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Impact of Fiscal Policy on Pakistan's GDP: How Much and How Long?

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Contents

Abstract

Implications of fiscal policy for Pakistan's GDP have been evaluated through estimation of fiscal multipliers based on quarterly structural vector autoregressive models. Estimation results show that government consumption multiplier is positive only for initial two quarters and has a peak value of only 0.6. Government investment multiplier, initially depicting a weak and cyclical behavior, reaches a peak value of 1.5 in the eighth quarter. Net tax multiplier remains negative for initial five quarters. Subsequently, the stabilizing effects of consolidating fiscal policy exceed the initial output costs and the net tax multiplier becomes positive to attain its peak value of 1.12 in 13^{th} quarter. These results confirm that the use of consumption based expansionary fiscal policy to boost real GDP growth has no empirical support in case of Pakistan. Fiscal consolidation has positive effects on medium term growth outcomes.

Keywords: Fiscal policy, National Government Expenditure, VAR Model

JEL Codes: E62, H5, C320

Non-technical Summary

This paper evaluates implications of fiscal policy for Pakistan's GDP growth using quarterly data models. To contextualize this empirical exercise, Pakistan's economic performance has been evaluated relative to a set of peer countries and over time. This country profiling exercise points towards a resource constrained environment, characterized by persistent use of expansionary fiscal policy which is accompanied by crowding out effects.

Estimation results show that positive effects of government consumption expenditures are very weak and short-lived. Government investment expenditures are found to have positive effects on GDP growth in the medium term, although at the expense of short term volatility. Increase in net taxes is found to reduce real GDP growth in the short term. However, stabilization effects of this consolidating fiscal policy boost real GDP growth in the medium term.

Our findings suggest that the government should rationalize subsidies, control interest payments through prudent debt management, increase revenues and improve efficiency of its investment expenditures to ensure sustainability of growth.

1 Introduction

Objective of this paper is to empirically estimate the size of fiscal multipliers in a dynamic setup and at a dis-aggregated level for Pakistan. Spending multipliers inform about the change in GDP owing to one rupee change in fiscal spending or taxes. Fiscal spending, broadly distributed between current expenditures and development expenditures, is often used as a fiscal policy tool. Keynesian theory postulates that if economy is in recession and private sector sentiments are down, then raising fiscal spending may boost output growth and employment. Similarly, tax cuts may also boost GDP growth. If one rupee increase in fiscal impulse leads to more than one rupee increase in real GDP, then multiplier is larger than one and such fiscal policy intervention is considered effective. Hence, to justify the use of expansionary fiscal policy, magnitude of fiscal multipliers should be greater than one.

Literature shows that fiscal multipliers are contingent upon a host of economic factors including level of economic development, flexibility of exchange rate, trade openness, level of public debt (Ilzetzki et al. 2013) and, state of business cycle (Linnemann & Winkler 2016). Apart from above mentioned factors, spending multipliers are also different for different components of spending e.g. government consumption (current expenditures) versus government investment (development expenditures) (Boehm 2020). Still other important sources of variation in empirical estimates of multipliers are various empirical methods, identification strategies (Geli & Moura 2023) and economic theories used to analyse fiscal policy (Fontana 2009).

The analysis of fiscal multipliers for Pakistan is motivated by three observations. First, a cross-country comparison, interpreted together with findings of Ilzetzki et al. (2013), suggests that spending multipliers should be on lower side in case of Pakistan. Figure 1 shows that Pakistan has relatively low savings rate, high interest rate, high debt servicing burden, high inflation, highly volatile exchange rate and very low trade openness[1]. Collectively, these facts suggest that GDP growth in Pakistan has remained suboptimal owing to supply constraints rather than slackness in aggregate demand. The key objective of expansionary fiscal intervention is to make-up for the slack in demand to boost output. In a resource-constrained situation, use of expansionary fiscal policy may further exacerbate the problem of excess demand, leading to crowding out of private sector credit, investment, net exports and consumption. This situation calls for careful analysis of fiscal policy effectiveness through empirical estimation of multipliers for justifying the use of expansionary fiscal policy.

[1]Interpreted under the light of Ilzetzki et al. (2013) findings, all of these indicators except low trade openness suggest low value of spending multipliers in case of Pakistan. Ilzetzki et al. (2013) show that low trade openness is associated with high value of spending multipliers.

Figure 1: Cross country comparison of indicators important for fiscal multipliers

Second motivating observation is that despite resource constrained situation depicted by Figure 1, overall fiscal policy stance has been expansionary in Pakistan. To demonstrate this fact, we present charts of five-year averages of two indicators of fiscal policy stance namely deficit-GDP ratio and debt-GDP ratio followed by some key macroeconomic indicators like real GDP growth, private investment growth, private sector credit to GDP ratio and US dollar exchange rate in Figure 2 for the sample period of fiscal year 2001 to 2023. The 5-year averages allow concentration upon long run trends by side stepping the short-term noise. The analysis of these long run trends shows that there has been fairly consistent rise in deficit and debt, showcasing an expansionary fiscal policy stance. In the meanwhile, sharply declining share of private sector credit and sinking growth rate of private investments potentially point towards strong crowding out effects of this expansionary fiscal policy stance. This analysis of long run trends motivates us to evaluate effectiveness of fiscal policy in case of Pakistan.

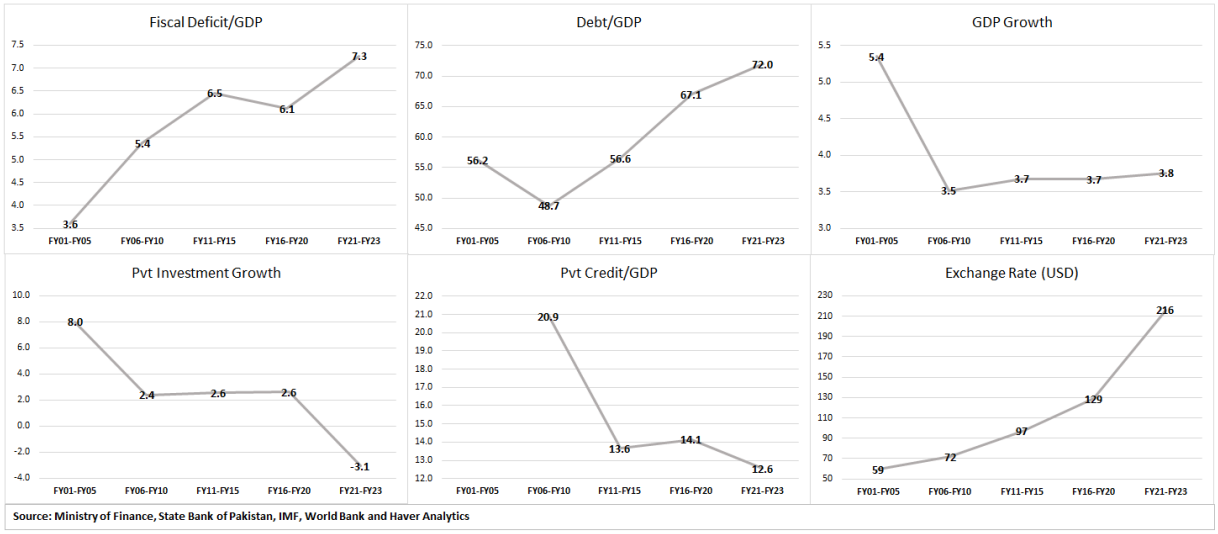

Figure 2: 5-year averages of key economic indicators of Pakistan economy

Finally, as a result of persistently increasing deficit, which is mainly financed through domestic sources, domestic banking sector exposure to government has increased to 60.6 percent of total assets of banking sector balance sheet assets[2]. The heavy reliance of fiscal authority and banks on each other leads to the phenomenon of "sovereign-bank nexus" which could have adverse consequences for macro-financial stability (Deghi et al. 2022). Accordingly, there is a need to critically evaluate the effectiveness of deficit creating expansionary fiscal policy through empirical estimation of fiscal multipliers.

Following a vast body of literature (Batini et al. 2014), we use vector auto-regressions (VAR) to estimate fiscal policy multipliers. VAR models are suitable for estimation of fiscal multipliers as their multiple equation structure allows them to deal with simultaneity problem. Another important strength of VAR models is to isolate discretionary fiscal policy shocks from automatic response of fiscal variables to business cycle fluctuations. During estimation of fiscal multipliers, we are interested in calculation of exogenous fiscal shocks: the changes in fiscal variables that are caused by deliberate fiscal policy actions rather than automatic response of built-in stabilizers like proportional tax revenues and transfer payments. This isolation of exogenous fiscal shocks from automatic response of fiscal variables to business cycle fluctuations is referred to as "identification of structural fiscal shocks". Structural VAR (SVAR) models are widely utilized for identification of structural fiscal policy shocks.

The two main identification strategies to estimate structural shocks are non-recursive identification introduced by Blanchard & Perotti (2002) and recursive identification offered

[2]State Bank of Pakistan, Financial Stability Review 2023, Chapter 1.

by Sims (1980). In this paper, we apply multiple variations of both of the identification strategies to seek robust estimates of fiscal multipliers. Using the two identification strategies, we estimate multipliers for aggregate spending, current expenditures, development expenditures and net taxes.

The rest of the paper has been organized as follows. The section 2 presents literature review, section 3 introduces VAR model, identifications strategies and methodology to calculate multipliers from VAR impulse response functions (IRFs), section 4 presents data and estimation results. The last section 5 presents conclusion, policy implications and potential extensions.

2 Literature Review

We divide the literature review section in two parts: determinants of fiscal multipliers and fiscal policy evaluation in context of Pakistan.

2.1 Determinants of fiscal multipliers

In an influential paper, Ilzetzki et al. (2013) use panel SVAR based on quarterly data of 44 countries to analyze how fiscal multipliers are affected by various country characteristics. Their findings show that government consumption multipliers are larger in industrial economies and fixed exchange rate countries. Conversely, multipliers are found to be lower in developing countries, highly open trade countries and, zero in flexible exchange rate countries. The authors also document that government consumption multipliers are negative in high debt countries. Choudhary et al. (2016) develop a DSGE model and support their findings with SVAR model to show that increase in fiscal spending may be highly detrimental for output if level of public debt is high and government excessively relies upon domestic banks for deficit financing in under developed financial markets.

Geli & Moura (2023) use a panel data set of 177 countries to estimate multipliers for taxes, government consumption and government investment. The authors show that slight changes in identification strategy and calculation methodology of multipliers may lead to over-estimation of size of multipliers. Their baseline estimation results show that level of development turns out to be an important factor of fiscal policy effectiveness. They show that government consumption multiplier for developing economies is -0.5 and 1.9 for advanced economies. Government investment multipliers for developing and advanced economies are estimated to be 0.3 and 1.7, respectively.

