

THREE ESSAYS ON FISCAL BEHAVIOR IN PAKISTAN



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Abstract

Pakistan like other developing economies is confronted the issue of fiscal imbalances accompanied by an increasing debt burden that is the root cause of macro-economic instability, which in turn has impeded the medium-to-long term growth prospects. The study attempts to address three significant issues relating to the persistently large fiscal imbalance in Pakistan. First, the rising trend in the interest burden on domestic debt threatens the sustainability of the current macro-economic stance. Second, servicing the country's domestic debt puts large claims on government resources, which reduces the government's capacity to spend on development activities. Thirdly, the government must rely on foreign economic assistance to fulfill its development and non-development spending needs. Pakistan is placed among the family of aid-dependent developing countries and this characteristic of Pakistan's economy makes it a pertinent case for scrutinizing budgetary response to aid. In essay one, the present study looks at the influence of disaggregated aid flows on key fiscal variables in Pakistan using a fiscal response model applied to annual time series data over the period 1972 to 2016. Along with investigating how does the project aid and program aid influence the fiscal aspect of the government and study also investigates the magnitude of fungibility in foreign aid for Pakistan. We have disaggregated government expenditures into three categories i.e., current expenditure, development expenditure, and socio-economic expenditures. The study has decomposed foreign aid into project aid and program aid. The study has used tax revenue to measure the revenue side. For empirical analysis, the study has used the 3SLS estimation technique. The findings of the study paint quite a dismal picture prevailing in the country. Program aid and Project aid are largely earmarked for non-development public spending respectively this shows that project aid and program aid both are fungible in the case of Pakistan although extent of fungibility is high for program aid as compared to project aid. Results further reveal that the inflow of foreign economic assistance in the form of project aid and program aid tends to displace tax revenue in the country which is a grave adverse fiscal consequence of aid for the country. In essay two the study conducts analysis for exploring the effects of fiscal policy shocks in the presence of institutional quality on some important macroeconomic variables at the national level and output at the provincial level. To this end, initially, impulse functions are used to examine the response of macroeconomic variables to a fiscal policy shock. Then, a variance decomposition analysis is applied to regulate the contribution of fiscal policy variables in the forecasted errors of all variables at the national and provincial levels. The result shows that fiscal policy shocks have

limited stabilization effects on the economy because government-spending shock is transmitting inflationary pressure in the economy. At national and provincial levels, we find that the improvement in institutions increases the efficiency of fiscal policy. The institutions being the central element of fiscal policy effectiveness, to attain stabilization of economy, institutional quality needs to be strengthened. In most cases at national and provincial levels, government expenditure has a significant positive effect on output level but this influence is not as robust as anticipated theoretically. Consequently, there is a need to direct the available public expenditures for making an investment under development projects instead of consuming for current expenditures. Results further reveal that government expenditures and government revenues both are causing each other but government expenditures impact is dominant, suggesting that the government can control the fiscal deficit by managing its expenditures. Hence, the government should follow the expenditure regulated fiscal policy. In essay three, the study also examines the influence of fiscal decentralization and institutional quality on government size of Pakistan. The study has used three measures of fiscal decentralization, tax revenue decentralization, revenue decentralization based on federal transfers to provinces, and expenditure decentralization. The study uses the generalized method of moment (GMM) method to investigate this link between fiscal decentralization and government size. The result shows that tax revenue decentralization decreases government size, however, expenditure decentralization increases the government size in Pakistan. However, the relative size of government reduces the presence of good quality institutions.

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List of Abbreviations and Acronyms

ADB	Asian Development Bank
AIC	Akaike Information Criteria
ADF	Augmented Dickey-Fuller
ARDL	Autoregressive Distributive Lag
BD	Budget Deficit
BOP	Balance of Payment
CPI	Consumer Price Index
ED	Expenditure decentralization
EIB	European Investment Bank
FATA	Federally Administered Tribal Areas
FD	Fiscal Decentralization
FIML	Full Information Maximum Likelihood
FRD	Federal Transfers to Provinces
FY	Fiscal Year
GDP	Gross Domestic Product
GDS	Crude Oil and Surcharge on Natural Gas
GGDPPC	Per Capita Growth Rate of GDP
GMM	Generalized Method of Moments
IBRD	International Bank of Reconstruction and Development
IDA	International Development Association
ICRG	International Country Risk Guide
IDB	Islamic Development Bank
IFAD	International Fund for Agriculture Development
IMF	International Monetary Fund
IFC	International Finance Corporation
IQ	Institution Quality

IV	Instrumental Variable
IVLS	Instrumental Variable Least Squares
KPK	Khyber Pakhtun Khuwah
LGDPCC	Per Capita GDP
LIML	Limited Information Maximum Likelihood
NFC	National Finance Commission
OLS	Ordinary Least Squares
OPEC	Organization of Petroleum Exporting Countries
PCA	Principal Component Analysis
PD	Population density
PRS	Political Risk Services
RP	Relative Price
SVAR	Structural Vector Auto-regressive
TO	Trade Openness
TRD	Tax Revenue or own-source revenue decentralization
U.A.E	United Arab Emirates
US	United States
USSR	United Soviet Socialist Republics
VAR	Vector Auto Regression
WAPDA	Water and Power Development Authority
2SLS	Two Stages Least Squares
3SLS	Three Stages Least Squares

Chapter 1

INTRODUCTION

In Pakistan, as in many other developing countries, fiscal imbalances and resulting debt burden have been the basic cause of macro-economic instability, which in turn has impeded the medium-to-long term growth prospects. Slippages on both the expenditure and revenue sides of the federal budgets have contributed to mounting the fiscal imbalances. Pakistan's tax structure has hurt from numerous weaknesses that include a narrow and punctured base, over-reliance on import-related taxes, multiplicity of taxes, and weak tax administration. The combined effects of these weaknesses through low tax elasticity and buoyancy are caused by a low tax/GDP ratio. On the government spending side, the structure of existing expenditure has become more flexible and dynamic. Large resources are preempted by the spending of crucial and mandatory appeals such as debt servicing and national security. A major share of the current expenditure of the federal government is devoted to debt servicing and national security defense expenditures, leaving little room for economizing expenditures.

Due to the relative upward inflexibility of revenues and relative upward inflexibility of expenditures, the overall fiscal deficit tends to increase. Persistently large fiscal imbalances raise three main concerns. First, the rising trend in the interest burden on domestic debt threatens the sustainability of the current macro-economic stance. Second, servicing the country's domestic debt puts large claims on government resources, which reduces the government's capacity to spend on development activities. Thirdly, the government must rely on foreign economic assistance to fulfill its development and non-development spending needs. Furthermore, it also creates a need for higher taxation that

damages efficiency. No doubt, foreign economic assistance has done an imperative job in initiating and accelerating the speed of economic development by supplementing domestic resources but it affects the fiscal behavior of developing countries like Pakistan. In keeping view, the general financial health of Pakistan economy this study has chosen three fiscal issues of Pakistan economy. The first essay discusses the issue of the effect of foreign economic support on the fiscal behavior of Pakistan's economy, the second essay discusses the issue of fiscal policy shocks and institutional quality impact on macro-economy of Pakistan at national and provincial level and the last essay discusses the effect of fiscal decentralization and institutional quality on the relative size of government.

In the first essay, we are analyzing the "Fiscal Response of Foreign Economic Assistance in Pakistan". Foreign economic assistance has been a vital wellspring of development financing for the capital deficit underdeveloped economies since the conclusion of World War II. Both the United States (US) and United Soviet Socialist Republics (USSR), keeping in mind the end goal to keep up their political dominion, offered enormous monetary and technical aid to various poor nations. However, the extent to which foreign aid programs have promoted economic development in these countries, at best remains controversial as reflected in the vast body of economic literature. One significant factor hindering the full impact of foreign economic assistance in developing economies is the phenomenon of fungibility of aid flows, which is also recognized by the donors and supporters of foreign aid. In the face of serious domestic resource constraints, these countries tend to shift the flow of foreign aid from productive to non-productive uses. This phenomenon has serious consequences in the face of a sudden stoppage of foreign aid. Hence, it raises the query as to how will an aid recipient government prioritizes the allocation of resources between different spending heads.

Since independence in 1947, Pakistan has been one of the poor countries of the world. The country has been trusting of foreign aid to supplement its domestic resources, needed for economic growth and development. Due to the increasing foreign debt burden, unnecessarily tough conditionalities attached to aid flows, especially with US aid, Pakistan's economic assistance history does not portray a pleasant picture. This inauspicious reality has motivated a hot debate concerning the repercussions of foreign aid for the macroeconomic performance of the country. It is an undeniable fact that aid flows to Pakistan have remained quite significant during the last seven decades, but the growth experience of the country is not somewhat remarkable which provokes the issue of aid effectiveness in Pakistan. Understanding the fiscal reaction to aid is a pre-requisite to identifying the broader effects of aid on the economy. Unfortunately, in the case of Pakistan, the aid-growth literature fails to recognize the fact that aid is given mainly to the administration, and hence any effect of aid on macroeconomic performance of the economy will be mediated by the government fiscal behavior.

This analysis of the fiscal behavior of foreign aid is preferred because it is the current issue of the Pakistan economy. The significance of the present study is apparent from its distinctive nature vis-a-vis existing studies related to fiscal response and aid association in the case of Pakistan as briefly discussed in the subsequent section on literature review. This study will provide useful guidelines and policy implications to the policy-making authorities and the donors at the same time. Along with investigating the magnitude of fungibility in foreign aid for Pakistan, the study also investigates how does the project aid and program aid influence the fiscal aspect of the government. We have disaggregated government expenditures into three categories i.e., current expenditure, development expenditure, and socio-economic expenditures. The study has decomposed foreign aid into program aid and project aid. The study has used tax revenue to measure the revenue side. For empirical

analysis, the study has used 3SLS estimation technique. The study has chosen this technique because there is an issue of Heteroskedasticity and simultaneity bias/endogeneity in all models and this technique is capable of capturing these issues simultaneously. In order to test Heteroskedasticity the study has used Park test, Harvey test and Breusch-Pagan-Godfrey test and for endogeneity, testing Durbin Wu-Hausman test is used. The results of these tests confirm the existence of Heteroskedasticity and endogeneity in models. The results of 3SLS indicate that variables on public spending under current and socio economic expenditure and public investment under development expenditures head are significantly and positively related to project aid and program aid. Results further reveal that major portions of both types of foreign aid flow to fulfill the budgetary needs of public spending under current and socio-economic expenditures heads. This shows that program aid and project aid are fungible in Pakistan although level of fungibility is high for program aid as compared to project aid. Results further reveal that the inflow of foreign economic assistance in form of project aid and program aid results in reducing tax revenues, which confirms that foreign economic assistance plays the role of tax restricting agents in Pakistan.

In second essay, we are analyzing the “Fiscal Policy Shocks, Institution and Macro-Economy of Pakistan”. Fiscal policy plays a dynamic role in resource distribution to each sector, accelerating sustainable economic growth, and maintaining macro-economic stability. Like many other developing countries, fiscal policy in Pakistan is one of the major tools in the hand of policymakers to propagate and stabilize demand side of the economy but the question arises about how fiscal policy influences the economic activities. In this essay, we try to investigate what happened to macro-economy of Pakistan when a sudden shock occurs in government expenditures and government revenues. Moreover, how the quality of institutions plays role in determining the influence of fiscal policy shocks on macroeconomic indicators of Pakistan. We are further investigating what happened to the provincial output

level when any sudden shock occurs in provincial-level government expenditures and revenues. We have tested four objectives in this study. In objective one, the study tries to examine the effects of the fiscal policy shocks on macroeconomy of Pakistan at national level as the significance stems from the fact that revenue and expenditure shocks contribute significantly to bringing variation in key macroeconomic variables at the national level. In objective two, the study makes an effort to examine the effect of fiscal policy shocks on macroeconomic variables of Pakistan in the presence of institutions, which is a novel contribution in the literature of fiscal policy shocks, and macroeconomy of Pakistan. Third objective is to scrutinize the effect of fiscal policy shocks on output level at provincial level because fiscal policy shocks favorably affect output level in four provinces of Pakistan. In the last objective, the study is determining the impact of fiscal policy on output level in the presence of institutions at provincial level. For empirical tasks, we have developed a SVAR model based on four variables i.e., government revenue, government expenditure, output, and price level. For provincial-level analysis SVAR model is developed separately for each province based on three variables i.e., provincial government expenditure, provincial government revenue and provincial level GDP. Before estimating SVAR, an Augmented Dickey Fuller unit root test employed and outcomes show that all the indicators are non-stationary at $I(0)$ and they become stationary at their $I(1)$. For lag length selection, the present study has employed the AIC, which is one of the most widely used measures of lag length selection. Based on AIC lag selection criterion, the lag length is selected at 1 for Sindh and 2 for National level, Punjab, KPK and Balochistan. Few additional diagnostic tests are executed to confirm the stability of models these include; Autocorrelation LM Test, Normality test and White Heteroskedasticity tests. After these preliminary analyses, it is confirmed that all the models are stable over lag length and time. National level results show that fiscal policy shocks have limited stabilization effects on the economy. Government

spending shocks need to be financed imposing serious strains on economic performance as an increase in public spending results in increasing inflationary pressure. However, at the provincial level, the main results of this exercise can be summarized individually for each province. At the provincial level, the price level is omitted from the system because it is determined at the national level (provinces cannot print money and their fiscal behavior should not affect inflation). In the case of Punjab, the result shows, fiscal policy works effectively in the presence of stable institutions and expansionary fiscal policy role is more dominant on output level as compare to revenue shock in the province. Meanwhile spending shock and revenue shock both are positively affecting each other. In case of Sindh, both kinds of fiscal policies work effectively in the presence of stable institutions and spending shock and revenue shock both are positively affecting each other. In KPK, both types of fiscal policies work effectively in the presence of stable institutions and spending shock and revenue shock both are positively affecting each other for two periods. Lastly, in case of Balochistan the effect of fiscal policy is quite negligible and the reason behind this small impact is probably because provincial Government spending and Revenues are low in this poor province.

In essay three, we are investigating the problem of “Fiscal Decentralization, Institutional Quality and Government Size in Pakistan”. For the last few decades, it has been realized that decentralized governments are more accountable and their performance is more welfare enhancing. Decentralization of powers most commonly refers to fiscal decentralization that is the transfer of fiscal controls to sub-national governments. Under fiscal decentralization, central governments perform their stabilization and redistributions functions more efficiently and allocative efficiency is improved when subnational governments are allowed to generate their own resources to collect taxes and govern their own expenditures. Brennan and Buchanan (1980) exploring the idea of the Leviathan

hypothesis, who discusses the relationship between fiscal decentralization and government size. The mainframe of the hypothesis is that “total government intrusion into the economy should be smaller, *ceteris paribus*, the greater the extent to which taxes and expenditures are decentralized”. Later on, many researchers investigate this relationship by using different proxies for government size and fiscal decentralization for different samples. This essay is the first study, of which we are aware, examining the impacts of fiscal decentralization on government size in the case of Pakistan. To measure fiscal decentralization three proxies have been used these are expenditure decentralization, decentralization based on federal transfers to provinces and decentralization based on provincial own-source revenue or tax revenue decentralization. For the empirical task, GMM technique has been used along with a set of six control variables. These variables are per capita GDP, Relative price, trade openness, growth rate of GDP, budget deficit and population density. The results show the positive link between expenditure decentralization and government size, while negative impact of revenue decentralization on government size.

The rest of the study is structured as follows: in chapter two fiscal response of foreign aid with reference to Pakistan is discussed, chapter three follows the discussion on fiscal policy shocks, institutions and macroeconomy of Pakistan and chapter four carries a detail discussion on the issue of fiscal decentralization, institutional quality and government size in case of Pakistan. In the end, a consolidated conclusion of the complete dissertation and implications are discussed in chapter five.

Chapter 2

Essay 1: FISCAL RESPONSE OF FOREIGN AID IN AN AID-RECIPIENT ECONOMY: AN EMPIRICAL ASSESSMENT FOR PAKISTAN

2.1 Introduction

There are numerous lofty expectations regarding the role and influence of development aid in the initial days of its provision. For many developing countries, aid is thought to be an essential supplement to domestic resources. Without it, many argue, these countries could not produce at adequately rapid, eventually self-sustaining, rates essential to transforming their economies from an initial to the final stage. Of course, there were many initial opposite views, who noted that aid as a mode of keeping poor economies poor and dependent upon their much richer, western counterparts. To determine the foreign economic assistance impact on the economies of the recipient countries, earlier research adopted two distinct approaches. One of these attempts to develop an association either between foreign economic assistance and economic growth or between foreign economic assistance and savings directly. The other is the fiscal response approach that establishes a relationship between aid and budgetary indicators of recipient countries. A fundamental flaw in the aid-growth theoretical and empirical literature is that it ignores a basic reality that donors to the public sector of recipients chiefly earmark aid. This fault will surely be serious if aid effects robustly public sector fiscal outcomes and if they, in turn, affect broader social and economic outcomes. As at the first stage foreign aid goes to the central treasury, therefore, it is logical to expect its significant influence on fiscal actions of aid recipient governments. There is, in short, a rational case for placing that the effect of aid on macroeconomic indicators including

economic growth will be enabled by the beneficiary government's use of it (McGillivray, 2009). Our focus is on the second approach in this respect, Heller (1975) first time examines the fiscal response of foreign aid. In view of Heller, the decision makers in the less developed countries maximize their utility function containing public policy aims focus on financing constraints. Heller's (1975) work led to the development of vast literature on the subject of fiscal response to aid, particularly in developing countries. For last few decades, many researchers try to explore it for different countries (see, for instance, Khan & Hoshino, 1992; McGillivray & Ahmed, 1999; Swaroop, Jha, & Rajkumar, 2000; Mavrotas, 2002, 2005; Gupta, Clements, Pivovarsky, & Tiongson, 2003; McGillivray & Ouattara, 2003; Mavrotas & Ouattara, 2003; Ouattara, 2006a, 2006b; Feeny, 2007; Erden & Guven, 2009; McGillivray, 2000, 2009; Feeny & McGillivray, 2010; Bakhtiari, Izadkhasti, & Tayebi, 2013; Dayanath & Ichihashi, 2013; Bwire, Lloyd, & Morrissey, 2017, among others). No doubt, this issue is very important as Pakistan is an aid receiving country since independence, the empirical research on the fiscal response of foreign aid is limited in Pakistan. Furthermore, the existing literature needs to be reviewed critically to highlight their shortcomings, which limit their significance and application.

Pakistan has received massive foreign funds in the form of grants, commodity aid and loans on hard and soft loans¹. Beginning out as an agrarian economy with few cotton and jute processing units in 1947, Pakistan developed rapidly as an industrial economy in the early 1960s. This development was based entirely on foreign aid and complete reliance on the advice of the experts from the donors². In the mid-1960s, it was declared by these experts that Pakistan was on the verge of take-off when all aid was suddenly stopped due to the war between India and Pakistan in 1965. As a result, by the end of 1960s Pakistan had reverted to

¹ Brief discussion regarding Pakistan's economy is based on Zaidi, S. A. (2015). See chapters 6, 7, 13, 17, 18 and 25.

² The major donor was the US for strategic reasons, mainly to block Russia from reaching the warm waters of the Middle East.

its agrarian structure while due to the easy and free flow of foreign funds Pakistan did not recognize the need to focus on domestic resource mobilization. In fact, Pakistan wasted the foreign funds as it pampered its industrial class with massive incentives including extended tax holidays, maintaining overvalued exchange rates, duty-free imports of industrial raw materials and machinery, and above all the payments of export bonuses to the industrialists in the form of foreign exchange, which could be parked abroad. Consequently, the high earners adopted lavish lifestyles but never learned to pay taxes to this day.

In the early 1970s, foreign inflows were mainly project- tied loans on soft and hard terms from the World Bank and Stand-By Arrangement with the International Monetary Fund (IMF). The inflow of foreign remittances from the Pakistani labor in the Middle- East in the second half of the 1970s blunted whatever little efforts were made to raise domestic resources. Furthermore, the Afghan war due to Russian intervention in the late 1970s once again led to an increased inflow of aid from the United States (US) and domestic resource mobilization was put on the back burner. The withdrawal of Russia from Afghanistan again led to the cessation of aid flows to Pakistan, as was the case in the late 1960s. The heavy and continued reliance on easy money from abroad and the neglect of the need for domestic resource mobilization led Pakistan into the IMF structural adjustment programs web beginning in 1987, when budget deficit peaked at 8.8% of GDP. Pakistan, due to all the borrowings over its existence has ended up in a debt trap due to a heavy conditionality burden and higher interest rates. To continue borrowing rather than improving domestic resource mobilization successive governments have chosen to fulfill the most serious conditionality of reducing budget deficits to less than 5% by imposing massive taxes on essential basic domestic inputs of the industrial and agricultural sectors like water, gas, and electricity. Furthermore, the overvalued exchange rate raised the cost of much needed imported machinery and technology for the major commodity-producing sectors. The rapid increases in

the cost of doing business in the 1990s ruined the economy as businesses moved out. In addition, continue to do so, to other countries that leading to massive unemployment and poverty while the official statistics manipulate the GDP and inflation figures.

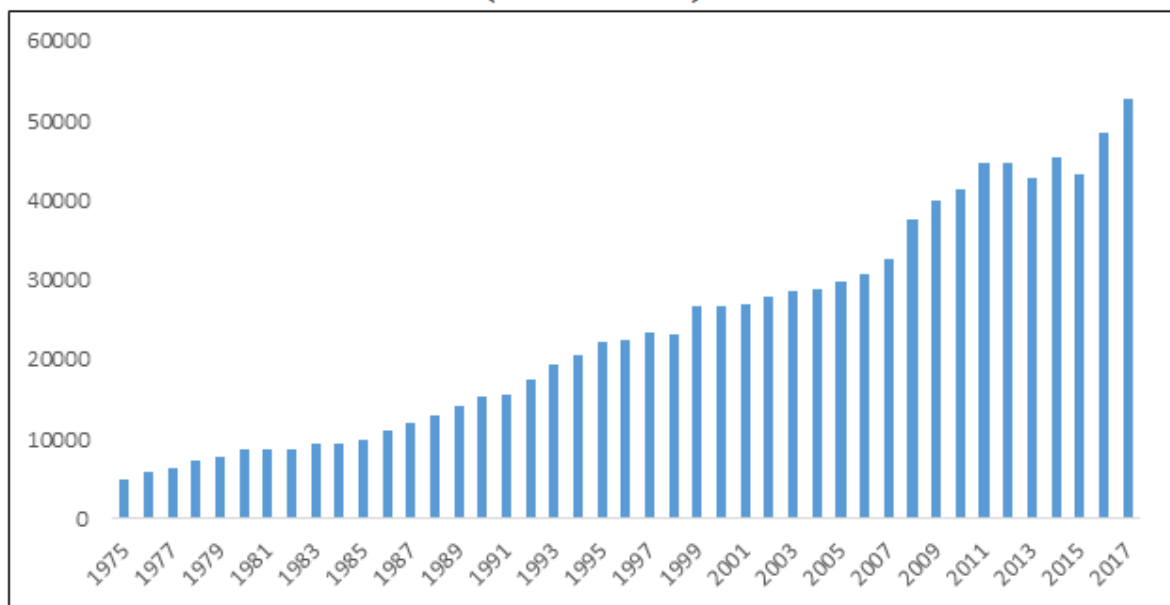
Keeping in view the poor fiscal response of foreign aid by the various governments, the present study has examined the impacts of international economic assistance on the fiscal behavior of the authority of Pakistan by estimating the impact of aid flows on public sector development spending, recurrent spending and socio-economic spending of government, tax revenue and domestic borrowing. The present study aims to assess the response of foreign aid on fiscal behavior in case of Pakistan through various sides. First, the study investigates the magnitude of fungibility in foreign aid for Pakistan. The study also investigates how does the project aid and program aid influence fiscal aspect of the government. Overall, the study is fruitful from the practical side to settle the issue of aid effectiveness in Pakistan by yielding evidence on the impacts of both types of foreign assistance on revenue and spending sides of the economy. In Pakistan, there is a serious dearth of literature on this issue and the existing literature suffers from some methodological problems [see for instance, Khilji and Zampelli, 1991; Otim, 1996; Iqbal, 1997; McGillivray, 2000; Ahmed, 2002; Butt and Javid, 2013]. Hence, the existing literature fails to present an accurate picture of fiscal response and foreign aid association in case of Pakistan. The significance of this analysis stems from the fact that it accounts for and overcomes all the methodological deficiencies of the existing literature on Pakistan to provide reliable evidence and recommendations to the policy makers.

The organization of this chapter is as follows: section 2.2 encloses a detailed discussion on foreign aid and fiscal performance indicators overtime; section 2.3 consists of survey of literature; section 2.4 describes the details of analytical framework, data and econometric methodology, section 2.5 describes the detailed discussion of results; and finally section 2.6 provides the conclusion with some policy recommendations.

2.2 Overview of Foreign Aid and Fiscal Variables in Pakistan

Foreign economic assistance to Pakistan started in 1950 and the period from latter part of fifties to the end of the sixties witnessed a high rate of accumulation of debt. The outstanding debt of Pakistan including Bangladesh jumped from 0.2 billion US dollars in 1960 to 3.6 billion US dollars in 1971. However, during the period of 1970, the rate of accumulation was much higher as external debt more than doubled during this period and raised at 8.0 billion US dollars at the end of December 1979, which constitute nearly 32 percent of Pakistan's GNP at that time. Several Domestic factors lead to this debt accumulation particularly agricultural loss due to extreme floods, droughts, Tarbela mishaps and pest attacks, which reduced our exportable surplus and resulted in higher imports.

Figure 2.1: Inflow of Foreign Economic Assistance to Pakistan (Million US \$)



Source: Handbook of Statistics on Pakistan's Economy 2015 and Annual Reports published by SBP.

Figure 2.1 shows inflow of foreign economic assistance to Pakistan by source. The stock of inflow of foreign economic assistance continued to grow in volume over the years. It can be seen that in 1975 Pakistan has received US \$ 4795 million inflow of aid. By the end June 1999, the total aid of public and publically guaranteed medium as well as long-term external

loans, including grants, has been assessed at US\$ 26735 and then it increases to US \$ 37535 million in 2008. Moreover, later on in 2017, it reaches US \$ 52,792 million.

