

**Table 4.2: ADF Test at Level and 1<sup>st</sup> differenced log-transformed series**

Variable	ADF Statistic (at Level)	p-value	ADF Statistic (1 <sup>st</sup> Differenced log-transformed series)	p-value
<b>Real GDP</b>	2.022	0.9987	-7.873	(0.0000)***
<b>Total Expenditure</b>	2.525	0.9991	-4.280	(0.0005)***
<b>Current Expenditure</b>	3.629	1.0000	-4.347	(0.0004)***
<b>Development Expenditure</b>	-0.680	0.8519	-4.223	(0.0006)***
<b>Inflation</b>	-0.927	0.7791	-3.744	(0.0035)***
<b>Tax Revenue</b>	0.936	0.9935	-4.812	(0.0001)***
<b>Real GDP per Capita</b>	-0.028	0.9562	-7.969	(0.0000)***

\*\*\* is the significance level at 1%

The next step after making the series stationary is to estimate the VAR model (details can be seen in the appendix, Table 4) and then get the exogenous shocks from the estimated VAR model, which is shown in Figure 4.2. Before getting the shock series, the study investigated the stability of all the VAR models using eigenvalues (as shown in the appendix table 5). As eigenvalues < 1 for all three models, all VAR models satisfy the stability condition, which validates the use of these models to get shock series.

**Figure 4.2: Exogenous Spending Shocks**

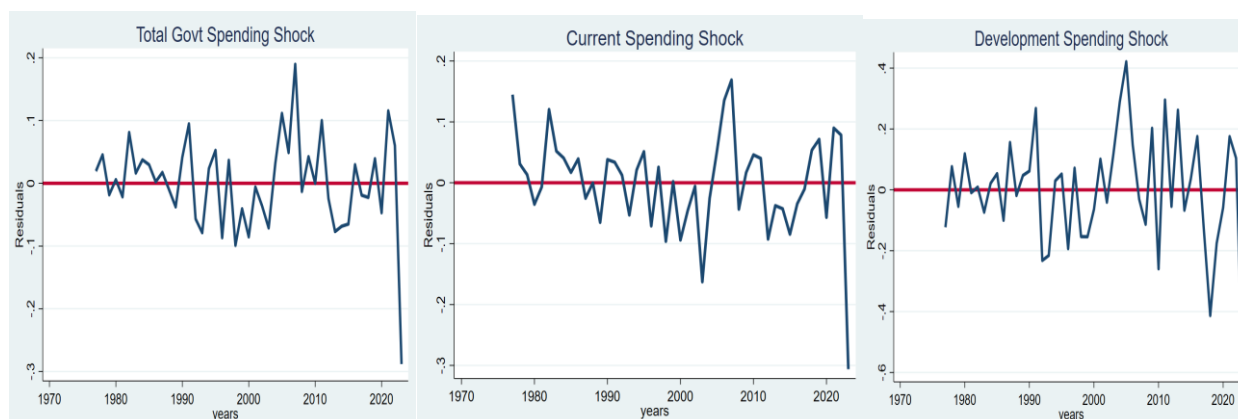


Figure 4.2 shows residual variations across time with positive spikes denoting non-slack fiscal

shocks and negative spikes denoting slack fiscal shocks. These are unanticipated changes that cannot be explained by the variables in the model.

*Figure 4.3: Combined plot of Estimated Shocks*

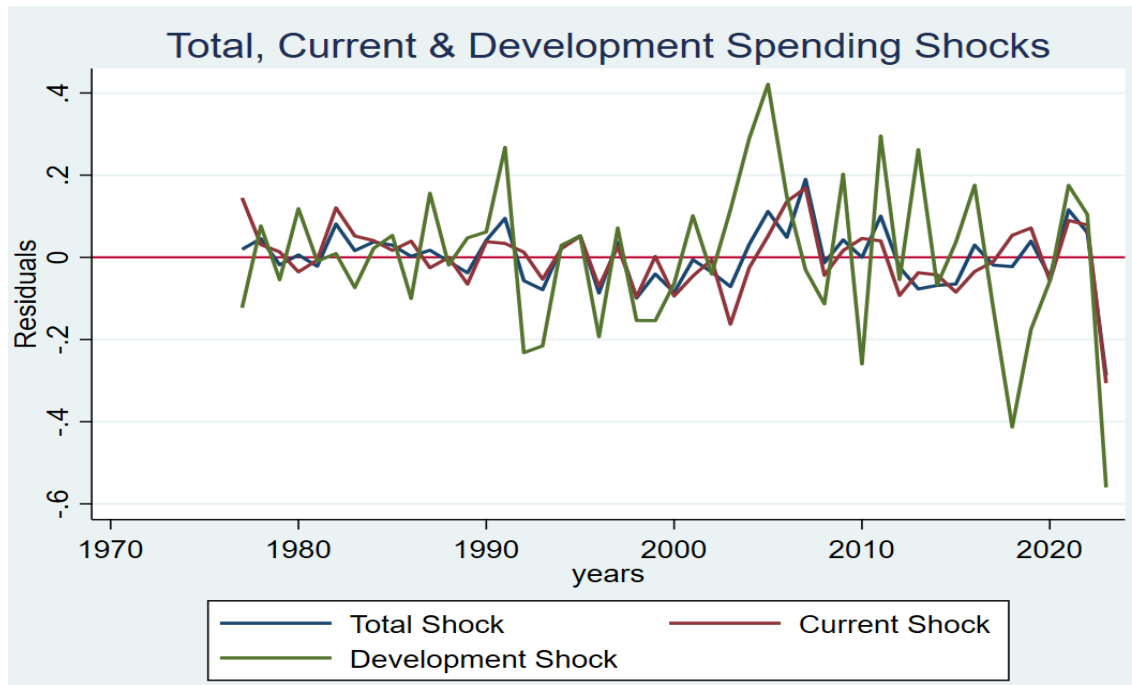


Figure 4.3 presents all spending shocks together. Since the total spending shock and the current spending shock display a similar pattern over time, the study opts to use only one of them<sup>4</sup>. The total spending shock is chosen because it captures the combined effects of both current and development spending shocks. In addition to the total shock, the development spending shock is also selected for further analysis. These two shocks, total and development, will be used in the Local Projection Method in the next section.

Although the model estimates responses to identified government spending shocks, it does not explicitly decompose the contribution of these shocks to overall output variation. Future extensions could include forecast error variance decomposition or historical decomposition techniques to quantitatively assess the contribution of these shocks in driving GDP fluctuations.

<sup>4</sup> We have used both current and total spending shocks in our analysis to estimate the results and found similar results.

### 4.1.3 Baseline Results Using LPM for Slack States

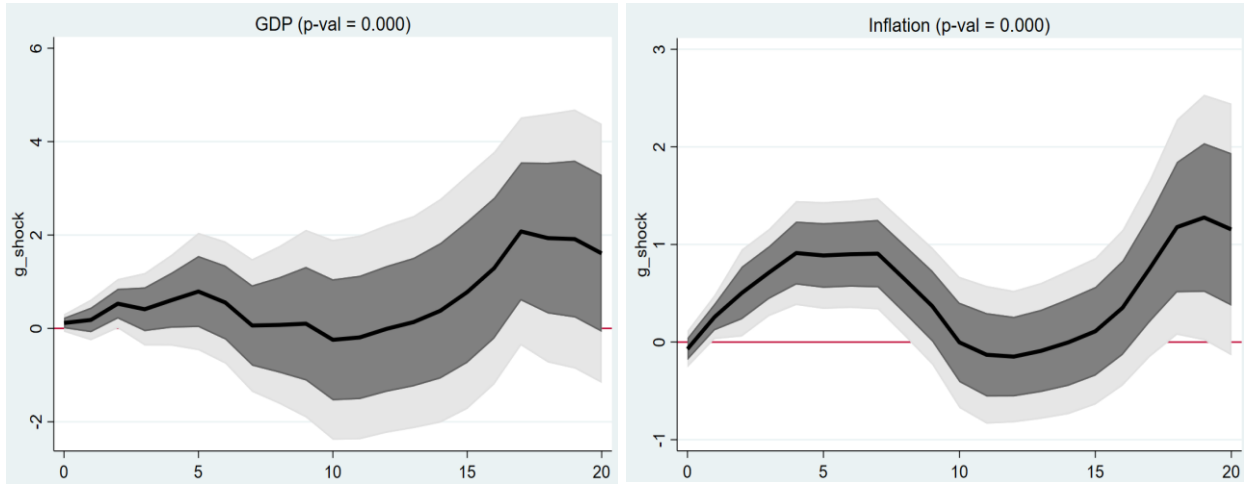
Lastly, this section presents our key findings based on the local projection technique using annual data. Based on Newey-West standard errors that account for serial correlation, Figure 4.4 displays the impulse response functions along with 90 percent confidence intervals. We begin with the linear model, in which fiscal multipliers are assumed to be independent of the state of the economy. According to this model, a shock to total government spending results in increases in GDP and inflation. It has a comparatively minor effect, which dies out after the 5<sup>th</sup> horizon, indicating a very short-term effect on GDP, with peaks at about the 17<sup>th</sup> horizon. Its impact on inflation, on the other hand, is stronger, peaking at the 18<sup>th</sup> horizon and dying out after the 8<sup>th</sup> horizon.

The primary question addressed in this study is, whether fiscal multipliers are state-dependent, meaning that they are higher during periods of economic slack. The calculated coefficients  $\beta_{A,h}$  and  $\beta_{\Pi,h}$  for output (Y) and inflation ( $\Pi$ ) are used to determine the state-dependent impulse responses. The second row of Figure 4.4 shows how Real GDP and inflation respond to a government spending shock during non-slack periods, or times when unemployment is low. In this period, total spending shock negatively affects real GDP with a peak after 17 horizons, whereas the effect of spending shock on inflation is slightly positive for just 1 period, with a peak on 18 horizons. The third row of Figure 4.4 shows the responses of Real GDP and inflation to a total government spending shock in the slack period (high unemployment). There's a slight positive impact on GDP, which dies down after the 5<sup>th</sup> horizon and shows a negligible effect with a peak at around 19<sup>th</sup> horizon. Whereas, for inflation, the total spending shocks have a significant positive impact, dying down after 4<sup>th</sup> horizons with a peak at 19<sup>th</sup> horizons.

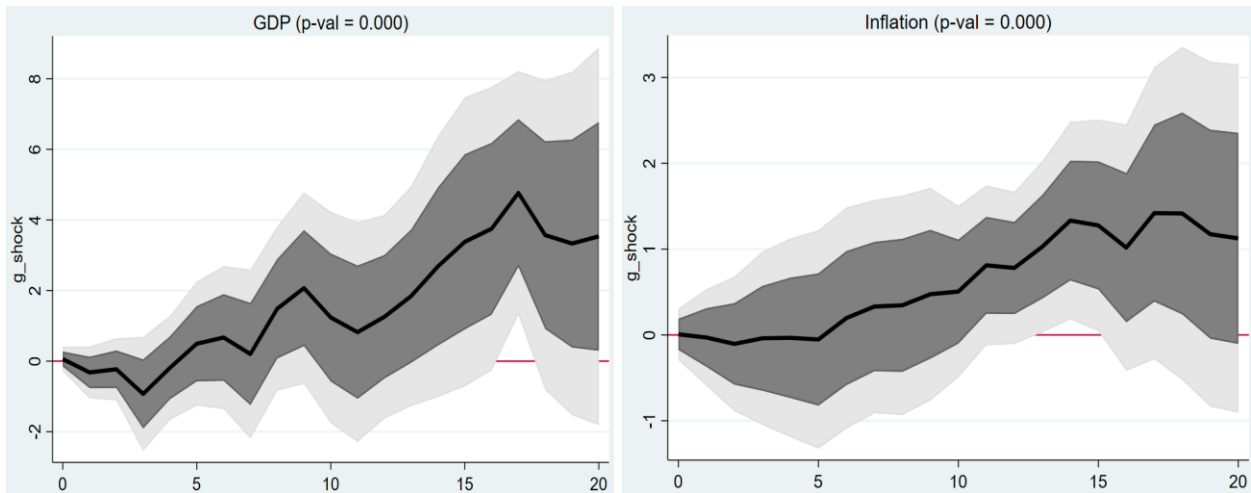
Overall, figure 4.4 concludes that the effect of government spending shock is having a stronger positive impact on inflation rather than increasing GDP, indicating limited effectiveness of fiscal policy in stimulating economic output, which supports the finding of Haque & Ullah (2023) regarding the crowding out effect of private investment when government have huge footprint in the economy. Our study shows as inflation responds significant and positive to spending shock, the effect on GDP is weak and short-term. It implies that fiscal stimulus translates more into price increase rather than increasing real economic activity, reflecting potential supply-side constraints, structural inefficiencies and leakage of government spending.