The determinants of fiscal multipliers; as listed down by Batini et al. (2014), include

trade openness, labour market rigidity, size of automatic stabilizers, exchange rate regime, debt level and quality of fiscal administration. Countries with lower imports, rigid labour market, lower level of automatic stabilizers, stable exchange rate, lower debt and better fiscal administration are expected to have higher fiscal multipliers and vice versa. The authors offer a "bucketing approach" wherein countries are assigned scores on the basis of the above-mentioned determinants to find a basic estimate of multiplier. The basic estimate may be scaled up or down based upon the existing conditions of two "conjunctural factors" namely the state of business cycle and monetary policy accommodation of fiscal shocks.

Kemp (2020) estimates fiscal multipliers for South Africa using a variety of identification approaches and specifications. The author concludes that the size of estimated multiplier is sensitive to identification strategy and modelling approach. Estimation results show that multipliers are positive but less than one. Matheson & Pereira (2016) estimate fiscal multipliers for Brazil using quarterly data of 1999-2014 using an eight-variable SVAR model. Their results show that in pre-global financial crisis sample, spending multipliers turn out to be around 0.5. However, once post financial crisis period is added in the estimation sample, value of spending multiplier drops to almost zero.

Boiciuc (2015) estimates spending and tax multipliers for Romania using quarterly data (2000 - 2012) SVAR models under recursive and non-recursive Blanchard & Perotti (2002) identification schemes. The estimation results show that both spending and tax multipliers are considerably less than one and close to zero. However, it is important to note that the author did not scale up the accumulated impulse response functions (IRFs) by dividing with spending to GDP ratio, generally done in literature to calculate multipliers from VAR IRFs. Even if scaling factor is applied, size of spending multipliers is likely to remain considerably lower than one. The author also notes that dynamics of recursive and non-recursive IRFs are similar, although non-recursive approach yields relative smaller IRFs.

2.2 Fiscal policy evaluation in context of Pakistan

In case of Pakistan, relatively older studies have relied upon annual data for empirical analysis as official quarterly national income accounts data are made available for 2015Q3 onwards. Ali et al. (2010) evaluate effectiveness of fiscal policy using annual data from 1972 to 2008 for Pakistan. The authors estimate different single equation dynamic models in which real GDP growth is regressed upon fiscal policy variables e.g. fiscal deficit, current expenditures and development expenditures. Based on their estimation results, the authors conclude that rise in fiscal deficit, an indicator of expansionary fiscal policy, has statistically significant but negative relation with real GDP growth. The authors opine that owing to politically

motivated and unproductive nature of government spending, expansionary fiscal policy has negative implications for GDP growth.

In another annul data study, Nazir et al. (2013) estimate vector error correction model based on sample from 1980 to 2012. The estimation results show that a rise in government consumption, the major part of total expenditures, has negative effects on real GDP growth. On the other hand, rise in taxes are found to have positive effects on real GDP growth. Based on these results, the authors recommend to reduce current expenditures and to improve tax mobilization structure.

Khalid & Ahsan-ul Haq (2016) use SVAR model to evaluate effectiveness of fiscal policy under Blanchard & Perotti (2002) identification. The SVAR model has been estimated under deterministic trend, stochastic trend and vector error correction mechanism (VECM) using annual data from 1971 to 2010. The study concludes that a rise in government expenditures and taxes leads to rise in GDP. A major limitation of the study is to use Blanchard & Perotti (2002) identification for annual data as the identification scheme was designed and justified for quarterly data.

Munir & Riaz (2019) use quarterly data from 1976Q1-2017Q4 to estimate non-stationary VAR models under recursive identification. The authors infer about effectiveness of fiscal policy based upon impulse response functions of VAR models for aggregate as well as disaggregated fiscal variables. Estimation results show that shocks to aggregate expenditures and taxes lead to rise in GDP. Results for disaggregate expenditure components show that rise in current expenditures leads to rise in GDP which lasts for around 19 quarters (i.e. around five years). On the other hand, positive response of GDP to rise in public investment and development expenditures lasts only for 9 to 10 quarters and GDP declines after that. An increase in direct and indirect taxes leads to rise in GDP. However, an increase in non-tax revenues leads to decline in GDP.

Although the Munir & Riaz (2019) use quarterly data and a VAR model, however the study has several limitations. First, the study does not use actual quarterly data. Instead, the study solely relies upon interpolated quarterly data. As mentioned by Giordano et al. (2005), non-interpolated quarterly data is required for proper estimation of quarterly VAR model. It is important to note that actual quarterly data of fiscal variables is available from 2001Q3 onwards while the actual quarterly data for inflation and interest rate is available for entire sample of the study. [3]Hence, despite existence of actual quarterly data, using interpolated data makes no sense.

[3]Official quarterly data of GDP has been made available by Pakistan Bureau of Statistics recently from 2015Q3 onwards. For older sample period, temporal disaggregation studies like Tahir et al. (2018) and Hanif et al. (2013) may be utilized.

Second, the recursive identification scheme orders variables as: expenditure, interest rate, GDP, revenues and prices. This ordering implies that shocks to interest rate can affect GDP and inflation contemporaneously while the converse is not true. However, this assumption is flawed because SBP monetary policy committee regularly convenes every two months to recalibrate monetary policy stance through changes in interest rate[4]. Therefore, interest rate can and does respond to inflation and GDP developments within a quarter.

Third, the study uses non-stationary VAR models based on natural log transformation. Many of the reported IRFs exhibit non-decaying pattern, even after lapse of 20 quarters. This contrasts with Batini et al. (2014) who document that in general, effects of fiscal impulse vanish in five years. Our results also show that multiplier estimates based on non-stationary VAR models may be biased upwards. Finally, without offering values of fiscal policy multipliers, the study concludes that Keynesian effects hold in Pakistan . To establish presence of Keynesian effects, spending multipliers should be positive and greater than one.

Hayat & Qadeer (2016) estimate fiscal multipliers for four South Asian countries, India, Pakistan, Sri Lanka and Bangladesh using annual data (1982-2014) panel VAR model. Their results show that aggregate spending multipliers are statistically significant and close to one; even nine years after the introduction of spending shock. There are three major limitations of this study. First, the study uses a 3-variable VAR comprising spending, taxes and GDP while ignoring key variables like inflation, interest rate and exchange rate. Blanchard & Perotti (2002), the pioneer of 3-variable VAR for fiscal policy analysis, admit that the small dimensional VAR models may suffer from omitted variable bias and including inflation in the model may be important[5]. As our results confirm, fiscal spending shocks have statistically significant implications for inflation and exchange rate and omitting these variables may lead to upward bias in estimation of multipliers.

Second limitation of the study is using annual data rather than quarterly data. Finally, the reported multipliers appear to be overestimated and too persistent under the light of literature (Batini et al. 2014). We argue that the use of non-stationary panel VAR model might be the reason behind inflated and too persistent estimates of spending multipliers.

To sum up, we do not find a single study which provides estimates of fiscal multipliers at disaggregate level in case of Pakistan. To bridge this gap, we estimate different specifications of VAR model and estimate multipliers using the quarterly data from 2001Q3 - 2024Q4. Ours is the first study which utilizes recently released official quarterly GDP data for Pakistan.

[4]In volatile situations, emergency MPC meeting may be called even before two months.

[5]It is important to bear in mind that Blanchard & Perotti (2002) introduced 3-variable fiscal policy VAR for USA. Like other advanced economies, in the era of so-called "Great Moderation", inflation has not been a major policy issue in USA as well. Therefore, omitting inflation may be justified in case of USA. However, this is not the case in developing economies.

3 The Vector Autoregressive (VAR) Model

Consider the general form of p^{th} order structural VAR with exogenous variables:

$$Ay_t = A_1^s y_{t-1} + A_2^s y_{t-2} + ... + A_p^s y_{t-p} + C^s x_t + Bu_t \tag{1}$$

where matrices A, lag coefficients A_i^s and exogenous variables' coefficient C^s are made up of structural parameters. Structural shocks are represented by vector u_t, elements of which are assumed to be uncorrelated owing to their structural nature.

To convert structural VAR into reduced form VAR, we pre-multiply both sides with inverse of the matrix that contains coefficients of contemporaneous relationships i.e. A^{-1}.

$$A^{-1}Ay_t = A^{-1}A_1^s y_{t-1} + A^{-1}A_2^s y_{t-2} + ... + A^{-1}A_p^s y_{t-p} + A^{-1}C^s x_t + A^{-1}Bu_t \tag{2}$$

$$y_t = A_1 y_{t-1} + A_2 y_{t-2} + ... + A_p y_{t-p} + Cx_t + \epsilon_t \tag{3}$$

where A_1, $A_{2,...,}A_p$ and C are matrices of reduced form VAR. Reduced form residuals, generally known as forecast errors are given as:

$$\epsilon_t = A^{-1}Bu_t = Su_t \tag{4}$$

where $S = A^{-1}B$. Variance-covariance of forecast errors is given as:

$$\sum\nolimits_{\epsilon} = E(\epsilon_t \epsilon_t') = E(A^{-1}Bu_t u_t' B' A^{-1\prime}) \tag{5}$$

$$= A^{-1}BB'A^{-1\prime} = SS' \tag{6}$$

as owing to orthogonality of structural shocks, $E(u_t u_t') = I_k$.

Owing to endogeneity induced by presence of contemporaneous terms, structural VAR cannot be estimated accurately. Accordingly, a reduced form VAR is estimated and evaluated using different criteria including lag length, normality of residuals, stability of system and autocorrelation etc. Once the estimated reduced form VAR model passes the evaluation criteria, a structural VAR model may be obtained by identification process. Identification of structural VAR refers to imposing restrictions on elements of matrices A and B. Restrictions on matrix A imply framing certain assumptions regarding contemporaneous relationships and sequence of different shocks affecting the system. On the other hand, restrictions on matrix B dictate the correlation structure of reduced form residuals as these restrictions define forecast errors as linear combinations of structural shocks.

In context of VAR models for fiscal policy analysis, the two widely used identification

strategies are non-recursive identification introduced by Blanchard & Perotti (2002) (BP2002 henceforth) and recursive ordering incorporating Cholesky decomposition.