Pakistan is receiving foreign economic aid from different sources; these include Paris Club, other bilateral sources, multilateral sources and IMF. Under the umbrella of Paris Club sources of aid, the countries include Austria, Australia, Belgium, Canada, Denmark, France, Finland, Germany, Italy, Japan, Korea, Netherlands, Norway, New Zealand, Russia, Spain, Switzerland, Sweden, USA, and United Kingdom. In Paris Club sources, Pakistan is receiving a major portion of aid from Japan, France, and United States. In 2012, Pakistan has received US \$8066 million from Japan that is the highest portion of aid from Japan ever recorded in history.

Pakistan receives aid from bilateral sources, including China, Kuwait, Romania, Saudi Arabia, and U.A.E... Pakistan also receives a larger share of foreign aid from multilateral sources these include the Asian Development Bank (ADB), International Development Association (IDA), International Bank of Reconstruction and Development (IBRD), European Investment Bank (EIB), International Fund for Agriculture Development (IFAD), Islamic Development Bank (IDB), International Finance Corporation (IFC) and Organization of Petroleum Exporting Countries (OPEC). ADB and IDA are major sources of aid providers to Pakistan.

Aid inflow to Pakistan from Paris Club, other bilateral sources and multilateral sources are given in table 2.1. Table shows from 1999 to 2006 most of the aid received by Pakistan is from Paris club and other bilateral sources. But in 2007 Pakistan's dependency on multilateral aid has been significantly increased as in 1999 inflow of foreign aid from Paris club and other bilateral sources is US \$ 12550 million and from multilateral sources, it is recorded as US \$ 14033 million. However, in 2007, it is recorded as US \$ 13693 million from Paris club and other bilateral sources and US \$ 18832 million from multilateral sources. Later

on, the proportion of aid from multilateral sources is gradually increasing and Pakistan economy is heavily depending on ADB and IDA for aid. Volume of foreign aid increases significantly after the incident of 9/11 and Pakistan-America partnership in the war against terrorism. Pakistan receives the bulk of foreign economic assistance for defense and development purposes and natural calamities.

**Table 2.1 Disbursement of Foreign Economic Assistance to Pakistan by Source
(In Million US \$)**

Years	Paris Club	Other Bilateral	Multilaterals
1999	11873	677	14033
2000	12428	697	13334
2001	11845	451	14413
2002	12516	429	14645
2003	12607	512	15181
2004	13558	720	14547
2005	13013	805	15540
2006	12789	832	16984
2007	12691	1002	18832
2008	13928	1189	21705
2009	13998	1998	23268
2010	13958	2510	24025
2011	15462	2665	25981
2012	15014	3860	25440
2013	13548	4687	24227
2014	13606	5036	26002
2015	11664	5992	24581
2016	12678	6759	27269
2017	11973	7551	32437

Source: Handbook of Statistics on Pakistan's Economy 2015 and Annual Reports published by SBP.

Pakistan receives the bulk of foreign economic assistance from international organization for multiple purposes in 2004 to 2008; however, the most common reason is the incident of earthquake in 2005. In 2005, Pakistan received US \$ 13818 million from Paris Club and bilateral sources and US \$ 15540 million from organizations. In 2010, because of floods, Pakistan received US \$ 24025 million from different international institutions and agencies. Afterwards, from 2011 to 2015, Pakistan received bulk of foreign aid from

international agencies and US for development purposes. In 2017, Pakistan has received US \$ 32437 million foreign economic assistance from multilateral sources in which ADB and IDB have provided aid of US \$ 9452 million and US \$ 12453 million respectively.

Table 2.2 Plan Wise Aid Commitment to Pakistan by type (1952-2018)

Committed Aid to Pakistan (1952-2018) by Type (in US\$ million)						
Plan/Year	Project Aid	Non Project Aid (Program Aid)				Total
		Non Food	Food	BOP	Relief	
Pre Plan (1952-55)	170	48	119	-	-	337
1 st Plan (1956-60)	527	375	173	-	-	1075
2 nd Plan (1961-65)	1702	699	510	-	-	2911
3 rd Plan (1966-70)	1582	881	474	-	-	2937
Non Plan (1971-78)	3762	1209	906	1090	-	6967
5 th Plan (1979-83)	4659	987	413	531	643	7233
6 th Plan (1984-88)	9132	1234	807	-	734	11907
7 th Plan (1989-93)	9960	1435	1561	413	545	13913
8 th Plan (1994-98)	8882	62	1986	1161	61	12152
9 th Plan (1999-03)	3974	-	883	4999	40	9896
10 Year perspective Development Framework (2001-11)	20836	358	171	19644	1909	42918
11 th Plan (2013-18)	31034	225	0	26727	37.37	58023.37
Total	96220	7513	8003	54565	3969.37	170269.37

Source: Economic Survey of Pakistan (various issues)

Foreign aid to Pakistan has mostly consisted of project aid and non-project aid/program aid. While, program aid is further divided into non-food commodity aid, food aid, BOP and relief aid. Project aid is normally provided for specific projects forming part of a development program, that is, after a determination of economic and technical

Table 2.3 Plan Wise Aid Disbursement to Pakistan by type (1952-2018)

Disbursed Aid to Pakistan (1952-2018) by Type (in US\$ million)						
Plan/Year	Project Aid	Non Project Aid (Program Aid)				Total
		Non Food	Food	BOP	Relief	
Pre Plan (1952-55)	170	48	119	-	-	337
1 st Plan (1956-60)	406	244	192	-	-	842
2 nd Plan (1961-65)	1209	420	765	-	-	2394
3 rd Plan (1966-70)	1811	763	469	-	-	3043
Non Plan (1971-78)	2543	1299	785	1090	-	5717
5 th Plan (1979-83)	3363	950	36	531	643	5523
6 th Plan (1984-88)	4882	791	776	-	734	7183
7 th Plan (1989-93)	7643	1922	1558	413	545	12081
8 th Plan (1994-98)	9564	61	1923	1139	61	12748
9 th Plan (1999-03)	4991	-	502	8307	35	13835
10 Year perspective Development Framework (2001-11)	13432	428	145	17968	1499	33472
11 th Plan (2013-18)	12650	90	-	25358	284	38382
Total	62664	7016	7270	54806	3801	135557

Source: Economic Survey of Pakistan (various issues)

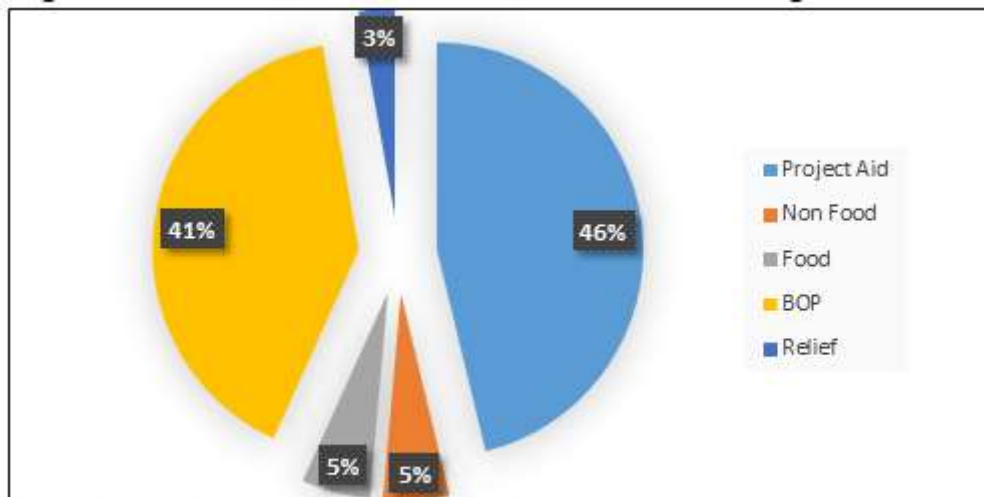
feasibility for each project submitted.³ Project aid is provided mostly for development projects like construction of dams and new roads, rural development projects, etc. Table 2.2 presents the plan wise commitment of entire foreign aid to Pakistan and Table 2.3 presents plan wise disbursement of whole foreign aid to Pakistan by natures.

The trend of project aid in the total disbursement is fluctuating over the years. In the period of 1990s, project aid was averaged at 1735 million USA dollars per annum. It is likely to be below average (985 million US dollars) in 2000-01. The non-project aid in this period, on yearly basis, averaged at 637 million US dollars. It declined to 318 million in 1999-2000 mainly because of lesser disbursement of aid and constraints in counterpart financing. It is obvious that the share of aid disbursement for BOP has increased drastically after 2002-03. In

³ Aid-giving countries and agencies in extending project assistance follow different procedures. Canada and the United States, for example, sign a formal statement with Pakistan describing mutual obligations, the purposes and the work programme relating to very project. On the other hand, Australia and New Zealand require no such formal agreements.

ninth Plan Pakistan received US \$ 8307 million in the head of BOP support that reaches to US \$ 25358 million in 11th Plan. Figure 2.2 shows the composition of total Aid Disbursed during 1972-2018 i.e., share of project aid is 46%, while the shares of the non-food, food, and relief aid are 5%, 5%, 3% respectively, however, share of BOP support is 41%.

Figure 2.2 Distribution of Total Aid Disbursed during (1972-2018)

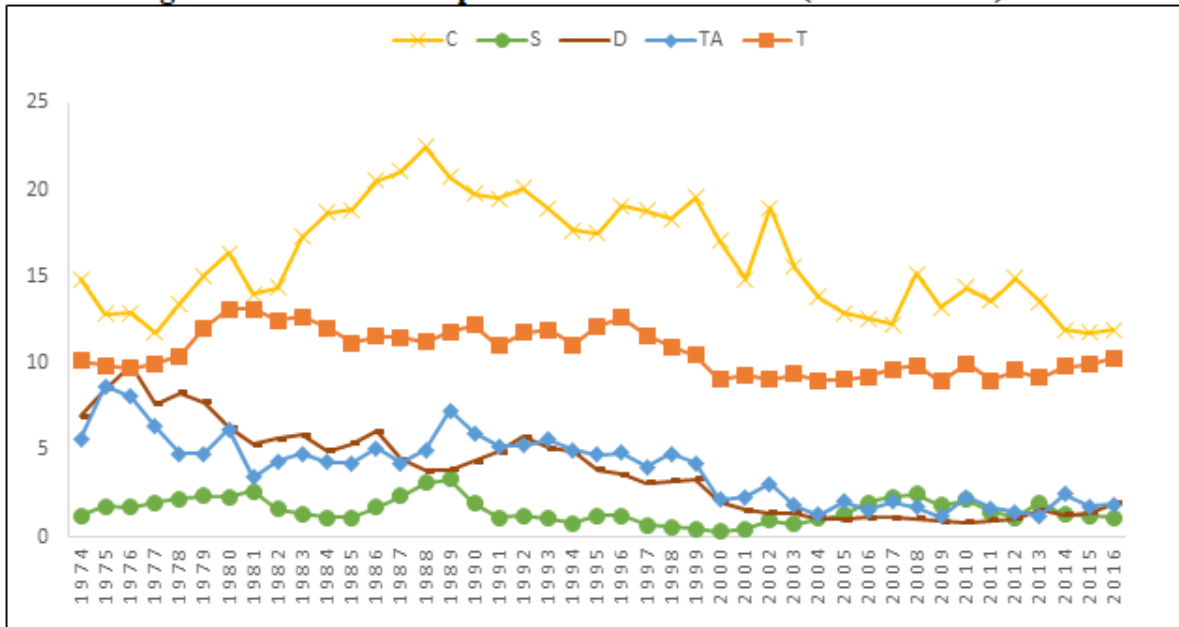


Source: Economic Survey of Pakistan (various issues)

Pakistan's foreign aid issues are also important from its impact on fiscal behavior as at the first stage foreign aid goes to the central treasury; therefore, it is logical to expect its significant influence on fiscal actions of aid recipient governments. Furthermore, another factor impeding the full effect of foreign economic assistance in Pakistan is the phenomenon of fungibility of aid flows. In the face of serious domestic resource constraints, it is possible to shift the flow of foreign aid from productive to non-productive uses. Figure 2.3 shows the behavior of Current Expenditure (C), Development Expenditure (D), Socio-economic expenditure (S) and Tax revenue (T) in the response to inflow of Total Aid (TA) overtime. It is apparent from figure 2.3 that whenever inflow of foreign aid is increasing it results in significantly increasing current expenditures and decreasing development and socio-economic expenditures along with negatively affecting tax revenue collection effort. The figure supports the argument that there is fungibility in the utilization of aid because aid led

to increase current expenditure and has contributed lesser in development expenditures (Ghulam, 2005).

Figure 2.3 Total Aid impact on Fiscal Variables (As % of GDP)



Source: Data for all variables is taken from Handbook of Statistics on Pakistan's Economy 2015 and Economic survey (various issues). Author transforms data for all variables as percent of GDP.

It can be seen in 1974 inflow of foreign aid is 5.6 percent of GDP and current expenditures, development expenditures, socio-economic expenditures and tax revenue are 14.8, 6.97, 1.23 and 10.15 per cent of GDP respectively. However, in 1975, inflow of foreign aid has increased to 8.6 percent of GDP in the response of foreign aid development expenditures are increasing but tax revenue has decreased to 9.88 percent of GDP. Later on, there is a pertinent decline in Tax revenue/GDP ratio in the decade of 1980s. However, in decade of 1990s Provincial government's revenues rises because of decentralization of authorities [Zaidi, 2005]. In 1988 due to Structural Adjustments Program inflow of aid increased in Pakistan that results in increasing current expenditures 22.4 percent of GDP and reducing the development spending to 6.33 percent of GDP. Development expenditures shrunk to only 4.2 percent of GDP during 1990s because of certain fiscal issues. Development expenditure continues to decline and during decade of 2010s they are on

average only 1.26 percent of GDP, and in 2013-16 on average development expenditures are 1.52 percent of GDP. The rising trends in current expenditures are under control during the FY 1999 to FY 2006 and it is recorded as 15.5 percent of GDP on average annually during that period. Current expenditures in 2013 are 13.5 percent of GDP. Despite higher growth in debt servicing, defense spending, and grants; the growth in current expenditure in 2014 remains low due to decline in subsidies recorded as 11.9 percent of GDP. Afterwards, there is no significant change in current expenditure in 2016. During 1980s annual average tax revenue was recorded 13.7 percent of GDP that declined to 13.1 percent of GDP in the 1990's and in 2007 tax revenues is recorded only 10.6 percent of GDP. Later on, there is substantial upsurge in tax revenue as shown in graph. In 2015, tax revenue is 10.2 percent of GDP; however, in 2016 tax revenue is recorded as 12.5 percent of GDP.

In short, since the separation of East Pakistan, aid has helped more in sustaining the economy than in its development. The planning and development expenditure and investment pattern was, during the first three plans, conditioned by the availability of foreign aid than by existing domestic saving rates and mobilization of internal resources. Secondly, the aid was used in the earlier stages for the legitimate purposes of financing the import gap on development account but later it came to be increasingly used for maintaining current consumption, thereby encouraging extravagant living. Thirdly, commodity aid was used to remove imbalances and meet shortages in critical areas of the economy. Fourthly, grants received for specific development projects as Tarbela dam materially made a significant contribution towards development of agriculture and other sectors of the economy. Lastly, by making possible imports of fertilizers, steel and other important agricultural and industrial inputs, aid helped both agricultural and industrial production to grow at rates that would otherwise have been simply unattainable.

2.3 Literature Review

The recent empirical literature on the effectiveness of development aid has been deliberated in recent years, but much of it is still focused on the aid-growth nexus (McGillivray and Morrissey, 2001). In this regard, Heller's (1975) pioneering study led to the development of vast literature on the subject of fiscal response to aid, particularly in developing countries. Heller (1975) develops fiscal model to investigate the fiscal behavior of foreign aid for eleven African developing countries. The study concludes that grants mostly affect public expenditure whereas concessional loans generally influence public investment. This section is further separated into two sub-sections: section 2.3.1 takes into account review of literature from developing world. Section 2.3.2 provides review of literature of studies related to Pakistan particularly highlighting shortcomings of these studies.

2.3.1 Survey of Literature for Developing World

Cashel and Craig (1990) study investigates the response of foreign aid on government expenses for a sample of 46 developing countries. The study only incorporates public spending on defense and nondefense expenditure. The study finds that foreign aid received from IMF significantly affects fiscal behavior of recipient government as compared to aid received from other sources. The study by Khilji and Zampelli (1994) shows the defense and nondefense expenditures in scrutinizing the fungibility of USA aid among eight main aid recipient economies including Pakistan. Khan and Hoshino (1992) found that foreign grants decrease tax effort while loans enhance increase tax effort in five South and Southeast Asian economies. However, Otim (1996) revealed that grants are more possible to leakage into consumption than loans. The study also suggests that donors should spread loans to developing economies rather than other economies. The study also shows that grants and loans increase tax effort.

McGillivray and Ahmed (1999) study shows that aid is negatively affecting public sector saving, taxation and other recurrent revenue. Swaroop *et al.*, (2000) study investigates the influence of foreign aid on fiscal behavior in case of India. Results confirm the existence of fungibility in utilization of foreign aid because more aid is consumed for non-development finance expenditures. Mavrotas (2002) study also scrutinizes the effect of aid on fiscal response of India and Kenya. The study finds that in case of Kenya very small share of tax revenue goes to the head of government spending because of inflow of foreign economic assistance. However, the situation is quite well in case of India as almost half proportion of tax revenue is used to finance investment project and the remaining proportion goes to finance government consumption. Gupta *et al.* (2003) study analyzed the effect of aid on tax collection efforts of 107 countries for time 1970 to 2000. The study concludes that aid in the form of loans enhances domestic revenue collection, however; grants lead to discouraging revenue collection. Mavrotas and Ouattara (2003) study disaggregate foreign aid into program aid, project aid, technical assistance, and food aid and for Côte d'Ivoire. Results show that foreign aid positively and significantly affecting public spending, however, it reduces investment, tax collection effort and domestic borrowing. McGillivray and Ouattara (2003) study also examines aid impact on fiscal response Côte d'Ivoire and the study reports that foreign aid results in increasing public debt. Njeru (2003) study reports the existence of fungibility for Kenya because most foreign aid is utilized for non-development expenditures instead of development projects. Similarly, Osei *et al.*, (2003) find that foreign aid is negatively related to domestic borrowing and tax collection efforts in Ghana. It also reports that foreign aid results in increasing public spending. Fagernas and Roberts (2004) study investigate the fiscal reaction of foreign aid for Zambia between 1964 and 2001. The study shows that the inflow of foreign aid raises both non-development and capital expenditure.

The study also finds that foreign aid results in reducing tax collection effort but it increases domestic borrowing.

Fagernas and Schurich (2004) study find that foreign aid positively affects public development spending and negatively associated with domestic borrowing in case of Malawi. However, foreign aid inflow has no significant effect on tax collection effort. Odedokun (2004) study finds that grants decrease tax effort in low-income economies. Osei *et al.* (2005) study find that foreign aid in Ghana is linked with reduced domestic borrowing and increased tax revenue. The study also reports evidence for aid fungibility because aid tends to increase non-development spending more as compared to development spending. However, Obben and Xayavong (2006) report opposite results, as inflow of foreign aid increases it reduces public investment and tax revenue. However, inflow of aid provokes an increase government consumption expenditure. Ouattara (2006a) study concludes that foreign aid is positively affecting development expenditures in developing countries. Furthermore, aid is not used for non-development expenditures and aid enhances tax collection effort. Ouattara (2006b) study finds that aid has no significant influence on total expenditure but it is linked with a decrease in borrowing on Senegal. Bhattarai (2007) study reports a positive association between foreign aid and current expenditures in Nepal that confirms the existence of fungibility in utilization of aid. The study also reports positive link between inflow of aid and development expenditures but at low extent.

Feeny (2007) study reports foreign economic assistance is positively affecting development and non-development expenditures in Pacific Island countries. Furthermore, foreign aid results in reducing domestic revenue. On the other side, for Ethiopian government, Martins (2007) study finds that foreign aid is positively associated with public investment but it exerts negative effect on domestic borrowing. Morrissey *et al.* (2007) study analyses the fiscal effects of aid grants and loans for Kenya. The results show that grants are

associated with increased spending that leads to growth and grants had a small positive link with economic growth. However, aid loans have a negative association with growth. Furthermore, tax revenue is exogenous but weak, suggesting that the government is unable to upsurge tax revenue in the short run to adjust to government budget deficits. Erden and Guven (2009) study show that aid inflows are positively linked with public investment in transition countries. Lloyd *et al.* (2009) also report that foreign economic assistance is positively affecting government spending of developing countries. In case of Philippines, McGillivray (2009) study shows that foreign aid results in decreasing public expenditure, taxation, public sector saving and recurrent revenue.

Feeny and McGillivray (2010) study also reveals a negative association between foreign aid, tax revenue and domestic borrowing in case of developing economies. Martins (2010) study investigates fiscal response of aid in Ethiopia. The study finds that aid in the form of grants outcomes in increasing development spending along with significant reduction in non-development spending. Clist and Morrissey (2011) study suggests that the poorest economies have lower tax to GDP ratios that is why these economies obtain more aid in the form of grants. Benedek *et al.* (2012) extended the Gupta *et al.* (2004) empirical study by using a comprehensive data set covering the period 1980–2009 and validate the previous findings of a negative result of grants. Bakhtiari *et al.* (2013) study reported positive effect of aid on development expenditures for a sample of 25 aid recipient economies in Latin America and Asia over the time period 1991-2010. However, aid has no significant impact on government current expenditures. While foreign aid also crowds out public borrowing and government revenue.

Bwire *et al.* (2013) study reports foreign aid increases revenue and public spending and reduces domestic borrowing in Uganda. Dayanath and Ichihashi (2013) study found that foreign aid does not offer rapid and sustainable growth in normal fiscal behavior in Sri

Lanka. Thamae and Kolobe (2016) investigate the fiscal impacts of aid inflows on Lesotho's economy and indicate significant negative long-run link between recurrent expenditure and foreign aid, while a positive but marginally significant relationship exists between foreign aid and capital expenditure. Mascagni (2016) study concludes that in Ethiopia aid is positively associated with tax revenues. Bwire *et al.* (2017) study concludes that aid is associated with increased tax effort and public spending and reduced domestic borrowing.

2.3.2 Fiscal Response to Foreign Aid: Survey of Literature from Pakistan

Khilji and Zampelli (1991) covering the period 1960 to 1986 do the first significant study for Pakistan. It analyzes the private consumption and investment, defense and non-defense expenditure allocations with reference to the US economic assistance to Pakistan. Their results indicate that USA military and non-military aid is quite fungible. This study is criticized on two bases; constant returns to scale (CRS) technology is used in production sector and Pakistan is only receiving foreign aid from US, these two assumptions do not hold in Pakistan. Hence, the outcomes of the study fail to assist in caulking out the fiscal response of foreign aid in the country. Studies by Chishti and Hasan (1992) and Otim (1996) apply the Heller's model to Pakistan for investigating the relationship between foreign economic assistance and budgetary response but ignore to account for the limitations of the Heller's model which are well documented in the fiscal response literature (for instance, White, 1994; McGillivray and Morrissey, 2001). Considering this, we have adopted a modified version of the fiscal response model keeping in view the deficiencies associated with the Heller's model.

Iqbal (1997) analyzes the response of foreign economic assistance on fiscal actions of Pakistan over the period 1976 to 1995. The result shows foreign economic assistance is affecting positively current, social expenditures and development expenditures as well. However, the extent of influence is strong in case of current and social expenditures as compared to development spending that confirms the existence of fungibility in utilization of

aid. The results also reveal that external economic assistance boosts tax collection struggles by the government. The findings of the study are not reliable for three reasons. Firstly, the sample size used in this study is very small. Secondly, the study has not disaggregated aid based on its use. Finally, the assumption of the study that domestic borrowing is allocated only for development purposes only is factually incorrect in case of Pakistan. Franco-Rodriguez *et al.* (1998) study is also done for Pakistan over the time period 1956 to 1995. The study reveals that aid is positively associated with public investment but it results in reducing tax collection. However, aid exerts positive influence on domestic borrowing. McGillivray (2000) inquires the fiscal response of foreign aid in Pakistan over the period 1956 to 1995. The study's findings are unconvinced, as the pre and post 1972 data are not compatible as pointed out earlier. Furthermore, when 11 out of the 16 estimated parameters are insignificant it indicates some inherent deficiency of the econometric methodology adopted by the study.

Ahmed (2002) analyzes the fiscal response to foreign aid from 1980 to 2000. The study reveals that foreign aid (loans and grants) is a significant driver of the fiscal budgetary actions in Pakistan. Foreign debt is mainly used for public sector development programs, and grants supplement the current and social economic spending. Furthermore, foreign loans and grants have opposite impacts on the tax revenue collection efforts in Pakistan; the former increases tax revenue collection efforts while the latter induces a reduction in taxes. However, this study is beset with serious methodological flaws. Firstly, the sample size of the study consists of twenty-one observations, which is inadequate to obtain reliable results from a time series analysis. Secondly, the study generates values of the target variable by means of a regression method is flawed as pointed out by White (1994). Furthermore, as pointed out earlier all data on the required target variables are available in Pakistan's annual budget statements. Finally, the study works with single equation models while a meaningful analysis

on the topic requires a simultaneous equation framework as developed by Heller (1975). Butt and Javid (2013) study shows that foreign aid leads to a decrease in tax collection effort, however, aid is positively linked with current, social-economic and development expenditures. This study is also plagued with data and methodological issues. Firstly, the scope of the study is restricted since it considers only the grant component of external aid. Over time the grant component is almost negligible and debt burden of loans has increased enormously. Hence, fiscal response to aid cannot be accurately estimated by excluding the debt component of aid from the analysis. Secondly, the study does not justify the model employed, as it does not qualify to be in the class of standard Heller's fiscal response model or any of its modified versions. It is not clear why the study is trying to estimate a set of interdependent equation by means of the autoregressive distributive lag (ARDL) model that is a single equation technique.

Moreover, all the concerning fiscal response to aid in Pakistan is based on an assumption that the government does not set any target for domestic borrowing. However, this assumption is extremely erroneous, as it does not have conformity with real fiscal behavior in Pakistan. Because every year a particular target is set for domestic borrowing in annual budget of government. Therefore, due to their methodological and data issues the existing relevant studies fail to yield convincing outcomes and policy recommendations for the donors and the policy makers in Pakistan to better utilize foreign aid. The present study is an attempt to go for conducting fiscal response to aid analysis in Pakistan in an empirically sound way.