**Figure 4.4: Real GDP and Inflation Response to Total Spending Shock**

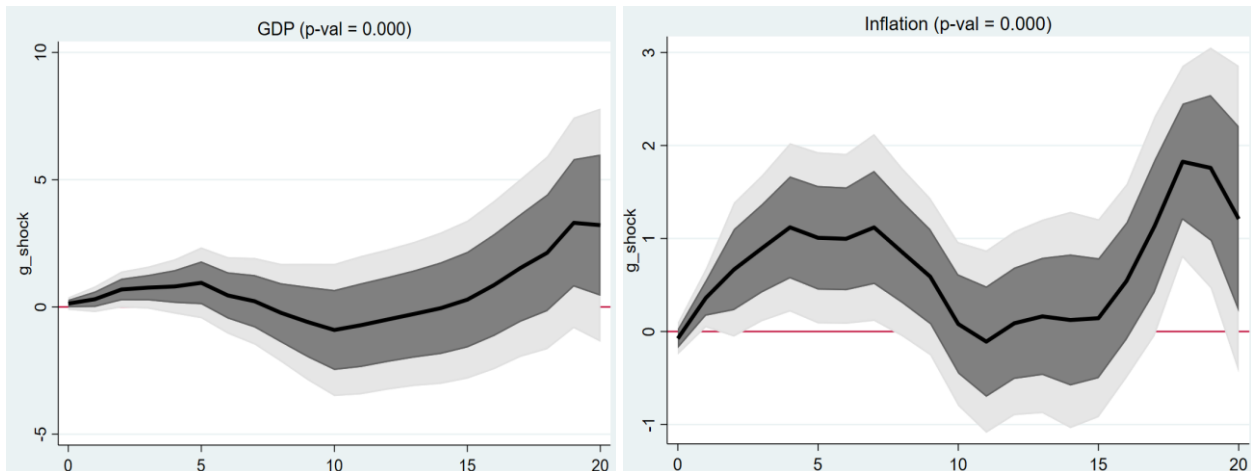
**Linear Model**



**Non-Slack Period (Low Unemployment)**



**Slack Period (High Unemployment)**



These results are contradictory to earlier studies on fiscal multiplier in Pakistan which have reported higher fiscal multipliers particularly during recession Malik (2020), which might be due to the reason for non-capturing the exogenous component of the government spending series. Further, to check the consistency of given results, using real GDP per capita as well as using development shock is also estimated (can be seen in appendix figures 1,2,3), which shows almost similar findings for GDP, but for inflation, the findings are little bit different, using development spending as a shock.

## 4.2 Results for Quarterly Data

As there was an issue of small sample bias in annual data, the second approach to deal with this issue is the use of quarterly data for a robustness check of results. We converted annual data into quarterly frequency using the linear interpolation method. So, this section will discuss the results estimated using quarterly data. It will discuss the state identification, shock identification, and final results of the local projection method for linear and non-linear models.

### 4.2.1 State Identification (Slack)

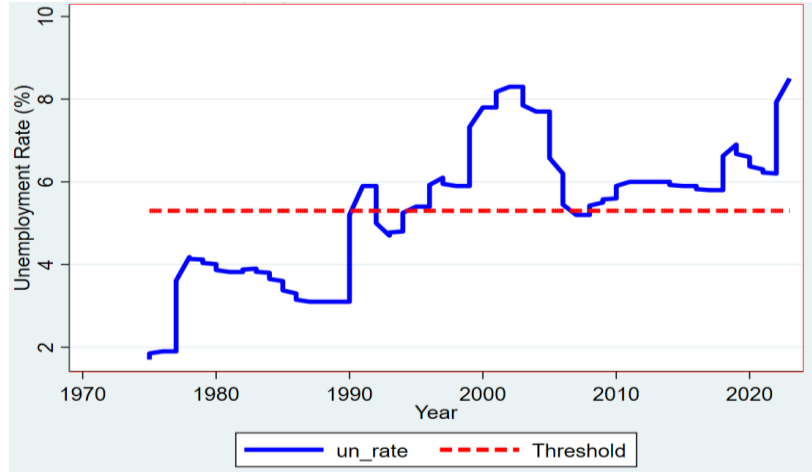
The quarterly unemployment rate is used to assess the state of the economy. Throughout the sample period (1975-2023), the average unemployment rate is approximately 5.3%. This is used as the conventional criterion to differentiate between slack and non-slack times by constructing a dummy variable for slack using the unemployment series.

**Table 4.3: Slack Identification**

State	Frequency	Percentage
Non-slack (0)	79	40.93%
Slack (1)	114	59.07%
Total	193	100.00%

Table 4.4 shows, if the unemployment rate is  $\geq 5.3$ , it's declared as a slack period (1), whereas if it's  $< 5.3$  it is declared as non-slack period (0). Out of the 193 quarterly observations, 114 (59.07%) are in the slack state, while 79 (40.93%) were in the non-slack periods. Which prevents small sample bias and is sufficient sample for state-dependent analysis.

*Figure 4.5: Unemployment Rate with Slack Threshold*



As illustrated in Figure 4.5, the red dotted line is a threshold of unemployment, which is 5.3, and the blue solid line is a plotted series of unemployment rates. The “slack” dummy variable is designed to be equal to 1 when the unemployment rate is equal to or above the threshold and 0 otherwise.

#### **4.2.2 Two-Step Shock Identification**

It is necessary to ensure the stationarity of the variables to get exogenous shocks using the two-step shock identification method. In this context ADF test is applied on both the level and log-transformed first-differenced variables. The variables where log transformation is required, such as GDP, spending, and revenue, are log-transformed. Table 4.5 shows the stationarity testing of series at level and after 1<sup>st</sup> difference of variables using the Augmented Dickey Fuller test (ADF). For getting exogenous shocks using the VAR model, variables must be stationarity. The p-values are greater than 0.05 and all test statistics are below the corresponding critical values (1%, 5%, 10%) by checking the stationarity of variables at level, thus the ADF results show that all of the variables are non-stationary at level confirming that all of the variables have unit roots, and require differencing to become stationary. After differencing of log-transformed variables, the stationarity is then rechecked by reapplying the ADF test to these first-differenced series, and as p values are less than 0.05, so series have become stationary.

**Table 4.4: ADF Test at Level and 1<sup>st</sup> differenced log-transformed series**

Variable	ADF Statistic (Level)	p-value	ADF Statistic (1st Differenced Log-Transformed Series)	p-value
Real GDP	3.294	1.0000	-5.651	(0.0000)***
Total Expenditure	3.489	1.0000	-3.702	(0.0041)***
Current Expenditure	4.991	1.0000	-3.863	(0.0023)***
Development Expenditure	-0.425	0.9058	-3.514	(0.0076)***
Inflation	0.704	0.9899	-2.966	(0.0382)**
Tax Revenue	1.409	0.9972	-4.197	(0.0007)***
Real GDP per Capita	0.745	0.9907	-5.674	(0.0000)***
Industrial Production	1.661	0.9980	-5.180	(0.0000)***

\*\*\* is significance level at 1%, \*\* is significance level at 5%

The next step after making the series stationary is to estimate the VAR model (details can be seen in the appendix, Table 8) and then get the exogenous shocks from the estimated VAR model, which is shown in Figure 4.6. Before getting the shock series, the study investigated the stability of all the VAR models using eigenvalues (as shown in the appendix table 9). As eigenvalues < 1 for all three models, all VAR models satisfy the stability condition, which validates the use of these models to get shock series.

**Figure 4.6: Exogenous Spending Shocks**

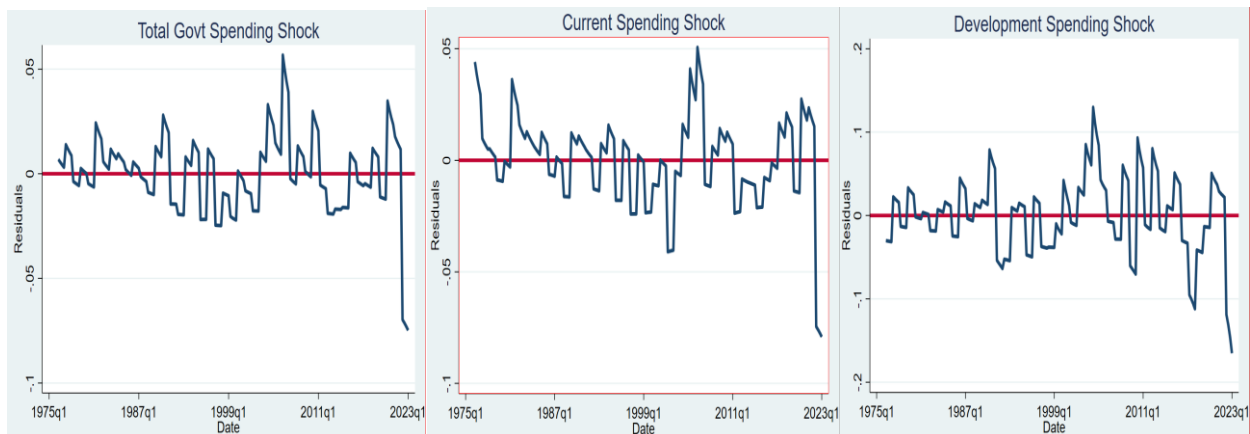
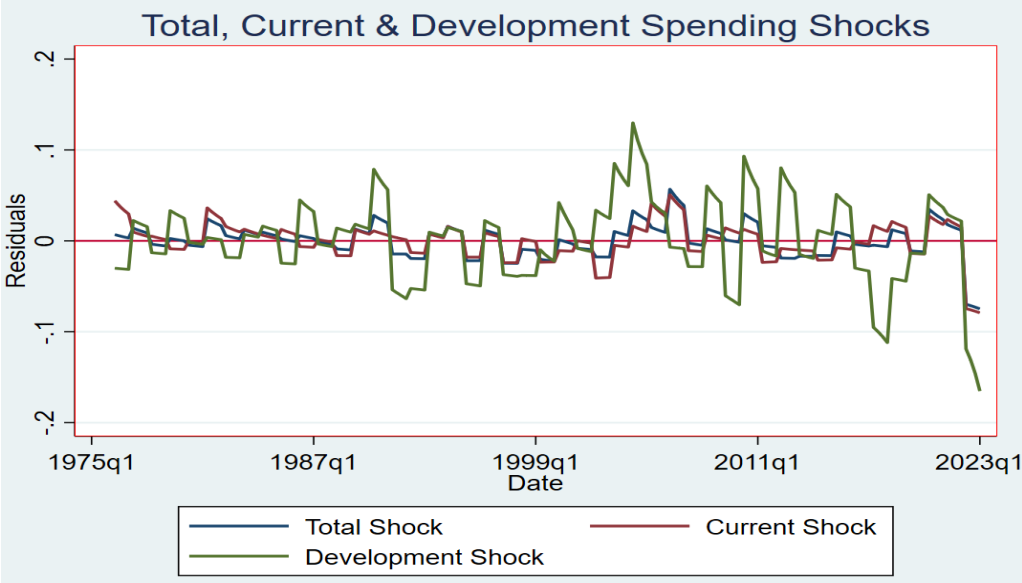


Figure 4.6 shows residual variations across time with positive spikes denoting non-slack fiscal shocks and negative spikes denoting slack fiscal shocks. These are unanticipated changes that cannot be explained by the variables in the model.

**Figure 4.7: Combined plot of Estimated Shocks**



All of the anticipated spending shocks are displayed in Figure 4.7. Because the patterns of the current spending shock and the total spending shock are similar, the study chooses to exclude only one to avoid repetition. Total spending shock is a better indicator of overall fiscal intervention since it accounts for the combined effects of current and development spending. The development expenditure shock, which represents investment-driven expenditures that may have various macroeconomic impacts, is also used in addition to the overall expenditure. For a more focused and effective analysis, the total and development shocks will be used in the next part to estimate their dynamic consequences on key macroeconomic variables using the Local Projection Method.

**4.2.3 Baseline Results Using LPM for Slack States**

The dynamic reactions of inflation and actual GDP to a shock in total government spending for quarterly data are depicted in Figure 4.8 for three different scenarios: the linear model, the non-slack period (low unemployment), and the slack period (high unemployment). To account for serial correlation, 90% confidence bands are created using Newey-West standard errors, and the estimations are based on a local projection methodology. The linear model states that a government spending shock raises real GDP and inflation to a certain extent, assuming that the effects of fiscal

policy are constant across all economic conditions. The GDP reaction is light and temporary, disappearing after the 5<sup>th</sup> horizon, whereas inflation exhibits a larger and more substantial effect, which dies down after the 8<sup>th</sup> horizon and peaking around the 18<sup>th</sup> horizon.