3.1 Non-Recursive Identification: BP 2002

We estimate a 3-variable VAR model containing fiscal spending, revenues and GDP using quarterly data of Pakistan economy. Reduced form representation is given as:

$$y_t = A(L)y_t + Cw_t + U_t \tag{7}$$

where

$$y_t = [S_t, T_t, X_t]'. \tag{8}$$

S_t, T_t and X_t respectively represent fiscal spending, fiscal revenue and real GDP. All three variables were made real and converted into per-capita terms. Considering quarterly frequency of data, we use four lags to estimate all VAR models. We estimate the 3-variable VAR under BP2002 identification using log and year-on-year (YoY) growth transformation of variables. The vector of exogenous variables which includes intercept, time trend, square of time trend, three seasonal dummies, and dummy variables to capture heightened volatility observed during 2007-08, Covid-19 pandemic and more recently in 2023, is given by[6]:

$$w_t = [\alpha, t, t^2, S_1, S_2, S_3, D_{covid}, D_{08}, D_{23}]' \tag{9}$$

$A(L)$ and C respectively represent matrix lag polynomial for lags of endogenous vector y_t and exogenous vector w_t. The vectors $U_t = [s_t, t_t, x_t]'$ and $e_t = [e_t^s, e_t^t, e_t^x]$ respectively represent vectors of reduced form residuals and structural shocks. As discussed above, U_t and e_t are related as:

$$U_t = A^{-1}Be_t \tag{10}$$

$$AU_t = Be_t \tag{11}$$

Non-recursive identification of Blanchard & Perotti (2002) was based on assumptions regarding response of discretionary fiscal policy actions towards fluctuations in GDP and

[6]For YoY growth models, vector of exogenous variables does not include seasonal dummy variables.

institutional knowledge. These restrictions may be shown as:

$$\begin{bmatrix} 1 & 0 & -a_{sx} \\ 0 & 1 & -a_{tx} \\ -a_{xs} & -a_{xt} & 1 \end{bmatrix} \begin{bmatrix} s_t \\ t_t \\ x_t \end{bmatrix} = \begin{bmatrix} 1 & b_{st} & 0 \\ b_{ts} & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} e_t^s \\ e_t^t \\ e_t^x \end{bmatrix} \tag{12}$$

or

$$\begin{aligned} s_t &= a_{sx}x_t + b_{st}e_t^t + e_t^s \\ t_t &= a_{tx}x_t + b_{ts}e_t^s + e_t^t \\ x_t &= a_{xt}t_t + a_{xs}s_t + e_t^x \end{aligned} \tag{13}$$

The coefficient a_{tx} and a_{sx} show automatic plus discretionary fiscal response effects of changes in GDP on taxes and spending, respectively. As expenditure based discretionary fiscal policy measures are characterized by extended legislative process and implementation delays, therefore $a_{sx} = 0$. Blanchard & Perotti (2002) estimate a_{tx}, response of taxes to contemporaneous GDP, through weighted average tax component elasticities. The calculated value of a_1 for US is 2.08, indicating quite strong buoyancy of taxes to GDP. We estimate this parameter through an OLS regression of log of taxes on GDP. This single equation does not suffer from endogeneity bias as it is assumed that government is not able to respond to GDP fluctuations through tax changes in a quarterly data setup.

The coefficients b_{ts} and b_{st} show contemporaneous response of taxes and spending on each other. Assuming that taxes respond to spending fluctuations, Blanchard & Perotti (2002) use the restriction that $b_{st} = 0$. The coefficient b_{ts} is estimated through VAR model. The coefficients a_{xt} and a_{xs}; showing contemporaneous response of GDP to taxes and spending are estimated through a two stage least square (2SLS) regression estimation of x_t on t_t and s_t as independent variables.

3.2 Recursive Ordering Identification

The recursive ordering identification strategy imposes restrictions on contemporaneous relationships among the variables included in the VAR model. In this identification scheme, variables included in VAR model are sequenced in decreasing order of exogeneity. The variables placed first is assumed to be the most exogenous while the variable placed last is assumed to be the most endogenous variable in the system. Structural shocks to the most exogenous variable (the first one) affect all variables instantly. However, during initial period, the most exogenous variable is affected only by its own structural shock.

We estimate VAR models, as given by Equation 7 under recursive ordering using following specifications:

1. 3-variable VAR under log and YoY growth specifications
2. 5-variable VAR under log, YoY and QoQ growth transformations
3. 6-variable VAR under YoY and QoQ growth transformations

3.2.1 3-variable VAR

The 3-variable VAR under log transformation uses the same data as used in the 3-variable BP2002 identification. Under recursive identification, Equation 12 becomes:

$$\begin{bmatrix} 1 & 0 & 0 \\ -a_{ts} & 1 & 0 \\ -a_{xs} & -a_{xt} & 1 \end{bmatrix} \begin{bmatrix} s_t \\ t_t \\ x_t \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} e_t^s \\ e_t^t \\ e_t^x \end{bmatrix} \tag{14}$$

Accordingly, Equation 13 becomes:

$$\begin{aligned} s_t &= e_t^s \\ t_t &= e_t^t + a_{ts} s_t \\ x_t &= e_t^x + a_{xs} s_t + a_{xt} t_t \end{aligned} \tag{15}$$

First equation shows that government spending is assumed to be the most exogenous as forecast errors in government spending are attributed to its own structural shocks only. The second equation shows that forecast errors in spending affect net taxes in the same quarter. Finally, the third equation shows that forecast errors in spending and taxes, along with structural shocks to GDP affect GDP contemporaneously. Hence the recursive ordering implies that government spending is the most exogenous while the GDP is the most endogenous variable.

3.2.2 5-variable VAR

As discussed in the section 2, Blanchard & Perotti (2002) admit that a 3-variable VAR may suffer from omitted variable bias owing to absence of inflation in the model. As discussed in section 2, literature also shows that exchange rate volatility and accommodation by monetary policy affect the size of fiscal multipliers. Accordingly, inflation, exchange rate and interest rate are the variables which may be included in the VAR model. After inclusion of two

new variables of US dollar based bilateral exchange rate and real interest rate, we have a 5-variable VAR model[7]. for which vector of endogenous variables is given as:

$$y_t = [S_t, T_t, X_t, USD_t, RR_t]' \tag{16}$$

Real interest rate is obtained by subtracting 4-quarters ahead inflation from current level of 6-months T-Bills rate.

The recursive ordering implies that spending is assumed to be the most exogenous variable while real interest rate is assumed to be the most endogenous variable. Considering the fact that exchange rate data are available on monthly frequency and the SBP conducts monetary policy meeting every two months, our assumption that interest rate may respond to shocks to all variables within a quarter is justified. The vector of exogenous variables is same as Equation 9.

3.2.3 Disaggregated 6-variable VAR

With a view to analyze how current expenditures (aka government consumption) and development expenditures (aka government investment) affect macro economy, we estimate a disaggregated VAR with following vector of endogenous variables:

$$y_t = [S_t^c, S_t^{inv}, T_t, X_t, USD_t, RR_t]' \tag{17}$$

where $S_t^c + S_t^{inv} = S_t$ shows distribution of total government spending in government consumption S_t^c and S_t^{inv} government investment.

3.2.4 Calculation of Fiscal Multipliers

We follow Mountford & Uhlig (2009) for calculation of cumulative multipliers from SVAR impulse response functions (IRFs). This approach takes the ratio of present values of IRFs of GDP and fiscal shock and scales up this ratio by dividing it with average share of fiscal component to GDP.

$$\Lambda_k^{PV} = \frac{\Delta y_k}{\Delta G_k} = \frac{\sum_{j=0}^{k} (1+r)^{-j} \hat{y}_j \bar{y}}{\sum_{j=0}^{k} (1+r)^{-j} \hat{g}_j \bar{g}} \tag{18}$$

[7]Initially, we included CPI inflation as endogenous variable but this led to stability issues in the model. Although not as an endogenous variable yet, our model still incorporates inflation in definition of real interest rate.

where Λ_k^{PV} shows present value cumulative multiplier k quarters after introduction of fiscal shock. Average real interest rate is represented by r. Owing to very low level of average real interest rate in Pakistan, Raashid et al. (2020) inform that present value multipliers are almost equal to cumulative multipliers[8]. In cumulative multipliers, we simply take ratio of cumulative IRFs rather than using discounted sum of IRFs. Accordingly, we have used following formula to calculate cumulative multipliers:

$$\Lambda_k^{CUM} = \frac{\Delta y_k}{\Delta G_k} = \frac{\sum_{j=0}^{k} \hat{y}_j \bar{y}}{\sum_{j=0}^{k} \hat{g}_j \bar{g}} \tag{19}$$

Multipliers calculated using this approach provide cumulative change in real per capita GDP owing to one rupee increase in fiscal spending after k quarters.

4 Data and Estimation Results

4.1 Data

Our estimation sample ranges from 2001Q3 - 2024Q4, with 94 quarterly observations. The quarterly data of fiscal indicators[9], CPI, 6-months T-Bill rate, real effective exchange rate and bilateral USD exchange rate have been accessed from Haver Analytics. The net tax series is computed by deducting interest payments and subsidies from total revenues.

For sample period 2015Q3-2024Q4, the data of nominal quarterly GDP has been taken from Pakistan Bureau of Statistics. Official quarterly GDP data is not available prior to this sample. For the sample period 2001Q3-2015Q2, we have taken quarterly GDP data from Tahir et al. (2018). Fortunately, we have a sample period where both official and interpolated quarterly GDP data are available. Availability of both series at a common sample allows comparison to assess accuracy of interpolated data. Figure 10 shows that growth rates of both the series are quite close. This shows that the interpolated data used is a good approximation of actual quarterly GDP data. With the exception of quarterly GDP prior to 2015Q3, all of our quarterly data are actual.

Pakistan's quarterly fiscal data is characterized by strong seasonality and presence of outliers (Figure 11). As demonstrated by Anscombe (1973), OLS estimates are sensitive to

[8] Raashid et al. (2020) report that annual average value of real interest rate over the sample period 2002Q2-2019Q4 is only 0.30 percent.

[9] Consolidated Federal and Provincial fiscal data about expenditures and revenues is released quarterly by Ministry of Finance.

presence of outliers. To deal with outliers related to conspicuous economic event like Covid-19 and economic crises in 2007-08 & 2023, we use dummy variables. On the other hand, to deal with outliers that are generated owing to fiscal accounting issues, we adjust quarterly values in such a way that annual sums on fiscal-year basis remain unchanged. A few outliers found in series of net taxes and government investment have been adjusted in this manner[10].

4.2 Estimation Results

As discussed in section 3, we have used three functional forms namely log transformation, quarter-on-quarter (QoQ) growth rate and year-on-year (YoY) growth rate and, two identification schemes of BP2002 and recursive ordering. Under the recursive ordering, we have estimated aggregate i.e. 3-variable and 5-variable models and, disaggregate 6-variable models[11]. Based on thorough evaluation of IRFs and corresponding estimates of multipliers, we choose 5-variable and 6-variable YoY growth based models of recursive identification as our baseline specification. Log and QoQ transformations suffer from the issues of non-stationarity and seasonality.

YoY growth models have been preferred over log transformation and QoQ growth models for following reasons. First, IRFs and multipliers pertaining to the non-stationary log transformed models, under both recursive and non-recursive orderings, have been reported in Appendix B. Figure 15 shows that the non-stationary models yield overestimated and non-decaying estimates of multipliers. Under the light of modern literature (Batini et al. 2014) and our discussion in section 1 and section 2, this size and persistence of multipliers is not plausible and might be attributable to non-stationarity of data used for estimation of VAR models.

Next, we discuss comparison of multipliers estimated based on YoY versus QoQ transformations. We find the results from YoY models to be more stable and robust. As shown in Figure 11 and Figure 12, fiscal variables and GDP exhibit very high degree of seasonality in levels and QoQ growth rates. Although we applied seasonal adjustment, the estimated IRFs and multipliers were quite volatile in case of QoQ growth models. Multipliers estimated from aggregate and disaggregate QoQ models are reported in Figure 17 and Figure 18, respectively.

Accordingly, we find that in case of Pakistan, YoY specification is preferable over QoQ specification as it effectively overcomes the issue of strong seasonality, as shown in Figure 13.

[10]For net taxes, outliers have been adjusted for fiscal years FY02, FY08, FY23 and FY25. For government investment, outliers have been adjusted for FY03, FY04 and FY05.