2.4 Analytical Framework for Fiscal Response Model

While discussing literature it is seen that most of the work is done in the context of aid saving and aid growth relationship, no mention was made of behavioral links. It is well known that when an amount of aid goes into the recipient economy it first goes into a central treasury. Because of the fungibility problem, a portion of aid finds its way to other expenditure categories for which it is not originally intended. This can change the behavior of various fiscal response variables of the recipient. This section is further divided into five subsections: we discuss the rationale for using a fiscal response model in section 2.4.1. Section 2.4.2 follows a critical discussion of the Heller (1975) model, which is taken as the base model for the present study. Section 2.4.3 discusses suggested changes to the model to be considered by the present study. This section also describes a set of models to be developed in the light of those solutions. Section 2.4.4 discusses the description of data to be used for the study. Lastly, Section 2.4.5 outlines the econometric methodology.

2.4.1 The Rationale for Using a Public Sector Fiscal Response Model for Assessing the Impact of Aid

As discussed earlier, various researchers argue that instead of increasing investment foreign capital inflows are used to increase consumption. Please (1967 and 1972) notes a higher tax burden is used for non-productive forms of public consumption. Griffin (1970) and Griffin and Enos (1970) suggest that in order to maximize the utility, the public sectors of the developing countries reduce tax collection and in case of inflow of aid their public savings decline. Although they have used simple aid-saving models that only focus the effect of aid on the recipients' domestic savings, the study nevertheless recognizes it that aid may influence other fiscal variables like current, social economic and development expenditures, taxation and domestic borrowing. We hypothesize here that aid has a significant effect on different fiscal response variables of the recipient economy, and that analyzing the impact of

foreign aid should begin with analyzing the impact on fiscal variables like tax revenue, government current and development expenditures and domestic borrowing.

Heller (1975) develops an econometric model to investigate the fiscal response of external aid. Heller considered a variant of the Garamlich (1969) model; which utilized a public sector quadratic loss function (for both states and local governments in the USA) to show the influence of federal grants on fiscal response indicators of the local and state government among other things. Heller hypothesized that fiscal decision makers in less developed countries maximize utility function comprising of public policy aims subject to financing constraints. By extending Heller's framework, Mosley and Hudson (1984) argued that in common with their developed counterparts, policy makers of the aid recipient countries have complex welfare objectives which include growth maximization but not to the exclusion of other goals. Thus, in the econometric modeling few more independent variables are added which are seen as important to capture the influence of those additional variables.

Thorpe (1965) and Hussain (1985) demonstrated that aid agencies recognized the fact that government sector first receives foreign capital inflow. Hence, to enhance the impact of aid, the agencies expended significant efforts to alter recipients' overall policy objectives with respect to aid. From literature it has been observed, there exists a significant variation in the effect of aid among developing countries. This issue of inter-country variation of aid effectiveness has been examined closely by Mosley *et al.* (1992) who concluded that variation may occur due to dissimilarities in economic policy preferences and the limits faced by the recipient with respect to aid spending. They also concluded that this variation might be the consequence of inter-sector variation in the allocation aid between the capital and the recurrent budget, and the variation in the allocation of aid between different sectors. It has been observed that the allocation and use of aid funds are not straightforward and involves several policy complexities. Heller (1975) recognized these complexities of the use of aid and

developed a macroeconomic model of the aid allocation in less developed countries. The model assumes that recipients attempt to minimize a quadratic loss function in which any deviation of actual from desired values of public investment and consumption is considered to create disutility to the decision makers.

2.4.2 Description of the Heller Model and Critiques

For convenience, Heller's (1975) employed by Gang and Khan (1991) and Khan and Hoshino (1992) models are described below along with the constraints. All these authors have used the following functional form to represent the public sector utility function in any period t .

$$U = f\{I_g, (Y-T), G_c, G_s, B, A_1, A_2\} \quad (\text{A})$$

In equation (A) I_g is development expenditures or public investment expenditure, $(Y-T)$ is private disposable income, G_c is socio-economic expenditures of government, G_s is public sector civil consumption, B is public sector domestic borrowing, A_1 is foreign aid in the form of grants, and A_2 is foreign aid in the form of loans.

From equation (A) the authors assume that:

$$U = \alpha_0 + \alpha_1(I_g - I_g^*) - \frac{\alpha_2}{2}(I_g - I_g^*)^2 + \alpha_3(G_c - G_c^*) - \frac{\alpha_4}{2}(G_c - G_c^*)^2 + \alpha_5(G_s - G_s^*) - \frac{\alpha_6}{2}(G_s - G_s^*)^2 - \alpha_7(T - T^*) - \frac{\alpha_8}{2}(T - T^*)^2 - \alpha_9(B - B^*) - \frac{\alpha_{10}}{2}(B - B^*)^2 \quad (\text{B})$$

In equation (B) $\alpha_i \geq 0$ for all $(i = 1, 2, \dots, 10)$ and $*$ denotes a target level of the variables.

Gang and Khan, and Heller stated that the functional form was chosen in such a way that all the variables such as I_g, G_c, G_s, T, B diminishing marginal utility is ensured as they rise up to the target level and fall when target levels are surpassed. The authors have used the following set of constraints:

$$I_g = B + (1 - \rho_1)T + (1 - \rho_2)A_1 + (1 - \rho_3)A_2 \quad (C)$$

$$G_s + G_c = \rho_1 T + \rho_2 A_1 + \rho_3 A_2 \quad (D)$$

where $0 < \rho_i < 1$ for all i ($i = 1, 2, 3$). The constraints assume that B is only used to finance government investment I_g and, due to fungibility, A_1 (grants) and A_2 (other foreign inflows) can finance I_g and government consumption. It is further assumed that the target level indicators for the above model could be determined as follows:

$$I_g^* = \alpha_{11} Y_{t-1} + \alpha_{12} I_p \quad (E)$$

$$T^* = \alpha_{13} Y_t + \alpha_{14} M_{t-1} \quad (F)$$

$$G_c^* = \alpha_{15} G_{c,t-1} \quad (G)$$

$$G_s^* = \alpha_{16} E + \alpha_{17} Y_t + \alpha_{18} (Y_t - Y_{t-1}) \quad (H)$$

$$B^* = 0 \quad (I)$$

where Y_t is the gross domestic product in time t , M is the value of total real imports, E is primary school enrollments in units of ten thousand students, I_p is real private investment expenditure.

It is well known that the amount of aid first becomes a part of national treasury in developing countries. Due to fungibility problem, a fraction of aid goes to other spending heads for which aid is not originally intended. This situation tends to affect fiscal management of a country, which is certain to influence the macroeconomic variables of the economy including economic growth. Thus, examining the effect of foreign aid on fiscal behavior is essential to judge the aid effectiveness [McGillivray and Morrissey, 2001]. In this regard, Heller (1975) comes up with a fiscal response model in an econometric form that has continued to serve as the basis for the rising stock of literature in the area of fiscal response to aid. Heller assumes that his fiscal response model is the reflection of policy makers' action in

the less developed economies. The public decision makers strive for utility maximization given some budget constraints. His model identifies not only the nature of association among budget aggregates it also reveals the efforts of a government to achieve certain revenue and expenditure targets. Over time, it is discovered that this model is plagued with some grave defects.

Firstly, the use of linear terms in utility function makes it impossible to achieve maximum utility despite attaining target values of choice variables [Binh and McGillivray, 1993]. Secondly, the regression-based method of generating values of target variable as presented by Heller is rejected on the ground that it is certain to create an issue of consistency between targets so computed and budget constraints [White, 1994]. Additionally, in a developing state like Pakistan the government usually does not allocate domestically borrowed funds to its development programs only which is absolutely in contrast with the assumptions developed by Heller (1975). Finally, it is a standard practice in Pakistan and others such as countries that their governments set some annual targets for domestic borrowed capital but Heller has built his model negating this reality. All these deficiencies in the Heller's model significantly brought down its value and attraction as a fundamental tool for examining the fiscal response of foreign aid. Since 1990s, the researchers have engaged in developing some modified fiscal response models to investigate the budget response to aid (see, for instance, Binh and McGillivray, 1993; White, 1994; McGillivray, 2000; Mavrotas and Ouattara, 2003). Consequently, for a valid and meaningful fiscal response analysis, it is direly required that some better alternative to Heller's model ought to be employed. The present study is a move in this direction.

2.4.3. The Models

The present study has developed three models to examine the influence of foreign aid on fiscal behavior in Pakistan. These models are based on the following features:

- Quadratic and symmetric utility function is used,
- Targeted values are directly obtained from annual budget statements,
- Model B and Model C assume that domestic borrowing can be employed for public investment expenditure for development purposes and non-development purposes,
- Target level borrowing is assumed zero in model A and B, however, this assumption is relaxed in Model C, and
- Final assumption is that program aid and project aid are exogenous variables in the models.

A brief review of the three models is as follows:

Model A: This is the same model used by Heller (1975), Gang and Khan (1986, 1991), and Khan and Hoshino (1992) without incorporating linear terms. This model assumes that aid variables are exogenous. It is also assumed that domestic borrowing (B) is used for government investment i.e., development expenditures (D) and targeted borrowing (B^*) is zero.

Model B: A utility function with P_j and P_m exogenous to the model. However, B is assumed not only to be used for D but also for other government expenditures like current expenditures (C) and socio-economic expenditure (S) purposes. The model utilizes symmetric utility function and B^* is still zero in this model.

Model C: This model holds all the assumptions of model two with only one exception i.e., $B^* \neq 0$.

2.4.3.1 Why Propose Three Versions of Model?

Model A is of interest to us because, upon estimation, we can compare the results readily with the previous studies done by Heller (1975), Gang and Khan (1986, 1991), and Khan and

Hoshino (1992). This comparison is of interest because we can compare what happened to the estimated coefficients when the linear terms are dropped from the equation. Afterward we estimate the other two relatively complex models. Estimation of model B and C is of interest because we can compare the estimated coefficients of these models with one another once the restriction on domestic borrowing and targeted domestic borrowing is relaxed. This exercise is quite productive for deciding the suitability of a fiscal response model with Pakistan's data.

For each of the utility functions, structural equations have been derived followed by derivation of the reduced-form equations for each of the models. The rationale for each of the assumptions mentioned above are given in the appropriate places.

2.4.3.2 Derivation of the Structural and Reduced-Form Equations

The public sector utility function for Pakistan in period t is as follows:

$$U = f(D, T, S, C, B) \tag{1}$$

where,

D = capital investment expenditure or development expenditure

T = Public tax revenue

S = public sector recurrent developmental expenditures or socio-economic expenditure

C = government expenditure for non-developmental purpose or current expenditure

B = domestic public borrowing from all sources

Model A

Model A is somewhat similar to the Heller, Gang, and Khan and Hoshino models in the sense that the assumption regarding domestic borrowing is the same. However, there is a

difference, which is that the utility function is quadratic as opposed to linear-quadratic. The utility function can be written as:

$$U = \beta_0 - \frac{\beta_1}{2}(D - D^*)^2 - \frac{\beta_2}{2}(T - T^*)^2 - \frac{\beta_3}{2}(S - S^*)^2 - \frac{\beta_4}{2}(C - C^*)^2 - \frac{\beta_5}{2}(B - B^*)^2 \quad (2)$$

where the symbols show exogenous targets of endogenous variables and $\beta_i \geq 0$ for $i = 1, \dots, 5$. From utility function (2) it transpires that the government of Pakistan set targets for expenditure and revenue categories every year and it makes struggles to realize these targets. Any change from these targets leads to loss in utility. The constraint may take the following simple form:

$$T + B + P_j + P_m = D + S + C$$

In this model, it is assumed that the development expenditures would be borne by portions of T, P_j, P_m and by borrowing (B). We further assume that Pakistan government would not finance their current and socio-economic expenditure out of funds received by borrowing. Instead, it is assumed that the entire current and socio-economic expenditures are financed out of tax revenue. But historically it has been found that the governments of less developed countries use some portion of aid for current consumption (such as S and C) irrespective of the level of objectives. This is the so-called *Fungibility* problem associated with aid receipts. Therefore, we may include aid (P_j and P_m) in current and socio-economic consumption which would suggest the following final set of constraints:

$$D = B + (1 - \rho_{12})T + (1 - \rho_{22})P_j + (1 - \rho_{32})P_m \quad (3)$$

$$S + C = \rho_{12}T + \rho_{22}P_j + \rho_{32}P_m \quad (4)$$

where $0 < \rho_i < 1$ for all i ($i = 12, 22, 32$) and $\rho_{12}, (1 - \rho_{12})$ associated with T implying that a certain portion of tax is going to finance D, S and C respectively. $(1 - \rho_{22})$ and $(1 - \rho_{32})$

associated with P_j and P_m respectively in equation 3 suggest that certain portions of P_j and P_m are allocated to finance D . Similarly, ρ_{22} and ρ_{32} in equation 4 imply that the remaining portion of P_j and P_m is going to finance C and S .

For maximizing (2) subject to (3) and (4) outcomes in the following Lagrange function:

$$L = \beta_0 - \frac{\beta_1}{2}(D - D^*)^2 - \frac{\beta_2}{2}(T - T^*)^2 - \frac{\beta_3}{2}(S - S^*)^2 - \frac{\beta_4}{2}(C - C^*)^2 - \frac{\beta_5}{2}(B - B^*)^2 + \lambda_1(D - B - \rho_{11}T - \rho_{21}P_j - \rho_{31}P_m) + \lambda_2(S + C - \rho_{12}T - \rho_{22}P_j - \rho_{32}P_m) \quad (5)$$

where λ_1 and λ_2 are Lagrangean multipliers. Targeted level of domestic borrowing (B^*) is supposed to be 0. After the application of first order conditions on equation (5), we yield the following system of structural equations:

$$C = \phi_1(\rho_{12}T + \rho_{22}P_j + \rho_{32}P_m) - \phi_1S^* + \phi_2C^* \quad (6)$$

$$S = -\phi_2C^* + \phi_1S^* + (1 - \phi_1)(\rho_{12}T + \rho_{22}P_j + \rho_{32}P_m) \quad (7)$$

$$D = (1 - \phi_6)(\rho_{11}T + \rho_{21}P_j + \rho_{31}P_m) + \phi_6D^* \quad (8)$$

$$T = \rho_{11}\phi_4(D - \rho_{21}P_j - \rho_{31}P_m) - \phi_5\rho_{12}(S - S^*) + \phi_3T^* \quad (9)$$

This system of Equations (6) to (9) level the ground for gauging the fiscal response of foreign aid in Pakistan. From these structural equations, we have derived the following reduced-form equations for model A for each of the endogenous variables in the system.

$$S = \alpha_1C^* + \alpha_2S^* + \alpha_3T^* + \alpha_4D^* + \alpha_5P_j + \alpha_6P_m \quad (10)$$

$$D = \alpha_7D^* + \alpha_8P_j + \alpha_9P_m + \alpha_{10}T^* + \alpha_{11}S^* + \alpha_{12}C^* \quad (11)$$

$$T = \alpha_{13}T^* + \alpha_{14}D^* + \alpha_{15}P_j + \alpha_{16}P_m + \alpha_{17}S^* + \alpha_{18}C^* \quad (12)$$

$$C = \alpha_{19}T^* + \alpha_{20}D^* + \alpha_{21}P_j + \alpha_{22}P_m + \alpha_{23}S^* + \alpha_{24}C^* \quad (13)$$

Model B

In model A we have assumed that the government does not finance the recurrent expenditures (such as C and S) from domestic borrowing (B). In this model we assume that some portion of the recurrent expenditures (C and S) are being financed by domestic borrowing. The target borrowing (B^*) continues to be assumed to zero for all sets of equations.

The utility function can be described as

$$U = \beta_0 - \frac{\beta_1}{2}(D - D^*)^2 - \frac{\beta_2}{2}(T - T^*)^2 - \frac{\beta_3}{2}(S - S^*)^2 - \frac{\beta_4}{2}(C - C^*)^2 - \frac{\beta_5}{2}(B - B^*)^2 \quad (14)$$

The public decision makers are faced with the following two budget constraints, which are pivotal in utility maximization process:

$$D = (1 - \rho_{12})T + (1 - \rho_{22})P_j + (1 - \rho_{32})P_m + (1 - \rho_{42})B \quad (15)$$

$$S + C = \rho_{12}T + \rho_{22}P_j + \rho_{32}P_m + \rho_{42}B \quad (16)$$

where, $0 < \rho_i < 1$ for all i ($i = 12, 22, 32, 42$) and

$\rho_{12}, (1 - \rho_{12})$ associated with T implying that a certain portion of tax is going to finance D, S and C respectively. $(1 - \rho_{22})$ and $(1 - \rho_{32})$ associated with P_j and P_m respectively in equation 15 suggest that certain portions of P_j and P_m are allocated to finance D . Similarly, ρ_{22} and ρ_{32} in equation 16 imply that the remaining portion of P_j and P_m is going to finance C and S . $\rho_{42}, (1 - \rho_{42})$ associated with B denotes proportion of domestic borrowing assign to finance D, S and C respectively.

Maximizing utility function in equation (14) subject to constraints in (15) and (16) yields the following Lagrangean function as:

$$L = \beta_0 - \frac{\beta_1}{2}(D - D^*)^2 - \frac{\beta_2}{2}(T - T^*)^2 - \frac{\beta_3}{2}(S - S^*)^2 - \frac{\beta_4}{2}(C - C^*)^2 - \frac{\beta_5}{2}(B - B^*)^2 \quad (17)$$

$$+ \lambda_1(D - \rho_{12}T - \rho_{22}P_j - \rho_{32}P_m - \rho_{42}B) + \lambda_2(S + C - \rho_{12}T - \rho_{22}P_j - \rho_{32}P_m - \rho_{42}B)$$

Following Iqbal (1997), Franco-Rodriguez *et al.* (1998) and McGillivray (2000) it is assumed that the public decision makers set no target for domestic borrowing in Pakistan i.e., $B^* = 0$. After the application of first order condition on equation (17), we yield the following system of structural equations:

$$C = \phi_1(\rho_{12}T + \rho_{22}P_j + \rho_{32}P_m + \rho_{42}B) - \phi_1S^* + \phi_2C^* \quad (18)$$

$$S = (1 - \phi_1)(\rho_{12}T + \rho_{22}P_j + \rho_{32}P_m + \rho_{42}B) - \phi_2C^* + \phi_1S^* \quad (19)$$

$$D = \phi_8\rho_{41}^2D^* + \phi_9\rho_{41}^2(\rho_{11}T + \rho_{21}P_j + \rho_{31}P_m) - \phi_{10}\rho_{41}\rho_{42}(S - S^*) \quad (20)$$

$$T = \phi_3T^* - \phi_5P_j - \phi_6P_m - \phi_4B + \phi_{16}\rho_{11}D^* + \phi_7\rho_{12}S^* + \phi_7\rho_{12}C \quad (21)$$

$$B = \phi_{11}\rho_{41}D^* + \phi_{12}\rho_{42}C + \phi_{12}\rho_{42}S^* - \phi_{13}T - \phi_{14}P_j - \phi_{15}P_m \quad (22)$$

The estimation of system of equations (18) to (22) yields structural parameters of the model from which direct incremental effects of revenue variables including foreign aid effect on fiscal aggregates have been revealed. However, this estimation exercise fails to yield total impact of foreign aid, taxes and domestic borrowing on different budget aggregates. This situation makes it imperative to employ the reduced form set of equations so that total impact (direct and indirect) situation can be gauged. The reduced form solution of the structural equations (18) to (22) gives rise to the following system of equations:

$$C = \Psi_1T^* + \Psi_2S^* + \Psi_3P_j + \Psi_4P_m + \Psi_5D^* + \Psi_6C^* \quad (23)$$

$$B = \Psi_7T^* + \Psi_8S^* + \Psi_9P_j + \Psi_{10}P_m + \Psi_{11}D^* + \Psi_{12}C^* \quad (24)$$

$$T = \Psi_{13}T^* + \Psi_{14}S^* + \Psi_{15}P_j + \Psi_{16}P_m + \Psi_{17}D^* + \Psi_{18}C^* \quad (25)$$

$$S = \Psi_{19}S^* + \Psi_{20}C^* + \Psi_{21}T^* + \Psi_{22}P_j + \Psi_{23}P_m + \Psi_{24}D^* \quad (26)$$

$$D = \Psi_{25}D^* + \Psi_{26}T^* + \Psi_{27}S^* + \Psi_{28}P_j + \Psi_{29}P_m + \Psi_{30}C^* \quad (27)$$

Model C

For model A and model B it is assumed that $B^* = 0$. In contrast to all fiscal response studies related to Pakistan, we have dropped the assumption that public decision makers' sets zero targets for domestically borrowed money because it does not coincide with the real situation prevailing in the country.

The public utility function can be described as follows:

$$U = \beta_0 - \frac{\beta_1}{2}(D - D^*)^2 - \frac{\beta_2}{2}(T - T^*)^2 - \frac{\beta_3}{2}(S - S^*)^2 - \frac{\beta_4}{2}(C - C^*)^2 - \frac{\beta_5}{2}(B - B^*)^2 \quad (28)$$

The public decision makers face the following two budget constraints

$$D = (1 - \rho_{12})T + (1 - \rho_{22})P_j + (1 - \rho_{32})P_m + (1 - \rho_{42})B \quad (29)$$

$$S + C = \rho_{12}T + \rho_{22}P_j + \rho_{32}P_m + \rho_{42}B \quad (30)$$

where $0 < \rho_i < 1$ for all i 's ($i = 12, 22, 32, 42$) and $\rho_{12}, (1 - \rho_{12})$ associated with T implying that a certain portion of tax is going to finance D, S and C respectively. $(1 - \rho_{22})$ and $(1 - \rho_{32})$ associated with P_j and P_m respectively in equation (29) suggest that certain portions of P_j and P_m are allocated to finance D . Similarly, ρ_{22} and ρ_{32} in equation (30) imply that the remaining portion of P_j and P_m is going to finance C and S . $\rho_{42}, (1 - \rho_{42})$ associated with B denotes proportion of domestic borrowing assign to finance D, S and C respectively.

For maximizing (28) subject to (29) and (30) outcomes in the following Lagrange function:

$$L = \beta_0 - \frac{\beta_1}{2}(D - D^*)^2 - \frac{\beta_2}{2}(T - T^*)^2 - \frac{\beta_3}{2}(S - S^*)^2 - \frac{\beta_4}{2}(C - C^*)^2 - \frac{\beta_5}{2}(B - B^*)^2 + \lambda_1(D - \rho_{11}T - \rho_{21}P_j - \rho_{31}P_m - \rho_{41}B) + \lambda_2(S + C - \rho_{12}T - \rho_{22}P_j - \rho_{32}P_m - \rho_{42}B) \quad (31)$$

After applying first order condition on equation (31) we yield the following system of structural equations:

$$C = \phi_1(\rho_{12}T + \rho_{22}P_j + \rho_{32}P_m + \rho_{42}B) - \phi_1S^* + \phi_2C^* \quad (32)$$

$$S = (1 - \phi_1)(\rho_{12}T + \rho_{22}P_j + \rho_{32}P_m + \rho_{42}B) - \phi_2C^* + \phi_1S^* \quad (33)$$

$$D = \gamma_1\rho_{41}^2D^* + \gamma_2(\rho_{11}T + \rho_{21}P_j + \rho_{31}P_m + \rho_{41}B^*) - \gamma_3\rho_{41}\rho_{42}(S - S^*) \quad (34)$$

$$T = \phi_3T^* - \phi_5P_j - \phi_6P_m - \phi_4B + \phi_{16}\rho_{11}D^* + \phi_7\rho_{12}S^* + \phi_7\rho_{12}C \quad (35)$$

$$B = \delta_1B^* - \delta_3T - \delta_3P_j - \delta_6P_m + \delta_4\rho_{41}D^* + \delta_2\rho_{42}(C + S^*) \quad (36)$$

Equations (32) to (36) level the ground for gauging fiscal response of foreign aid in Pakistan. However, they can only provide direct impact of given categories of revenue variables including foreign aid on three types of government spending. In order to have a total impact (direct and indirect) analysis the following reduced form equations are attained from the set of structural equations that are given in equations (32) to (36).

$$C = \Theta_1T^* + \Theta_2B^* + \Theta_3S^* + \Theta_4P_j + \Theta_5P_m + \Theta_6D^* + \Theta_7C^* \quad (37)$$

$$B = \Theta_8B^* + \Theta_9T^* + \Theta_{10}S^* + \Theta_{11}P_j + \Theta_{12}P_m + \Theta_{13}D^* + \Theta_{14}C^* \quad (38)$$

$$T = \Theta_{15}T^* + \Theta_{16}B^* + \Theta_{17}S^* + \Theta_{18}P_j + \Theta_{19}P_m + \Theta_{20}D^* + \Theta_{21}C^* \quad (39)$$

$$S = \Theta_{22}S^* + \Theta_{23}C^* + \Theta_{24}T^* + \Theta_{25}B^* + \Theta_{26}P_j + \Theta_{27}P_m + \Theta_{28}D^* \quad (40)$$

$$D = \Theta_{29}D^* + \Theta_{30}T^* + \Theta_{31}B^* + \Theta_{32}S^* + \Theta_{33}P_j + \Theta_{34}P_m + \Theta_{35}C^* \quad (41)$$

2.4.4 Econometric Methodology

2.4.4.1 The Structural Equations

Our structural equations are a set of simultaneous equations. Before discussing the econometric procedure of estimation, a brief discussion on the simultaneous equations is in

order. In models, Y is a sole dependent variable and X 's is a set of explanatory variables, the X 's. Therefore, we can run cause-and-effect in models from X 's to Y . However, there may be situations such that a one-way or unconditional cause-effect is not meaningful. This infers that if Y is determined by X 's, in turn, determined by Y . If we have two-way relationship in a function, then a single equation model should not be employed for a description of the relationship between the two variables. Therefore, we use a multi-equation model, which would embrace separate equations in which X and Y would appear as endogenous variables although they might look as explanatory variables in other equations of the model. A system describing the joint dependence of variables (such is the case with our equations) is called a system of simultaneous equations.