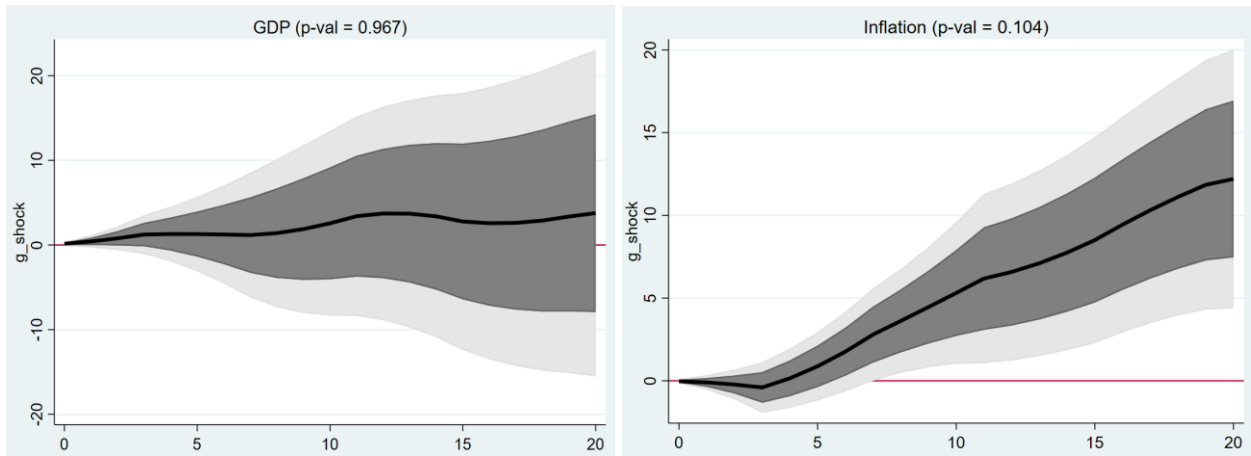
In the non-slack period of low unemployment, real GDP suffers from the total expenditure shock. It suggests that fiscal expenditures during boom periods may crowd out private investment or face supply-side constraints, as the contractionary effect is greatest around the 17<sup>th</sup> horizon. The inflationary impact is marginally negative, peaking at the 18<sup>th</sup> horizon and then declining over the course of one period, suggesting that there are very little price pressures. On the other hand, during slack period (times of high unemployment), real GDP reacts favorably but temporarily to the government expenditure shock, declining after the 5<sup>th</sup> horizon and reaching its peak at the 19<sup>th</sup>. However, its impact on inflation is much stronger positive, peaking at the 19<sup>th</sup> horizon and waning by the 4<sup>th</sup>. This pattern demonstrates that fiscal stimulus is more likely to cause inflation than to spur growth, even when it is slack.

The finding that average multipliers are close to zero aligns with recent literature (e.g., Ramey & Zubairy, 2018) and suggests limited fiscal transmission. In the context of Pakistan, this could reflect structural rigidities, crowding out of private investment, or a weak link between government spending and productive capacity. These findings raise concerns over the effectiveness of conventional fiscal stimulus measures currently practiced in Pakistan.

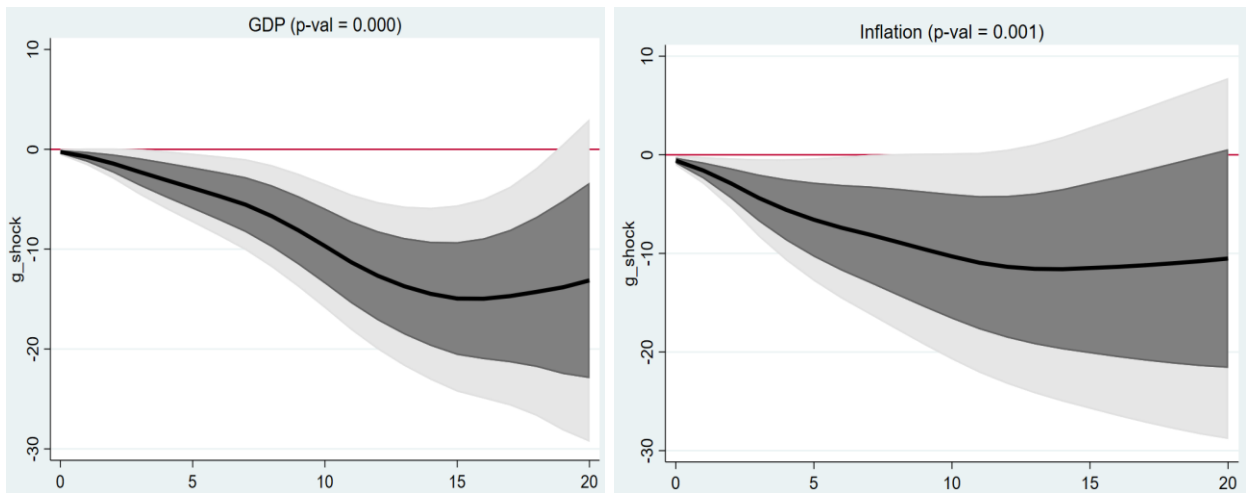
In general, Figure 4.8 confirms the earlier finding that shocks to government spending have insignificant and limited effects on output but have greater inflationary implications, especially when unemployment is high. It indicated that during the slack period, the effect of the spending shock is ineffective for the economy, and during the non-slack period, an increase in government spending causes the crowding-out effect in the economy due to a huge government footprint Haque & Ullah (2023). This points to potential fiscal transmission inefficiencies that could result from supply shortages, leakages, or weak multiplier effects on actual activity. According to the data, current fiscal expansion may contribute more to price hikes than economic expansion. Further, to check the consistency of given results, using industrial production as a proxy for GDP, real GDP per capita, as well as using the development shock, is also estimated (can be seen in appendix figures 4,5,6,7,8), which shows almost similar findings for GDP.

**Figure 4.8: Real GDP and Inflation Response to Total Spending Shock**

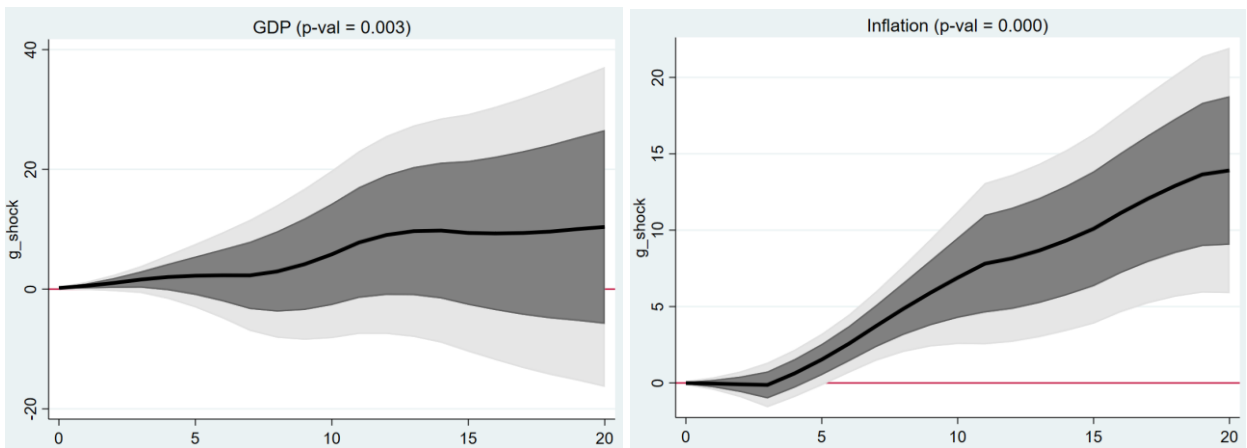
**Linear Model**



**Non-Slack Period (Low Unemployment)**



**Slack Period (High Unemployment)**



### 4.3 Robustness Check

In order to test the sensitivity of our results, we performed two sensitivity analyses. First, we examined the results using quarterly data along with annual data in order to investigate whether the frequency of data affects the results. Second, we modified the threshold for determining slack periods based on the unemployment rate. In particular, for the quarterly data, we adjusted the unemployment threshold from 5.3% to 6.0%, taking into account that the unemployment rate in Pakistan has historically remained high. Notably, we employed a smooth transition function for the annual data instead of a slack dummy variable, which restricts the adoption of a threshold-based approach in that case. Table 4.5 displays the frequency of observations by slack and non-slack under the new threshold level.

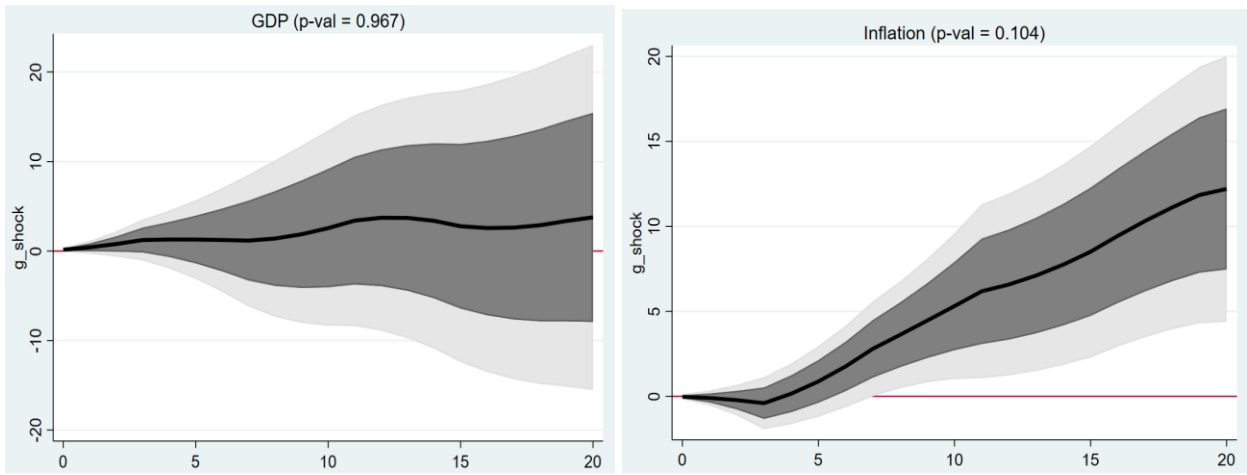
*Table 4.5: Slack Identification (Threshold = 6.0)*

State	Frequency	Percentage
Non-slack (0)	129	66.84
Slack (1)	64	33.16
Total	193	100

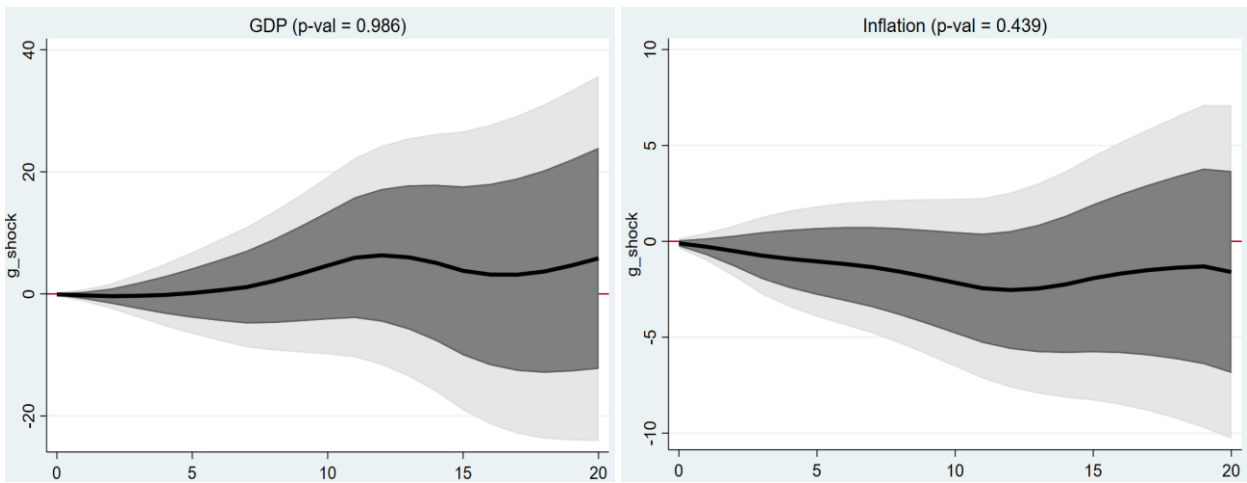
The findings show that our primary results are stable to changes in both the frequency of data and the unemployment threshold. The stability here implies that our conclusions are insensitive to these adjustments. Real GDP and inflation responses to shocks in total government spending under the new threshold are shown in Figure 4.9.