[11]BP2002 identification has been used only for log and YoY specifications of 3-variable VAR model. Multipliers based on both the identification strategies turn out to be almost identical (see Figure 15 and)

Further, Batini et al. (2014) inform that usually, the shape of spending multiplier is like inverted U, which attains peak value in second year and vanishes within five years. As we discuss below, multipliers estimated from YoY models possess these properties.

4.2.1 Aggregate Models' IRFs and Multipliers

Total government spending shock Figure 3 presents the cumulative IRFs[12] for spending shock in YoY transformation of 5-variable model. We can see that except for a very small initial surge, which lasts only for two quarters, cumulative response of GDP growth to spending shock is negative.

US dollar-based exchange rate IRF shows that fiscal spending shock leads to depreciation of domestic currency. The spending shock leads to an initial dip in real interest rate which is followed by a rise in the real interest rate. The initial dip in real interest rate might be attributable to the situation wherein rise in inflation outweighs the rise in nominal interest rate. In subsequent quarters, rise in nominal interest rate outweighs the rise in inflation, implying increase in real interest rate, leading to crowding out of private sector credit and investment.

[12]We prefer to present and discuss cumulative IRFs rather than IRFs as the former are more relevant for calculation of multipliers.

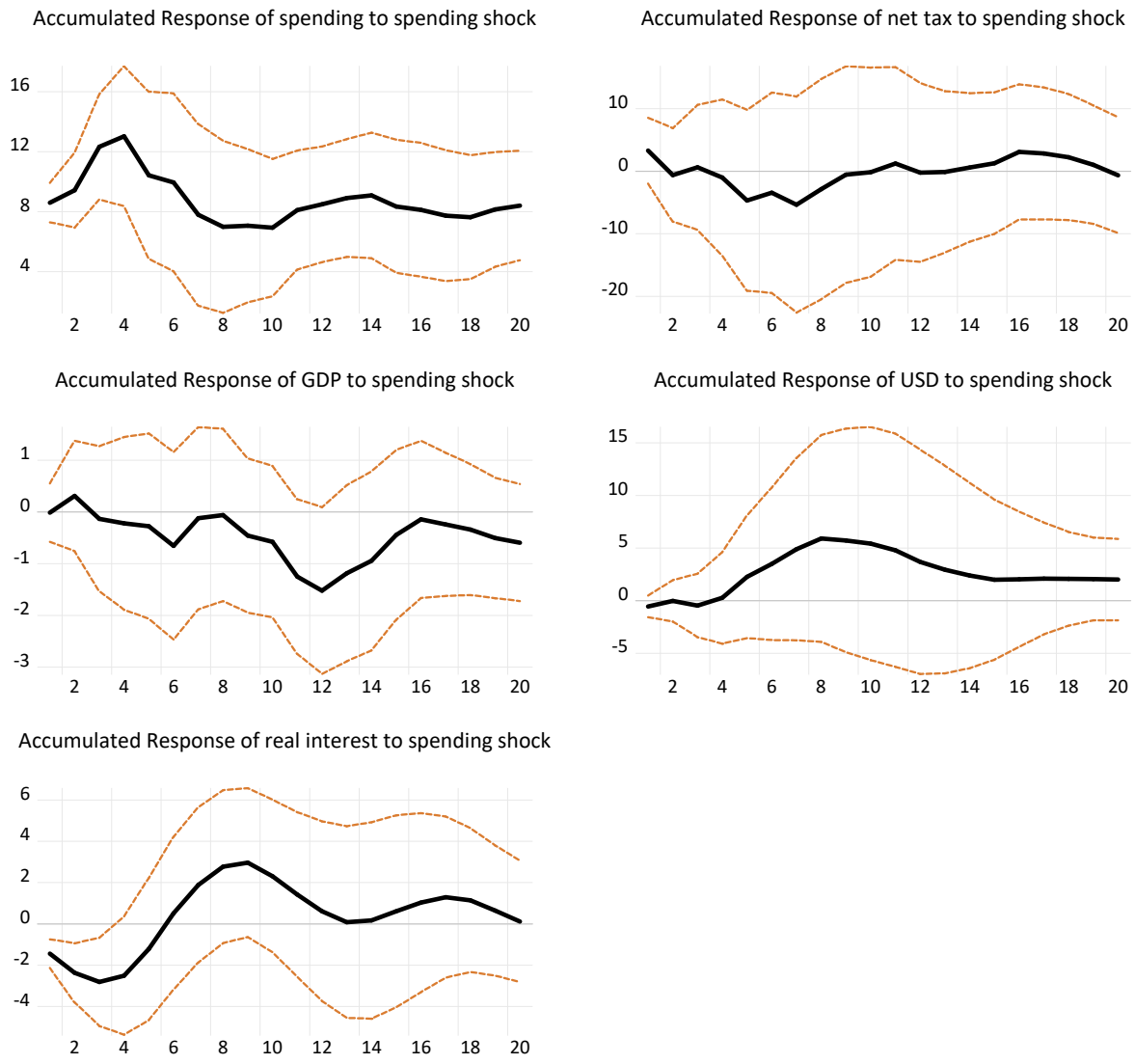

Figure 3: Cumulative IRFs for total spending shock

Net taxes shock Figure 4 shows cumulative IRFs for net taxes shock. We can see that real GDP growth declines initially in response to tax shock. However, the response becomes positive after five quarters and gradually converges to zero in 20^{th} quarter. Other IRFs show that tax shock leads to appreciation of local currency and ease in financial markets which is reflected by decline in real interest rate. Collectively, cumulative IRFs for net tax shock show that in the medium term, positive effects of fiscal consolidation may outweigh its initial negative effects as output growth responds positively when interest rate declines and local currency strengthens.

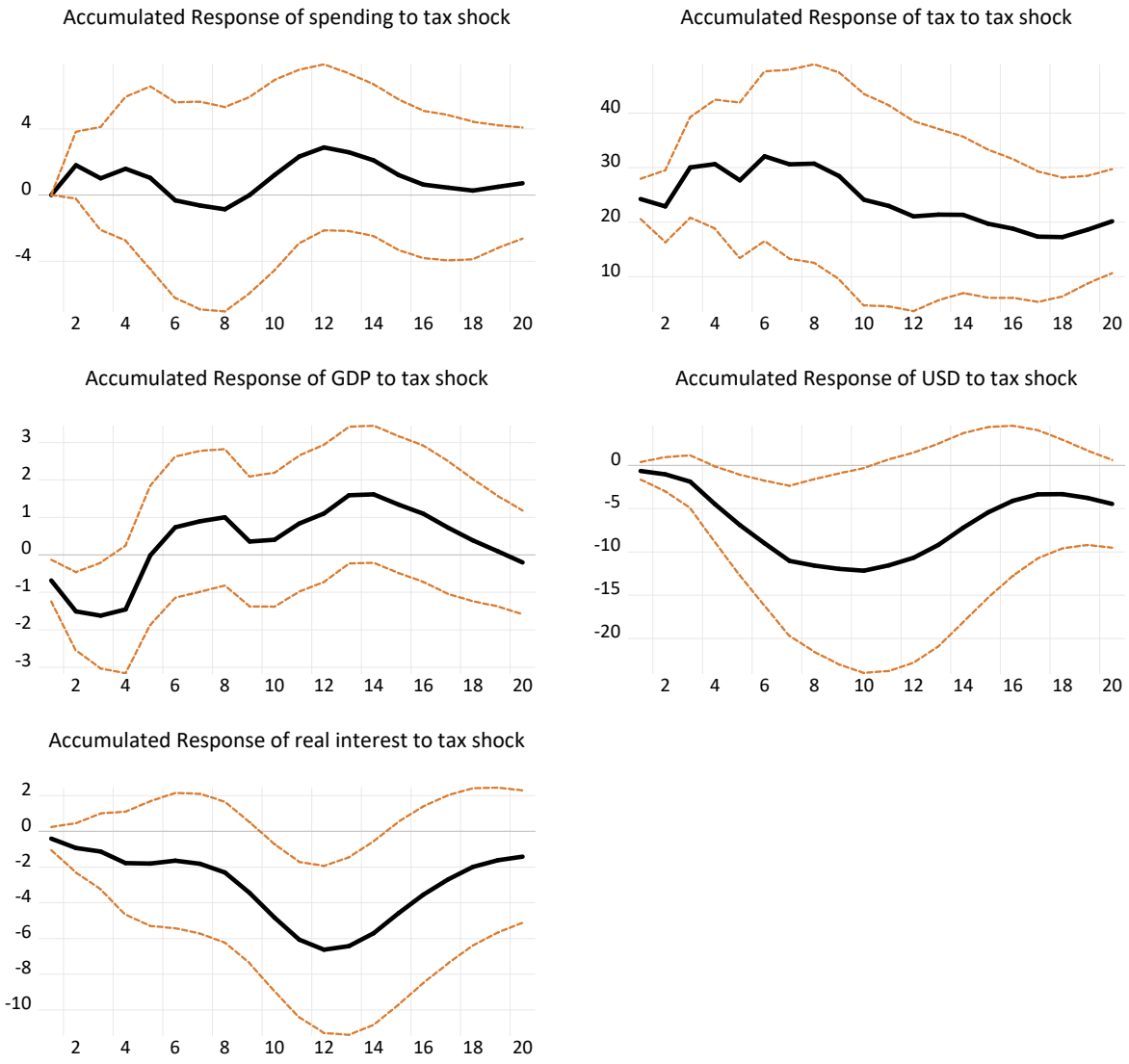

Figure 4: Cumulative IRFs for net tax shock

Aggregate model multipliers Figure 5 shows the multipliers for total spending and taxes over a time horizon of 20-quarters or five years. These multipliers have been computed by applying Equation 19 on cumulative IRFs of GDP and relevant fiscal indicators presented in Figure 3 and Figure 4. Average ratios of total spending to GDP and net taxes to GDP, which have been utilized for calculation of multipliers, are computed to be 19.0% and 7.3%, respectively.

Figure 5 shows that the impact spending multiplier is positive and reaches its peak value of only 0.17 in the second quarter. The spending multiplier quickly becomes negative in the third quarter and remains in the negative territory after that. The lowest value of -0.94 is

realized in 12^{th} quarter after which the multiplier converges towards zero. This shows that positive effects of aggregate fiscal spending shock are negligible and very short lived.

On the other hand, tax multiplier is negative at impact. The trough value of tax multiplier is around -0.91, which is realized in the second quarter. However, the net tax multiplier becomes positive after fifth quarter, attains its peak value of 1.04 in 14^{th} quarter. Subsequent to 14^{th} quarter, the cumulative net tax multiplier remains positive and gradually converges to zero.

As discussed earlier, net taxes represent total revenues minus subsidies and interest payments. The behavior of cumulative net tax multiplier indicates the positive effects of fiscal consolidation in the medium term. However, these positive effects cannot be obtained without short run costs.