2.4.4.2 The Choice of an Econometric Technique

The problem of choosing an econometric technique arises from the fact that any relationship in econometric theory almost certainly belongs to a system of simultaneous equation, whose parameters may be estimated using various econometric techniques. Traditionally researchers used the asymptotic properties of the coefficient estimates for ranking the techniques. An estimator $\hat{\beta}$ is a consistent estimator of the true parameter β , if it is asymptotically unbiased. It may be said that $\hat{\beta}$ is a consistent estimate of β if:

$$\lim_{n \rightarrow \infty} E[\hat{\beta}(n)] = \beta$$

And

$$\lim_{n \rightarrow \infty} [Var \hat{\beta}(n)] = 0$$

An asymptotically efficient estimator will be reliable and consistent and have a smaller variance than other estimators. Another valuable cause to be measured during the technique selection process is, that whether the technique uses more information compared to

other comparable techniques or not. It is intuitively clear that the more (less) information the technique uses in estimating the parameters, the more (less) efficient the estimate will be.

The consistency criterion does not allow us to rank various techniques. Because with the exception of the Ordinary Least Squares all other techniques (listed below) yield consistent estimates. However, using the criterion of asymptotic efficiency, we can order the methods as follows, starting from the effective method and proceeding with the methods yielding more efficient estimates.

(1) Ordinary Least Squares (OLS) method. This method is useless because the estimates are unreliable because there are some problems in estimation.

(2) The Instrumental Variable (IV) approach. This method uses some of the other equations in the system namely; some of the predetermined variables are also added in the equations of the system.

(3) The Two-Stage Least Squares (2SLS) and the Limited Information Maximum Likelihood (LIML) methods use a similar amount of information and efficiency. During the estimate, these techniques use all the predetermined indicators. These methods are certainly an improvement over the IV method.

(4) The Three-Stage Least Squares (3SLS) and the Full Information Maximum Likelihood (FIML) methods are by far the best approaches for estimating a simultaneous system of equation.

In this study, we shall not be using the FIML method. This method assumes that the whole specification of all the equations of the system is known among other things. Given the fact that our model is a partial one, that is, it does not explain all the economic variables of an economy, the application of the FIML method will not be appreciated. Given this, for the current study, we have used the 3SLS method of estimation. 3SLS technique helps to mitigate the issues of Heteroskedasticity and endogeneity. Endogeneity occurs when one of the

independent variables becomes endogenous variable. It may happen when regressor is associated with the error term. Therefore, the presence of endogeneity makes OLS coefficients biased. On the other hand, Heteroskedasticity occurs when the variance in error terms is not constant over time. In this study, heterogeneity and endogeneity both exist (see Table 2.4 and 2.5 in section 2.5.1), Hence, in order to capture the endogeneity and heterogeneity problem 3SLS is chosen. Other reasons for adopting this method are given in the next Section.

2.4.4.3 The Three-Stage Least Squares (3SLS)

This method uses more information in estimation than any other methods listed above because it uses all the indicators in the system of equations in mathematical form separately. That is why during the estimation process it considers the structure of equations in the system. The method is also an extension of the 2SLS and established by Zellner and Theil (1962). This methodology is applied to all equations at the same time and gives simultaneous estimates of all the parameters. In the opposite of single equation methods, the 3SLS has imposed restrictions on the values of the parameters in structure. If any model has a simultaneous equation system then it is almost certain that the random variable of any equation μ_i will be correlated with the random variable of the other equations. While the single equation techniques ignore this fact, while the 3SLS recognizes this process in computation. One point worth mentioning here is that computations of the 3SLS are much more complicated and data requirements are enormous. Because in a simultaneous equation system all the parameters are estimated at the same time, the sample must comprise more number of observations than the total number of parameters of the entire system.

As mentioned earlier, the 3SLS is an extension of the 2SLS and applies least square techniques in three stages. While the early two stages are similar as in the 2SLS, the third

stage includes the application of the least square to a set of changed equations in which the transformation is obtained from the residuals of the earlier stage.

The following are some of the assumptions of the 3SLS. Firstly, the complete specification of the system is known. Secondly, the assumption of non-autocorrelation is made. That is the $\mu_{i,t}$ (random terms) of each equation are serially independent. Thirdly, the assumption of contemporaneous dependence of random variables of the various relations of the system is made. Fourthly, the simultaneous equation system is over identified. If some equations are under identified we render them identifiable by changing their specification, or the equations are dropped. Goldberger (1964) mentions that the identifiers and definitional equations are also dropped after using them to eliminate the relevant variables from the system. In our system of equations most of the equations are over identified while few are exactly identified. None are under identified. Given the above discussion, for the present study, we have used the 3SLS method of estimation.⁴

2.4.5 Description of Data

To examine the fiscal response of foreign aid in Pakistan data from 1972 to 2016 has been used. The study has used tax revenue, development expenditure, socio-economic expenditures, current expenditure and domestic borrowing for analyzing the fiscal response of the economy. Current expenditures are calculated through the current expenditures on revenue account and current expenditures on capital account. Development expenditures are measured through development expenditure on capital account and socio-economic expenditures are calculated by the development expenditure on revenue account. Domestic borrowing is composed of permanent debt, floating debt and unfunded debt. Project aid is given for a specific project such as construction of specific roads, hospitals, and dams such as raising the height of the Mangla dam in Pakistan. However, program aid is may consist of

⁴ For more discussion on the 3SLS assumptions see Jorgenson and Laffont (1975) and Amemiya (1977).

non-food aid, food aid, relief assistance, and balance of payments supports. Data for all targeted variables is taken from Annual Budget Statements. However, data for actual values of current expenditures, social economic expenditures, development expenditures and tax revenue is taken from Pakistan's Economic survey 2015 and various reports of the State Bank of Pakistan. Data for domestic borrowing, project aid and program aid is sourced from Economic Survey of Pakistan. All the data is taken at constant prices of 2010 and the variables are transformed as a percent of GDP.

2.5 Results and Discussion

In the previous section the set of models for the present study has been developed. It is shown that both the reduced form and structural equations are estimated to get the total effects of foreign aid on the fiscal response indicators of Pakistan. This section presents the estimates of all the models and the interpretation of results. This section is separated into three sub-sections. Section 2.5.1 describes the results of diagnostic testing for endogeneity and Heteroskedasticity. Section 2.5.2 describes the results of the estimates of structural equations for all the models. Section 2.5.3 offers a discussion of the estimation of the reduced form equations for all the models.

2.5.1 Diagnostic Testing

As a preliminary analysis, two diagnostic tests are performed to confirm the existence of endogeneity and Heteroskedasticity issues in the models. Durbin Wu-Hausman test is used to test the endogeneity problem in the models. However, Breusch-Pagan-Godfrey test is used to determine the existence of heterogeneity in the models. The results of both tests are reported in sections 2.5.1.1 and 2.5.1.2.

2.5.1.1 The Durbin Wu-Hausman test: Regressor Endogeneity Test

For endogeneity, we apply the Durbin-Wu-Hausman test on the models. A regressor is endogenous if it is described by the instruments in the model, while, in adverse, exogenous variables are those which are not described by instruments. The null hypothesis is that there is no simultaneity problem. If the null is rejected, it infers that regressor and error term both are correlated. Therefore, in this way, OLS estimator could not produce reliable and efficient estimators. In this case, we can apply 2SLS methodology (Heckmen, 1979) and the generalized method of moment (GMM) (Mackinaly and Richardson, 1991). The results of Durbin Wu-Hausman test for all three models are given in table 2.4. It is apparent from Table 2.4 that there is an issue of simultaneity bias in all models and all the variables are endogenous in the systems.

Table 2.4 Results of Durbin Wu-Hausman Test

Models	Endogenous variables to treat as exogenous	Difference in J-Stat
Fiscal Response Model A	$D, C, S, T, D^*, C^*, S^*, T^*, P_j, P_m$	8.003 (0.045)
Fiscal Response Model B	$D, C, S, T, B, D^*, C^*, S^*, T^*, P_j, P_m$	7.899 (0.095)
Fiscal Response Model C	$D, C, S, T, B, D^*, C^*, S^*, T^*, B_t, P_j, P_m$	9.101 (0.586)

Note: Probability is given in parenthesis.

2.5.1.2 Heteroskedasticity Tests

Heteroskedasticity occurs when the variance of error terms is not constant with time. The null hypothesis for Heteroskedasticity is that the variance of error terms is constant with time, while alternative is variance of error terms is not constant with time. Harvey test, Breusch-Pagan-Godfrey, and Glejser tests are used to Heteroskedasticity in all three models. Table 2.5 describes the existence of Heteroscedasticity in each model. As our results are statistical

significant for every model, therefore, the null hypotheses of Breusch-Pagan-Godfrey test, Harvey test and Glejser test are rejected.

Table 2.5 Results of Heteroskedasticity Tests

Models	F-Stats for Breusch-Pagan-Godfrey test	F-Stats for Glejser Test	F-Stats for Harvey Test
Fiscal Response Model A	2.021 (0.065)	3.213 (0.006)	3.496 (0.003)
Fiscal Response Model B	1.981 (0.067)	3.097 (0.006)	3.213 (0.005)
Fiscal Response Model C	2.426 (0.025)	2.953 (0.008)	1.307 (0.267)

Note: Probability is given in parenthesis.

2.5.2 Results for Estimates of Structural Equations

Section 2.5.2.1 describes the analysis of findings of the first fiscal response model. Section 2.5.2.2 gives the interpretation of the results of fiscal response model B. The last section revolves around the interpretation of outcome of fiscal response model C.

2.5.2.1 Fiscal Response Model A

The estimated outcomes of the structural equations (6) to (9) are given in table 2.6. In this model, development expenditures, current expenditures, socio-economic expenditures and tax revenue are treated as endogenous variables. However, target variables project aid and program aid are taken as exogenous in the system. We have used 3SLS method to estimate model A.

Table 2.6 indicates that all the estimated parameters are significant and the estimated coefficients of budget constraint equations ρ_{12} , ρ_{22} and ρ_{32} are between 0 and 1. It confirms that available amount of tax revenue, project aid and program aid is distributed in development expenditure, current and socio-economic expenditures. Furthermore, all the parameters carry a positive sign as expected. It has been observed from literature that for consistency between fiscal response model and its empirical results the coefficients of budget

constraint equations must lie between zero and one and all the structural parameters must be positive (McGillivray and Outtara, 2005; Feeny and McGillivray, 2010).

$$D = B + (1 - 0.579)T + (1 - 0.111)P_j + (1 - 0.641)P_m$$

$$S + C = 0.579T + 0.111P_j + 0.641P_m$$

The tax parameter (ρ_{12}) is 0.579 which implies that 58 percent share of tax revenues flow to public spending budget under current and socio-economic expenditures head and 42 percent share of tax revenues flow to the investment budget under development expenditure head. It shows larger portion of tax revenue is utilized in current expenditures as compared to development purposes.

Table 2.6 Results of Structural Parameters of Model A (Equations 6 to 9)

Parameters	Estimates	t-values	Probabilities
ρ_{12}	0.579	15.571	0.0000
ρ_{22}	0.111	2.0243	0.0446
ρ_{32}	0.641	1.9623	0.0514
ϕ_1	0.747	18.355	0.0000
ϕ_2	0.252	6.6944	0.0000
ϕ_3	0.863	41.614	0.0000
ϕ_4	0.085	1.9296	0.0536
ϕ_5	0.317	3.1592	0.0018
ϕ_6	0.976	69.042	0.0000
Summary Statistics			
Equations	R-squared		
Socio-Economic Expenditure (<i>S</i>)	0.128		
Current Expenditure (<i>C</i>)	0.516		
Development Expenditure (<i>D</i>)	0.948		
Tax Revenue (<i>T</i>)	0.458		

The project aid parameter (ρ_{22}) carries the value 0.111 which indicates that only 11 percent share of project aid flow to public spending budget under current and socio-economic expenditures heads in Pakistan. However, 89 percent of project aid flows to public investment budget under development projects head. The result shows absence of fungibility in utilization of project aid in case of Pakistan. We cannot rely on this finding because model A is based on few restrictions and it is not depicting the true picture of economy. These findings are inconsistent with Mavrotos (2005) and Feeny and McGillivray (2010), as according to these studies larger share of project aid is used to finance current and socio-economic expenses in case of Uganda and Papa New Guinea respectively. The coefficient of Program aid (ρ_{32}) is 0.641 which reveals that 64 percent program aid flows to public spending budget under current and socio-economic expenditures heads and only 36 percent share of program aid flows to public investment budget under development expenditures head. This finding confirms the existence of fungibility in case of Pakistan.

We do not interpret the structural parameters (i.e. ϕ_1 to ϕ_6) in table 2.7 as they appear in various places in the structural equations (e.g., (6) to (9) above) so clear interpretation is difficult. For the incremental analysis, we substitute the values of all the parameters given in table 3.2 into the system of structural equations (6) to (9) to yield:

$$C = 0.432T + 0.083P_j + 0.478P_m - 0.747S^* + 0.252C^* \quad (6-a)$$

$$S = -0.252C^* + 0.747S^* + 0.146T + 0.028P_j + 0.162P_m \quad (7-a)$$

$$D = 0.009T + 0.021P_j + 0.008P_m + 0.976D^* \quad (8-a)$$

$$T = 0.035D - 0.031P_j - 0.012P_m - 0.183S + 0.183S^* + 0.863T^* \quad (9-a)$$

Table 2.7 Incremental Impact Results for Model A

Impact	Mechanism	Estimate
P_j on C	$\phi_1\rho_{22}$	0.083
P_j on S	$(1-\phi_1)\rho_{22}$	0.028
P_j on D	$(1-\phi_5)(1-\rho_{22})$	0.021
P_j on T	$-\phi_4(1-\rho_{12})(1-\rho_{22})$	-0.031
P_m on C	$\phi_1\rho_{32}$	0.478
P_m on S	$(1-\phi_1)\rho_{32}$	0.162
P_m on D	$(1-\phi_5)(1-\rho_{32})$	0.008
P_m on T	$-\phi_4(1-\rho_{21})(1-\rho_{32})$	-0.012
T on C	$\phi_1\rho_{12}$	0.432
T on S	$(1-\phi_1)\rho_{12}$	0.146
T on D	$(1-\phi_5)(1-\rho_{12})$	0.009

Equation 6-a shows project aid and program aid are positively affecting current expenditures as one additional rupee of project aid enhances current expenditures by 0.083 rupees and one additional rupee of program aid enhances current expenditures by 0.478 rupees. This finding is also consistent with in line with the findings of Njeru (2003) for Kenya and Martins (2010) for Ethiopia. Equation 7-a shows that one additional rupee of project aid increases socio-

economic expenditures by 0.028 rupees and one additional rupee of program aid increases socio-economic expenditure by Rs 0.162. Project aid and program aid are positively affecting current and socio-economic expenditures. This phenomenon is may be due to the reason that relevant authority is inefficient to generate sufficient resources domestically to fulfill the requirements of current and socio-economic expenditures. Therefore, in order to finance public spending under current and socio-economic expenditures head government has to rely on project aid and program aid. Equation 8-a shows that project and program aid are positively affecting development expenditures. One additional rupee of project aid increases development expenditure by 0.021 rupees and one additional rupee of program aid increases development expenditures by 0.008 rupees. Equation 9-a shows that project and program aid discourages tax collection effort as shown by the negative signs associated with both aid variables. The negative association between tax collection effort and foreign aid is also documented by McGillivray and Ouattara (2003) for Côte d'Ivoire, Feeny (2007) for Melanesian countries, Martins (2007) for Ethiopia and Bakhtiari *et al.* (2013) for Asian and Latin American countries. On the other hand, in contradiction, positive link between foreign aid and tax collection effort is reported in the studies done by Osei *et al.* (2003) for Ghana, Bhattarai (2007) for Nepal.

The whole discussion of fiscal response model A concludes that foreign aid is mostly used to finance non-development expenses that confirm the existence of fungibility in Pakistan. No doubt, this finding is not helpful for describing fiscal response of foreign aid because we have estimated a restricted model that is not depicting the real situation of Pakistan. Moreover, this model assumes that domestic borrowing can only be used to finance development expenditures, which is not applicable in case of Pakistan. The only rationale behind estimating model A is that we want to use model A as a reference model for comparison with other two models.

2.5.2.2. Fiscal Response Model B

In this model, we have assumed that along with development expenditures, domestic borrowing (B) is also used to finance current and socio-economic expenditures. The model utilizes symmetric utility function and B^* is still zero in this model. The results of fiscal response model B in table 2.8 show that the estimated coefficients of budget constraint equations are between 0 and 1. Moreover, all the structural parameters are significant and carry a positive sign as expected. The budget constraint equations for fiscal response model B are:

$$D = (1 - 0.778)T + (1 - 0.187)P_j + (1 - 0.321)P_m + (1 - 0.591)B$$

$$S + C = 0.778T + 0.187P_j + 0.321P_m + 0.591B$$

The tax revenue parameter (ρ_{12}) carries the value 0.778 which indicates that 78 percent share of total tax revenue flow to public spending budget under current and socio-economic expenditures head and only 22 percent of tax revenue flows to public investment budget under development purposes head. However, in fiscal response model A, only 57 percent share of tax revenue flows to public spending budget under current and socio-economic expenditures head. This finding of fiscal response model B implies that major share of tax revenue flows to finance non-development spending heads in Pakistan. This finding corroborates Heller (1975), Chishti and Hasan (1992), Otim (1996), and Franco-Rodrigues et al., (1998), and Feeny and McGillivary (2010).

The project aid parameter (ρ_{22}) is 0.187 which shows that only 19 percent share of project aid flows to public spending budget under current and socio-economic expenditures head and 81 percent share of project aid is allocated for financing development expenditures. The same finding is reported in studies done by Heller (1975), Khan and Hoshino (1992) Martins (2007) Senbet & Senbeta (2009) and Feeny & McGillivary (2010).

Table 2.8 Results of Structural Parameters of Model B (Equations 18 to 22)

Parameters	Estimates	t-values	Probabilities
ρ_{12}	0.778	4.279	0.0000
ρ_{22}	0.187	3.977	0.0001
ρ_{32}	0.321	2.364	0.0190
ρ_{42}	0.591	6.348	0.0000
ϕ_1	0.678	8.941	0.0000
ϕ_2	0.315	4.441	0.0000
ϕ_3	0.646	8.627	0.0000
ϕ_4	0.056	2.661	0.0084
ϕ_5	0.481	4.061	0.0001
ϕ_6	0.311	2.491	0.0148
ϕ_7	0.661	3.096	0.0022
ϕ_8	1.711	12.232	0.0000
ϕ_9	0.134	2.542	0.0118
ϕ_{10}	0.181	2.177	0.0312
ϕ_{11}	0.168	2.172	0.0313
ϕ_{12}	0.205	3.624	0.0004
ϕ_{13}	0.121	4.164	0.0000
ϕ_{14}	0.381	0.198	0.0571
ϕ_{15}	0.239	1.837	0.0676
ϕ_{16}	0.582	2.386	0.0180
Summary Statistics			
Equations		R-squared	
Socio-Economic Expenditure (<i>S</i>)		0.629	
Current Expenditure (<i>C</i>)		0.522	
Development Expenditure (<i>D</i>)		0.955	
Tax Revenue (<i>T</i>)		0.572	
Domestic Borrowing (<i>B</i>)		0.516	

The estimate of ρ_{32} (coefficient of Program aid) is 0.321, which indicates that 32 percent share of program aid flows to public spending budget under current and socio-economic expenditures head. However, 68 percent share of program aid flows to public investment budget under development projects head. This confirms 32 percent share of program aid is fungible in case of Pakistan. Our result shows that program aid is more fungible as compare

to project aid. Mavrotas (2005) highlights that in case of Uganda the extent of fungibility in program aid is 57 percent and Mavrotas and Ouattara (2003) report 42% of program aid is fungible in Cote d'Ivoire. In case of domestic borrowing (ρ_{42}) 59 percent of domestic borrowing flows to public spending budget under current and socio economic expenditures head and only 41 percent of domestic borrowing flow to public investment budget under development expenditures head. The scenario in Pakistan is that tax-GDP ratio is quite low, which is between 10 to 14 percent from last five decades, this implies that tax revenue is not adequate to meet the expenses. Therefore, government of Pakistan relay on internal borrowing to fulfill its non-development expenditures. Similar type of results has been documented by Franco and Rodriguez (1998), Mavrotas and Ouattara (2003), and Senbet and Senbeta (2009).

We do not interpret other structural parameters (ϕ_i 's) of table 2.8. For the incremental analysis, we substitute the values of all the parameters given in table 2.9 into the system of structural equations (18) to (22) to yield:

$$C = 0.528T + 0.127P_j + 0.218P_m + 0.401B - 0.678S^* + 0.315C^* \quad (18-a)$$

$$S = 0.251T + 0.061P_j + 0.103P_m + 0.189B - 0.315C^* + 0.678S^* \quad (19-a)$$

$$D = 0.287D^* + 0.005T + 0.018P_j + 0.015P_m - 0.043S + 0.043S^* \quad (20-a)$$

$$T = 0.647T^* - 0.481P_j - 0.311P_m - 0.056B + 0.129D^* + 0.515S^* + 0.515C \quad (21-a)$$

$$B = 0.069D^* + 0.121C + 0.121S^* - 0.121T - 0.381P_j - 0.239P_m \quad (22-a)$$

Table 2.9 Incremental Impact Results for Model B

Impact	Mechanism	Estimate
P_j on C	$\phi_1 \rho_{22}$	0.127
P_j on S	$(1 - \phi_1) \rho_{22}$	0.061
P_j on D	$\phi_9 (1 - \rho_{42})^2 (1 - \rho_{22})$	0.018
P_j on T	$-\phi_5$	-0.481
P_j on B	$-\phi_{14}$	-0.381
P_m on C	$\phi_1 \rho_{32}$	0.218
P_m on S	$(1 - \phi_1) \rho_{32}$	0.103
P_m on D	$\phi_9 (1 - \rho_{42})^2 (1 - \rho_{32})$	0.015
P_m on T	$-\phi_6$	-0.311
P_m on B	$-\phi_{15}$	-0.239
T on C	$\phi_1 \rho_{12}$	0.528
T on S	$(1 - \phi_1) \rho_{12}$	0.251
T on D	$\phi_9 (1 - \rho_{42})^2 (1 - \rho_{12})$	0.005
T on B	$-\phi_{13}$	-0.121
B on C	$\phi_1 \rho_{42}$	0.401
B on S	$(1 - \phi_1) \rho_{42}$	0.189
B on T	$-\phi_4$	-0.056

Equation 18-a shows that program aid and project aid are affecting positively to current expenditures. One additional rupee of project aid increases current expenditures by

0.127 rupees respectively. However, one additional rupee of program aid leads to an increase current expenditures by 0.218 percent. These findings are in line with the finding of Feeny & McGillivray (2010) in Papua New Guinea and Iqbal (1997) in Pakistan. One additional rupee of tax revenue increases current expenditures by 0.528 rupees and one additional rupee of domestic borrowing increases current expenditures by 0.401 rupees.

Equation 19-a shows program aid and project aid are again affecting positively to socio-economic expenditures. One additional rupee of project aid upsurges socio-economic expenditures by 0.061 rupees and one additional rupee of program aid upsurges socio-economic expenditures by 0.103 rupees. Similar is the case for tax revenue and domestic borrowing, as one additional rupee increase of tax revenue increases socio-economic expenditures by 0.251 rupees and one additional rupee of domestic borrowing increases socio-economic expenditures by 0.189 rupees. Low tax-GDP ratio is the main reason behind this positive effect of foreign aid on non-development expenditures because government is bound to transfer some portion of project and program aid to fulfill its needs of resources under current and socio-economic expenditures heads.

Equation 20-a shows that program aid and project aid are affecting development expenditure positively. One additional rupee of project aid and program aid leads to increase in development expenditure by 0.018 and 0.015 rupees respectively. Tax revenue is also positively associated with development expenditure, although the strength of the relationship is weak as one additional rupee of tax revenue increases development expenditures by 0.005 rupees. Results in equation 21-a show that both categories of foreign aid are negatively affecting tax revenue. It means one additional rupee of both types of aid variables leads to discouraging tax revenue collection effort by 0.481 and 0.311 rupees respectively. Results from fiscal response model A and model B indicate that foreign aid in both forms is tax revenue collection effort discouraging agent in Pakistan. Domestic borrowing is also

negatively associated with tax collection effort as one additional rupee of domestically borrowed money leads to reduction in tax collection effort by 0.056 rupees.

Equation 22-a is also showing negative association between aid variables and domestic borrowing which implies that foreign aid substitutes domestic borrowing in Pakistan. The result shows one additional rupee of project aid and program aid increases domestic borrowing by 0.381 and 0.239 rupees respectively. However, the adverse effect of project aid on domestic borrowing is relatively larger as compared to program aid.

2.5.2.3 Fiscal Response Model C

Fiscal response model C assumes that domestic borrowing can be used to finance public investment under development projects head along with public spending under current and socio-economic expenditures head. Furthermore, targeted domestic borrowing is not equal to zero. Table 2.10 shows the results for fiscal response model C. All the parameters are positive and significant. Furthermore, the estimated coefficients are between 0 and 1 as required.