**Figure 4.9: Real GDP and Inflation Response to  $G_t$ - Shock (Threshold=6.0)**

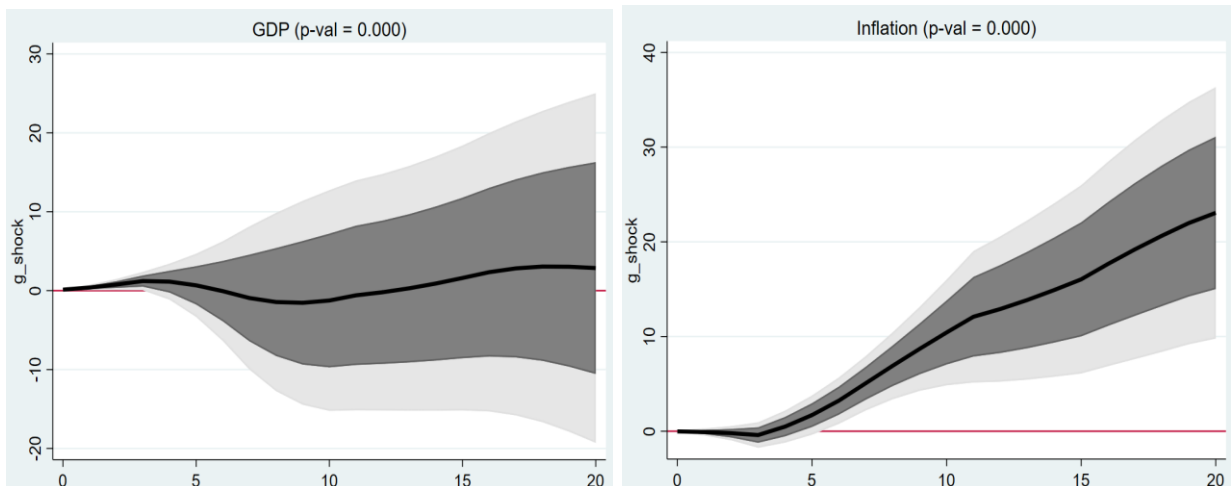
**Linear Model**



**Non-Slack Period (Low Unemployment)**



**Slack Period (High Unemployment)**



## CHAPTER 5

### CONCLUSIONS AND POLICY RECOMMENDATIONS

In the context of Pakistan, this study investigates that how fiscal shocks affect two important macroeconomic indicators: real GDP and inflation in two various states of economy. It emphasizes the state-dependent nature of fiscal multipliers in particular. The study determines the short- and medium-term dynamics of fiscal policy transmission under various economic conditions by applying the Local Projection Method (LPM) to the annual and quarterly data series. Impulse response functions offer compelling empirical support for the varying effects of fiscal policy over time and cyclical horizons. The empirical results demonstrate that government spending shocks in Pakistan have more substantial and long-lasting effects on inflation, but it has limited and insignificant effects on real GDP. This result holds true for quarterly and annual datasets. In the linear model, fiscal stimulus has limited and sharply declining output effects, but it has significant and more persistent effects on inflation. The asymmetry of fiscal multipliers is exposed when state-dependent modeling of economic situations is used. Shocks to government expenditure have a limited effect on inflation and a negative effect on real output in non-slack states (low unemployment). The GDP response is somewhat positive but short-term during slack periods (high unemployment), while the inflationary effect intensifies significantly with lag peaks in the horizon. These findings align with state-dependent Keynesian multiplier models' theoretical projections, which suggest that fiscal policy is most effective when there is economic slack and underutilized resources. However, even during times of slack, the slow GDP response resists conventional Keynesian prescriptions, indicating the existence of underlying structural constraints that diminish the real effectiveness of fiscal expansions, such as supply-side bottlenecks, inadequate public investment mechanisms, and low institutional capacity. Based on New Keynesian models, which use the zero lower bound and nominal rigidities to support fiscal activism, the results indicate that Pakistan's fiscal environment does not neatly meet these assumptions. The prevalence of inflationary effects and their limited real impact suggest that institutional inefficiencies, inadequate monetary-fiscal coordination, and inflationary financing are lowering the efficacy of fiscal policy, even during slack period.

## 5.1 Policy Recommendations

In light of the above findings, the following policy recommendations are offered in an effort to improve the efficacy of fiscal interventions in Pakistan:

- The results suggest that in slack states of high unemployment, fiscal stimulus does not significantly increase output instead it has a major contribution to inflationary pressure. Policymakers should not use expansionary fiscal policy to combat economic downturns since it does not deliver the desired response to output. Resources should instead be focused on structural reforms and specific employment programs that target labor market inefficiencies directly.
- The empirical findings also show that in non-slack periods, where the economy is at or close to full capacity level, rising government spending causes crowding-out. Under such circumstances, increased public sector spending increases interest rates and crowds out private investment, thus diluting the overall impact of fiscal expansion. This conclusion confirms the notion that fiscal stimulus in a non-slack economy can be ineffective, or worse, and counterproductive. Fiscal consolidation or balanced budget policies could better serve, and encouraging private sector growth through deregulation and ease of doing business is a best policy measure the government can take in such time periods.
- Most importantly, the general conclusion from this study is that fiscal policy, either during slack or non-slack times, cannot be a viable tool to spur long-term GDP growth in Pakistan. The nonexistence of robust multiplier effects in both economic conditions indicates structural deficiencies in the fiscal transmission mechanism. These may arise from leakages, government spending inefficiencies, low absorptive capacity, or inadequate institutional setups.
- In this stance, the government must actively stimulate private sector investment to foster sustainable development and reduce dependency on inflationary government spending. This includes improving macroeconomic stability, streamlining regulatory frameworks, and promoting public-private partnerships (PPPs). To get investor confidence and release private money for growth, policy statements must be clear and consistent.

## 5.2 Concluding Remarks

The analysis indicates that fiscal multipliers are generally weak, with values consistently below unity, and in some specifications approximating zero. This highlights that expansionary fiscal

policy in Pakistan may not generate the desired stimulus effect, particularly when crowding out and supply-side constraints exist. Therefore, reliance solely on government expenditure for economic revival may be misguided without structural reforms in the private sector, tax system, and public investment efficiency.

This study contributes to the growing body of research on non-linear fiscal multipliers in developing countries, particularly Pakistan, by demonstrating inflation-biased fiscal effects and presenting the evidence of asymmetrical effects of fiscal policy. The findings show that current fiscal policy is not a reliable tool for long-term output stabilization and is sensitive to inflationary spillovers, especially in environments with structural constraints. Therefore, increasing the effectiveness of fiscal policy necessitates a comprehensive reform program that incorporates structural transformation, macro-fiscal policy coordination, improved spending efficiency, and an atmosphere that supports growth led by the private sector. Fiscal interventions in Pakistan can only be expected to provide robust and inclusive economic performance with such coordinated reforms.

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## APPENDIX

### Using Annual Data

*Table 1: Optimal Lag Selection for VAR 1*

Lag	LL	LR Statistic	p-value	FPE	AIC	HQIC	SBIC
0	151.704	—	—	2.3e-07*	-6.75929*	-6.71417*	-6.63764*
1	157.545	11.682	0.232	2.7e-07	-6.61569	-6.43523	-6.12909
2	164.591	14.092	0.119	3.0e-07	-6.52686	-6.21107	-5.67532
3	168.771	8.3596	0.498	3.7e-07	-6.30776	-5.85663	-5.09127
4	176.887	16.233	0.062	4.0e-07	-6.26760	-5.68112	-4.68616

\* optimal lag

*Table 2: Optimal Lag Selection for VAR 2*

Lag	LL	LR	p-value	FPE	AIC	HQIC	SBIC
0	147.049	—	—	2.9e-07*	-6.5477*	-6.50259*	-6.42605*
1	153.812	13.526	0.140	3.2e-07	-6.44601	-6.26556	-5.95942
2	159.504	11.383	0.250	3.7e-07	-6.29562	-5.97983	-5.44408
3	171.186	23.364*	0.005*	3.4e-07	-6.41754	-5.96640	-5.20104
4	176.789	11.206	0.262	4.0e-07	-6.26312	-5.67664	-4.68168

\* optimal lag

*Table 3: Optimal Lag Selection for VAR 3*

Lag	LL	LR	p-value	FPE	AIC	HQIC	SBIC
0	109.928	—	—	1.6e-06*	-4.86036*	-4.81525*	-4.73871*
1	117.187	14.518	0.105	1.7e-06	-4.78122	-4.60076	-4.29462
2	123.966	13.559	0.139	1.9e-06	-4.68028	-4.36449	-3.82874
3	126.122	4.3107	0.890	2.6e-06	-4.36916	-3.91803	-3.15267
4	132.912	13.581	0.138	3.0e-06	-4.26873	-3.68226	-2.68729

\* optimal lag

### 1. Estimated VAR for Total, Current, and Development spending

Table 4 shows the results of three VAR models that examine how different government spending shocks (total, current, and development) affect GDP and tax income. Based on AIC, FPE, and the likelihood ratio test, optimal lags for all three VAR models is 1, as shown in the appendix (Tables 1, 2, 3).

*Table 4: Results of Estimated VAR Models*

	(1)	(2)	(3)
	d_ltg	d_lcg	d_ldg
<b>main</b>			
<b>L.d_ltg</b>	-0.0806 (0.187)		
<b>L.d_ltax</b>	0.163 (0.186)	0.185 (0.199)	-0.0273 (0.452)
<b>L.d_lgdp</b>	-0.0372 (0.106)	0.00956 (0.117)	-0.252 (0.260)
<b>L.d_lcg</b>		-0.0208 (0.176)	
<b>L.d_ldg</b>			-0.167 (0.168)
<b>Constant</b>	0.118*** (0.0307)	0.116*** (0.0332)	0.125 (0.0646)
<b>d_ltax</b>			
<b>L.d_ltg</b>	-0.0210 (0.173)		
<b>L.d_ltax</b>	0.100 (0.171)	0.118 (0.167)	0.0695 (0.168)
<b>L.d_lgdp</b>	0.0149 (0.0978)	0.0228 (0.0982)	0.0135 (0.0968)
<b>L.d_lcg</b>		-0.0815 (0.148)	
<b>L.d_ldg</b>			0.0309 (0.0625)
<b>Constant</b>	0.117*** (0.0283)	0.123*** (0.0279)	0.115*** (0.0241)
<b>d_lgdp</b>			
<b>L.d_ltg</b>	-0.141 (0.229)		
<b>L.d_ltax</b>	0.339 (0.227)	0.353 (0.221)	0.287 (0.225)
<b>L.d_lgdp</b>	-0.419** (0.130)	-0.406** (0.130)	-0.429*** (0.129)

<b>L.d_lcg</b>		-0.200	
		(0.195)	
<b>L.d_ldg</b>			0.00676
			(0.0835)
<b>Constant</b>	0.0417	0.0490	0.0297
	(0.0375)	(0.0369)	(0.0322)
<b>Observations</b>	<b>47</b>	<b>47</b>	<b>47</b>

Standard errors in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

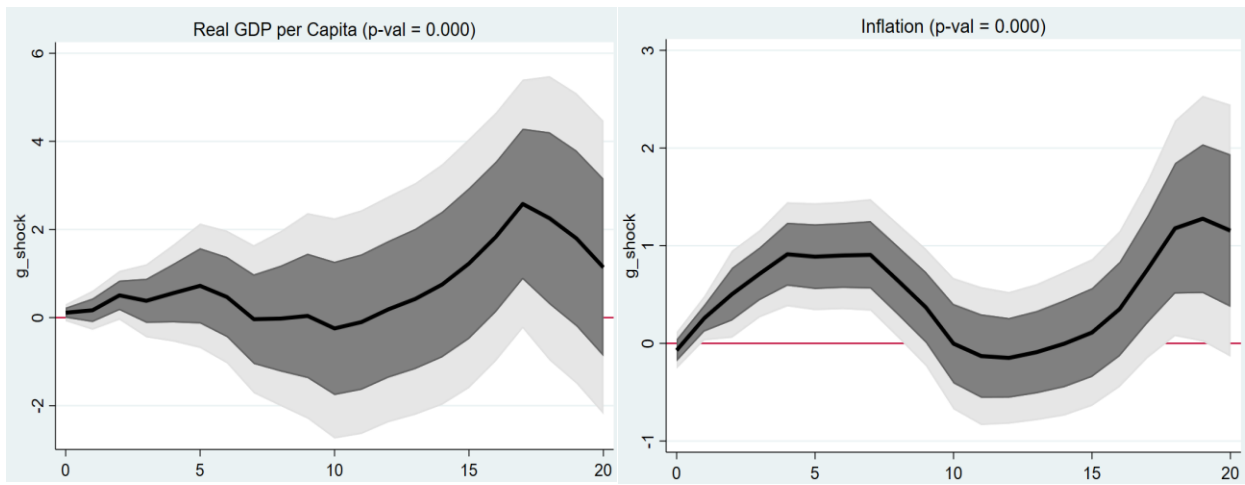
The above table shows that lagged tax income contributes positively and considerably to GDP in all models, which is consistent with a pro-cyclical relationship whereby higher tax revenues are associated with growth. The GDP consistently exhibits significant negative coefficients on its lag, which is consistent with its severe mean reversion. On the other hand, none of the shocks to current, development, or total (aggregate) spending have a statistically significant short-term positive effect on GDP, indicating lower short-term fiscal multiplier effects. The tax revenue itself is only slightly impacted by lagged GDP and spending. Overall, the findings show that tax revenues have a stronger short-term impact on GDP than government spending, with minimal evidence that spending shocks have a stimulus effect.