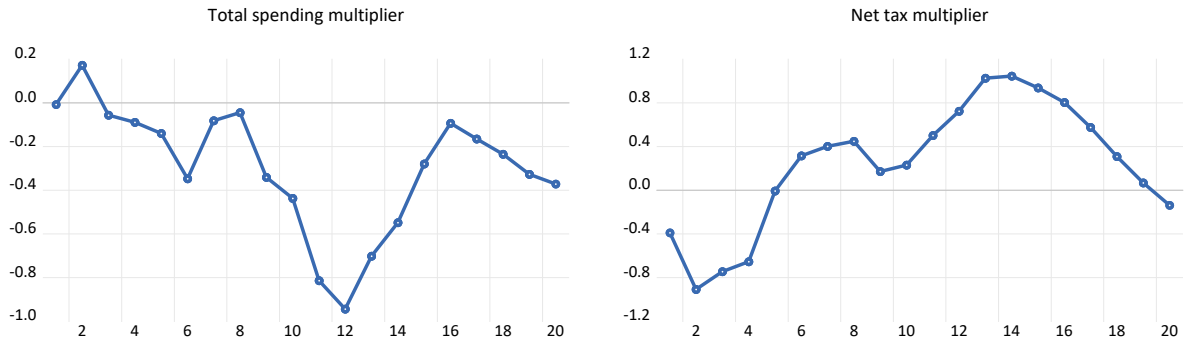

Figure 5: Total spending and net tax multipliers

4.2.2 Disaggregate Model's IRFs and Multipliers

Government consumption shock Accumulated IRFs for government consumption shock are presented in Figure 6. Since average share of government consumption in total government spending is 82%, therefore response of GDP to government consumption shock closely resembles its response to total spending shock shown in **??**. Except for a very small and short lived initial positive response, the IRF remains in the negative territory. Cumulative responses of exchange rate and real interest rate show increasing trend in response to government consumption shock. The IRFs for government investment and net taxes show negative response to government consumption shock.

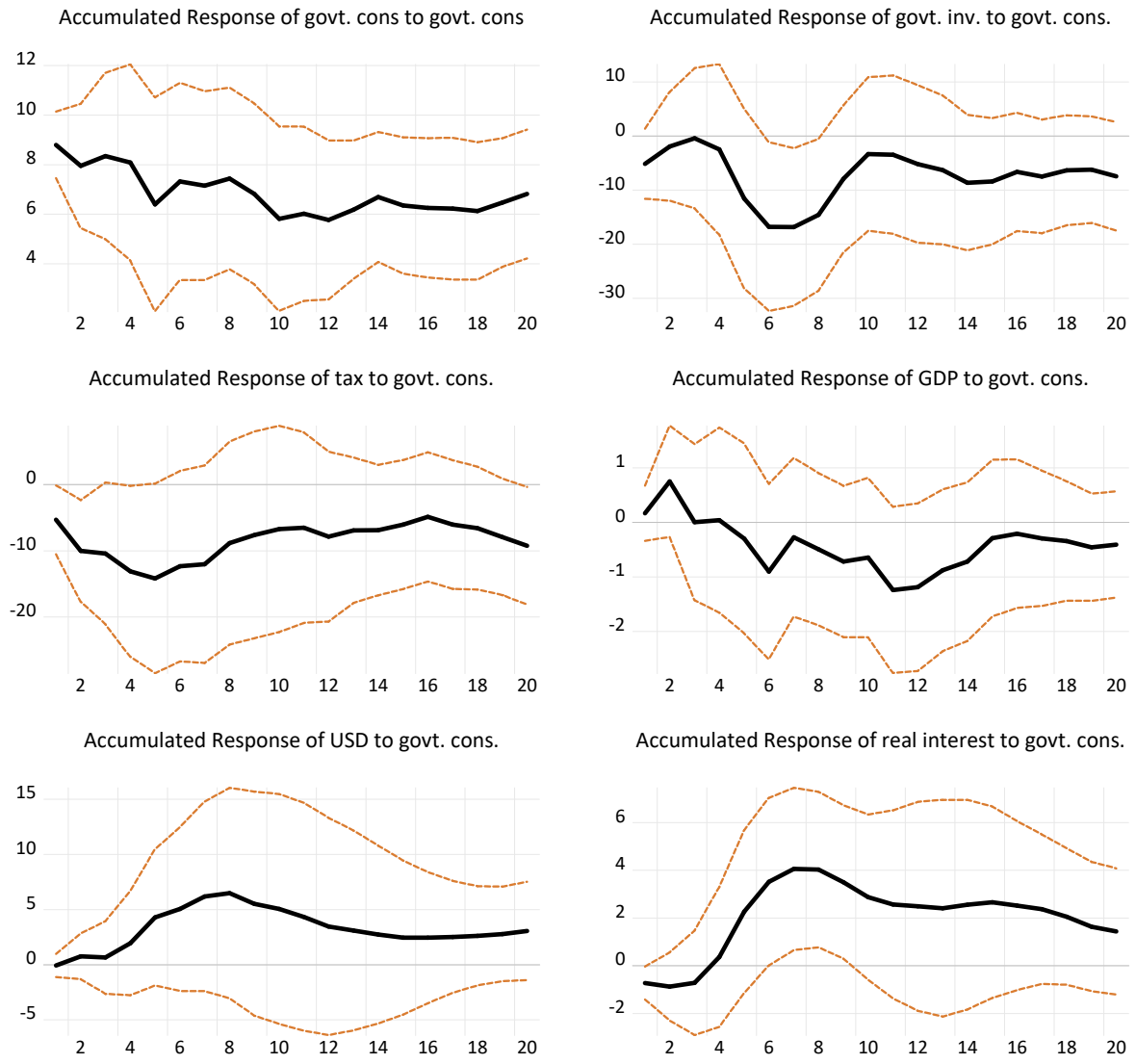

Figure 6: Cumulative IRFs for govt. consumption shock

Government investment shock The response of GDP growth to government investment shock (Figure 7) is markedly different from government consumption shock. The IRF shows positive initial response which lasts for three quarters. The response turns negative in the fourth quarter and becomes positive again after seventh quarter. The response converges to zero in 12^{th} quarter. Exchange rate and interest responses are quite muted when compared against their counterparts to government consumption shock.

Government investment IRFs show that increase in government investment has positive effects on GDP growth in the short run and medium term. However, these positive effects are quite weak and they are accompanied by negative effects on GDP growth.

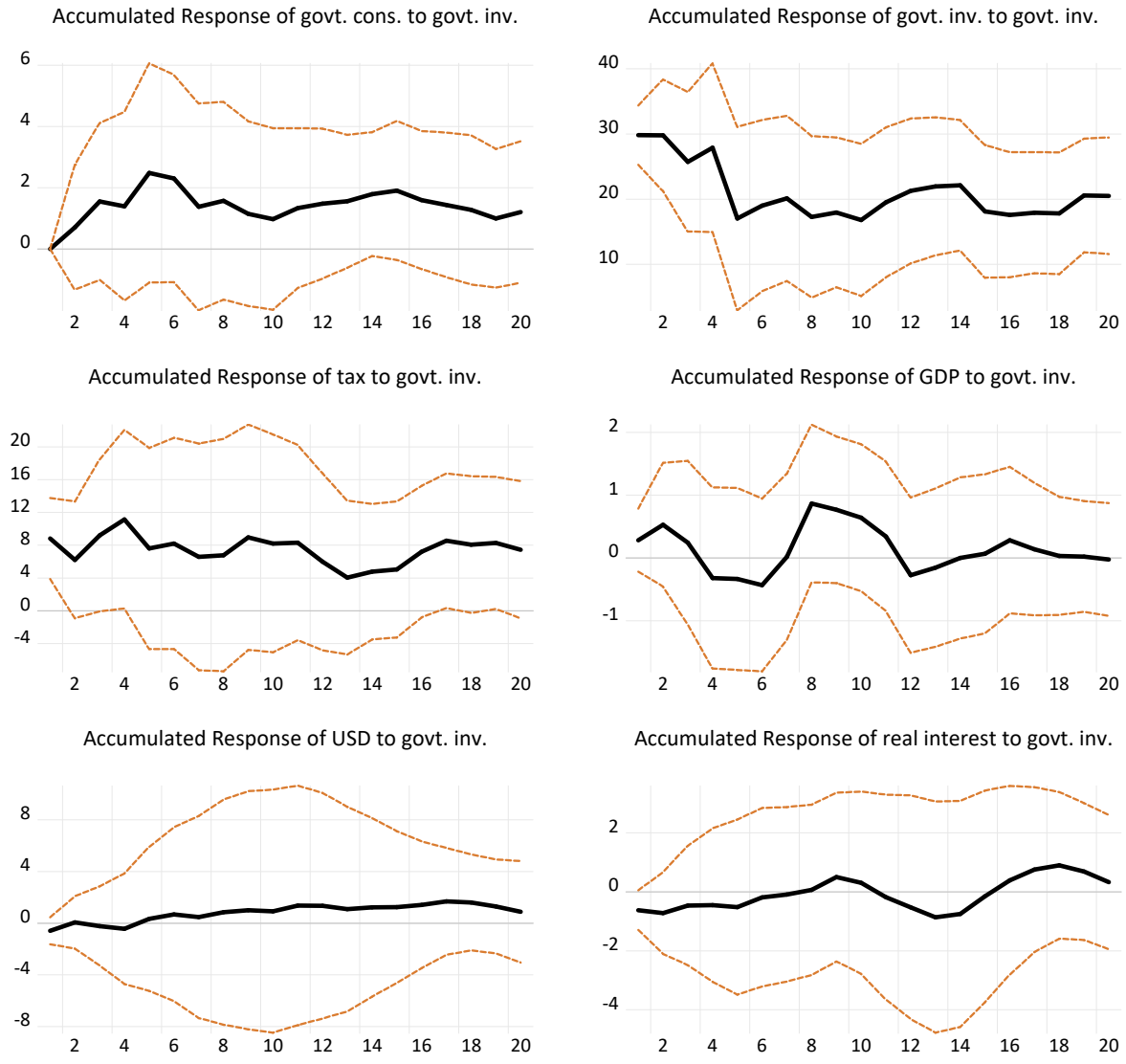

Figure 7: Cumulative IRFs for govt. investment shock

Net taxes shock Figure 8 presents cumulative IRFs for net tax shock in case of disaggregated model. These IRFs are robust with respect to their counterparts for aggregate model, presented in Figure 4.