The budget constraint equations for fiscal response model C are:

$$D = (1 - 0.761)T + (1 - 0.173)P_j + (1 - 0.298)P_m + (1 - 0.672)B$$

$$S + C = 0.761T + 0.173P_j + 0.298P_m + 0.672B$$

The tax parameter (ρ_{12}) is 0.761 which implies that 76 percent of tax revenues flow to public spending under current and socio-economic heads while 24 percent of the taxes flows to public sector development programs. This finding implies that the availability of domestic borrowing and foreign aid persuades the public decision makers in Pakistan to

Table 2.10 Results of Structural Parameters of Model C (Equations 32 to 36)

Parameters	Estimates	t-values	Probabilities
ρ_{12}	0.761	4.938	0.0000
ρ_{22}	0.173	2.861	0.0047
ρ_{32}	0.298	2.411	0.0063
ρ_{42}	0.672	4.181	0.0000
ϕ_1	0.766	11.618	0.0000
ϕ_2	0.233	3.781	0.0002
ϕ_3	0.655	9.382	0.0000
ϕ_4	0.213	2.694	0.0081
ϕ_5	0.399	3.569	0.0004
ϕ_6	0.463	2.427	0.0161
ϕ_7	0.341	2.708	0.0074
ϕ_{16}	0.245	2.306	0.0215
γ_1	0.496	11.891	0.0000
γ_2	0.212	3.512	0.0005
γ_3	0.133	2.661	0.0203
δ_1	0.529	3.905	0.0001
δ_2	0.174	2.463	0.0148
δ_3	0.116	3.981	0.0006
δ_4	0.223	1.949	0.0516
δ_5	0.281	4.234	0.0000
δ_6	0.699	1.851	0.0764
Summary Statistics			
Equations		R-squared	
Socio-Economic Expenditure (<i>S</i>)		0.391	
Current Expenditure (<i>C</i>)		0.537	
Development Expenditure (<i>D</i>)		0.957	
Tax Revenue (<i>T</i>)		0.503	
Domestic Borrowing (<i>B</i>)		0.688	

allocate more of tax money in financing the current budget. The tragedy with the country is that on one hand its overall tax to GDP ratio remained low i.e. it ranged between 9 to 14 percent approximately during the sample period of the study while on the other hand the economic management team of the country failed to make development-oriented use of the

tax revenue. this finding is in line with Heller (1975) for eleven African countries, Gang and Khan (1991) for India, Chishti and Hasan (1992), Iqbal (1997) and Franco-Rodrigues, et al., (1998) for Pakistan and Feeny and McGillivray (2010) for Papua New Guinea. However, McGillivray (2000) reports that only one third of tax revenue is allocated to the public consumption spending in Pakistan, which is surprising, and it points to some inherent problem in data and model estimation as the government statistics refute this evidence.

The estimate of coefficient of project aid (ρ_{22}) is 0.173 which shows that almost 17 percent of project aid goes to current and socio-economic expenditure in Pakistan. This finding confirms that project aid is development oriented in the country as 83 percent of project aid is utilized on the financing of development expenditures. Similar evidence has been documented by some previous studies related to various developing countries including Pakistan (see, for example, Heller, 1975; Khan and Hoshino, 1992; McGillivray, 2000; Ouattara, 2006a; Martins, 2007; Senbet and Senbeta, 2009; Feeny and McGillivray, 2010). Nonetheless, Feeny (2007) reports a contradictory finding for Melanesia⁵ where aid loans are mainly used in financing current public spending.

The estimate of program aid (ρ_{32}) is 0.298 which indicates that almost 30 percent of program aid is used in funding non-development spending. This confirms that program aid and project aid both are fungible in the country but project aid is less fungible as compare to program aid. If we compare the results of fiscal response model C with the estimates of fiscal response model B we conclude that the extent of fungibility of both types of foreign aid is less as compared to fiscal response model B. Finally, the estimate of domestic borrowing (ρ_{42}) is 0.672 which indicates that 67 percent of the domestically borrowed fund is consumed by current and socio-economic spending which leaves 33 percent for public sector investment

⁵ Four sovereign states, namely, Fiji, Papua New Guinea, Vanuatu, and Solomon Islands are included in this region.

in the presence of foreign aid. This finding is reliable with the studies done by Mavrotas and Ouattara (2003) and Senbet and Senbeta (2009).

As the aim of the study is to estimate the effect of foreign aid on fiscal behavior in Pakistan, therefore, we skip the interpretation of the structural parameters (i.e. ϕ s, γ s and δ s) given in table 2.10. For the incremental analysis, we have substituted the values of all the parameters given in table 2.11 into the system of structural equations (32) to (36).

$$C = 0.584T + 0.133P_j + 0.229P_m + 0.516B - 0.766S^* + 0.233C^* \quad (32-a)$$

$$S = 0.178T + 0.041P_j + 0.069P_m + 0.157B - 0.233C^* + 0.766S^* \quad (33-a)$$

$$D = 0.081D^* + 0.051T + 0.176P_j + 0.149P_m + 0.069B^* - 0.029(S - S^*) \quad (34-a)$$

$$T = 0.656T^* - 0.399P_j - 0.464P_m - 0.214B + 0.058D^* + 0.259S^* + 0.259C \quad (35-a)$$

$$B = 0.529B^* - 0.116T - 0.281P_j - 0.699P_m + 0.073D^* + 0.117(C + S^*) \quad (36-a)$$

From equation 32-a and 33-a, we can see that program aid, project aid, tax revenue, and domestic borrowing are positively affecting current expenditures and socio-economic expenditures. One additional rupee of project aid brings 0.133 rupees upsurge in current expenditure and 0.041 rupees increase in socio-economic expenditures. If we look at the behavior of program aid, we can see that one additional rupee of program aid leads to increase public spending under current and socio-economic expenditures head by 0.229 rupees and 0.069 rupees. It is obvious that the extent of fungibility is higher in the case of program aid as compared to project aid. Furthermore, one additional rupee of tax collection effort tends to increase current expenditures by 0.584 rupees and socio-economic expenditures by 0.178 rupees. Overall, one additional rupee of tax revenue increases public spending under

Table 2.11 Incremental Impact Results for Model C

Impact	Mechanism	Estimate
P_j on C	$\phi_1 \rho_{22}$	0.133
P_j on S	$(1 - \phi_1) \rho_{22}$	0.041
P_j on D	$\gamma_2 (1 - \rho_{22})$	0.176
P_j on T	$-\phi_5$	-0.399
P_j on B	$-\delta_5$	-0.281
P_m on C	$\phi_1 \rho_{32}$	0.229
P_m on S	$(1 - \phi_1) \rho_{32}$	0.069
P_m on D	$\gamma_2 (1 - \rho_{32})$	0.149
P_m on T	$-\phi_6$	-0.464
P_m on B	$-\delta_6$	-0.699
T on C	$\phi_1 \rho_{12}$	0.584
T on S	$(1 - \phi_1) \rho_{12}$	0.178
T on D	$\gamma_2 (1 - \rho_{12})$	0.051
T on B	$-\delta_3$	-0.116
B on C	$\phi_1 \rho_{42}$	0.516
B on S	$(1 - \phi_1) \rho_{42}$	0.157
B on T	$-\phi_4$	-0.214

non-development expenditures head by 0.762 rupees this situation confirms that in Pakistan a larger proportion of tax revenue flows to the heads of non-development expenditures. In case of domestic borrowing, the results are quite surprising as one additional rupee of domestic borrowing increases current expenditures by 0.516 rupees and socio-economic expenditures by 0.157 rupees in the presence of foreign aid. As the major share of domestic borrowing

flows to fulfill public spending needs under current and socio-economic expenditures, hence their remains little role for domestic borrowing to play in enhancing public sector development programs in the country. This clearly indicates that non- development needs of the government mainly finance through domestic borrowing, which creates a serious problem with regard to the use of domestic debt at the government level. This is the reason we have been observing the phenomenon of the rise in domestic debt and a decline in public investments under development projects.

Equation 34-a shows that one additional rupee of project aid and program aid increases public investment under development expenditures head by 0.176 and 0.149. In case of tax revenue results indicate that tax revenue is contributing productively, although the strength of relationship is weak as one additional rupee of tax revenue increases development expenditures by 0.051 rupees that is not satisfactory in case of developing country like Pakistan. Equation 35-a shows that project aid and program aid are adversely affecting tax revenues. Their incremental effect is quite noticeable and especially program aid has been proved to bring great reduction in tax effort as compare to project aid. One additional rupee of project aid and program aid discourages tax collection effort by 0.399 and 0.464 rupees respectively. This finding again proves that foreign aid is one of the hurdles in the way of increasing tax to GDP ratio in the country. Domestic borrowing is again negatively associated with tax revenue as one addition rupee in the form of domestic borrowing leads to tax reduction by 0.214 rupees. This implies that when government is able to get domestic loans to meet its needs then it is least interested to enhance tax collection. In other words, we can say that the governments in Pakistan have attempted to keep tax to GDP ratio low and they continue to increase domestic borrowing for meeting their spending requirements.

Finally, foreign aid has emerged as a substitute for domestic borrowing as the incremental impact of both the components of foreign aid is negative. Program aid influences

the domestic borrowing bigger as compared with the project aid. One additional rupee of project aid declines domestic borrowing by 0.281 rupees, whereas, one additional rupee of program results in declining domestic borrowing 0.699 rupees. This type of relationship between foreign aid and domestic borrowing is theoretically reasonable and accepted because the government has the opportunity to get foreign aid and it is least interesting to go for increasing domestic borrowing. Whenever government has the opportunity to get foreign aid, it does not show its interest in getting domestic debt. Foreign aid results in an increase in the inflow of foreign exchange, which is always, considered a blessing for developing countries like Pakistan.

2.5.3 Results for Estimates of Reduced Form Equations

As we know structural parameters measure only the direct effect, the reduced-form parameters measure the total effect, direct and indirect, of a change in the predetermined variables on the endogenous variables. It is important, therefore, to report the reduced-form estimates so that we identify the total effect of a change in the foreign aid indicators on the dependent variables. In this section, we have reported the estimates of project aid and program aid and interpretation of results of all the reduced-form equations.

First we analyze the overall impact of project aid on three types of public spending categories along with tax revenue for the case of fiscal response model A. It is obvious from table 2.12 that the total effect of project aid on current, socio-economic and development spending is positive but it is less than its direct impact on current spending and socio-economic spending, whereas, in case of development expenditures it surpasses its direct effect. Furthermore, total effect of project aid on development expenditure has a dominant effect on current and socio-economic expenditures in Pakistan. This finding underlines relatively more pro-development use of project aid in the country. The signs of estimated

reduced form project aid parameter are negative for the tax revenue implying adverse total effect of project aid on tax revenues. However, the extent of negative effect is slightly greater than the direct impact of tax revenue. In case of model B and model C total effect of project aid on current spending, socio-economic spending and development spending is positive but it is more than its direct impact in case of current spending and socio-economic spending. However, it tends to fall in case of development spending vis-à-vis its direct impact.

Table 2.12 Reduced Form Estimates of Foreign Aid for Models A to C

Impact	Model A (equations 10-13)	Model B (equations 23-27)	Model C (equations 37-41)
P_j on C	0.069	0.455	0.256
P_m on C	0.461	0.056	0.369
P_j on S	0.023	0.103	0.179
P_m on S	0.156	0.017	0.119
P_j on D	0.177	0.013	0.172
P_m on D	0.069	0.055	0.144
P_j on T	-0.033	-0.648	-0.404
P_m on T	-0.041	-0.313	-0.411
P_j on B		-0.169	-0.424
P_m on B		-0.644	-0.738

Note: we have estimated the reduced-form parameters from the system of structural equations.

Furthermore, in model B the total effect of project aid on public spending under current and socio-economic expenditure head dominate its impact on public investment under development projects in Pakistan. This finding confirms the existence of fungibility as most proportion of project aid flow to public spending under current and socio-economic expenses head in the country. The signs of estimated reduced form project aid parameters are negative

in case of tax revenue and domestic borrowing, which implies that total effect of project aid, is adverse for tax revenue and domestic borrowing. However, the magnitude of negative impact is less in case of domestic borrowing but it is more in case of tax revenue as compared to the direct impact analysis. Model C results for total impact are quite similar to the outcomes of fiscal response model B. The total effect of project aid on all type of expenditures are again positive and it is more than its direct impact in case of current and socio-economic expenditures and less than in case of development expenditure. The total effect of project aid on non-development expenditures again dominate the total impact on development expenditure and confirm the phenomenon of fungibility in Pakistan. The signs of estimated reduced form project aid parameter are negative for the tax revenue and domestic borrowing implying adverse total effect of project aid on both tax revenues and domestic borrowing. However, the extent of negative impact is greater than the direct impact of tax revenue and domestic borrowing.

In case of fiscal response model A, total impact of program aid is also similar to that project aid on three categories of public expenditure in Pakistan. This finding strengthens the direct impact case that program aid mostly flows to public spending under current and socio-economic expenditures heads of the budget in Pakistan. Finally, total impact of program aid on tax revenue is negative but its extent is more than that in case of direct impact. In fiscal response model B, the total effect of program aid on current, socio-economic and development spending is positive but it is less than its direct impact on current spending and socio-economic spending, whereas, in case of development expenditures it surpasses its direct effect. However, the total impact of program aid on non-development expenditures again dominates the total impact on development expenditure and confirms the phenomenon of fungibility in Pakistan. This finding strengthens the direct impact case that program aid mainly goes to the non-development spending sides of the budget. Total negative impact of

program aid on tax revenue and domestic borrowing exceeds their direct effect on their counterparts. Finally, in case of fiscal response model C the total impact of program is also similar to that of project aid on public investment under development expenditures and public spending for current and socio-economic expenditures heads in Pakistan. This finding strengthens the direct impact case that program aid mainly goes to the non-development spending sides of the budget. Total negative impact of program aid on domestic borrowing exceeds its direct effect on its counterpart. Finally, total impact of program aid on tax revenue is negative but its extent is less than that of direct impact case.

2.6 Conclusions and Policy Implications

The present study has analyzed public sector fiscal response of Pakistan's economy in the presence of foreign aid. The study has decomposed foreign aid into program aid and project aid. To examine the effect of project aid and program aid on budgetary variables the study has used three fiscal response models. In doing so, the study has considered the problems associated with the study done by Heller (1975) and similar kinds of studies done by others (see section four). It is shown that to be able to obtain a meaningful result for the effect of foreign aid, the problems mentioned in section four are to be considered and used as a basis to develop a model, which can account for these problems. In this study public expenditures are comprised of current expenditures, socio-economic expenditure and development expenditures. However, revenues include tax revenue and domestic borrowings. Consistent time series annual data for the period 1972 to 2016 has been employed for analyzing the fiscal response of foreign aid in Pakistan. In this study for the empirical task, we have used the 3SLS method of estimation. As we know, the structural parameters show only the indirect effects, reduced-form parameters show total effect (both direct and indirect).

Therefore, to obtain the total effect of project aid and program aid, the study has calculated the required reduced form parameters from the system of structural equations.

The results of structural equations indicate that variables on public spending under current and socio economic expenditure and public investment under development expenditures head are positively and significantly related to project aid and program aid. Results further reveal that major portions of both types of foreign aid flow to fulfill the budgetary of public spending under current and socio-economic expenditures heads. This shows that project aid and program aid are fungible in Pakistan although the extent of fungibility is high for program aid as compared to project aid. Findings of fiscal response model A indicate that when domestic borrowing is only used for investment purposes then project aid is 11 percent fungible as 11 percent of project aid flows to public spending under current and socio-economic expenditures heads. When we relax this assumption in model B & C then the extent of fungibility goes high as 18 and 17 percent respectively. Also, when domestic borrowing is not accessible for non-development expenditures then program aid is 64 percent fungible in case of Pakistan. Again when we relax this assumption in model B & C then 32 and 29 percent program aid is used for non-development expenditures. This shows that foreign aid is fungible in Pakistan but still the main share of foreign aid is distributed for development expenditures.

All three models reveal that the inflow of foreign economic assistance in the form of project aid and program aid results in reducing tax revenues, which confirms that foreign economic assistance plays the role of tax restricting agents in Pakistan. The inflow of foreign aid has made the governments complacent and blunted the needed efforts to increase the tax/GDP ratio. While the impact of tax revenue is positive for current, socio-economic expenditures and development expenditures. However, a major amount of tax revenue flows to public spending under current and socio-economic expenditures heads and a very small

portion of tax revenues flows to public investment under development expenditures head. In model B & C, the negative relationship of tax revenue with domestic borrowings implies that the low tax/GDP ratio in Pakistan is the primary reason for a rapid increase in domestic borrowing in Pakistan. Finally, domestic borrowing is also mainly earmarked for non-development expenditures as shown by budget constraint equations of Model B & C, because major share of domestic borrowing flows to public spending under current and socio-economic expenditures heads. This indicates less productive use of the ever-increasing burden of domestic debt and interest payments.

Some important policy recommendations are put forward based on the results of the study. Firstly, a major portion of project aid and program aid flow to budgetary heads of public spending under current and socio-economic expenditures and a very low portion of aid flows to the public investment under development spending head that is why Pakistan is unable to get full productive use of foreign aid for development purposes. In this regard, the need is to revise the current foreign aid utilization policy in Pakistan so that major share of foreign aid should be allocated for development purposes in the country. Secondly, the negative association between foreign aid and tax revenue reveals that foreign aid inflows are discouraging tax collection effect, which suggests that government should revise its current fiscal management stance in such a manner that tax to GDP can be increased so that the reliance of government on foreign aid may come down. Thirdly, the results show that major portion of tax revenue flows to public spending under current and socio-economic expenditures heads, which indicates that our government remained unsuccessful in utilizing tax revenue for productive purposes. In this situation, there is a need for such a fiscal strategy that leads to better utilization of tax revenue in financing public sector investment efficiently. Fourthly, domestic borrowing is mostly used for non-development expenditures, which clearly indicates the misuse of domestic resources. Hence, there is a need to formulate such

rules which restrict the government to use the expenditure efficiently and make more production-oriented uses of domestic resources. Finally, the government should increase tax revenue collection effort so that extent of domestic borrowing can be reduced. For this purpose, the government should introduce some reforms in the taxation system such that all the sectors of the economy come under the income tax net so that the tax base gets widen.

Chapter 3

Essay 2: FISCAL POLICY, INSTITUTIONS, AND MACROECONOMY OF PAKISTAN

3.1 Introduction

Economic policies can broadly be classified into fiscal and monetary policies. Though adhered earlier in economic literature, these were unprecedented economic circumstances in 1930s that brought the dire need of fiscal policy to play an important role in achieving sustainable economic growth. However, the economic stagnation of the 1970s and exacerbated volatility all over the world in the subsequent decades⁶ provoked apprehension about the stabilization role of fiscal policy. As the fiscal policy contributes significantly to influencing economic activity, this issue has been extensively discussed among both academics and policy makers. The key objective of fiscal policy is to take decision regarding expenditure and revenue in a way that positively affects the economy. Any exogenous shock in expenditures and revenues can affect the macroeconomic variables mainly inflation rate, interest rate, output, exchange rate, aggregate demand, saving, investment, and income distribution.

To examine the impacts of fiscal policy shocks, the existing literature is divided into the Neo-Classical school of thoughts and the new Keynesian school of thought. Both schools of thought anticipate that an upsurge in government expenditure positively affects the output level while an upsurge in taxation negatively affects the output level. However, neoclassical theory reasoned that an upsurge in government expenditure decrease private consumption due to the miserable wealth effect, while the new Keynesian theory exposed that an upsurge in

⁶These include the oil prices shocks in the 1970s and international debt crises, credit crunch, and deterioration of commodity prices in the 1980s.

government expenditure increases private consumption due to the Ricardian behavior. Furthermore, it is commonplace in economics that deficits resulting from expansionary fiscal policies are inflationary. Fiscal policies can lead to both current and persistent increases in the price level. The current price level responds to an increase in aggregate demand owing to deficits. However, a persistent increase in price level is associated with the sustained growth of money supply. Fiscal deficit financed by raising seignorage or by selling government bond to central bank increase inflation through its impact on the monetary base [Abel and Barnanke, 2003].

As Pakistan is a developing economy and like other developing countries, it is also confronted with the twin targets of deficit and debt reduction. Extensive efforts have been made in the decade of 2000s to reduce the hostility of debt and deficit for the economy. The fiscal position of Pakistan improved considerably as the overall deficit as a percentage of GDP averaged nearly at 3.8 percent in 2001-2010 as compared to the 7 percent during the 1990s and it is 2.3 percent of GDP in the first half of FY2018. Yet the improvement can be momentary⁷ as public debt in Pakistan tends to show volatile. Total public debt was 91.7 percent of GDP in 1990 that shrinks to 78.9 percent of GDP in 2000, public debt has reduced considerably to 66.3 percent in the first half of FY2018, yet expected exchange rate depreciation, and prospects of both current account and budget deficit widening are likely to offset this reduction. Though the dynamic impacts of fiscal policy shocks in Pakistan have been explored quite extensively at national level, yet adequate knowledge of the functioning of fiscal policy is far incomplete at the provincial level. In this context, one of the objectives of this essay is to scrutinize the impacts of the fiscal policy shocks on macroeconomy of Pakistan at national level as the significance stems from the fact that revenue and expenditure shocks contribute significantly to bringing variation in key macroeconomic variables at

⁷The improvement in budgetary position is because of inflow of aid due to Pakistan being an ally in war against terror and for earthquake stricken areas may be among the reasons for this improved level of deficit.

national level. This study is also examining the influence of fiscal policy shocks on macro economy of Pakistan via institutions, which is a new contribution to literature of fiscal policy shocks, and macroeconomy of Pakistan. The study is not only analyzing the effect of fiscal policy shocks on the key macroeconomic variables at national level but it also analyzes the influence of fiscal policy shocks on output level at provincial level because fiscal policy shocks favorably affect output level in four provinces of Pakistan. This study is also determining the effect of fiscal policy and on output level via institutions at the provincial level. Furthermore, this study is a pioneer in estimating the impact of fiscal policy shocks on output level at the provincial level in Pakistan.

The organization of this chapter is as follows: section 3.2 provides an analysis of public finance at the federal and provincial level; section 3.3 consists of a survey of literature; section 3.4 describes the details of SVAR framework to be used in the study and detail discussion on data, section 3.5 describes the detailed discussion of results; and finally section 3.6 gives the conclusion with some important policy recommendations.

3.2 An Analysis of Public Finance at Federal and Provincial Level

Pakistan's perennial fiscal deficit, and hence the ever-increasing debt burden, is considered to be one of the most serious problems of the economy, affecting a number of other variables as well. Fiscal deficit and debt burden are playing the role of major hurdles in development and macroeconomic stability in the country. In this section, we tried to analyze the budgetary position for the overall economy and provincial economy in Pakistan from FY1982 to FY2018. Table 3.1 takes into account the information about revenues and expenditures of government of Pakistan at the consolidated, federal and provincial levels. The table presents the decade wise analyses from FY1982 to FY2010 and yearly basis analysis from FY2011 to FY2018 of the major fiscal aggregates of Pakistan.

Table 3.1 Expenditures and Revenues Profile at Federal and Provincial Level as Percent of GDP

Revenues Expenditures Profile		1982- 1990	1991- 2000	2001- 2010	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Total Revenues	Total	21.74	21.32	18.29	18.36	18.75	19.30	20.66	20.32	21.54	21.90	22.20
	Federal	16.23	15.44	12.91	11.73	12.09	12.40	13.61	13.37	13.79	14.28	13.65
	Provincial	5.51	5.87	5.38	6.63	6.65	6.90	7.05	6.95	7.75	7.62	8.54
Tax Revenue	Total	14.28	15.28	12.98	14.77	15.68	15.26	15.84	16.64	18.66	18.63	19.43
	Federal	11.00	10.43	8.87	8.94	9.71	9.15	9.47	10.27	11.41	11.45	11.82
	Provincial	0.62	0.54	0.47	0.35	0.53	0.67	0.76	0.75	0.96	1.01	1.17
provincial share in federal revenue as percent of GDP		2.43	4.28	3.64	5.47	5.44	5.43	5.61	5.62	6.29	6.17	6.45
Non-Tax Revenue	Total	6.96	4.78	4.82	3.60	3.07	4.05	4.82	3.68	2.81	3.29	2.76
	Federal	4.73	3.71	3.56	2.79	2.39	3.25	4.14	3.11	2.38	2.83	1.83
	Provincial	2.46	1.07	1.26	0.81	0.68	0.80	0.68	0.58	0.44	0.46	0.93
Total Expenditures	Total	31.64	28.77	22.36	19.25	19.79	22.00	21.45	20.67	20.52	21.82	22.29
	Federal	24.30	21.76	16.13	13.36	13.03	15.38	15.00	13.74	13.25	13.69	13.68
	Provincial	7.33	7.01	6.24	5.89	6.76	6.62	6.45	6.93	7.27	8.13	8.61
Current Expenditures	Total	23.28	22.87	18.11	16.26	15.91	16.69	16.24	16.32	16.01	16.43	17.14
	Federal	17.91	17.26	13.59	11.72	11.02	11.73	11.51	11.21	10.74	10.97	11.09
	Provincial	5.38	5.62	4.52	4.55	4.89	4.96	4.74	5.11	5.27	5.46	6.05
Development Expenditures	Total	8.35	5.89	4.25	2.99	3.88	5.31	5.21	4.35	4.43	5.34	4.85
	Federal	6.40	4.50	2.53	1.64	2.01	3.65	3.49	2.52	2.42	2.66	2.29
	Provincial	1.96	1.39	1.72	1.34	1.87	1.66	1.72	1.82	2.00	2.67	2.56

Source: Handbook of Statistics on Pakistan's Economy 2015 and Annual Reports published by SBP and calculations are done by Author.

Revenues generation in a country depicts the potential of economy to produce resources to finance its public investment under development expenditures and public spending under non-development expenditures heads. Total revenue as a percent of GDP also depicts the average size of the economy. The table shows average annual revenues generation as percent of GDP is 21.74 and 21.32 in the decade of 1990s and 2000s that declines to 18.29 percent of GDP in the decade 2010 mostly due to structural lacks in the tax collection system. These structural deficiencies include most importantly unchecked tax evasion and dependence on indirect taxes.

Afterward, an increasing trend can be observed in total revenues as in 2011-12 total revenues as percent of GDP are recorded as 18.75 that reach to 20.66 percent of GDP in 2013-14. This increase in total revenues is due to the reason that government collected bulk of revenues under tax revenues and non-tax revenues head in subsequent years. This increase in revenue collection continues in subsequent years as total revenue increases to 22.20 percent of GDP in 2017-18. A similar trend of revenue to GDP ratio can be observed for federal government and provincial government. Provincial governments' revenues start increasing in the decade of 1990s due to nationalization policy and devolution of powers and it tends to increase later on. Provincial total revenues are recorded as 6.63 percent of GDP in 2010-11 that reaches to 7.05 percent of GDP in 2013-14 and 8.54 in 2017-18. The table shows that at national and federal level tax collection as percent of GDP are continuously increasing. Excise duty and taxes on international trade and sales taxes are playing the role of major contributor in generating tax revenue for the government. However, non-tax revenues show a declining trend both at national and federal level.