*Table 5: Stability Check for All Three VAR Models using Eigenvalues*

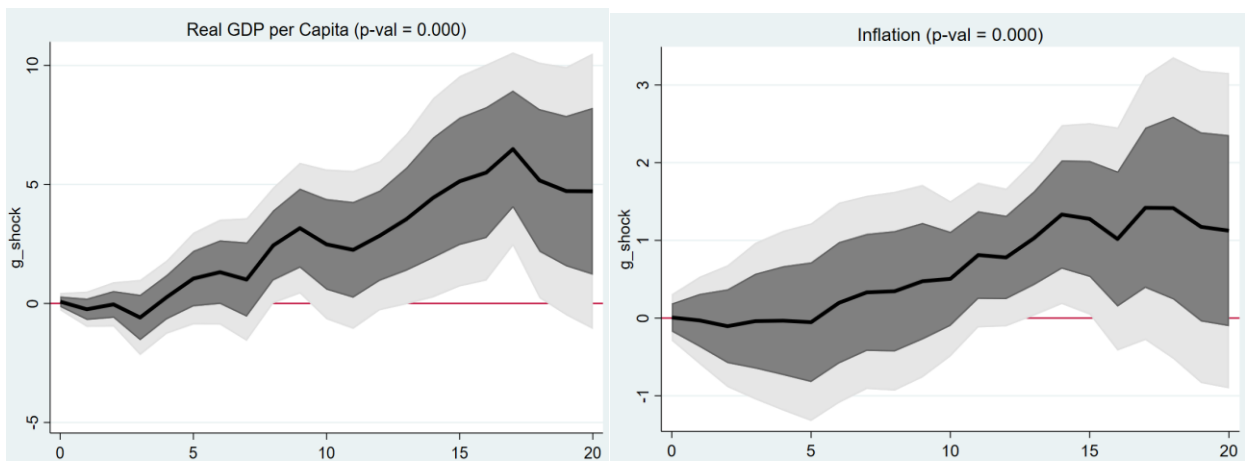
VAR 1		VAR 2		VAR 3	
Eigenvalue	Modulus	Eigenvalue	Modulus	Eigenvalue	Modulus
-0.4426809	0.442681	-0.4200658	0.420066	-0.445874	0.445874
0.08823105	0.088231	0.05567381 + 0.1038878i	0.117865	-0.1337453	0.133745
-0.04482544	0.044825	0.05567381 - 0.1038878i	0.117865	0.05293725	0.052937
Stability Condition: Satisfied		Stability Condition: Satisfied		Stability Condition: Satisfied	

*Figure 1: Real GDP Per Capita and Inflation Response to Total Spending Shock*

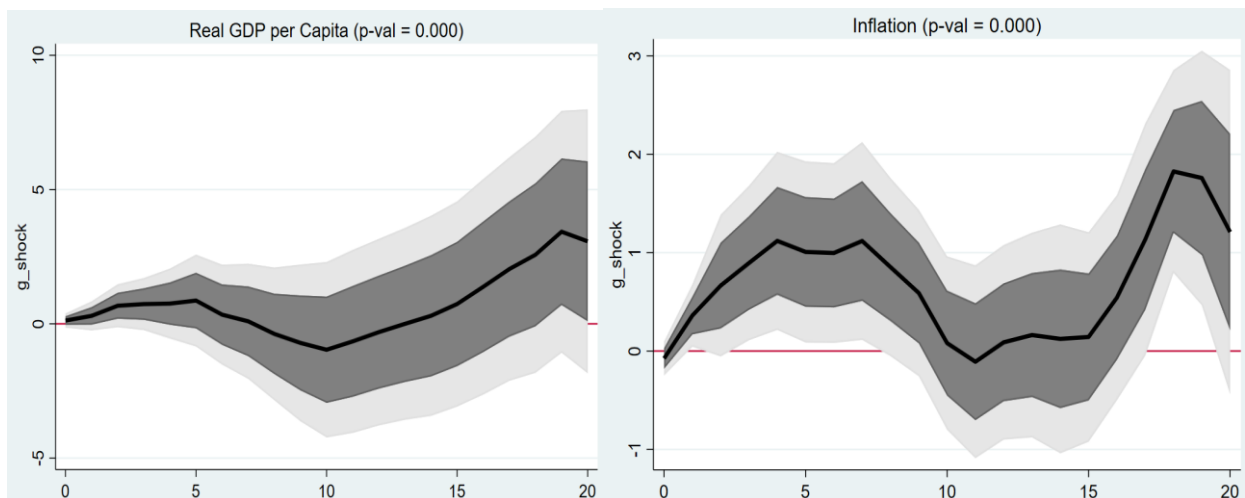
**Linear Model**



**Non-Slack Period (Low Unemployment)**

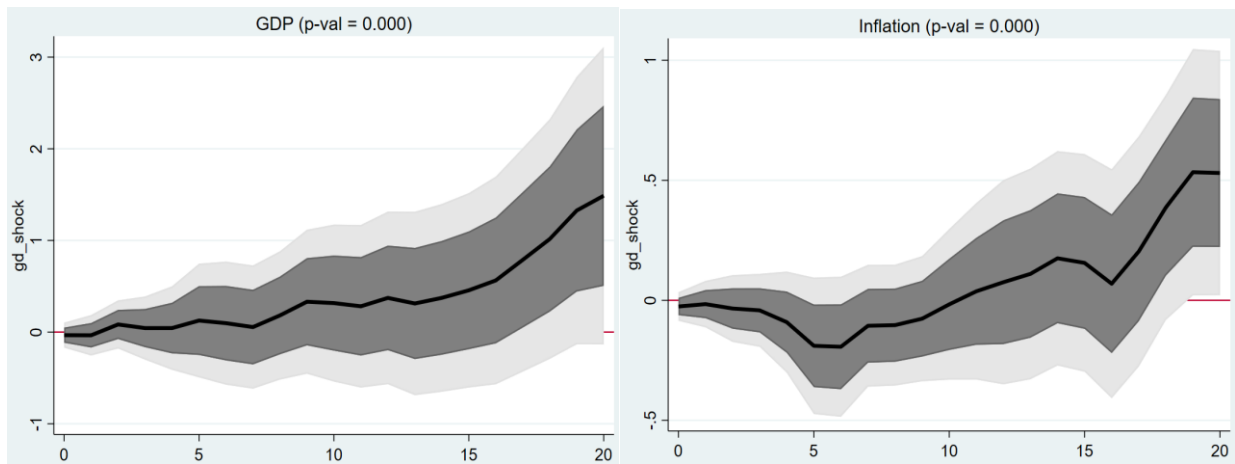


**Slack Period (High Unemployment)**

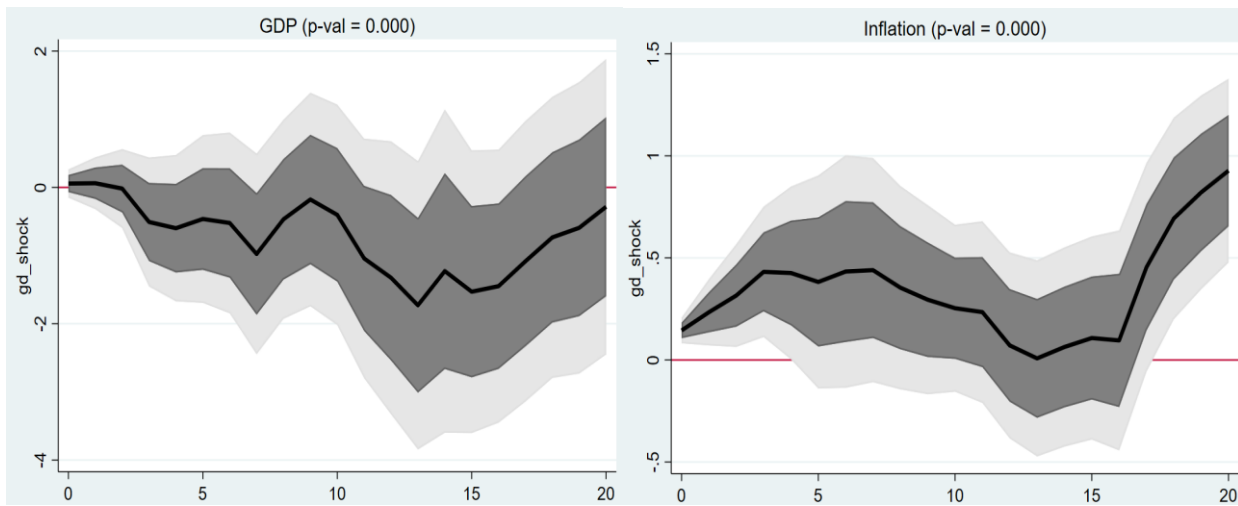


*Figure 2: Real GDP and Inflation Response to Development Spending Shock*

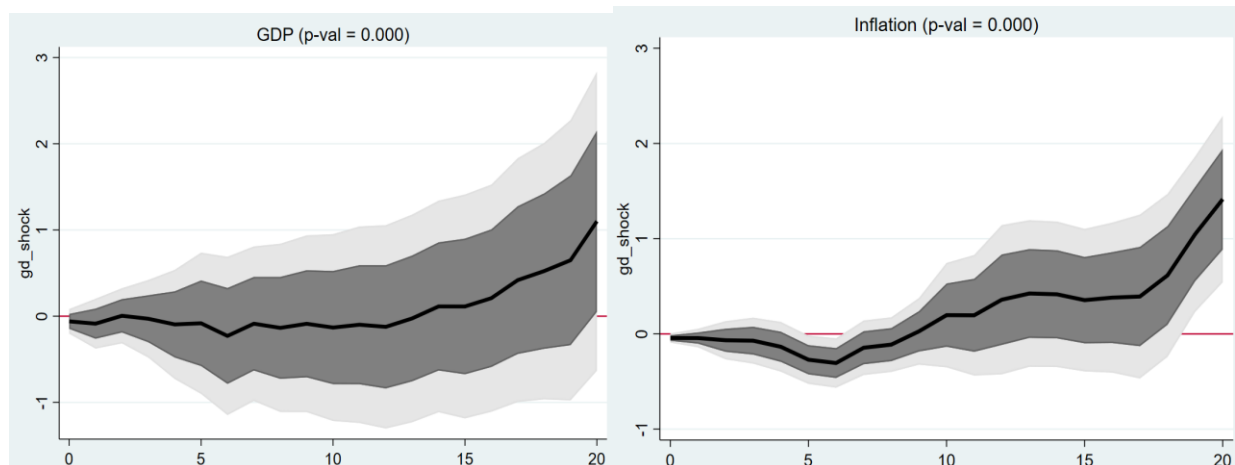
**Linear Model**



**Non-Slack Period (Low Unemployment)**

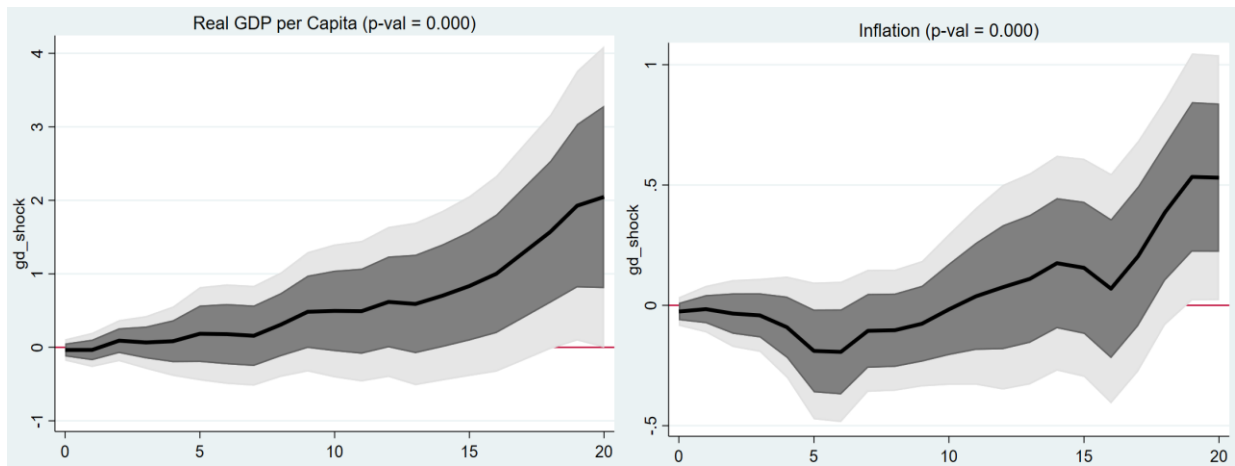


**Slack Period (High Unemployment)**

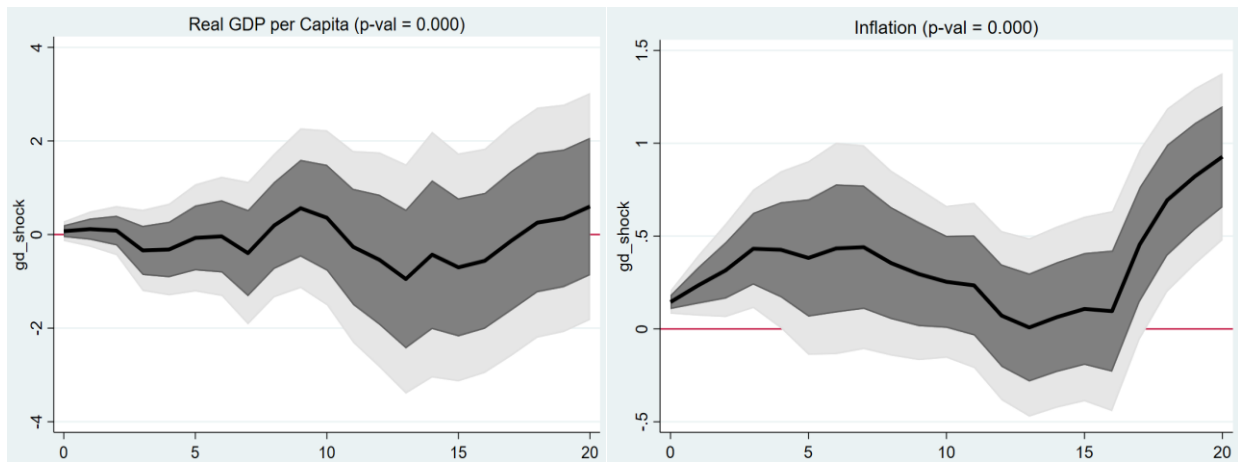


*Figure 3: Real GDP Per Capita and Inflation Response to Development Spending Shock*