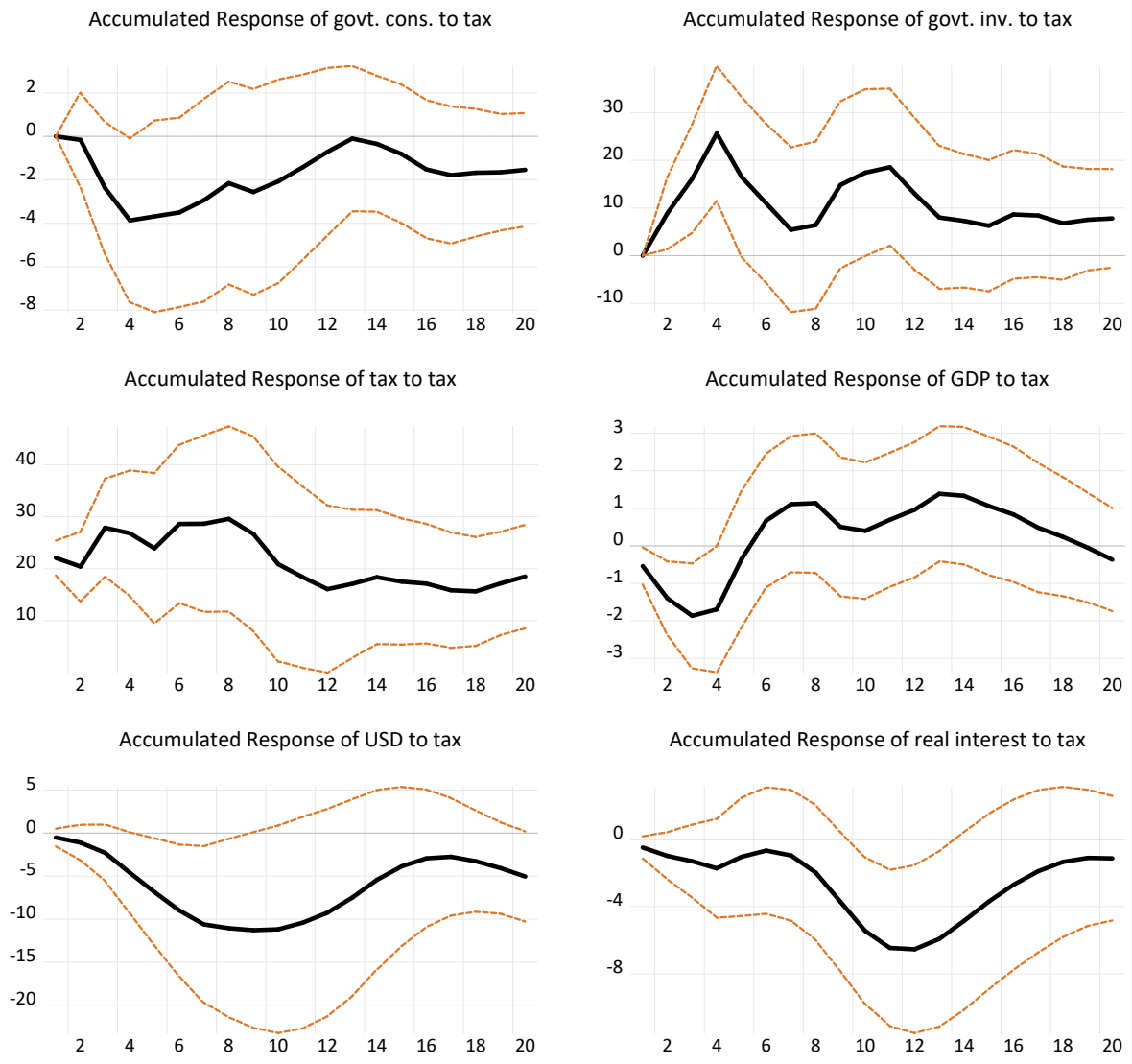

Figure 8: Cumulative IRFs for net tax shock

Disaggregate model multipliers Figure 9 presents government consumption, government investment and net tax multipliers. These multipliers have been calculated by application of formula given in Equation 19 on cumulative IRFs discussed above. Average ratio of government consumption to GDP is 15.6%, government investment to GDP is 3.4% and net taxes to GDP is 7.3%.

Government consumption multiplier is positive at impact and reaches its peak value of 0.60 in the second quarter. Subsequently, the multiplier remains in the negative territory for the entire horizon of 20-quarters and falls to its trough value of -1.32 in 12^{th} quarter. The multiplier converges to zero after 12^{th} quarter.

On the other hand, the initial positive episode of government investment multiplier is followed by a negative phase in which it reaches its trough value of -0.67 in the sixth quarter. The multiplier becomes positive subsequently and reaches its peak value of 1.48 in the eighth quarter. The investment multiplier converges to zero after 12^{th} quarter.

Dynamics and magnitude of investment multipliers suggest that investment based expansionary fiscal policy has some potential to support GDP growth in the medium term. However, these medium term positive effects are realized at the expense of short term volatility in GDP growth, as evidenced by negative values of multipliers in the second year. Leeper et al. (2010) show that implementation delays and distortionary adjustments in deficit financing may lower the size of government investment multipliers. Inefficiencies in government investment projects, coupled with associated fiscal burden, may lead to loss of their effectiveness and adverse consequences for GDP growth.

Tax multiplier from disaggregated model is similar to aggregate model in terms of dynamics yet slightly different in terms of peak value. The peak value of disaggregated model's tax multiplier is 1.12, which is realized in 13^{th} quarter[13].

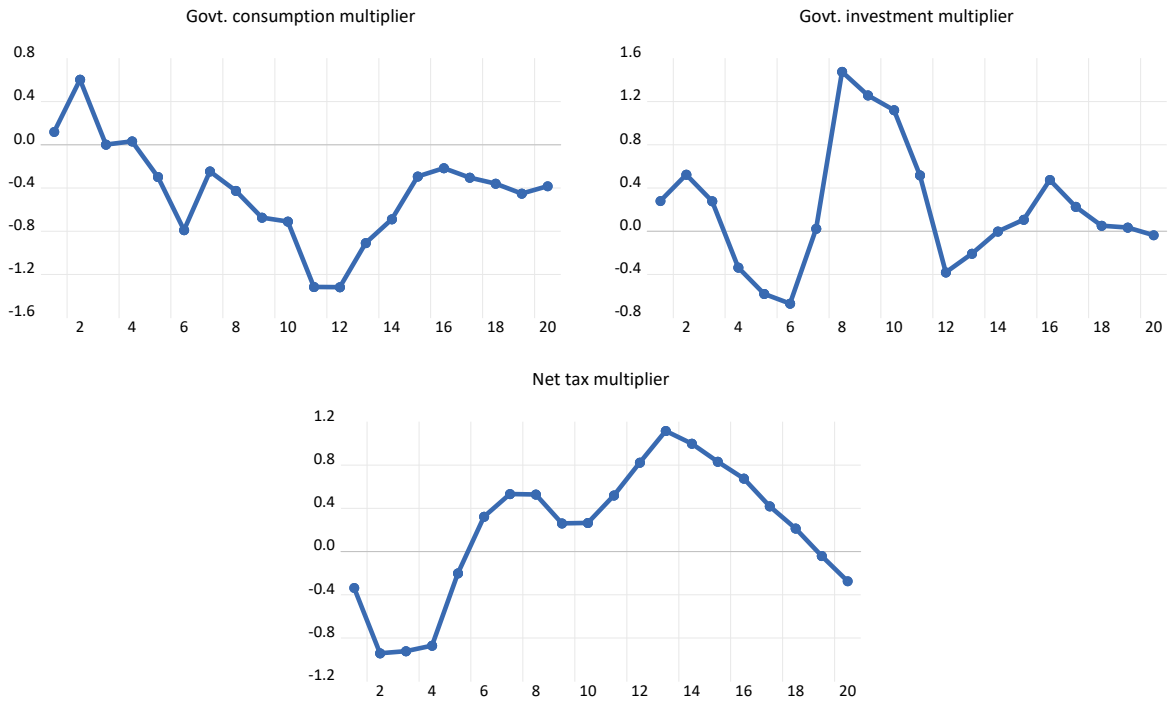

Figure 9: Multipliers from disaggregated model

[13]Peak value of aggregate model's tax multiplier is 1.04, which is realized in 14^{th} quarter.

5 Conclusion

We estimate fiscal multipliers for government spending and net taxes using different variations of structural VAR models. We find that variations in data transformations e.g. stationary versus non-stationary models, may lead to substantial variations in estimated values of multipliers. Similarly, changes in calculation methodology of multipliers have also important implications for their estimated values. The variation in SVAR based fiscal multipliers have been documented in literature. For instance, Čapek & Crespo Cuaresma (2020) show that variations in shock identification strategy, data definitions and data smoothing techniques etc. may lead to substantial variations in estimates of multipliers. Kemp (2020) also shows that magnitude of fiscal multipliers depends upon modeling choice and identification strategy.

To find appropriate empirical estimates of multiplier which are plausible under the light of existing literature and country characteristics, we perform a cross-country comparison and historical analysis of key macro indicators. Cross country comparison shows that Pakistan ranks low in terms of savings rate and trade openness and, high in terms of interest rate, debt-servicing burden, exchange rate volatility and inflation. Ilzetzki et al. (2013) show that all of these factors, except for low trade openness, are correlated with lower or even negative values of spending multipliers. Historical analysis of Pakistan data shows that a persistent rise in fiscal deficit and debt is accompanied by a decline in private sector credit together with decelerating private investments, exhibiting strong symptoms of crowding out effects.

Subsequent to country profiling and review of relevant literature, we estimate SVAR models under multiple specifications and identification strategies. Baseline aggregate model's results show that except for a temporary surge realized in the second quarter after shock, a rise in total spending has negative effects on GDP growth over a 20-quarter horizon. On the other hand, although a rise in net taxes leads to reduction in GDP growth in the first year after the shock yet, the medium term effects of this rise in taxes or reduction in subsidies for GDP growth are positive.

Baseline disaggregate model's results show that government consumption multiplier is positive only for first two quarters and becomes negative after one year. Government investment multiplier initially depicts a volatile pattern but reaches its peak value of around 1.5 at the end of second year. Dynamics of investment multiplier show that a rise in government investment has some potential to boost GDP growth in the medium term; albeit at the cost of short term volatility.

Our results show that consumption based expansionary fiscal policy interventions lead to reduction in GDP growth, depreciation of local currency and tightening of financial market

conditions. Accordingly, our results suggest that the use of consumption based expansionary fiscal policy, with a view to boost real GDP growth, has no empirical support in case of Pakistan. To ensure sustainability of growth, the government should design its fiscal policy in a prudent manner.