At the provincial level, the situation is quite adverse as shown in table provinces are making less effort in collecting tax revenues, tax revenues collection in 2010-11 is recorded as

0.35 percent of GDP that reaches to 0.75 percent of GDP in 2014-15 and 1.17 percent of GDP in 2017-18. However, in 7th NFC Award under 18th Constitutional Amendment, the provincial share in federal revenues has increased significantly. If we compare pre and post record of 2009-10, we can see that in the decade of 2001-10 average annual share of federal transfers to provinces was just 3.64 percent of GDP that reaches to 5.47 of GDP in 2010-11. In 2017-18 federal transfers to provinces has reached up to 6.45 percent of GDP. In short, tax revenues collection at federal and provincial level and federal transfers to provinces are continuously increasing, however, the ratio of non-tax revenue remained small throughout the period as described in table 3.1.

The role of public expenditures is very imperative to boost growth of economy and to reduce poverty and income inequality. The expenditure pattern of the economy depicts the share of government in overall economic activity. A huge amount of public expenditures is utilized to finance the heads of energy subsidies, interest payments, untargeted subsidies, loss-making PSEs, and security related issues. Therefore, government is unable to make sufficient expenditures in backward areas of the economy. On the other hand, low revenues are a constraint to finance public expenditures. This situation results in the rise of fiscal deficit. The table show increasing trend in all categories of expenditures both at federal and provincial level overtime. But unfortunately, it can be observed the government is spending more resources on making non-development types of expenditures as compared to development expenditures. Furthermore, public expenditures exceed the government revenues that confirm the prevalence of budget deficit in the economy. The table shows an increasing trend in total expenditures as a percent of GDP throughout history and total revenue share in GDP is also increasing over time but the major defect is that it is mostly consumed in making current and non-development expenditures.

Another major issue is that defense and mark-up payments accounted for more than half of all government expenditures.

Table 3.2 provides the detailed structure of revenues, provincial shares in federal revenue and expenditures for all the provinces individually. Table shows that after 2009-10 total revenues has increased significantly mainly because provincial shares in divisible pool increased sharply and after devolution of more powers to provinces in 7th NFC award under 18th Constitutional Amendment.

Before 7th NFC award the provinces received federal transfers of revenues on the basis of population and Punjab was receiving major share of federal revenue on the basis of dense population but Baluchistan was receiving lowest share of federal revenue. Balochistan position has improved after 2009-10 because of increase in Balochistan's share of revenue from federal. In decade of 1991-2000 annual average share of federal transfers to Punjab, Sindh, KPK and Balochistan were recorded as 1.87, 1.72, 2.28 and 3.18 percent of GDP respectively. However, annual average federal transfers to provinces have increased in decade of 2001-10, it is recorded as 3.88 percent of GDP for budget of Punjab, 3.52 for Sindh, 4.89 for KPK and 6.28 for Balochistan. In 2010-11 federal transfers to provinces are recorded as 9.35 percent of GDP to Punjab, 10.27 to Sindh, 15.17 to KPK and 23.57 to Balochistan. Provincial tax revenue and non-tax revenue are also showing an increasing trend after 2009-10. An interesting fact is Balochistan is generating highest non-tax revenue as compared to other provinces. As far as province-wise expenditure pattern is concerned, the scenario is quite similar to consolidated federal and provincial expenditure structure. Provinces are also spending more on non-development and current expenditures as compared to make expenses on development projects.

Table 3.2 Provincial Expenditures and Revenues Profile as Percent of Provincial GDP

	1982-1990	1991-2000	2001-2010	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Total Revenue									
Punjab	1.03	2.40	5.39	10.77	11.51	13.15	14.48	15.46	18.12
Sindh	0.80	2.24	5.83	12.13	13.61	15.28	16.20	16.93	19.38
KPK	1.80	4.57	7.83	21.50	20.27	21.65	25.86	23.64	28.30
Balochistan	1.56	3.91	9.28	29.47	30.16	33.13	36.41	38.59	38.46
Tax Revenue									
Punjab	0.13	0.28	0.52	0.66	0.82	1.45	1.74	1.70	2.37
Sindh	0.12	0.23	0.62	1.01	2.14	2.33	2.61	2.98	3.72
KPK	0.09	0.18	0.34	0.34	0.34	0.36	1.00	0.93	1.02
Balochistan	0.03	0.07	0.20	0.23	0.22	0.24	0.60	0.53	0.84
Provincial share in Federal Revenue									
Punjab	0.51	1.87	3.88	9.35	10.05	10.67	11.64	12.59	14.96
Sindh	0.37	1.72	3.52	10.27	10.11	10.99	12.67	12.88	14.77
KPK	0.61	2.28	4.89	15.17	16.33	17.72	20.02	20.54	23.47
Balochistan	0.52	3.18	6.28	23.57	24.14	27.12	30.29	31.80	33.22
Non-Tax Revenue									
Punjab	0.39	0.25	0.98	0.76	0.65	1.03	1.10	1.16	0.78
Sindh	2.10	0.29	1.69	0.86	1.35	1.95	0.92	1.07	0.34
KPK	1.10	2.11	2.60	5.98	3.60	3.57	4.83	2.18	3.82
Balochistan	1.01	0.66	2.79	5.66	5.80	5.78	5.53	6.25	4.40
Total Expenditures									
Punjab	1.36	2.78	6.15	9.80	11.69	12.94	13.48	15.12	16.44
Sindh	1.09	2.59	6.72	11.38	14.62	13.86	14.83	16.38	17.85
KPK	2.40	5.46	9.17	16.66	20.61	22.02	22.18	26.78	27.94
Balochistan	2.17	4.73	12.46	25.82	25.87	29.95	34.38	37.50	41.33
Current Expenditures									
Punjab	1.01	2.31	4.22	7.62	8.63	10.05	9.94	11.49	11.71
Sindh	0.80	2.20	5.30	9.10	10.57	10.35	10.83	12.16	13.79
KPK	1.80	4.37	6.37	11.69	13.80	15.43	15.98	18.17	19.18
Balochistan	1.47	3.28	7.92	20.11	19.39	21.21	25.70	27.08	29.52
Development Expenditures									
Punjab	0.35	0.47	1.93	2.18	3.06	2.90	3.54	3.64	4.73
Sindh	0.30	0.39	1.42	2.28	4.05	3.51	3.99	4.22	4.06
KPK	0.60	1.10	2.80	4.97	6.81	6.60	6.20	8.61	8.76
Balochistan	0.70	1.44	4.55	5.69	6.47	8.72	8.69	10.42	11.81

Source: Pakistan's Economic survey 2015 and annual reports published by SBP and calculations are done by Author.

3.3 Review of Literature

The worldwide economy starts witnessing the period of integration extremely comparable with the existing phenomenon of globalization immediately after the twentieth century. The augmented coherence of economic systems magnified the flexibility in the response of various macroeconomic indicators towards internal and external factors. Consequently, challenges for macroeconomic stabilization increased inducing researchers to recommend policy situations. During the same period, implications of fiscal policy remained controversial in economic literature observing the cycle of favor and disfavor. A voluminous body of theoretical literature assesses the significance of fiscal policy, which is being supported and occasionally disregarded by the increasing amount of empirical estimations. This section provides a review of literature discussing the public expenditures and revenues shock impact on macroeconomic variables both from developing and developed countries.

Perotti (2005) is one of the pioneers discussing the issue of fiscal policy shocks effect on different macroeconomic variables by using structural VAR framework. The study has used data for time period 1960-2000 for five countries, and the study employs SVAR model with five variables, i.e., government revenue, spending, interest rate, price level and GDP. The study finds weak significant effects of fiscal policy on GDP and price level, though uncertain effect on interest rate. Caldara and Kamps (2006) document contrasting evidence from the above-mentioned study for the US economy and find that fiscal policy is significantly affecting output in the short and the long run during the period 1955 to 2005. A study was done by Fernandez and de Cos (2006) for Spain for quarterly time period from 1980 to 2004. The study reports positive association between government expenditure and output in the short run and negative association in the long run. Furthermore, it reports that government expenditure is directly causing output.

Prices and interest rate seem to have had a significant and consistent relationship with revenues and public expenditure. The study concludes that fiscal policy has a tendency to stimulate economic activity. Restrepo and Rincon (2006) investigate this relationship for Chile (1989: Q1 to 2005: Q4) and Columbia (1990: Q1 to 2005: Q2). The study finds tax revenue is negatively affecting GDP and government expenditure is positively affecting GDP in Chile. However, in case of Columbia tax shocks effect on GDP is insignificant, however, government expenditure shock is significantly affecting GDP but the magnitude is very small. In case of US economy, Mountford and Uhlig (2008) highlight that deficit-financed tax cut helps raise the GDP. For Euro area and US economy, another study is done by Burriel *et al.* (2010). They find that in the response to government spending shocks GDP and inflation increase.

By using quarterly data from 1976 to 2009 Baum and Gerrit (2011) study investigates the public expenditure and revenue shock impact on GDP in the presence of business cycle phenomenon. In a linear benchmark structural VAR model, they find that spending shock yields a short-run fiscal multiplier of around 0.70, while an increase in taxes and social security yield a fiscal multiplier of around -0.66. Mancellari (2011) investigates the public expenditure and revenue effect on macroeconomy of Albania by using quarterly data from 1998 to 2009. The study reports that tax cut and capital expenditure have highest multiplier effect on output. The fiscal spending shock insignificantly affecting interest rate and current expenditure shock is positively affecting prices. In their study, Afonso and Ricardo (2012) report the same impact of public spending shock on GDP. However, revenue shock has an ambiguous influence on housing prices and relatively small and positive impacts on stock prices. Jooste, Liu and Naraidoo (2013) aim to examine the impact of public spending and revenue shocks on GDP by using Structural VAR methodology. The results reveal that government-spending shock is positively affecting

output but the effect is insignificant in long run. The study also reports that in short run taxes are negatively affecting GDP. Parkyn and Vehbi (2013) report that in short run public spending shock is modestly affecting output, however, in medium and long run effect becomes less effective.

By using SVAR framework for a quarterly time period from 1980 to 2010 Akpan and Atan (2015) report that government capital spending shock is positively and significantly affecting private consumption and real output and it causes higher inflation in short run. It further implies that oil revenue shock positively and significantly affects real output through the channel of public spending. Bhattarai and Trzeciakiewicz (2017) report that public consumption and investment give the highest GDP multipliers in short term, however, private consumption and income tax on capital yield dominating effect in the long run. Kabashi (2017) reports government-spending shock is positively affecting output but the magnitude of the effect is small. In other recent study, Morita (2017) reports public spending and revenues shock are positively affecting consumption and output.

However, we have not come across any study that specifically examines the exogenous public spending and revenue shocks effect on output at provincial level by using structural VAR framework. Thus, there is a need to move in this direction as it is a neglected area of research despite its much significance in fiscal policy formulation. It should be noted that some studies have been done in Pakistan, which have explored the link between fiscal policy and some of macroeconomic variables at national level like Looney (1995) Hyder (2001) and Naveed and Naqvi (2002). A common limitation in all these studies is that these studies lack dynamic investigation of fiscal policy shocks impact on main macroeconomic indicators in Pakistan at national level. Furthermore, no study has been done in Pakistan so far capturing the effect fiscal

policy shocks on output level at provincial level. Our study attempts to fill this deficiency of existing empirical literature on the relationship between fiscal policy shocks and macroeconomic variables in the case of Pakistan at national and provincial level.

3.4 Analytical Framework

Section 3.4.1 deals with the mechanics of structural VAR model to be used for investigating the public expenditures and revenues shocks impact on macro-economic variables in Pakistan. Section 3.4.2 provides discussion on sources of data and construction of variables for policy and macroeconomic variables. Section 3.4.3 discusses the data on Institutional Quality and construction of an index for institutional quality. Section 3.4.4 describes the details of econometric methodology and diagnostic tests to be used in analysis.

3.4.1 The Structural Vector Auto Regression Methodology

This section discusses the description of structural vector auto regression (SVAR) methodology employed in this study to analyze the public expenditures, revenues shock effect on output and price level for national economy; and provincial government expenditure, and revenues shock effect on provincial output level of each province separately. In the subsection 3.4.1.1, the general theory of VAR is discussed. However, in subsection 3.4.1.2 various steps in the construction of a basic models for analysis are given.

3.4.1.1 General Theory of VAR Models

In order to understand the SVAR model, a brief description of Vector Auto Regression (VAR) model is given in this subsection. The dynamic functioning of macroeconomic variables can be assessed using a variety of tools that ranges from univariate time series model involving one variable to large models containing systems of equations. Stock and Watson (2001) define

the VAR as the large class of models, which include the system of equations where each indicator is articulated as a function of its own lagged value and past and current value of remaining variables in the system. VAR is comprised of three approaches; recursive form, reduced form, and structural VAR. In reduced form VAR, each variable is described as a linear function of its own previous values, the previous values of all other indicators and a serially uncorrelated with the error term.

This system is appropriate for forecasting, however, it disregards the contemporaneous relationship of variables, necessary for policy inference. A recursive approach to VAR overcomes this deficiency by incorporating contemporaneous variables as regressors while giving vent to robustness problems simultaneously. A structural VAR approach extracts concurrent relationships between variables from theory fulfilling bi-dimensional motive of forecasting and inference. These concurrent relationships among variables are known as identifying assumptions. These identifying assumptions depend on the inventiveness of researchers as they can include either whole VAR or some specific links.

There has been an extensive use of the VAR technology to account for the dynamic functioning of various macroeconomic variables since Sims (1980). Though there is a extensive empirical literature base regarding the impacts of monetary policy in this context, only a few researchers have pursued the effects of fiscal policy in such setting. Originally, Blanchard and Perotti (2002) proposed the identification of fiscal policy in Structural Vector Auto regression (SVAR) context, which is now on the wedge of popularity due to flexibility it entails. Focal idea was to bring the fiscal policy decision lags resulting from the discretionary actions of fiscal authorities – exogenous to macroeconomic model and dismantled from the functioning of automatic stabilizer – are seen as structural shocks in SVAR approach. While our empirical work

relies on SVAR methodology. A four variables equation system is developed for estimation, that is, government expenditure, government revenue, consumer price index and output. (g_t, y_t, p_t, r_t) . Structural shocks include aggregate demand shocks, inflation shock and fiscal shocks. These shocks are assumed mutually uncorrelated, so the isolated impact of each shock can be examined.

3.4.1.2 Construction of Basic Model

Following literature,⁸ the steps are as follows:

$$X_t = A(L)X_{t-1} + U_t \quad (1)$$

where X_t is the 4×1 vector of endogenous variable, that is, $X_t \equiv [g_t, y_t, p_t, r_t]$, $A(L)$ is 4×4 matrix of lag polynomials and U_t is the 4×1 vector of reduced form innovation, that is, $U_t' \equiv [u_t^g, u_t^y, u_t^p, u_t^r]$. These residual are identically and independently distributed with variance covariance matrix $E(U_t U_t') = \Sigma$.

while, Amisano and Giannini (1997) proposed the following link between reduced form and structural shocks in the model:

$$AU_t = BV_t \quad (2)$$

Where V_t are structural shocks variables and A and B are 4×4 matrices depicting instantaneous link between indicators and linear link between reduced-form innovation and structural shocks respectively. Therefore, structural form of VAR from the reduced VAR can be attained by pre multiplying equation 1 with A as

$$AX_t = AA(L)X_{t-1} + AU_t \quad (3)$$

⁸ See, for instance, Caldara and Kamps (2006), Restrepo and Rincon (2006), Blanchard and Perotti (2002) and Hoppner (2001).

Resultantly,

$$AX_t = AA(L)X_{t-1} + BV_t \quad (4)$$

With lag length equals to one, equation (4) takes the form:

$$\begin{bmatrix} 1 & -\alpha_{12} & -\alpha_{13} & -\alpha_{14} \\ -\alpha_{21} & 1 & -\alpha_{23} & -\alpha_{24} \\ -\alpha_{31} & -\alpha_{32} & 1 & -\alpha_{34} \\ -\alpha_{41} & -\alpha_{42} & -\alpha_{43} & 1 \end{bmatrix} \begin{bmatrix} g_t \\ y_t \\ p_t \\ r_t \end{bmatrix} = \begin{bmatrix} \gamma_{11} & \gamma_{12} & \gamma_{13} & \gamma_{14} \\ \gamma_{21} & \gamma_{22} & \gamma_{23} & \gamma_{24} \\ \gamma_{31} & \gamma_{32} & \gamma_{33} & \gamma_{34} \\ \gamma_{41} & \gamma_{42} & \gamma_{43} & \gamma_{44} \end{bmatrix} \begin{bmatrix} g_{t-1} \\ y_{t-1} \\ p_{t-1} \\ r_{t-1} \end{bmatrix} + \begin{bmatrix} 1 & \delta_{12} & \delta_{13} & \delta_{14} \\ \delta_{21} & 1 & \delta_{23} & \delta_{24} \\ \delta_{31} & \delta_{32} & 1 & \delta_{34} \\ \delta_{41} & \delta_{42} & \delta_{43} & 1 \end{bmatrix} \begin{bmatrix} g_t^g \\ y_t^y \\ p_t^p \\ r_t^r \end{bmatrix}$$

Solving equation (4) for X_t yields

$$X_t = A^{-1}A(L)X_{t-1} + A^{-1}BV_t \quad (5)$$

$$\begin{bmatrix} g_t \\ y_t \\ p_t \\ r_t \end{bmatrix} = \begin{bmatrix} 1 & -\alpha_{12} & -\alpha_{13} & -\alpha_{14} \\ -\alpha_{21} & 1 & -\alpha_{23} & -\alpha_{24} \\ -\alpha_{31} & -\alpha_{32} & 1 & -\alpha_{34} \\ -\alpha_{41} & -\alpha_{42} & -\alpha_{43} & 1 \end{bmatrix}^{-1} \begin{bmatrix} \gamma_{11} & \gamma_{12} & \gamma_{13} & \gamma_{14} \\ \gamma_{21} & \gamma_{22} & \gamma_{23} & \gamma_{24} \\ \gamma_{31} & \gamma_{32} & \gamma_{33} & \gamma_{34} \\ \gamma_{41} & \gamma_{42} & \gamma_{43} & \gamma_{44} \end{bmatrix} \begin{bmatrix} g_{t-1} \\ y_{t-1} \\ p_{t-1} \\ r_{t-1} \end{bmatrix} + \begin{bmatrix} 1 & -\alpha_{12} & -\alpha_{13} & -\alpha_{14} \\ -\alpha_{21} & 1 & -\alpha_{23} & -\alpha_{24} \\ -\alpha_{31} & -\alpha_{32} & 1 & -\alpha_{34} \\ -\alpha_{41} & -\alpha_{42} & -\alpha_{43} & 1 \end{bmatrix}^{-1} \begin{bmatrix} 1 & \delta_{12} & \delta_{13} & \delta_{14} \\ \delta_{21} & 1 & \delta_{23} & \delta_{24} \\ \delta_{31} & \delta_{32} & 1 & \delta_{34} \\ \delta_{41} & \delta_{42} & \delta_{43} & 1 \end{bmatrix} \begin{bmatrix} g_t^g \\ y_t^y \\ p_t^p \\ r_t^r \end{bmatrix}$$

In abbreviated form Equation (5) becomes:

$$X_t = C(L)X_{t-1} + \varepsilon_t \quad (6)$$

where $C(L) = A^{-1}A(L)$ and $\varepsilon_t = A^{-1}BV_t$.

$$\begin{bmatrix} \varepsilon_t^g \\ \varepsilon_t^y \\ \varepsilon_t^p \\ \varepsilon_t^r \end{bmatrix} = \begin{bmatrix} 1 & -\alpha_{12} & -\alpha_{13} & -\alpha_{14} \\ -\alpha_{21} & 1 & -\alpha_{23} & -\alpha_{24} \\ -\alpha_{31} & -\alpha_{32} & 1 & -\alpha_{34} \\ -\alpha_{41} & -\alpha_{42} & -\alpha_{43} & 1 \end{bmatrix}^{-1} \begin{bmatrix} 1 & \delta_{12} & \delta_{13} & \delta_{14} \\ \delta_{21} & 1 & \delta_{23} & \delta_{24} \\ \delta_{31} & \delta_{32} & 1 & \delta_{34} \\ \delta_{41} & \delta_{42} & \delta_{43} & 1 \end{bmatrix} \begin{bmatrix} g_t^g \\ y_t^y \\ p_t^p \\ r_t^r \end{bmatrix}$$

Equation (6) expresses autoregressive model in which each variable is described as the function of previous values of itself and other variables of the equation. Secondly, it indicates that reduced form equations are linear combination of structural equations. Following Perotti (2005), reduced form fiscal residuals u_t^g and u_t^r can be thought of combination of three types of shocks: a) automatic responses of government spending and revenue to output and prices innovations, b) systematic discretionary policy responses to variables in the model and c) uncorrelated structural fiscal shocks or random policy actions. Moving average representation of structural model states endogenous variables in X_t as functions of current and past reduced-form innovations, ϵ_t .

Equation (6) can be arranged to have a moving average symbol as follows:

$$X_t = [1 - C(L)L]^{-1} \epsilon_t \quad (7)$$

where $C(L)$ is structural autoregressive lag polynomial. It is not possible to estimate (7) without imposing restriction on A and B . In our research triangular restrictions have been imposed on the matrices in equation (2). For National Economy the restrictions are given as follows:

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ -\alpha_{21} & 1 & 0 & 0 \\ -\alpha_{31} & -\alpha_{32} & 1 & 0 \\ -\alpha_{41} & -\alpha_{42} & -\alpha_{43} & 1 \end{bmatrix}^{-1} \begin{bmatrix} \epsilon_t^g \\ \epsilon_t^y \\ \epsilon_t^p \\ \epsilon_t^r \end{bmatrix} = \begin{bmatrix} NA & 0 & 0 & 0 \\ 0 & NA & 0 & 0 \\ 0 & 0 & NA & 0 \\ 0 & 0 & 0 & NA \end{bmatrix} \begin{bmatrix} g_t^g \\ y_t^y \\ p_t^p \\ r_t^r \end{bmatrix}$$

For Provincials' economy, the restrictions are as follows:

$$\begin{bmatrix} 1 & 0 & 0 \\ -\alpha_{21} & 1 & 0 \\ -\alpha_{31} & -\alpha_{32} & 1 \end{bmatrix}^{-1} \begin{bmatrix} \epsilon_t^g \\ \epsilon_t^y \\ \epsilon_t^r \end{bmatrix} = \begin{bmatrix} NA & 0 & 0 \\ 0 & NA & 0 \\ 0 & 0 & NA \end{bmatrix} \begin{bmatrix} g_t^g \\ y_t^y \\ r_t^r \end{bmatrix}$$

Government spending is ordered first as it does not react contemporaneously to shocks to other variables in the system. Dynamics in government expenditure, unlike movements in taxes are

mainly unrelated to the business cycle. Consequently, it looks reasonable to assume that government expenditure is not affected contemporaneously by shocks creating in the private sector. While output level does not respond contemporaneously to the shocks in price and revenue but it is affected contemporaneously by expenditure shocks. Price level does not respond contemporaneously to revenue shock, but it is affected contemporaneously by government output shocks and expenditure. Public revenue is ordered last as it is affected contemporaneously by all shocks in the system.

3.4.2 Description of Data for Fiscal Policy and Macroeconomic Variables

The data comprised a longitudinal set of four variables including government expenditure, government revenues, consumer price index, and gross domestic product (g_t, r_t, p_t, y_t) at national level and a set of three variables including government expenditure, revenue and GDP for each province separately. The required data for conducting the analysis is collected from Pakistan's economic survey 2015 and annual reports published by SBP. Total expenditure and total revenue are in percent of GDP at national and provincial levels. The output is measured as real GDP at base 2005-06 at national level. Interest payments are subtracted from total expenditures at national level. As for provincial GDP, no officially published data is available in Pakistan. Fortunately, many researchers tried to estimate the portions of each province in national GDP. Bengali and Sadaqat (2005) estimated the share of four provinces in national GDP from 1973 to 2000. Arby (2007) has further updated the estimates of provincial GDP to 2005. Later on, the Institute of Public Policy (2012), SPDC (2013 & 2014), Institute of Policy reforms (2015), GoP (2017), and Tahir (2017) Pasha (2018) have estimated the share of provinces in national GDP. We have used Bengali and Sadaqat (2005) and Pasha (2018) studies to construct a consistent series of provincial GDP from 1982 to 2017. We have used standard

splicing methodology to construct a consistent series of provincial GDP in Pakistan. All the time series are logarithmic. The data covers the annual time-period from 1984 to 2017. The study is using annual data series from 1984 due to some data constraints. Firstly, data for output series is not available on quarterly basis both at national and provincial levels. Secondly, data for provincial government revenues and expenditures are available from 1982. Lastly, the study is incorporating institutional quality index as exogenous variable at both national level and provincial level. The institutional quality data is computed by ICRG at national level only and it is representative of provincial and local states of the country. The data on institutions is available from 1984 that is why the study is using time period from 1984 to 2017 for analysis.

3.4.3 Data and Index of Institutional Quality

As the objectives of the study are to measure the effect of fiscal policy shocks on macroeconomy of Pakistan via institutional quality and the impacts of provincial fiscal policy shocks on provincial output via institutional quality. For that purpose, the study is incorporating quality of Institutions as exogenous variables. The data on institutional quality is taken from International Country Risk Guide (ICRG) that is published by the Political Risk Services (PRS) Group. The Political Risk Services category is comprised of twelve political risk components: “Socioeconomic Conditions, Government Stability, Investment Profile, External Conflict, Internal Conflict, Corruption, Religious Tensions, Military in Politics, Ethnic Tensions, Law and Order, Bureaucracy Quality, and Democratic Accountability”.

To measure the institutional quality, Nawaz *et al.* (2014) study have used index of institutional quality based on six components of political risk service group these are “control of corruption, political stability and absence of violence/terrorism, government effectiveness, rule of law, regulatory quality, and voice and accountability”. Ahmad *et al.* (2016) study measure

institutional quality by using two indicators are Corruption and Democratic Accountability. Garayeva (2016) and Canh *et al.* (2017) study employs World Governance Index (WGI) from World Bank to measure institutional quality. The World Governance Index is computed on the basis of indicators namely “Voice and Accountability, Government Effectiveness, Political Stability and Absence of Violence, Rule of Law, Regulatory Quality, and Control of Corruption, each of which is estimated in the range of -2.5 to 2.5 interval and compute simple means to get an index for the quality of institutions”. Madni and Chaughary (2017) study develop institutional quality index based on all twelve indicators of ICRG data. Plouffe (2017) study develops two indexes based on indicators of WGI and ICRG for measuring institutional quality. From WGI the study uses four components “government effectiveness, regulatory quality, rule of law, and control of corruption” and from ICRG the study uses only three components “bureaucratic quality, law and order, and corruption”. In another study, Canh (2018) uses three indicators of WGI independently “government effectiveness, control of corruption, and regulatory quality” to measure institutional quality. Our study uses six indicators from ICRG data to construct institutional quality index. These indicators include “Government stability, Law and Order, Control over Corruption, Military in Politics, Bureaucracy Quality, and Democratic Accountability”. Table 3.3 describes the theoretical definition and range of each indicator. These definitions are taken from ICRG methodology and the range of each indicator is different; for instance, government stability variable has ranged from 0 to 12, while corruption ranges from 0 to 6. In data, the higher value shows good quality of institutions and lower value shows bad quality of institutions.