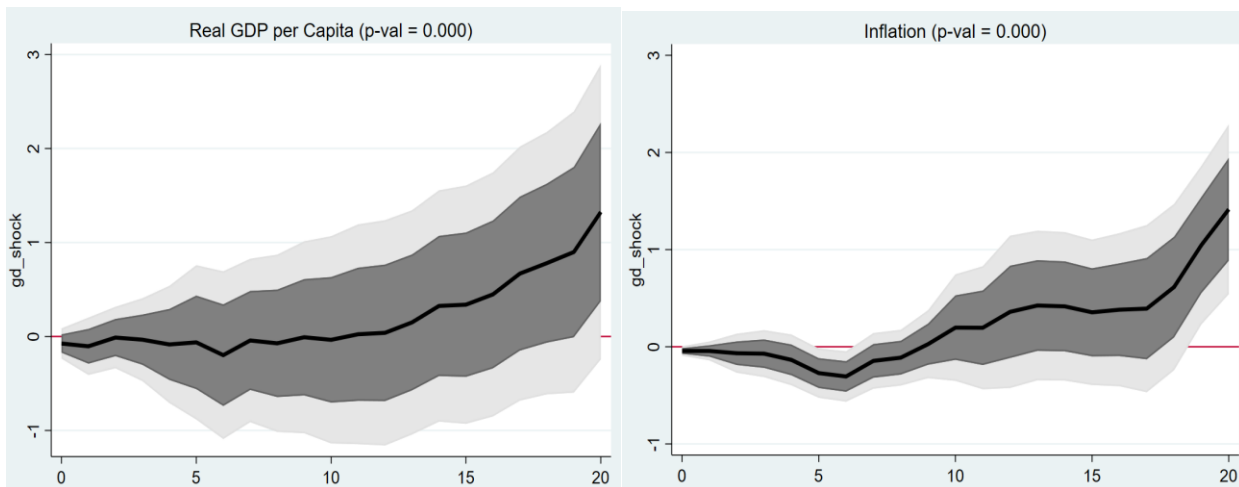
**Linear Model**



**Non-Slack Period (Low Unemployment)**



**Slack Period (High Unemployment)**



**Using Quarterly Data**

**Table 5: Optimal Lag Selection for VAR 1**

Lag	LL	LR Statistic	p-value	FPE	AIC	HQIC	SBIC
0	1427.18			5.3e-11	-15.1508	-15.1299	-15.0992
1	1648.64	442.93	0.000	5.5e-12	-17.4111	-17.3274	-17.2045*
2	1655.69	14.096	0.119	5.6e-12	-17.3903	-17.2439	-17.0288
3	1668.36	25.338	0.003	5.4e-12	-17.4294	-17.2201	-16.9129
4	1696.14*	55.561*	0.000*	4.4e-12*	-17.6292*	-17.3571*	-16.9578

\* optimal lag

**Table 6: Optimal Lag Selection for VAR 2**

Lag	LL	LR Statistic	p-value	FPE	AIC	HQIC	SBIC
0	1406.33			6.6e-11	-14.9290	-14.9081	-14.8774
1	1630.99	449.33	0.000	6.6e-12	-17.2233	-17.1397	-17.0168*
2	1637.76	13.537	0.140	6.8e-12	-17.1996	-17.0531	-16.8381
3	1649.93	24.339	0.004	6.6e-12	-17.2333	-17.0241	-16.7169
4	1676.73*	53.595*	0.000*	5.4e-12*	-17.4227*	-17.1506*	-16.7513

\* optimal lag

**Table 7: Optimal Lag Selection for VAR 3**

Lag	LL	LR Statistic	p-value	FPE	AIC	HQIC	SBIC
0	1246.44			3.6e-10	-13.2281	-13.2072	-13.1765
1	1456.80	420.71	0.000	4.2e-11	-15.3702	-15.2865	-15.1636*
2	1464.48	15.365	0.081	4.3e-11	-15.3562	-15.2097	-14.9947
3	1478.46	27.960	0.001	4.1e-11	-15.4092	-15.1999	-14.8927
4	1509.39*	61.850*	0.000*	3.2e-11*	-15.6424*	-15.3704*	-14.9710

\* optimal lag

## 2. Estimate VAR for Total, Current, and Development spending

The results of the three estimated VAR models shown in table 4.6 reflect how total government spending (ltg), current government spending (lcg), and development spending (ldg) are dynamically related. Based on AIC, FPE, and the likelihood ratio test, optimal lags for all three VAR models are 4, as shown in the appendix (Table 5,6,7).

*Table 8: Results of Estimated VAR Models*

	(1)	(2)	(3)
	d_ltg	d_lcg	d_ldg
<b>main</b>			
<b>L4.d_ltg</b>	-0.0736 (0.0937)		
<b>L4.d_ltax</b>	0.170 (0.0929)	0.192 (0.0992)	-0.00846 (0.226)
<b>L4.d_lgdp</b>	-0.0357 (0.0530)	0.00941 (0.0583)	-0.242 (0.130)
<b>L4.d_lcg</b>		-0.0123 (0.0878)	
<b>L4.d_ldg</b>			-0.163 (0.0841)
<b>Constant</b>	0.0290*** (0.00382)	0.0284*** (0.00414)	0.0303*** (0.00808)
<b>d_ltax</b>			
<b>L4.d_ltg</b>	-0.0149 (0.0863)		
<b>L4.d_ltax</b>	0.106 (0.0856)	0.124 (0.0835)	0.0764 (0.0840)
<b>L4.d_lgdp</b>	0.0153 (0.0488)	0.0229 (0.0490)	0.0144 (0.0483)
<b>L4.d_lcg</b>		-0.0750 (0.0738)	
<b>L4.d_ldg</b>			0.0317 (0.0313)
<b>Constant</b>	0.0288*** (0.00352)	0.0303*** (0.00348)	0.0285*** (0.00300)
<b>d_lgdp</b>			
<b>L4.d_ltg</b>	-0.142 (0.116)		
<b>L4.d_ltax</b>	0.340** (0.115)	0.354** (0.111)	0.288* (0.113)
<b>L4.d_lgdp</b>	-0.406***	-0.392***	-0.416***

	(0.0654)	(0.0654)	(0.0651)
<b>L4.d_lcg</b>		-0.200*	
		(0.0985)	
<b>L4.d_ldg</b>			0.00657
			(0.0422)
<b>Constant</b>	0.0103*	0.0120**	0.00725
	(0.00472)	(0.00464)	(0.00405)
<b>Observations</b>	<b>188</b>	<b>188</b>	<b>188</b>

Standard errors in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

GDP growth (lgdp) is significantly positively impacted by the lagged log of tax receipts (ltax) across all models, with Model 2 reporting the largest effect. In every scenario, lagged GDP seriously affects its own future growth. Lagged ltax has a marginally favorable effect on ldg, but surprisingly has good effects on ltg and lcg. Apart from the negative effect of ldg on itself, lag ltg, lcg, and ldg often have negligible or weak effects on the dependent variables. In most of the equations, the constant terms are statistically significant, suggesting recurring underlying trends. In general, tax revenues seem to have a significant impact on shaping both short-term GDP growth and expenditures.

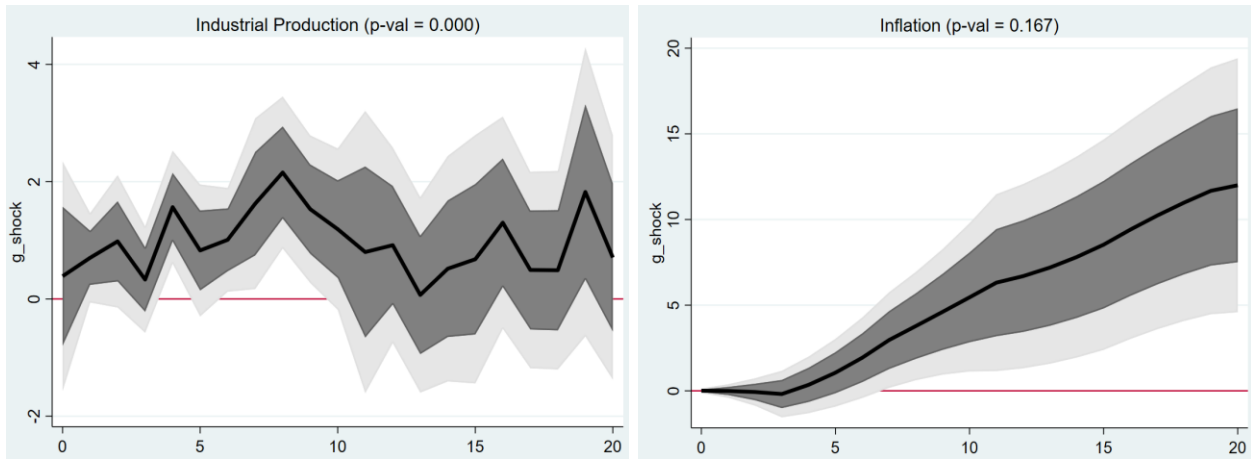
**Table 9: Stability Check for All Three VAR Models using Eigenvalues**

VAR 1		VAR 2		VAR 3	
Eigenvalue	Modulus	Eigenvalue	Modulus	Eigenvalue	Modulus
.5770236 + .5770236i	0.816035	-.569766 + .569766i	0.805771	.5781654 + .5781654i	0.817649
.5770236 - .5770236i	0.816035	-.569766 - .569766i	0.805771	.5781654 - .5781654i	0.817649
-.5770236 + .5770236i	0.816035	.569766 + .569766i	0.805771	-.5781654 + .5781654i	0.817649
-.5770236 - .5770236i	0.816035	.569766 - .569766i	0.805771	-.5781654 - .5781654i	0.817649
-.5614498	0.561450	.1476808 + .5692778i	0.588121	.4272215 + .4272215i	0.604182
.5614498	0.561450	.1476808 - .5692778i	0.588121	.4272215 - .4272215i	0.604182
1.388e-17 + .5614498i	0.561450	-.1476808 + .5692778i	0.588121	-.4272215 + .4272215i	0.604182
1.388e-17 - .5614498i	0.561450	-.1476808 - .5692778i	0.588121	-.4272215 - .4272215i	0.604182
-.3225566 + .3225566i	0.456164	.5692778 + .1476808i	0.588121	-.5033157	0.503316
-.3225566 - .3225566i	0.456164	.5692778 - .1476808i	0.588121	.5033157	0.503316