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Appendix A Data Issues

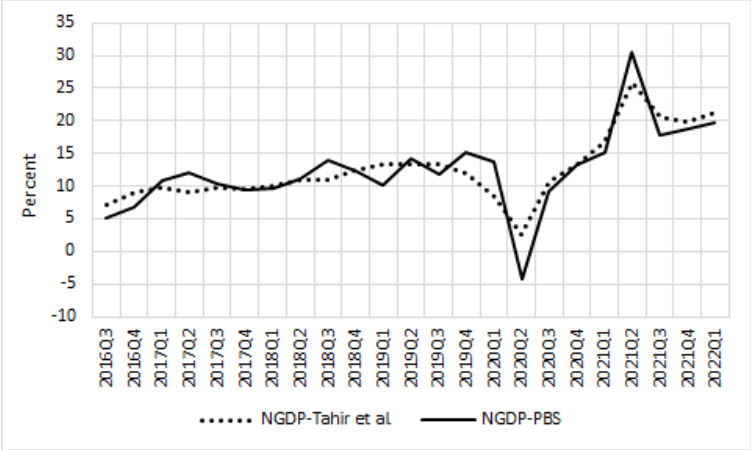

Figure 10: Official versus interpolated quarterly nominal GDP growth rates

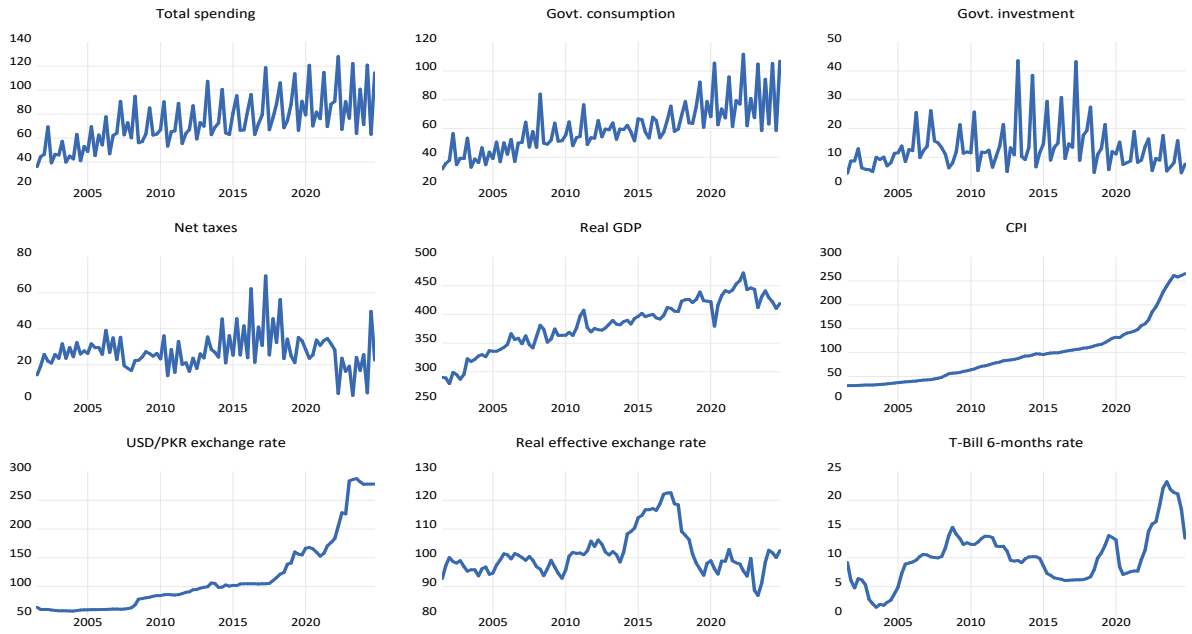

Figure 11: Data in levels form

Spending and taxes data are in billion PKR and in nominal form. Real GDP data is also in billion PKR. In estimations, we have used real data of spending, taxes and GDP.

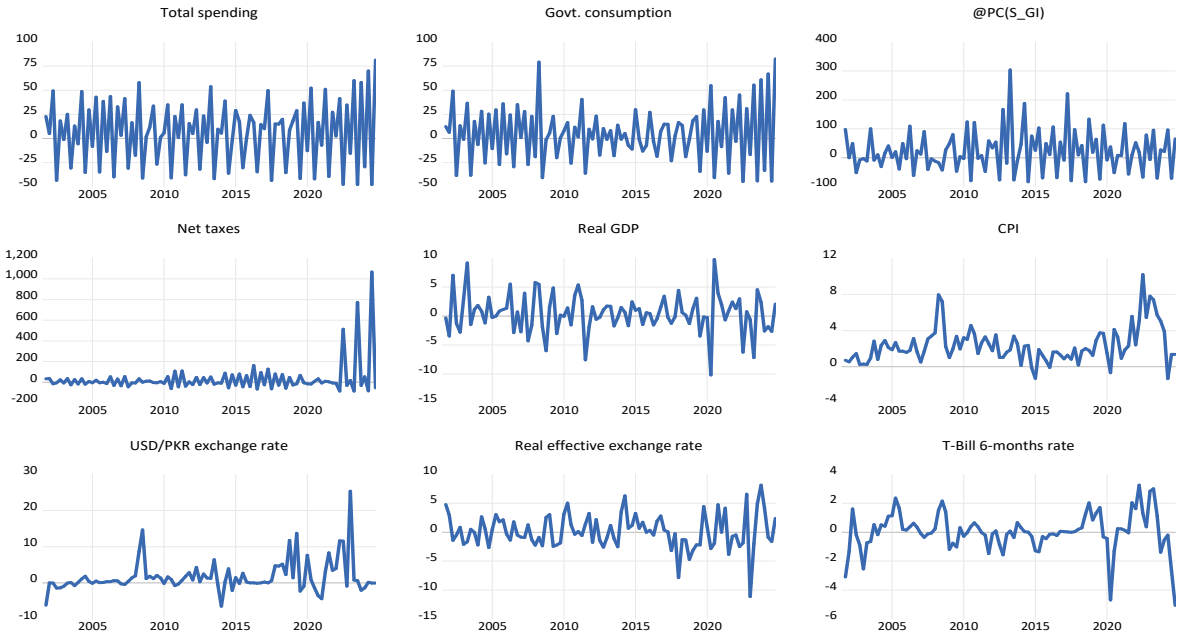

Figure 12: Data in quarter-on-quarter growth transformation

Quarter-on-quarter growth rates have been converted into percent by multiplying with 100 but NOT annualized by multiplying with 4. For interest rate, the chart shows first difference rather than percent change.

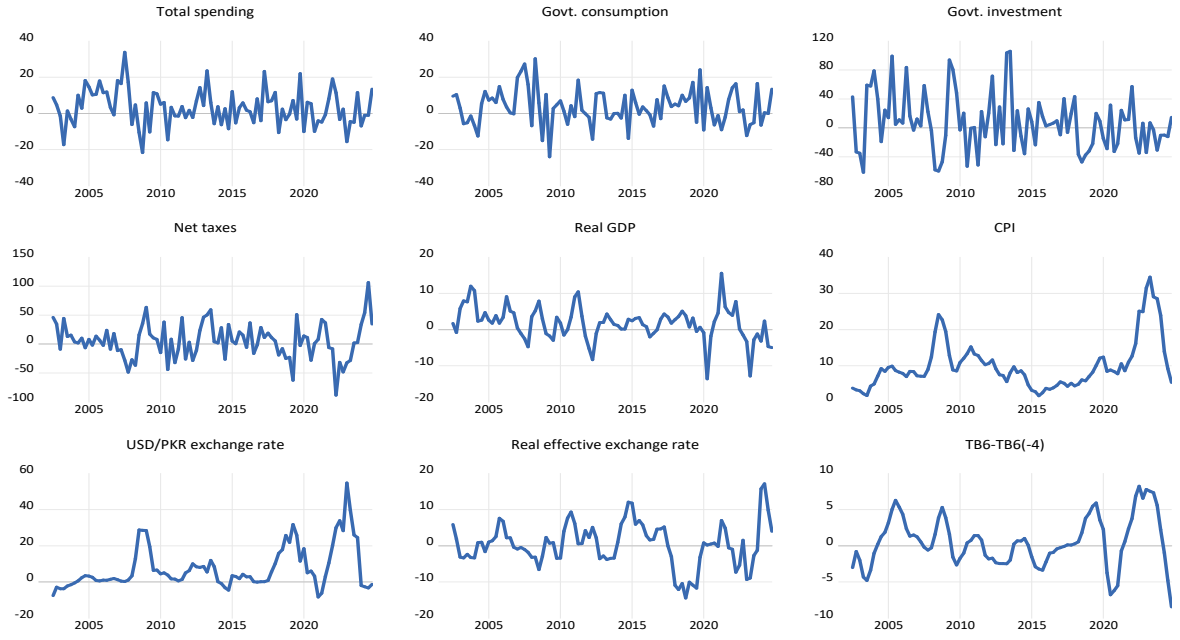

Figure 13: Data in year-on-year growth transformation

Year-on-year growth rates have been converted into percent by multiplying with 100. For interest rate, the chart shows current minus 4^{th} lag.

Appendix B Estimation Results for 3-variable models under recursive and BP2002 identifications

B.1 Non-stationary log transformation models

This appendix presents estimates of cumulative IRFs and multipliers for 3-variable VAR specifications estimated under BP2002 and recursive ordering.

Figure 14 shows that change in identification strategy leads to change in magnitude of IRFs. However, dynamics remain similar under both the identification schemes. Similar results have also been reported by Boiciuc (2015) in case of Romania.

Figure 15 presents the multipliers calculated through application formula given in **??**. The estimated multipliers for both the specifications are almost identical.

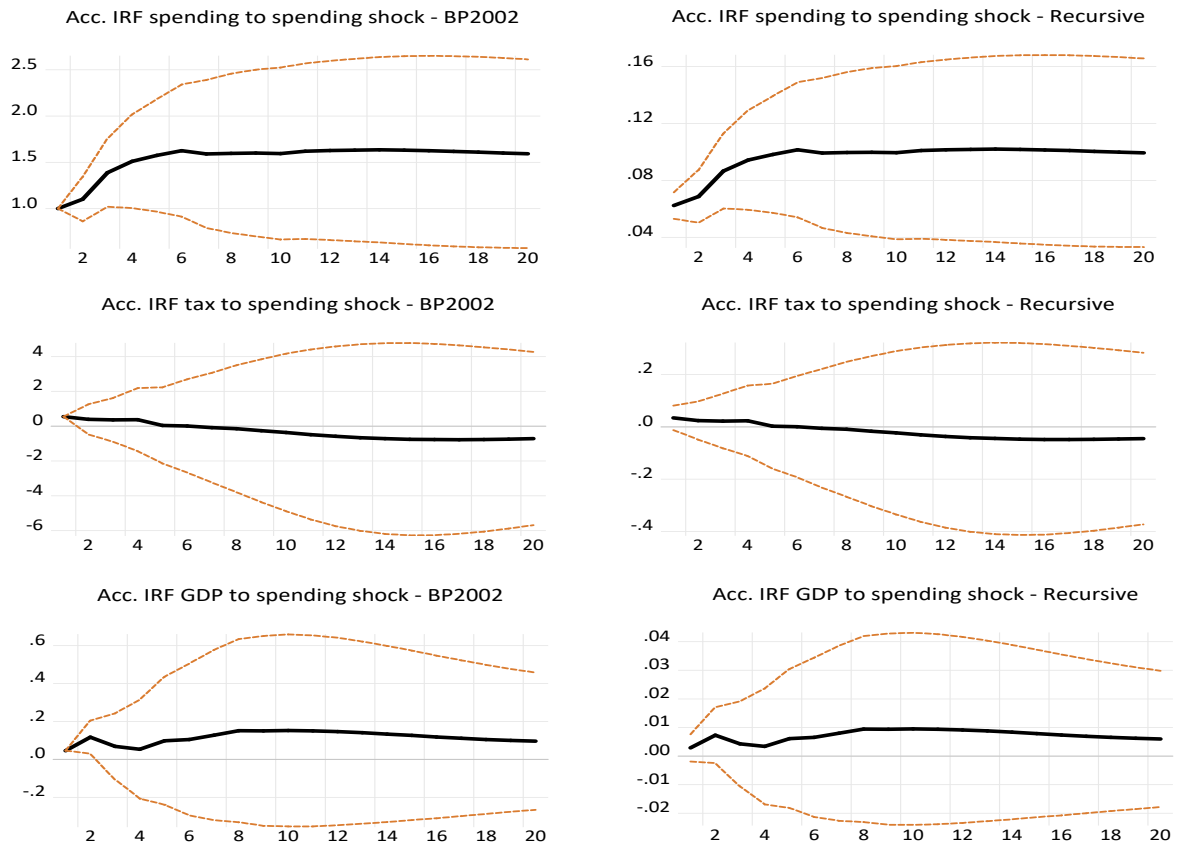

Figure 14: 3-variable SVAR - Cumulative IRFs

First column shows responses of spending, net taxes and real per capita GDP to spending shock under BP2002 identification. Second column shows responses of the same variables to spending shock under recursive ordering identification. Both models are in log specification.