For construction of institutional quality index, the present study has used Principle Component Analysis (PCA). PCA is a statistical famous technique that transformation the multiple variables into a linear variable. The normalized weights used in the construction of

Table 3.3 Conceptual Definitions and Range of Indicators; ICRG Methodology 2017

Conceptual Definitions and Ranges
<p>Government stability “This is an assessment both of the government’s ability to carry out its declared program, and its ability to stay in office. Risk is measured through three subcomponents namely Government Unity, Legislative Strength and Popular Support. Each component contains maximum score of four points (very low risk) and a minimum score of 0 points (very high risk). The cumulative score of this indicator ranges from 0 to 12, 0 means very high risk and vice versa”.</p>
<p>Control over Corruption “This is an assessment of corruption within the political system that causes distortion in economic and financial system. The most common form of corruption met directly by business is financial corruption in the form of demands for special payments and bribes connected with import and export licenses, exchange controls, tax assessments, police protection, or loans. Such corruption can make it difficult to conduct business effectively, and in some cases may force the withdrawal or withholding of an investment. This indicator contains minimum score of 0 points (very high risk) and a maximum score of 6 points (very low risk)”.</p>
<p>Law and Order “Law and Order form a single component, but its two elements are assessed separately, with each element being scored from zero to three points. To assess the “Law” element, the strength and impartiality of the legal system are considered, while the “Order” element is an assessment of popular observance of the law. The cumulative score of both components Ranges between 0 (very high risk) to 6 (very low risk)”.</p>
<p>Military in Politics “The military involvement in politics is a diminution of democratic accountability. The military might become involved in government because of an actual or created internal or external threat. Such a situation would imply the distortion of government policy in order to meet this threat, for example by increasing the defense budget at the expense of other budget allocations. A military takeover or threat of a takeover may also represent a high risk if it is an indication that the government is unable to function effectively and that the country therefore has an uneasy environment for foreign businesses. The score of this measure ranges from 0 to 6. The lower risk ratings indicate a greater degree of military participation in politics and a higher level of political risk and vice versa”.</p>

Democratic Accountability

“This is an assessment of how responsive government is to its people, by assuming that the less responsive it is, the more likely it is that the government will fall, peacefully in a democratic society, but possibly violently in a non-democratic one. The score ranges between 0 (very high risk) to 6 (very low risk)”.

Bureaucracy Quality

“This is an assessment of strengths and expertise of bureaucracy to govern independently and tend to be autonomous from political pressure. The score ranges between 0 (very high risk) to 4 (very low risk)”.

Institutional Quality Index are as follows: “Bureaucracy Quality = 0.121441, Control over Corruption = 0.193228, Democratic Accountability = 0.233663, Government Stability = 0.052917, Law and Order = 0.192167 and Military in Politics = 0.206584”. The institutional quality index is used in all the regressions to capture the effect of institutional quality.

3.4.4 Econometric Methodology

3.4.4.1 Stationarity of Variables and Unit Root Tests

A large number of macro-economic variables have a trend in series, which infers that they may be non-stationary. If nonstationarity was suspected, it was thought to be due to the deterministic trend component in the series that could easily be removed by using a linear (or polynomial) time trend in the regression model, i.e., by detrending the variable thought to be non-stationary. Granger and Newbold (1974) demonstrate that the existence of non-stationary variables may main to spurious regression results, in the sense, estimation has created high R^2 and t-statistics that may appear to be significant when in fact there is no significant link between the independent variables and dependent variable.

Similarly, Nelson and Plosser (1982) show that many macroeconomic variables have features of stochastic trends as opposite to deterministic trends as assumed former for instance,

most macroeconomic indicators are different in stationary rather than trend stationary. In short, stochastic processes describing the most macroeconomic variables cover at least one non-stationary in their autoregressive components. This study also stimulated a marvelous interest in applied and theoretical econometric research. The irresistible opinion of applied econometricians is that most macroeconomic indicators are characterized by the existence of non-stationary. A series that is stationary after being differenced d times is said to be integrated of order d , or $I(d)$. An $I(0)$ series is stationary and it remains stationary if differenced further.

A numerous diagnose test of stationarity has been proposed in the literature. Among them the Augmented Dickey-Fuller (ADF) test introduces by Dickey and Fuller (1979, 1981) and the Phillips-Perron (PP) test propose by Phillips and Perron (1988) are regularly used in econometric. We apply Augmented Dickey Fuller (ADF) test in the regression:

$$\Delta y_t = \mu + \beta t + \alpha y_{t-1} + \sum_{i=1}^k c_i \Delta y_{t-i} + \varepsilon_t$$

where y_t is series of variable being tested, t is time trend, Δ is difference operator, k is number of lags of y comprised in the model and ε_t is the independently and identically distributed error term.

3.4.4.2 Diagnostic Analysis

For scrutinizing the impacts of fiscal shocks on the macro economy of Pakistan, we have already explained the SVAR technique and through conducting impulse response function and variance decomposition analysis derived from SVAR model estimates the impact of fiscal shocks will be captured. In order to ensure the stability of SVAR model, we will identify structural breaks by using graphical method. As a preliminary analysis, we will perform few more

diagnostic tests to confirm the stability of SVAR models; these include Autocorrelation LM Test, Normality test and White Heteroskedasticity tests.

3.5 Results and Discussion

In this chapter, we made an effort to explore the public expenditures and revenue shocks effect on the macro economy of Pakistan. In this regard, the current section has been developed by applying the econometric framework discussed in section 3.4. The analysis for fiscal shocks contains the following sub-sections. Section 3.5.1 provides results of statistical test for SVAR including unit root properties of data and results of diagnostic tests, Section 3.5.2 describes results for fiscal policy shocks and macro-economy of Pakistan at national level, however in the end, section 3.5.3 elaborates the provincial government expenditures and revenue shocks effect on provincial output level for each province separately.

3.5.1 Statistical Test of SVAR

3.5.1.1 Stationarity Properties of Data

As a first step to estimate, the model, stationary properties of data have been tested. We have opted Augmented Dickey Fuller (ADF) unit root test for this purpose. Table 3.4 presents the stationarity test results of all the time series at both $I(0)$ and $i(1)$. All the indicators are non-stationary at $I(0)$ and they become stationary at their $I(1)$.

Table 3.4: ADF Stationarity Test Results

Variables	I(0)	I(1)	Order of Integration
Government Expenditure (national)	-1.54 (0.500)	-6.033 (0.000)	<i>I</i> (1)
Government Expenditure (Punjab)	-0.023 (0.949)	-5.176 (0.000)	<i>I</i> (1)
Government Expenditure (Sindh)	-0.462 (0.886)	-8.329 (0.000)	<i>I</i> (1)
Government Expenditure (KPK)	-0.304 (0.914)	-5.626 (0.000)	<i>I</i> (1)
Government Expenditure (Balochistan)	0.066 (0.958)	-5.860 (0.000)	<i>I</i> (1)
Government Revenue (national)	-1.872 (0.340)	-6.618 (0.000)	<i>I</i> (1)
Government Revenue (Punjab)	-0.637 (0.988)	-5.008 (0.000)	<i>I</i> (1)
Government Revenue (Sindh)	-0.135 (0.937)	-6.334 (0.000)	<i>I</i> (1)
Government Revenue (KPK)	-0.000 (0.952)	-5.442 (0.000)	<i>I</i> (1)
Government Revenue (Balochistan)	0.105 (0.961)	-5.158 (0.000)	<i>I</i> (1)
GDP (National)	-1.069 (0.716)	-4.410 (0.001)	<i>I</i> (1)
GDP (Punjab)	-2.391 (0.151)	-4.130 (0.002)	<i>I</i> (1)
GDP (SINDH)	-1.405 (0.567)	-5.676 (0.000)	<i>I</i> (1)
GDP (KPK)	-0.408 (0.896)	-5.618 (0.000)	<i>I</i> (1)
GDP (Balochistan)	-2.335 (0.167)	-5.776 (0.000)	<i>I</i> (1)
CPI	0.281 (0.973)	-2.653 (0.092)	<i>I</i> (1)

Note: Probabilities are given in parenthesis.

3.5.1.2 Diagnostic Tests

In this study, we are testing the effect of fiscal policy shocks on macroeconomic behavior at national and provincial levels in two SVAR frameworks. In first SVAR framework, we are simply dealing with government spending and revenue shock impact on output and prices at national level and only output at provincial level. In this regression, we have not performed any

diagnostic tests⁹. However, in second SVAR framework, we are testing fiscal policy shocks impact via institutional quality on output and prices at national level and on output at provincial level. In order to check the stability of SVAR model in this framework we have identified the structural breaks by using graphical method. After identifying structural breaks, we have introduced dummies to tackle the issue of breaks where required in regression analysis. Structural breaks differ not only from national level to provincials level but also from province to province because the economic conditions of all the provinces are divergent from each other and at consolidated level the situation is totally different. In order to avoid complications, we are interpreting the details of structural breaks and their respective dummies in result interpretation section of each SVAR framework where required.

Lag length selection is an essential requisite for dynamic regression model, especially when economic variables' response to policy stimuli is required. Various procedures have been suggested in literature for determining the appropriate lag length. The present study has employed the AIC, which is one of the most widely used measures of the lag length selection. The values of the AIC and the number of lag orders are reported in table 3.4. Based on AIC lag selection criterion, the lag length is selected at 1 for Sindh and 2 for National level, Punjab, KPK and Balochistan.

As a preliminary analysis, few more diagnostic tests are used to confirm the stability of models. Table 3.5 reports results for Autocorrelation LM Test, Normality test and White Heteroskedasticity tests. After these preliminary analyses, it is confirmed that all the models are stable over lag length and time. We now proceed into a more comprehensive analysis of fiscal policy shocks as given in the next section.

⁹ Structural Break test, LM Test, Normality Test, Heteroskedasticity Test

Table 3.4: Lag Order Selection Criterion

SVAR Framework	Lag Order on basis of AIC
National	(2, -14.992*)
Punjab	(2, -11.511*)
Sindh	(1, -7.3838*)
KPK	(2, -9.6228*)
Balochistan	(2, -9.6631*)

Note: * indicates lag order selected by criterion

Table 3.5 Diagnostic Tests

	National	Punjab	Sindh	KPK	Balochistan
Serial Correlation LM Test					
Lag	LM Stat	LM Stat	LM Stat	LM Stat	LM Stat
1	7.711 (0.9570)	9.501 (0.3924)	4.081 (0.9060)	6.973 (0.6399)	13.612 (0.1368)
2	22.721 (0.1214)	13.518 (0.1405)		9.669 (0.3779)	9.307 (0.4094)
Normality Test					
	Chi-sq.	Chi-sq.	Chi-sq.	Chi-sq.	Chi-sq.
Skewness	3.636 (0.4575)	2.111 (0.5497)	0.321 (0.9560)	2.184 (0.5349)	4.414 (0.2200)
Kurtosis	1.818 (0.7691)	2.518 (0.4720)	0.500 (0.9188)	3.761 (0.2885)	1.9796 (0.5766)
Jarque-Bera	5.454 (0.7081)	4.629 (0.5921)	0.821 (0.9915)	5.945 (0.4293)	6.394 (0.3805)
Heteroskedasticity Test					
	214.62 (0.2274)	61.375 (0.4264)	66.228 (0.1228)	99.063 (0.8392)	101.20 (0.6653)

Note: Probabilities are given in parenthesis.

3.5.2 Dynamics of Fiscal Policy at National Level

Dynamics of fiscal policy shocks and macroeconomy of Pakistan at national level are assessed using impulse response and variance decomposition techniques. Impulse response is derived

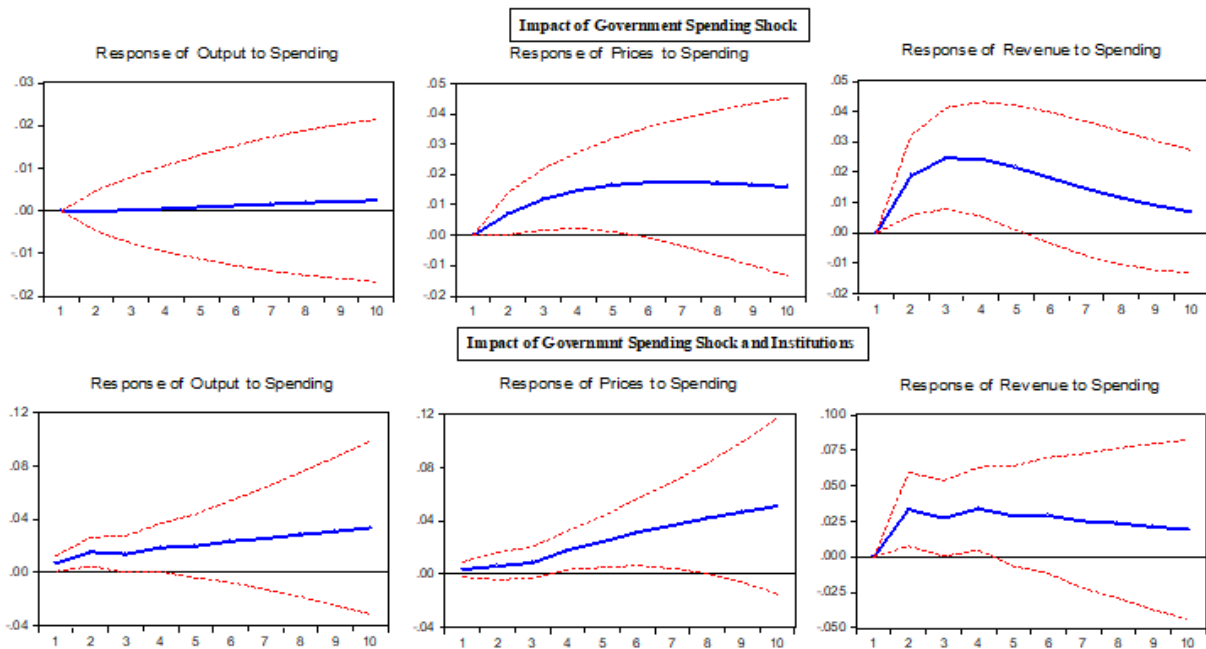
from reduced form VAR while variance decomposition depends on the identification scheme. Both of the techniques and their results are described as follows:

3.5.2.1 Impulse Responses of Government Spending and Revenue Shock at National level

Government revenues, CPI, and output are endogenous variables in regression one and in regression two we are incorporating institutional quality as exogenous variable along with all other endogenous variables. Upper part of figure 3.1 shows the responses of the endogenous variables to one standard deviation positive unanticipated shock in government spending and lower part of figure 3.1 shows the responses of the endogenous variable to one standard deviation positive unanticipated shock in government spending in the presence of institutional quality. Responses of government spending, CPI and output to one standard deviation shock of revenue are depicted in upper part of figure 3.2. Responses of Government spending, CPI and output to one standard deviation shock of revenue via institutional quality are depicted in lower part of figure 3.2. Structural break are identified in FY2009 and FY2011. There is a decline in government spending and output and increase in inflation rate in FY2009; and in FY2011, government revenues decline sharply. These imbalances occur because of change in structure of government as after ten-year period of Military government Musharraf handed power to democratically elected civilian government of Pakistan Peoples' party in 2008. In 2008 democratic transition was weak and the civilian government failed to mark its imprint on the political process through fear and incompetence and democracy could not substantially strengthened during the FY2008-13 period. To capture the effect of these two breaks we have introduced dummies for FY2009 and FY2011 in SVAR framework of fiscal policy shocks effect via institutional quality.

Spending Shock Impact: Revenues are responsive to government spending shocks. The spending shock induces government revenues to increase until the third year. However, after third year public revenues show a perpetual reduction till the end of fifth year. This result confirms that government spending causes positively to government revenues in Pakistan. An unexpected spending shock has no significant impact on output. Both the structuralist and monetarist factors can accelerate inflation in a country. Inflation increases as a response to unexpected positive government expenditure shock. This result shows that government spending plays role in increasing inflation in Pakistan.

Figure 3.1: Responses of Variables to Government Spending Shock

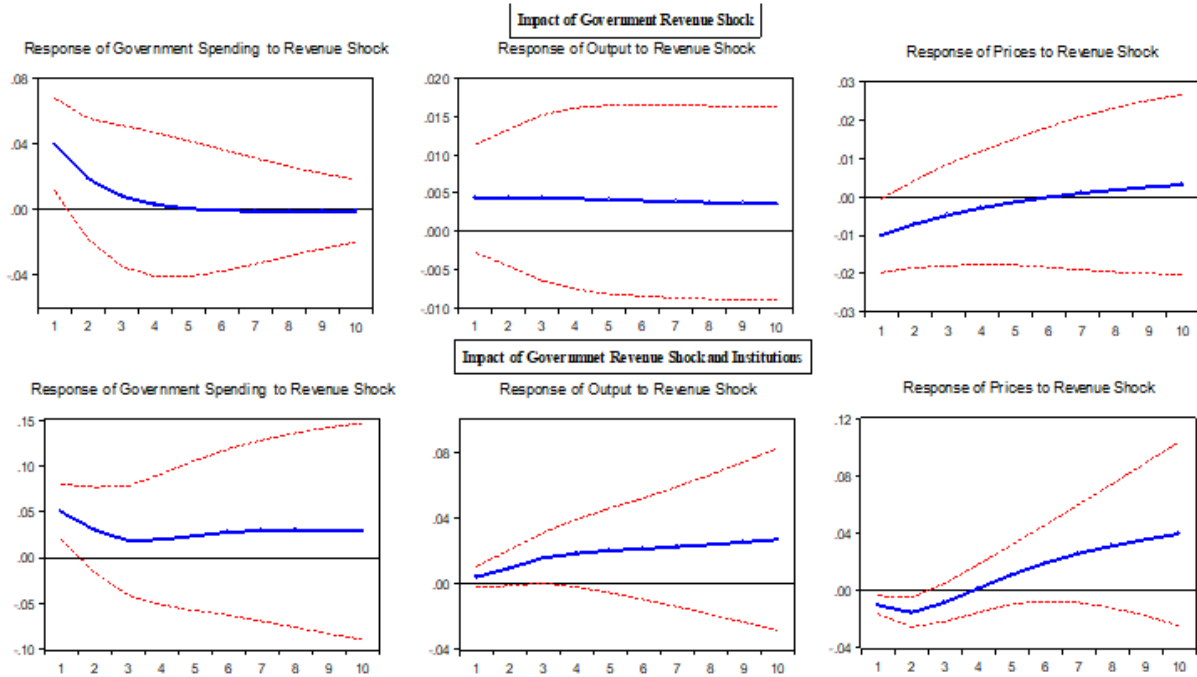


Spending Shock Impact via Institutional Quality: The result of this SVAR framework shows that output is responsive to government spending shock, which was irresponsive in previous case (spending Shock impact). The spending shock induces the output to increase till the end of fourth year. The spending shock effect on inflation is initially insignificant but after third year it

becomes significant and positive. After third year, Prices are gradually increasing due to unexpected positive spending shock till the end of eighth year. The impulse response of government revenue to government spending shock shows that positive government spending shock has positive effect on government revenue. Initially government revenues are increasing due to increase in government expenditures then in third year government revenues show a decline and in fourth it again starts increasing, the effect remained significant till the fourth year.

Revenue Shock Impact: Impact of revenue shock on spending is significant and positive initially but becomes insignificant at the end of first year. This finding negates the existence of the tax and spend hypothesis in Pakistan. As Tax and spend hypothesis means that causality in fiscal variables runs from government revenues to expenditure. Briefly, it is postulated that government spending shocks need to be financed imposing serious strains on economic performance. Response of output to revenue shock is insignificant. We are getting weak results because of smaller number of observations. In Pakistan, GDP data is not available at quarterly basis that is why we are restricted to run regression on smaller number of observations. Prices decline due to positive revenue shock but the response becomes insignificant immediately that is why we can say prices are also irresponsive to revenue shock.

Figure 3.2: Response of Variables to Government Revenue Shock



Government Revenue Shock impact via Institutional Quality: Impact of revenue shock on spending is almost same as described in the absence of institutional quality in previous SVAR framework. Spending increases as a response to positive revenue shock but it dissipates quickly at the end of first year. This result also negates the existence of tax and spend supposition in Pakistan. The revenue shock impact on output is initially insignificant until the end of second year. In the beginning of third year, the effect becomes significant and revenue shock induces the output to increase till the end of fourth year. The revenue shock effect on inflation is initially negative till the end of second year inflation decreases due to increase in government revenue then price level starts increasing but after third year it becomes insignificant. This result also confirms that revenues are not playing any role in increasing inflation in Pakistan.

3.5.2.2 Variance Decomposition Analysis for National Level

Table 3.7: Variance Decomposition of Standard Error

Variance Decomposition of G					
Period	S.E.	Government Spending Shock	Output Shock	Price Shock	Revenue Shock
1	0.08	66.15	12.83	0.79	20.21
3	0.14	73.71	15.79	0.66	9.82
5	0.16	75.44	16.55	0.59	7.39
6	0.16	75.81	16.67	0.58	6.93
9	0.17	76.29	16.71	0.55	6.43
10	0.17	76.37	16.69	0.55	6.38
Variance Decomposition of Y					
Period	S.E.	Government Spending Shock	Output Shock	Price Shock	Revenue Shock
1	0.02	0.00	95.92	0.00	4.07
3	0.03	0.00	95.41	0.04	4.53
5	0.04	0.05	95.17	0.14	4.62
7	0.05	0.19	94.96	0.26	4.57
9	0.05	0.40	94.74	0.37	4.47
10	0.06	0.52	94.62	0.43	4.41
Variance Decomposition of P					
Period	S.E.	Government Spending Shock	Output Shock	Price Shock	Revenue Shock
1	0.02	0.00	14.99	73.21	11.78
3	0.04	9.21	9.80	72.45	8.53
5	0.06	18.44	22.56	53.97	5.02
7	0.07	21.79	35.97	39.07	3.16
9	0.09	22.01	45.96	29.69	2.33
10	0.09	21.61	49.85	26.41	2.11
Variance Decomposition of R					
Period	S.E.	Government Spending Shock	Output Shock	Price Shock	Revenue Shock
1	0.05	0.00	0.00	0.00	100.0
3	0.07	18.47	6.14	0.01	75.37
5	0.08	30.15	9.92	0.01	59.91
7	0.08	34.52	11.22	0.01	54.24
9	0.08	36.08	11.58	0.01	52.31
10	0.082	36.43	11.63	0.01	51.92

Table 3.6 presents the variance decompositions of the four endogenous variables. The decompositions are also taken in percentage form at different horizons. The second column

presents the standard errors of the decompositions. In order to execute the variance decomposition analysis, the following recursive ordering is set: Public expenditure is given first order, output is given second order, inflation is assigned third order and last order is assigned to Public revenue.

Public spending own innovations stay a leading source of encouraging disparities in the public expenditure for short, medium, and long term. After own innovations output and revenue shocks are respectively important sources of explaining the forecasted standard error of government spending in the medium and the long term. The contribution of price innovations is negligible. The own innovations of output play the most significant role in forecast error of output for short, medium and long run. Revenue, prices and spending shocks are negligibly contributing to output standard error. In case of prices, it is obvious that after the own shocks, the role of aggregate demand innovations is most significant in describing the standard error of prices in medium and long run. Government spending shock is also explaining variations in prices in the long run. However, public revenue innovations are not contributing significantly in explaining the forecasted standard error of prices. The role of own innovations is most dominant in explaining standard error of revenues in short, medium and long run. As far as the importance of the innovations of the remaining variables is concerned, the most significant innovation in describing variation in revenues is public expenditures and output shocks. Nonetheless, the contribution of the price shock is negligible in explaining the standard error of revenues.

3.5.3 Fiscal Policy Shocks and Output at Provincial Level

The study is also investigating the fiscal policy shocks effect on output performance of each province separately. For that purpose, provincial government expenditure and revenue shocks impact on provincial output level has been tested in SVAR framework one. However, in

SVAR framework two, provincial government expenditure and revenue shocks impact on provincial output level has been tested via institutional quality. Price level is considered as exogenous in the system. Dynamics of fiscal policy shocks and output level of each province are assessed using impulse response and variance decomposition techniques. Sub-section 3.5.3.1 describes the impulse response of Punjab government expenditure and revenue shock on output level of Punjab along with variance decomposition analysis, sub-section 3.5.3.2 describes for Sindh, sub-section 3.5.3.3 for KPK, and lastly sub-section 3.5.3.4 describes for Balochistan. The sequences of provinces are ordered according to their economy size.