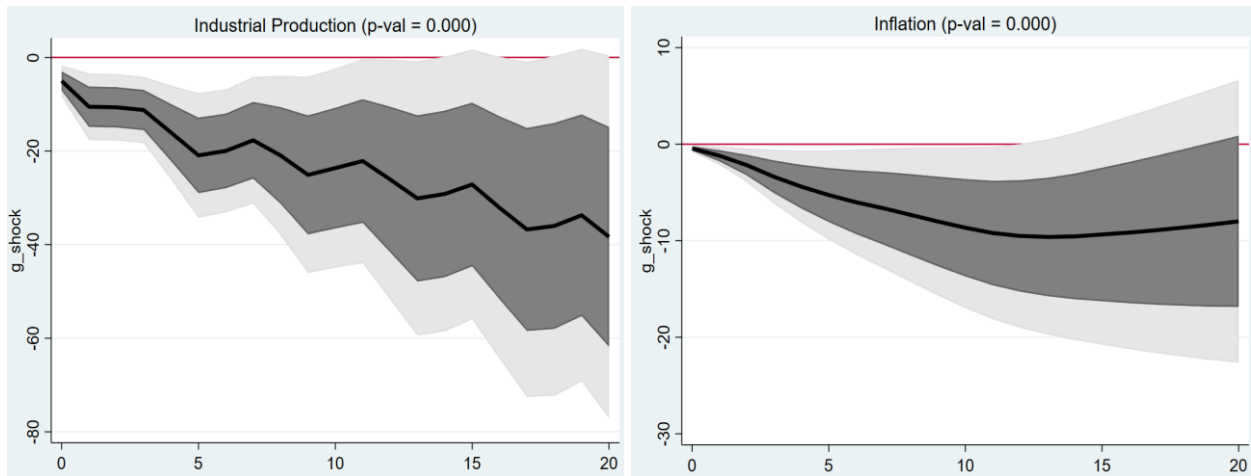
$.3225566 + .3225566i$	0.456164	$-.5692778 + .1476808i$	0.588121	$4.163e-17 + .5033157i$	0.503316
$.3225566 - .3225566i$	0.456164	$-.5692778 - .1476808i$	0.588121	$4.163e-17 - .5033157i$	0.503316
Stability Condition: Satisfied		Stability Condition: Satisfied		Stability Condition: Satisfied	