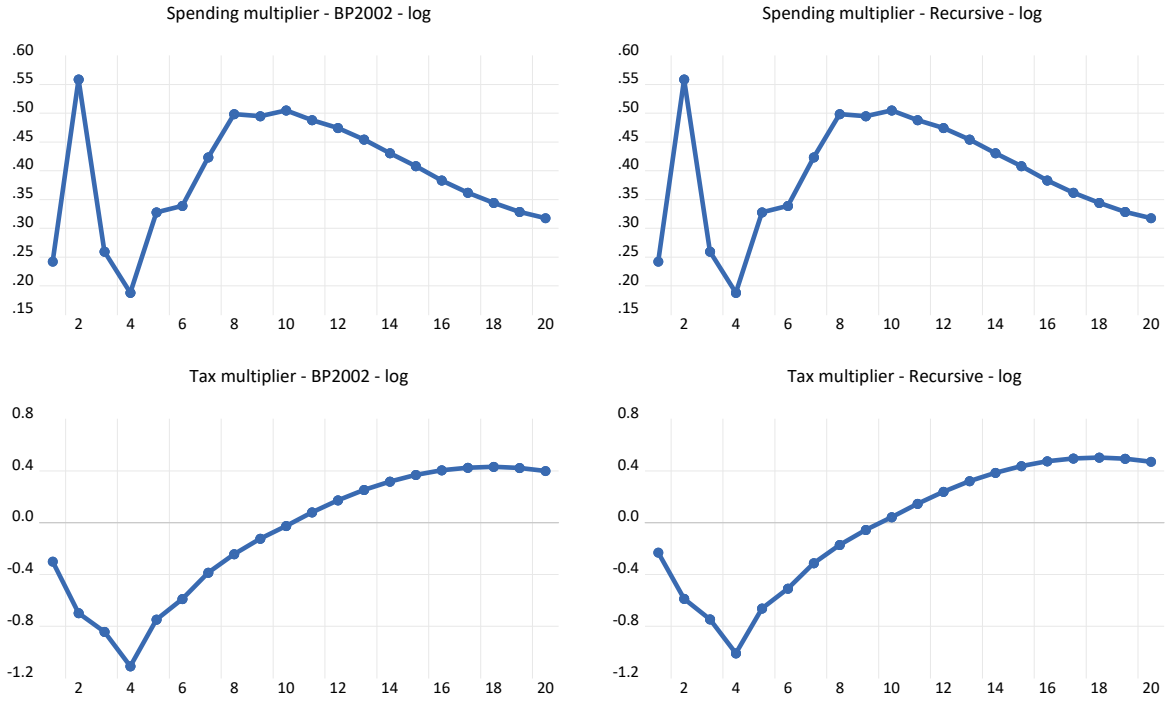

Figure 15: Spending and tax multipliers for 3-variable log specifications

B.2 Stationary YoY growth models under recursive and BP2002 identifications

Figure 16 shows the total spending and tax multipliers for both; BP2002 and recursive (Cholesky) ordering identifications under YoY growth transformation of variables.

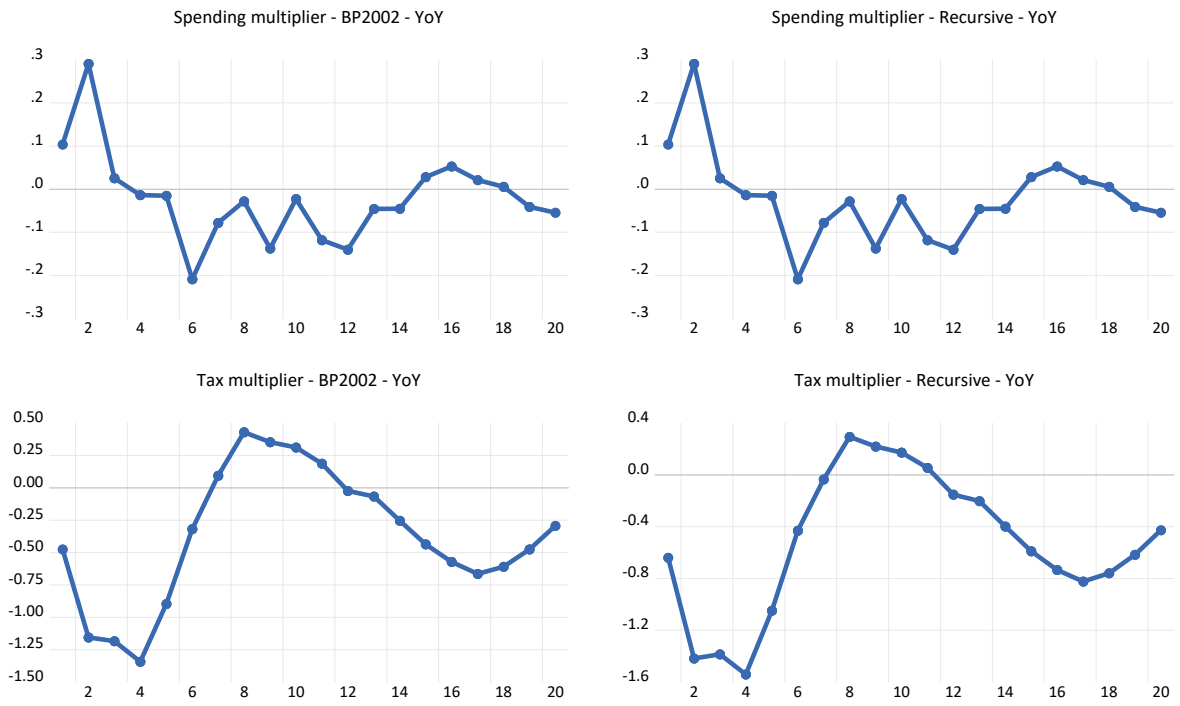

Figure 16: Total Spending and Tax Multipliers under 3-variable YoY Specification

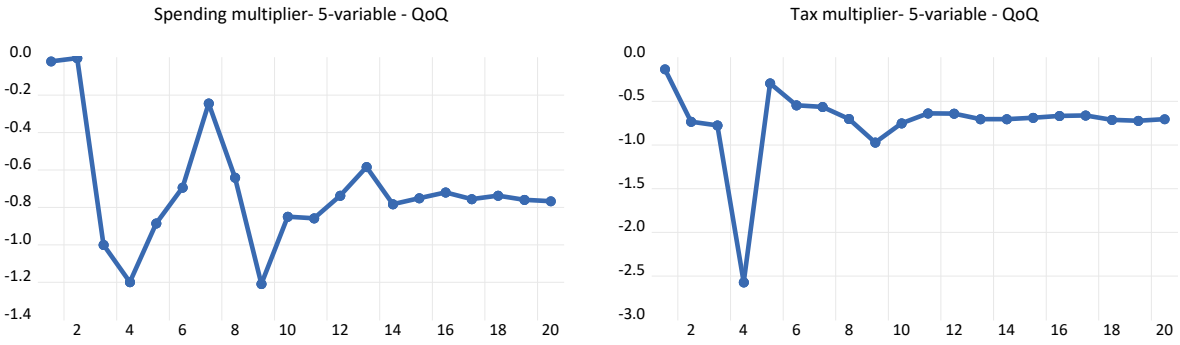

Figure 17: Total Spending and Tax Multipliers under 5-variable QoQ Specification

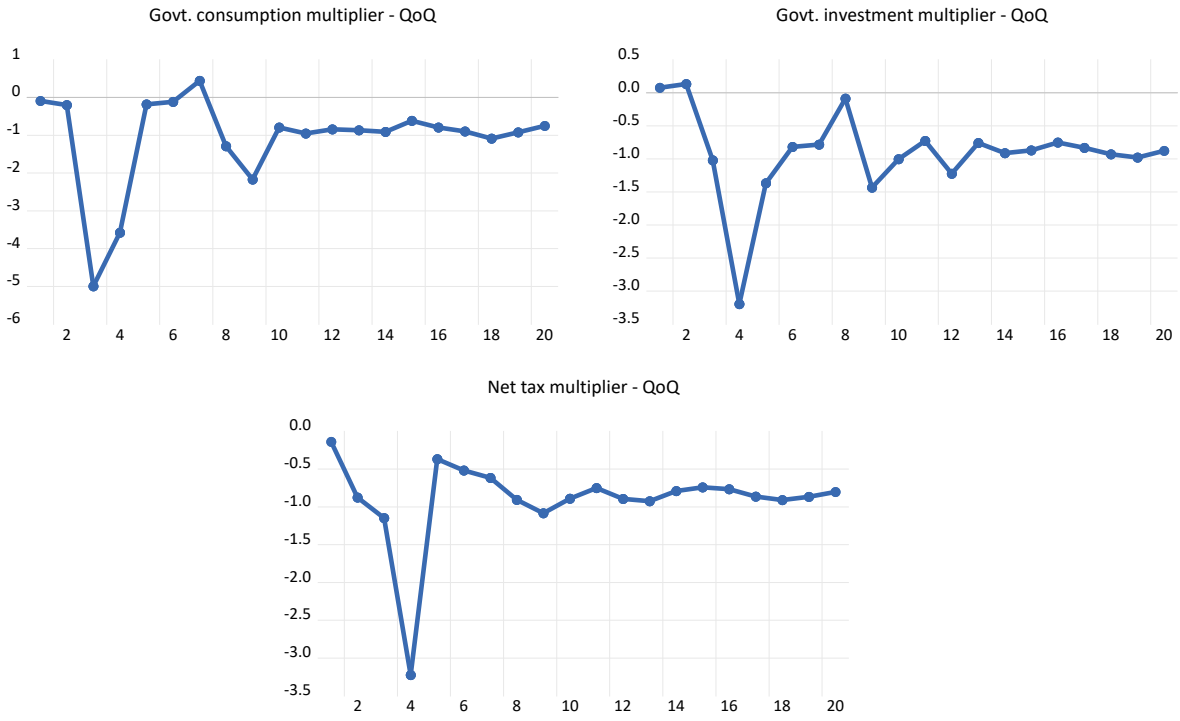

Figure 18: Govt. Consumption, Investment and Tax Multipliers under 6-variable QoQ Specification