**Figure 4: Industrial Production and Inflation Response to Total Spending Shock**

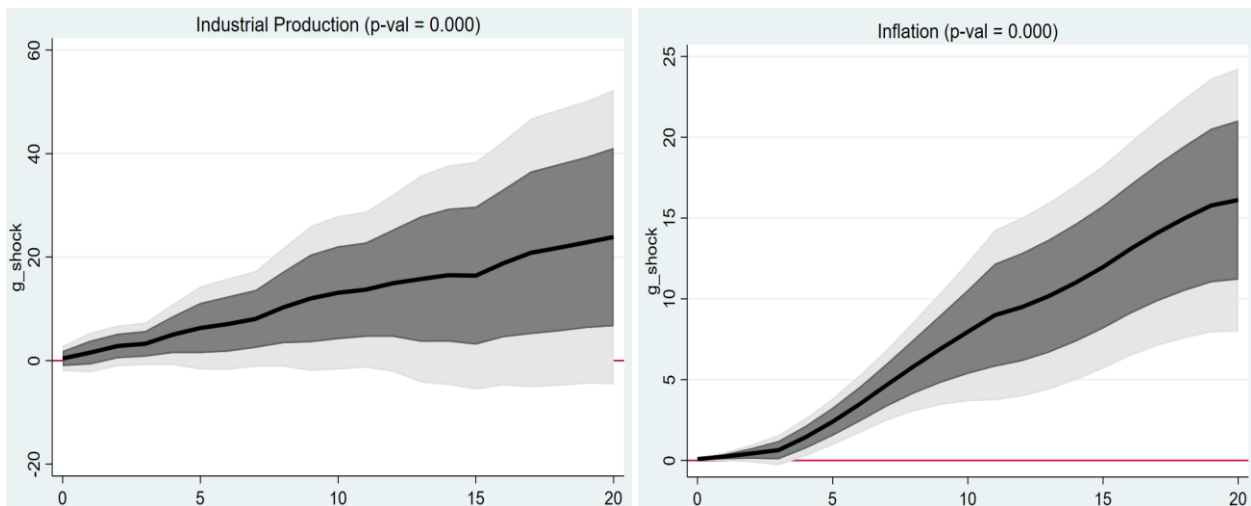
**Linear model**



**Non-Slack Period (Low Unemployment)**

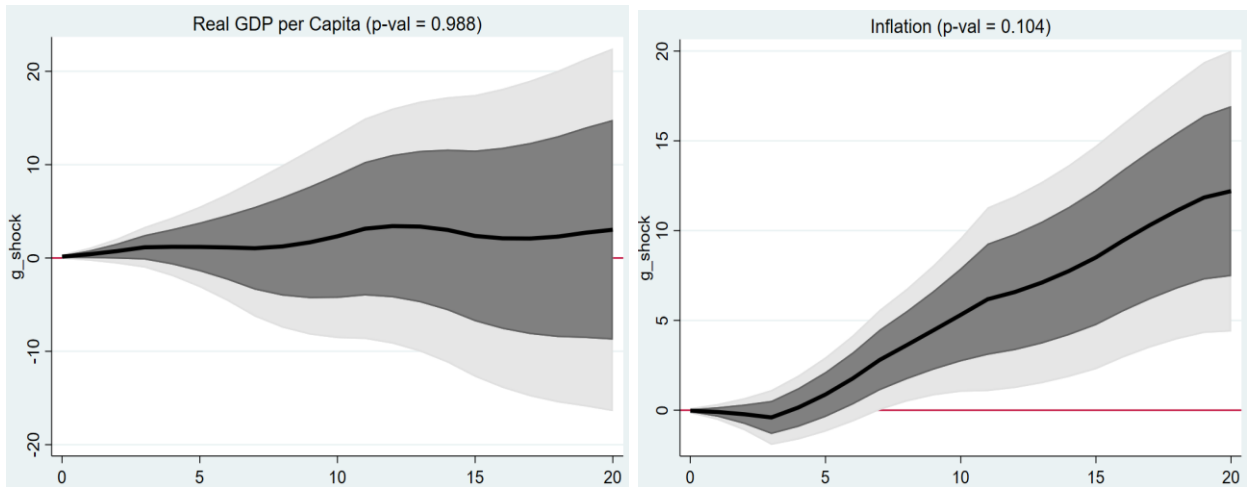


**Slack Period (High Unemployment)**

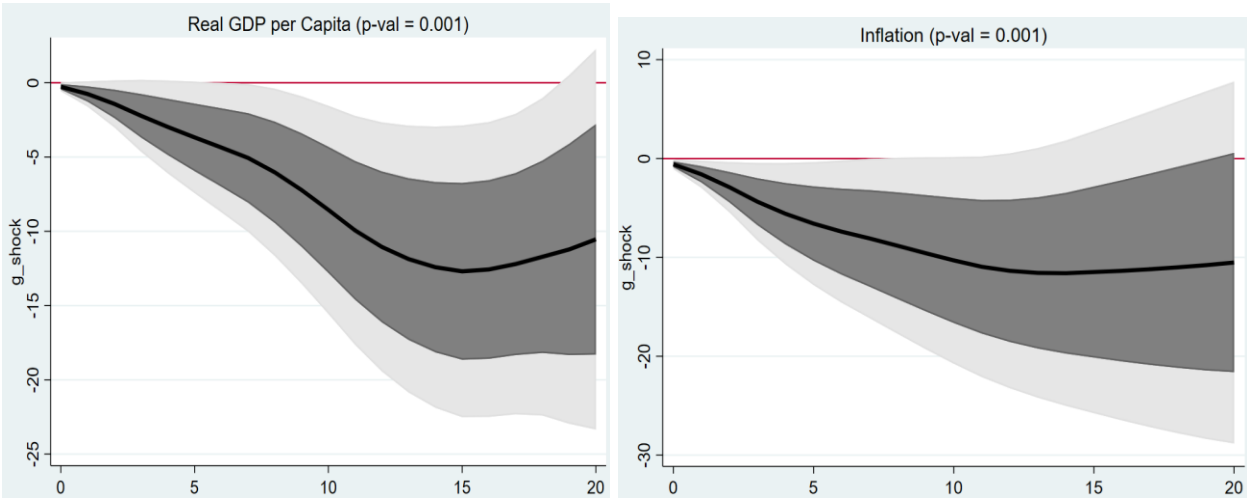


**Figure 5: Real GDP per Capita and Inflation Response to Total Spending Shock**

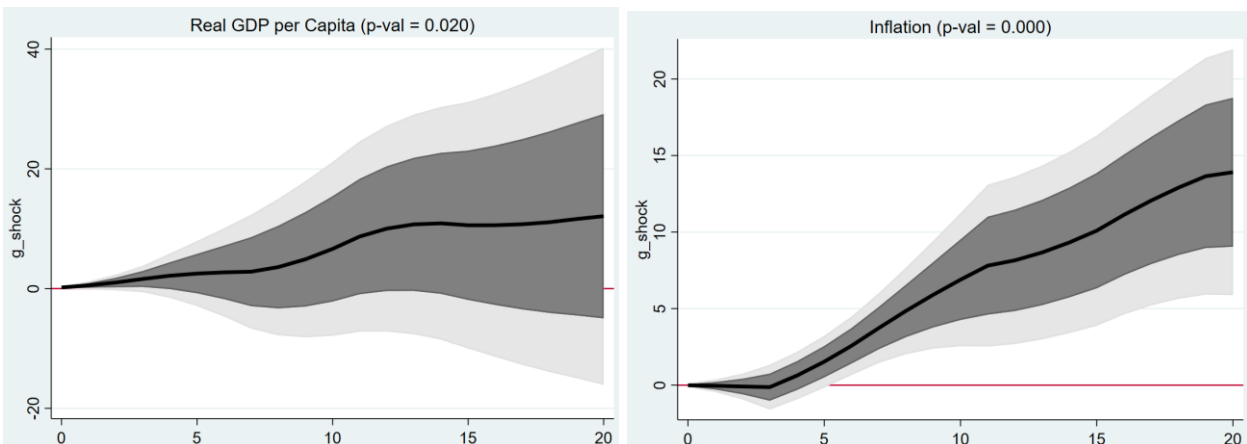
**Linear Model**



**Non-Slack Period (Low Unemployment)**

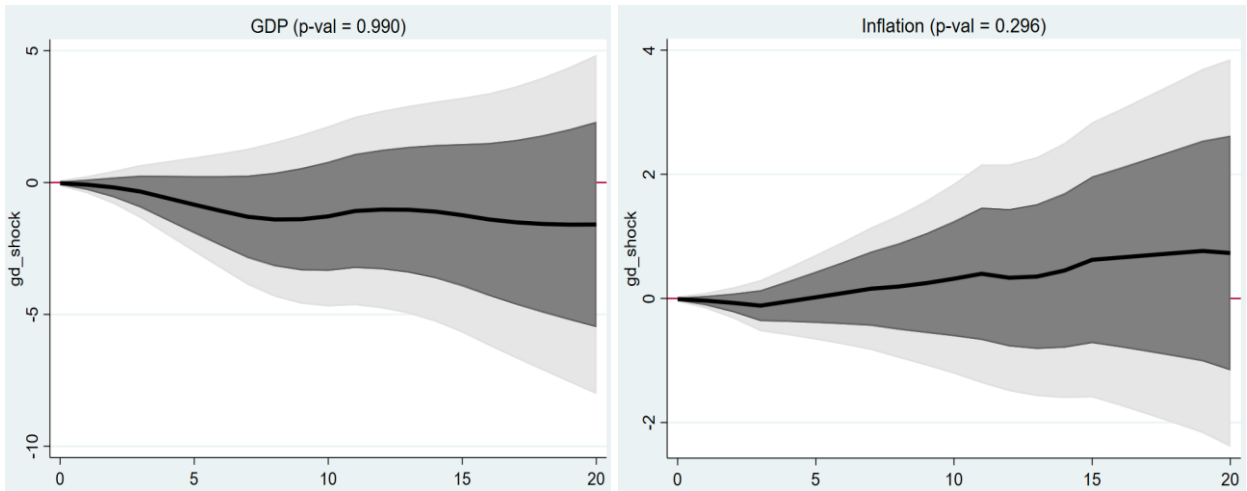


**Slack Period (High Unemployment)**

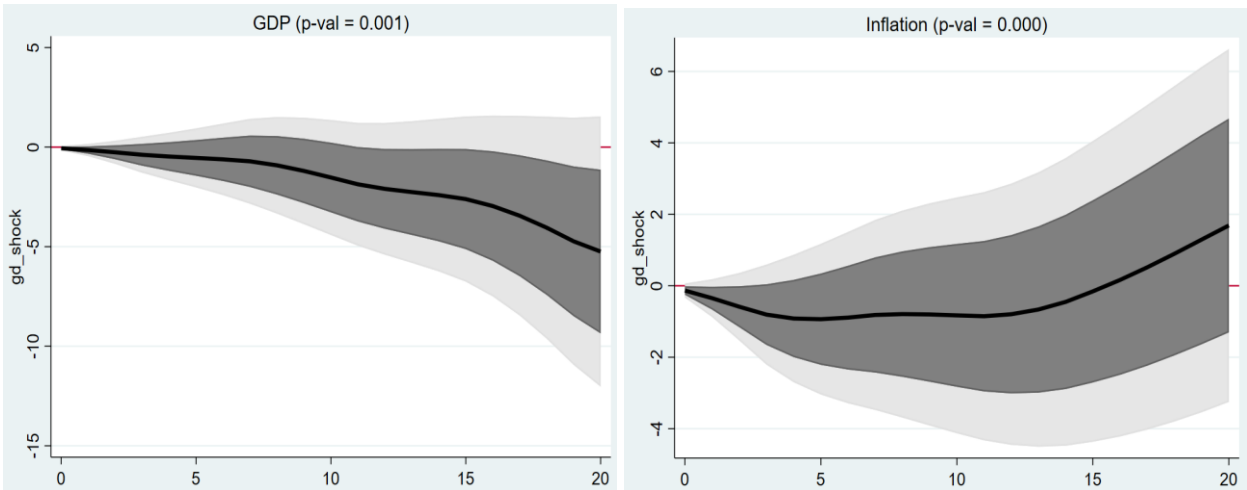


*Figure 6: Real GDP and Inflation Response to Development Spending Shock*

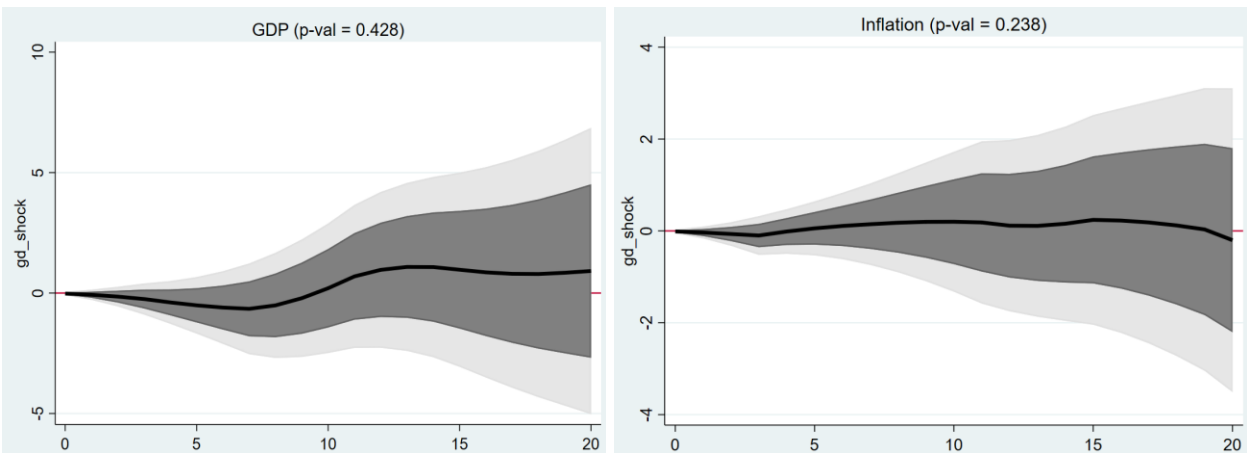
**Linear Model**



**Non-Slack Period (Low Unemployment)**

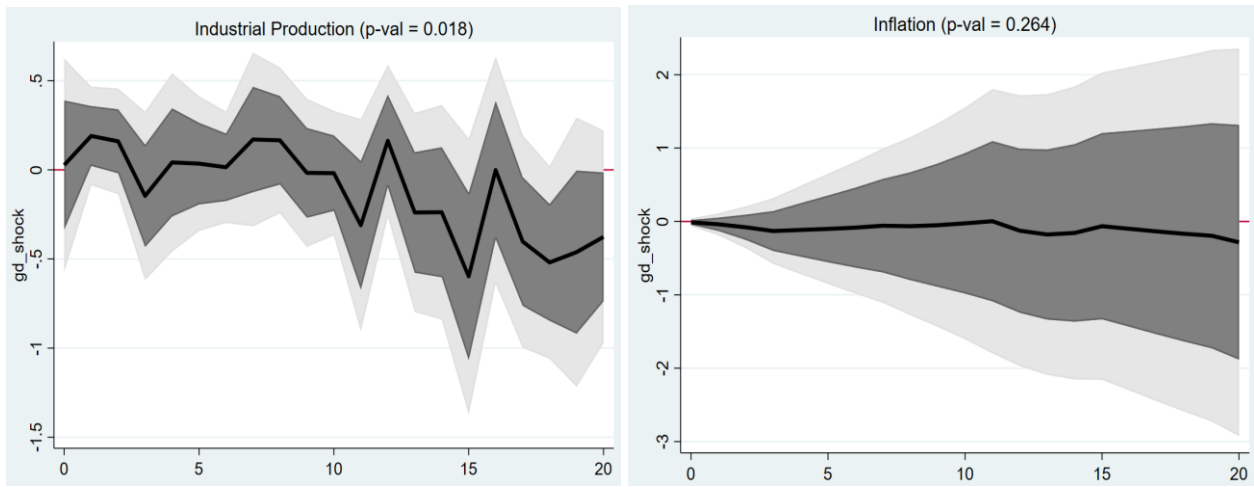


**Slack Period (High Unemployment)**

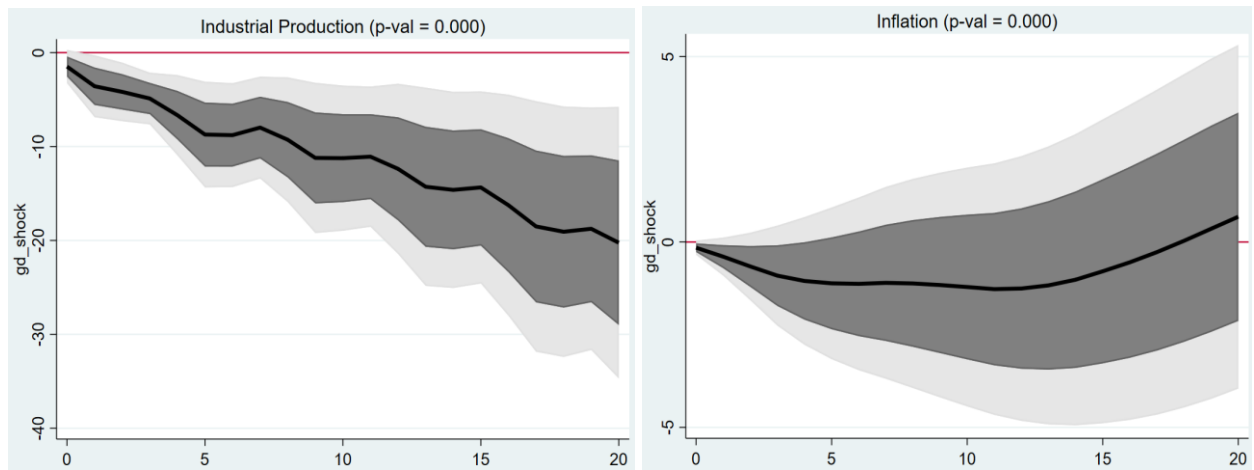


**Figure 7: Industrial Production and Inflation Response to Development Spending Shock**

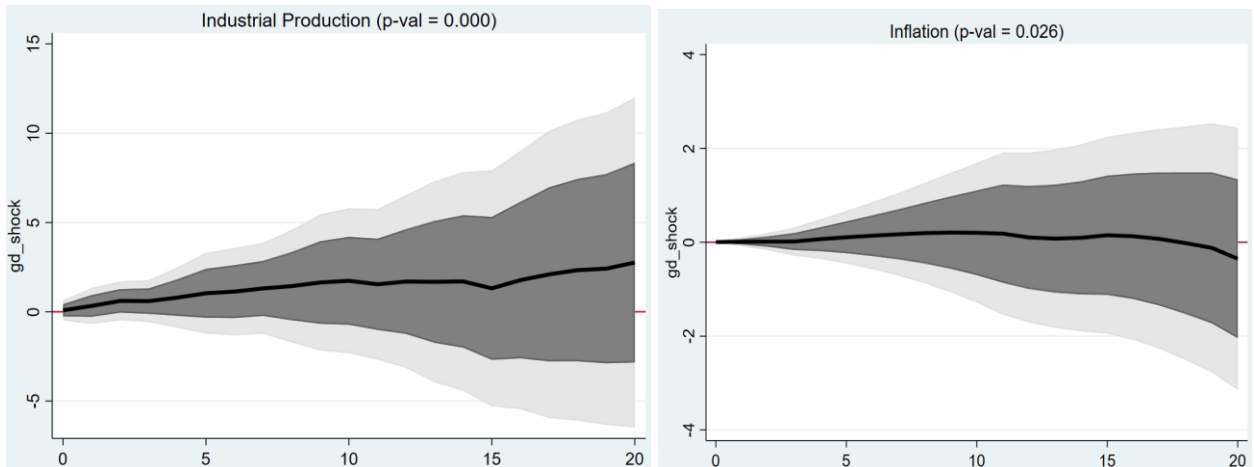
**Linear Model**



**Non-Slack Period (Low Unemployment)**

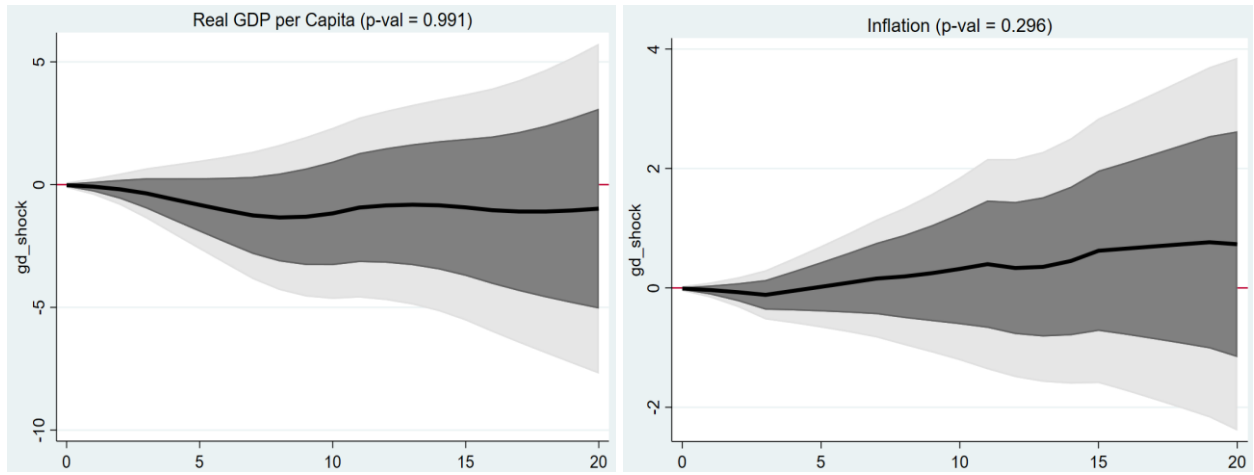


**Slack Period (High Unemployment)**

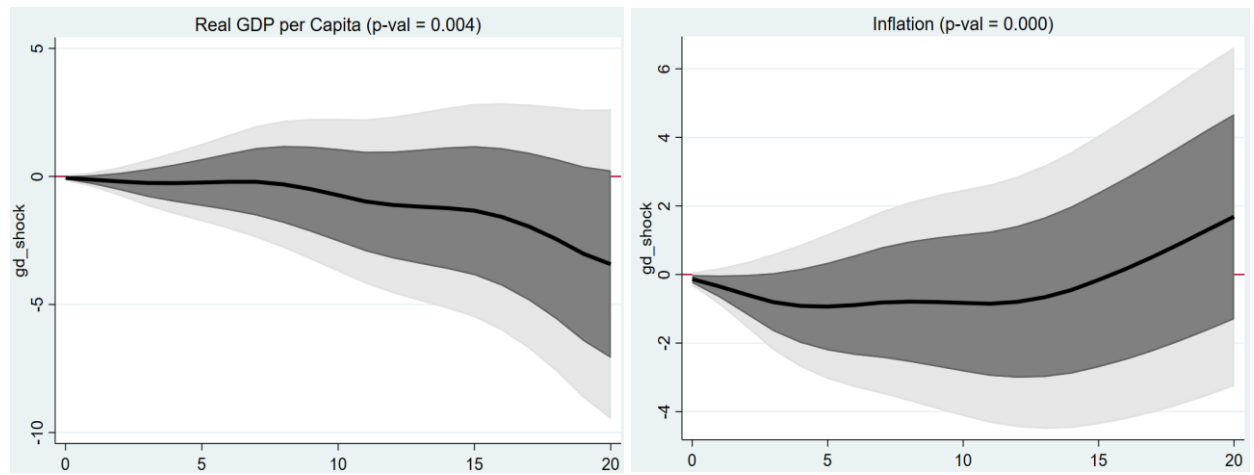


*Figure 8: Real GDP Per Capita and Inflation Response to Development Spending Shock*

**Linear Model**



**Non-Slack Period (Low Unemployment)**



**Slack Period (High Unemployment)**