3.5.3.1. Dynamics of Fiscal Policy Shocks and Output level: Punjab

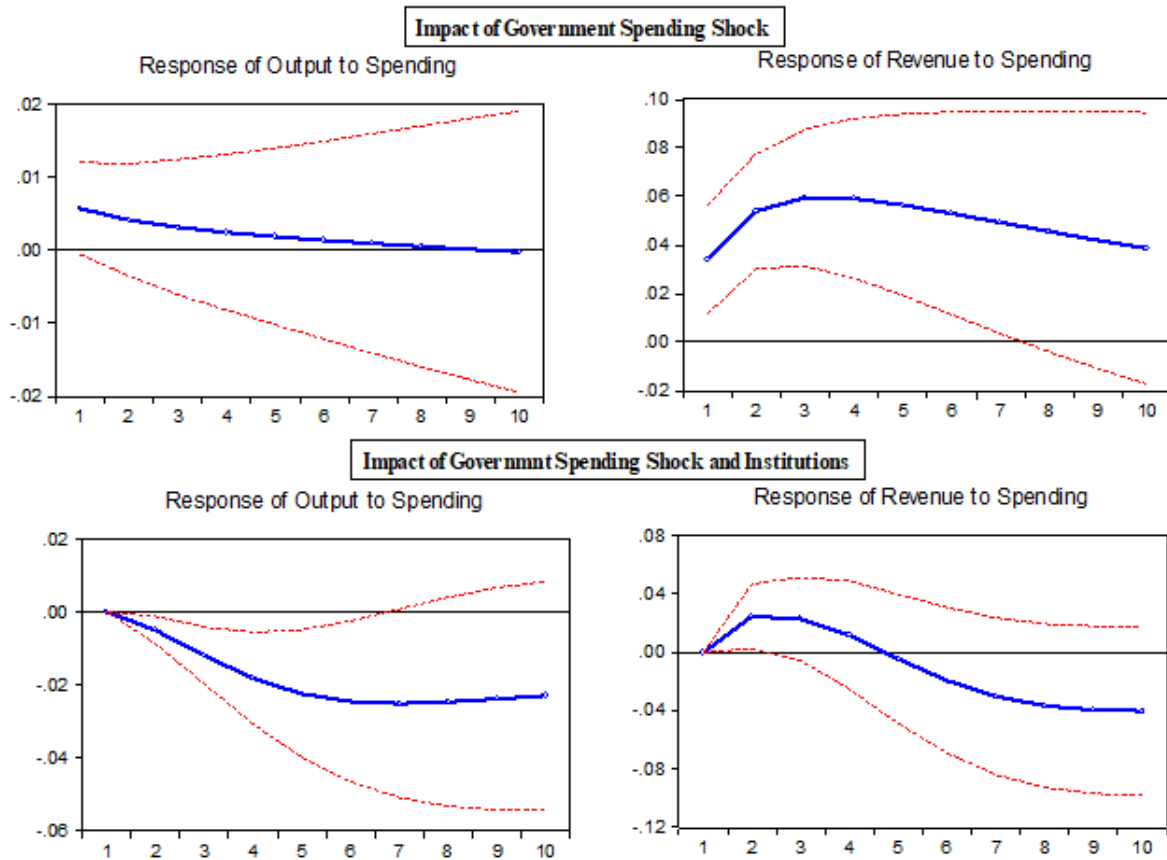
3.5.3.1.1 Impulse Responses of Government Spending and Revenue Shock

Pasha (2018) highlights in his book “Growth and Inequality in Pakistan” that Punjab is the largest sub-national economy with a portion of 54 percent in Pakistan’s economy in 2016-17. Punjab dominates in agriculture sector and services sector with a share of 62.3 percent and 55.7 percent respectively, in 2016-17. However, in industrial sector its share is 39.8 percent. In this SVAR framework Punjab government revenues and output are endogenous variables in regression one and in regression two we are incorporating institutional quality as exogenous variable along all other endogenous variables. The upper part of figure 3.3 shows the responses of the endogenous variables to one standard deviation positive unanticipated shock in Punjab government spending and lower part of figure 3.3 shows the responses of the endogenous variable to one standard deviation positive unanticipated shock in Punjab government spending in the presence of institutional quality. The upper part of figure 3.4 shows the responses of the endogenous variables to one standard deviation positive unanticipated shock in Punjab government revenue and lower part of figure 3.4 shows the responses of the endogenous variable

to one standard deviation positive unanticipated shock in Punjab government revenue in the presence of institutional quality. A structural break is identified in FY2001, in that specific period Punjab government spending; it may be because Pakistan became partner with US in campaign of war against terrorism and the government spending under head of defense spending increases. To capture the effect of this break we introduced dummy for FY2001 in the model.

Spending Shock Impact: Figure 3.3 shows output is irresponsive to government spending shock. Revenues are responsive to government spending shocks. The expansionary fiscal policy shock in the form of increase in government spending induces the government revenues to increase till the third year. It shows that uni-directional causal pattern running from the government expenditures to the government revenues, fiscal expansion of public spending results in increasing government revenues. However, after the third year, there is a slowdown in public revenues and the effect becomes persistent until the end of the seventh year.

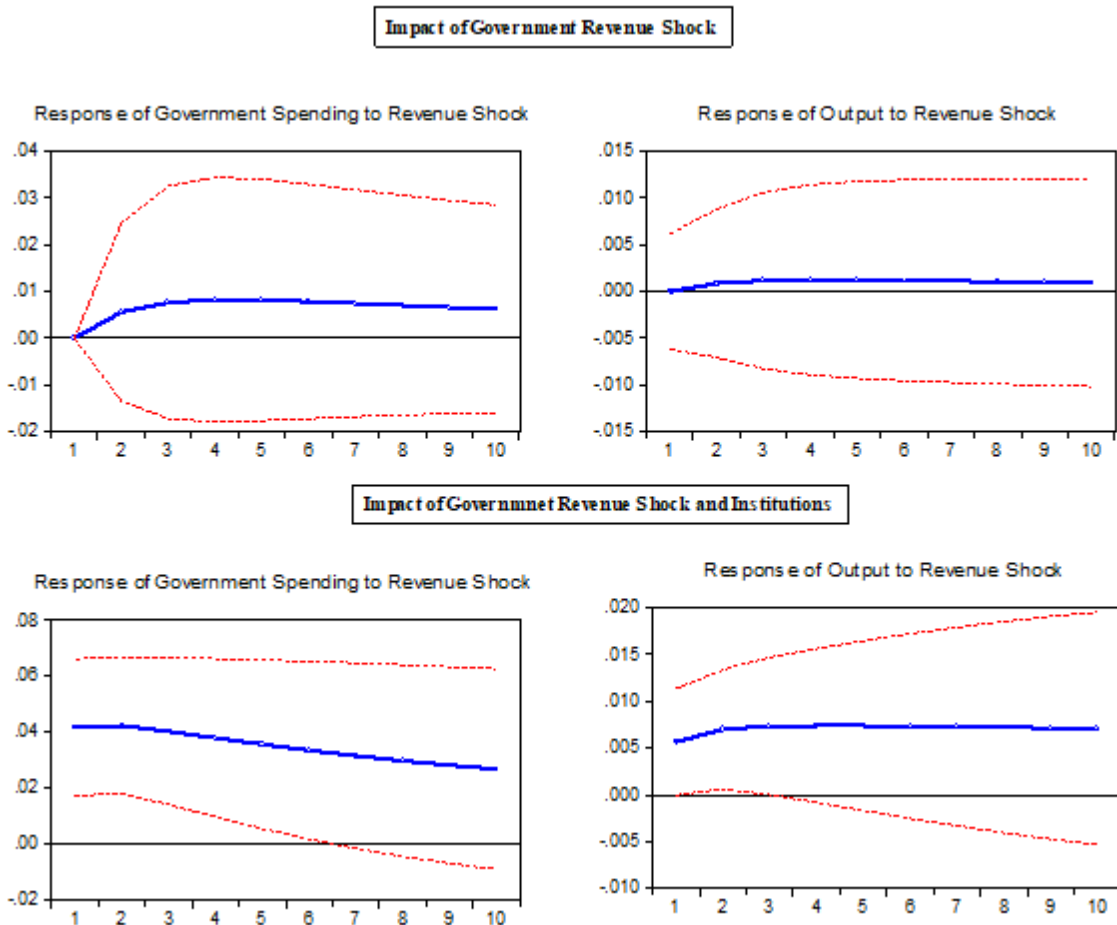
Figure 3.3: Response of Variables to Government Spending Shock



Spending Shock Impact via Institutional Quality: The result of this SVAR framework shows that government spending shock via institutional quality significantly affects output, which was irresponsive in previous case (spending Shock impact). The spending shock induces the output to decrease till the end of fifth year then affect becomes persistent and dissipates at the beginning of seventh year. A decrease in output because of positive spending shock indicates the presence of crowding out phenomenon. An unexpected spending shock has an immediate but provisional effect on output. The direction of the effect is negative which shows a reduction in aggregate demand. It might be the possible government-spending effect on output is ultimately *crowd out*

by private investment and consumption. The decrease in private investment and consumption¹⁰ is more than a proportionate increase in government spending resulting in the reduction of overall aggregate demand. The impulse response of government revenue to government spending shock shows that positive government spending shock has positive effect on government revenue. Government revenues increase due to spending shock until the end of second year and then the effect dissipates.

Figure 3.4 Response of Variables to Government Revenue Shock



¹⁰Though investment and consumption are not included in research but these two variables are driving force behind crowding out phenomenon.

Revenue Shock Impact: Upper part of figure 3.4 shows the responses of government expenditure and output variables to one standard deviation shock of revenues in case of Punjab. The result shows spending and output are irresponsive to government revenue shock in Punjab.

Government Revenue Shock impact via Institutional Quality: The response of government spending to government revenue via institutional quality indicates that positive government revenue shock positively affects government expenditures. An increase in government revenue tends to increase government spending for a period of six years and then effect disseminates. Output is also responsive to government revenue shock. As government revenues increases output also increases positively although the effect remains significant only for three years. No doubt, institutional quality is an exogenous variable but it plays important role in determining the effectiveness of any policy. As in case of positive revenue shock in the absence of institutional quality, output and spending are responding insignificantly, however, effects become significant after capturing the quality of institutions.

3.5.3.1.2 Variance Decomposition Analysis for Punjab

In case of Punjab it is evident from the table 3.7 that the public spending own innovations are leading source of encouraging variations in the public expenditure for short, medium, and long term. However, revenue shock role is almost negligible throughout the selected period. In case of output, the output shock own innovations are dominant source of inducing variations in the short medium and long run, however, government spending and revenue contribution are almost negligible. The role of own innovations is more dominant in explaining standard error of revenues in first year only. As far as the importance of the innovations of the remaining variables is concerned, the most significant innovation in describing variation in revenues is government expenditure after first year and then in medium and long run.

Table 3.8: Variance Decomposition of Standard Error

Variance Decomposition of G				
Period	S.E.	Government Spending Shock	Output Shock	Revenue Shock
1	0.07	100.0	0.00	0.00
3	0.11	98.89	0.37	0.72
5	0.13	97.39	1.31	1.29
7	0.14	95.61	2.76	1.62
9	0.15	93.51	4.67	1.81
10	0.15	92.33	5.79	1.87
Variance Decomposition of Y				
Period	S.E.	Government Spending Shock	Output Shock	Revenue Shock
1	0.02	9.26	90.73	0.00
3	0.03	5.83	93.96	0.20
5	0.04	4.12	95.57	0.30
7	0.05	3.11	96.55	0.33
9	0.05	2.46	97.21	0.33
10	0.06	2.23	97.44	0.32
Variance Decomposition of R				
Period	S.E.	Government Spending Shock	Output Shock	Revenue Shock
1	0.06	24.01	0.00	75.99
3	0.11	59.41	0.11	40.47
5	0.14	71.58	0.62	27.79
7	0.16	75.96	1.64	22.39
9	0.17	77.31	3.14	19.54
10	0.17	77.35	4.06	18.57

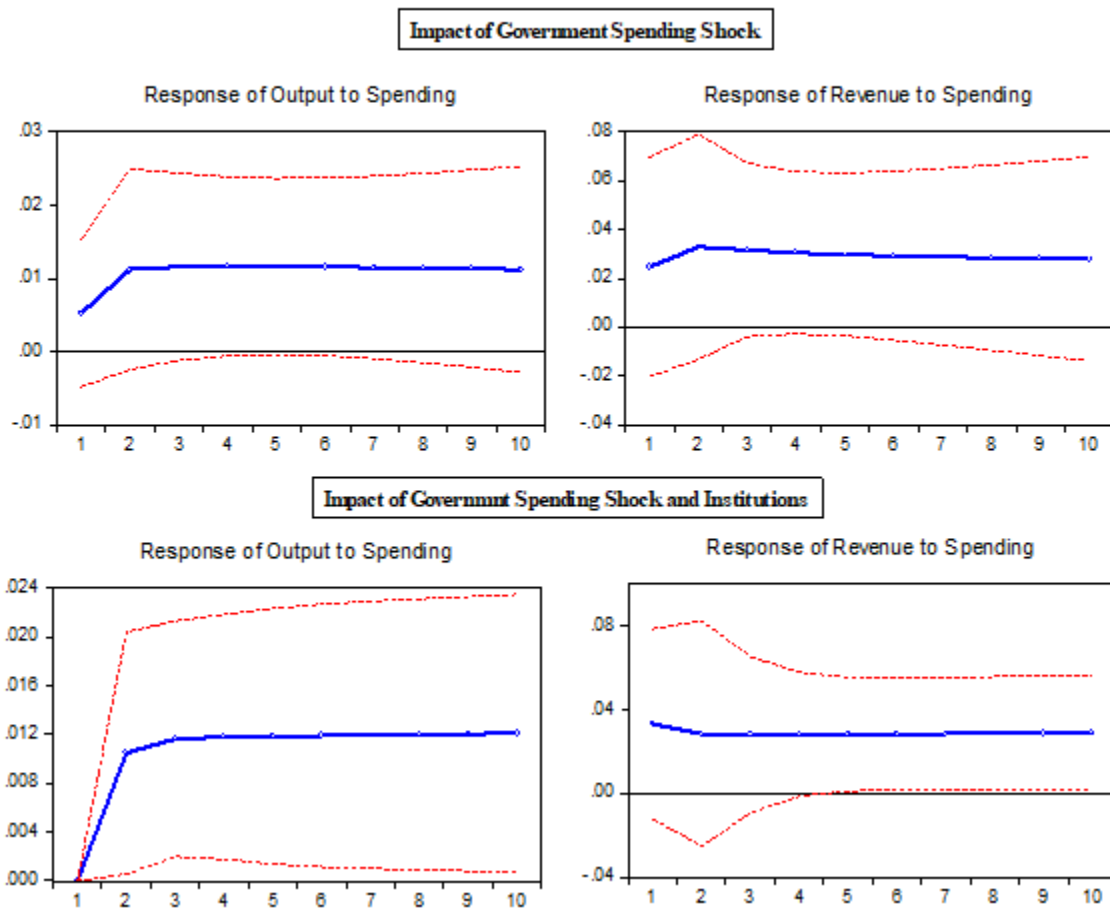
3.5.3.2 Dynamics of Fiscal Policy Shocks and Output level: Sindh

3.5.3.2.1 Impulse Responses of Government Spending and Revenue Shock

After Punjab, the next economy is Sindh with a share of over 30.1 percent in Pakistan's economy in 2016-17. Sindh dominates in industrial sector with share of 42.2 percent among others. However, in agriculture sector and services sector Sindh's share is 23.1 percent and 28.9 percent respectively, in 2016-17 [Pasha, 2018]. The upper part of figure 3.5 shows the endogenous variables response to one standard deviation positive unanticipated shock in Sindh's government expenditure and lower part of figure 3.5 indicates the responses of the endogenous

variable to one standard deviation positive unanticipated shock in Sindh government spending in the presence of institutional quality. Upper part of figure 3.6 indicates the responses of the endogenous variables to one standard deviation positive unanticipated shock in Sindh government revenue and lower part of figure 3.6 indicates the responses of the endogenous variable to one standard deviation positive unanticipated shock in Sindh government revenue in the presence of institutional quality.

Figure 3.5: Response of Variables to Government Spending Shock



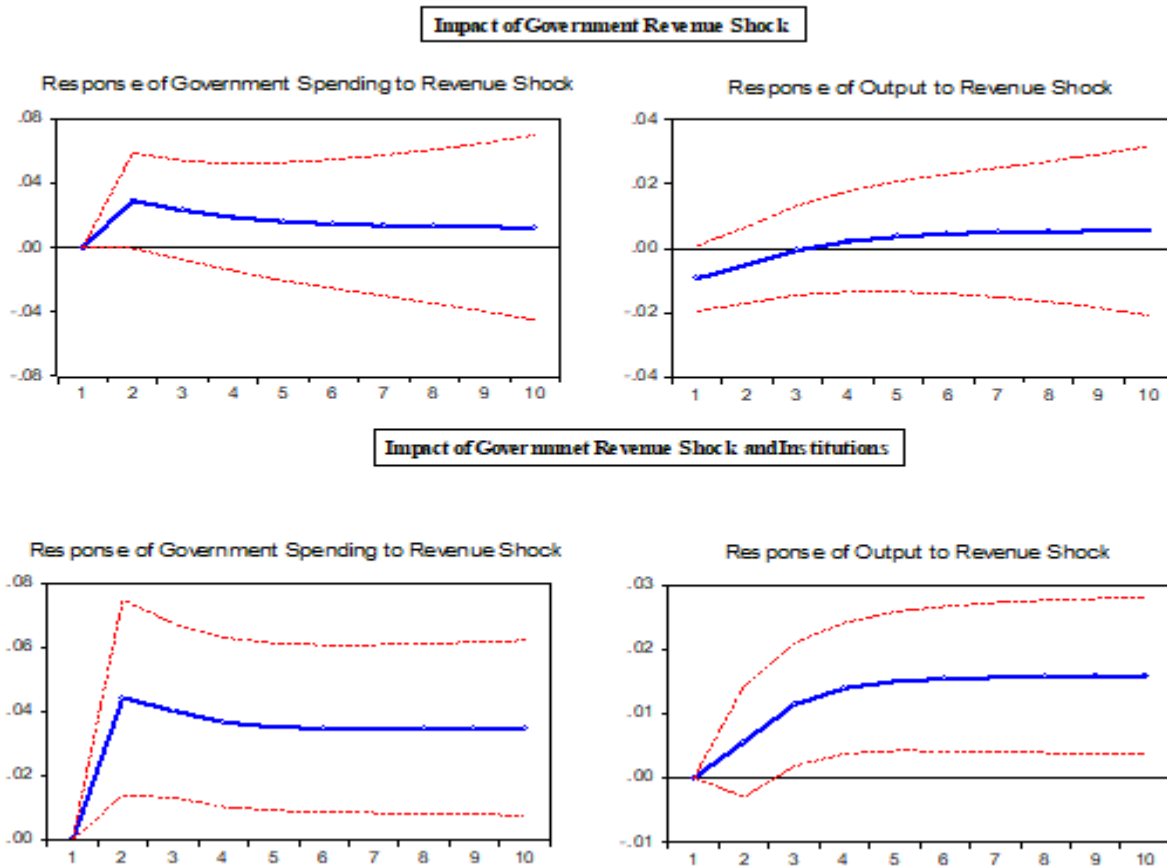
Spending Shock Impact: Upper part of figure 3.5 indicates the responses of government revenue and output variables to one standard deviation shock of government spending in case of

Sindh. The result shows revenue and output are irresponsive to government spending shock in Sindh.

Government Spending Shock impact via Institutional Quality: In this SVAR framework institutional quality plays significant role in determining the effectiveness of fiscal expansion via an upsurge in government spending. As in case of positive spending shock in the absence of institutional quality, output and revenues are responding insignificantly, however, effects become significant after capturing the quality of institutions. The fiscal expansion in the form of positive spending shock induces the output to increase sharply till the beginning of second year and then the effect becomes persistent. The response of output remains significant throughout the selected period. The response of government revenue to government spending shock via institutional quality is initially insignificant. However, after third year it becomes significant as the figure indicates that positive government revenue shock positively affect government expenditures and effect remains persistent till the end of remaining time period.

Revenue Shock Impact: As apparent from upper part of figure 3.6, that impact of revenue shock in the form of contractionary fiscal policy on spending is positive and significant but it disseminates at the end of second year. However, response of output to fiscal contraction in the form of revenue shock is insignificant throughout the selected time period.

Figure 3.6: Response of Variables to Government Revenue Shock



Government Revenue Shock impact via Institutional Quality: The responses of endogenous variables to revenue shock via institutional quality are quite similar to the responses obtained under SVAR framework for Punjab. The response of government spending to government revenue shock via institutional quality indicates that positive government revenue shock induces government spending to increase sharply until the beginning of second year. After that, the response of public spending becomes persistent but remains significant throughout the selected period. Output is initially irresponsive to government revenue shock. After second year, the effect becomes significant and remains persistent until the end of the selected period.

3.5.3.2.2 Variance Decomposition Analysis for Sindh

Table 3.9: Variance Decomposition of Standard Error

Variance Decomposition of G				
Period	S.E.	Government Spending Shock	Output Shock	Revenue Shock
1	0.08	100.0	0.00	0.00
3	0.11	76.26	12.65	11.07
5	0.12	66.15	21.72	12.11
7	0.14	60.22	27.93	11.83
9	0.15	56.28	32.28	11.42
10	0.16	54.76	33.99	11.24
Variance Decomposition of Y				
Period	S.E.	Government Spending Shock	Output Shock	Revenue Shock
1	0.02	3.51	85.26	11.22
3	0.04	15.94	77.69	6.35
5	0.05	21.20	73.75	5.03
7	0.05	24.12	70.65	5.21
9	0.06	25.95	68.41	5.63
10	0.06	26.63	67.54	5.82
Variance Decomposition of R				
Period	S.E.	Government Spending Shock	Output Shock	Revenue Shock
1	0.13	3.48	0.00	96.51
3	0.16	9.41	2.68	87.91
5	0.18	13.15	7.95	78.88
7	0.19	15.81	13.20	70.97
9	0.21	17.80	17.63	64.56
10	0.21	18.61	19.52	61.85

Table 3.8 shows that own innovations are leading cause of inducing variations in the public expenditure for short, medium and long term. However, after own innovations output shock is respectively most important source of explaining the forecasted standard error of government spending in the medium and the long run. After own innovation contribution in explaining major variation in standard error of output for short, medium and long run, the role of spending shock is quite significant in long run. The role of own innovations is more noticeable in explaining

standard error of revenues in short, medium and long run. Then, output and spending shocks are contributing significantly in describing variation in revenues in long run.

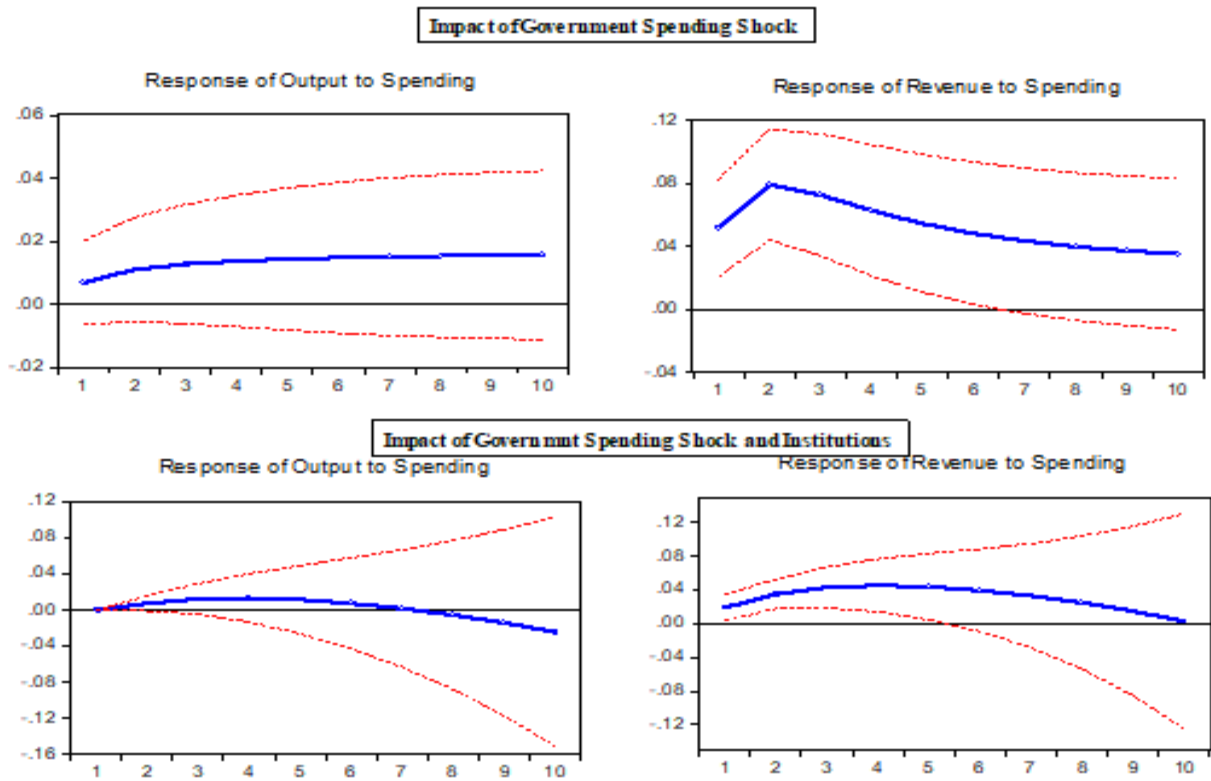
3.5.3.3 Dynamics of Fiscal Policy Shocks and Output level: KPK

3.5.3.3.1 Impulse Responses of Government Spending and Revenue Shock

According to Pasha (2018) study, the economy of Khyber Pakhtun khawa has 13 percent share in the national economy in 2016-17. KPK share in agriculture sector industrial sector and services sector is 10.5 percent, 14.2 percent and 13 percent respectively. Upper part of figure 3.7 shows the endogenous variables response to one standard deviation positive unanticipated shock in KPK's government spending and lower part of figure 3.7 indicates the responses of the endogenous variable to one standard deviation positive unanticipated shock in KPK government spending in the presence of institutional quality. Upper part of figure 3.8 indicates the responses of the endogenous variables to one standard deviation positive unanticipated shock in KPK government revenue and lower part of figure 3.8 shows the responses of the endogenous variable to one standard deviation positive unanticipated shock in KPK government revenue in the presence of institutional quality. Several structural breaks are identified in this SVAR framework. Several factors are responsible behind these structural imbalances in case of KPK economy. KPK growth strategy report 2013 to 2015 states that per capita income growth is lower in this province and population growth rate is highest in this province as compared to rest of Pakistan. Furthermore, the province faces challenges in the form of high poverty rate, highest dependency ratio, lowest rate of labor force participation and highest unemployment rate. In order to tackle down all these imbalances, we have introduced dummies for FY1992, FY2001, FY2011 and FY2015 in the model.

Spending Shock Impact: In this SVAR framework, output is irresponsive to government spending shock. However, fiscal expansion in the form of spending shock has positive significant impact on revenue. An unexpected spending shock has an immediate and positive effect on public revenue until the second year then public revenues start declining and effect dissipates at the end of sixth year.

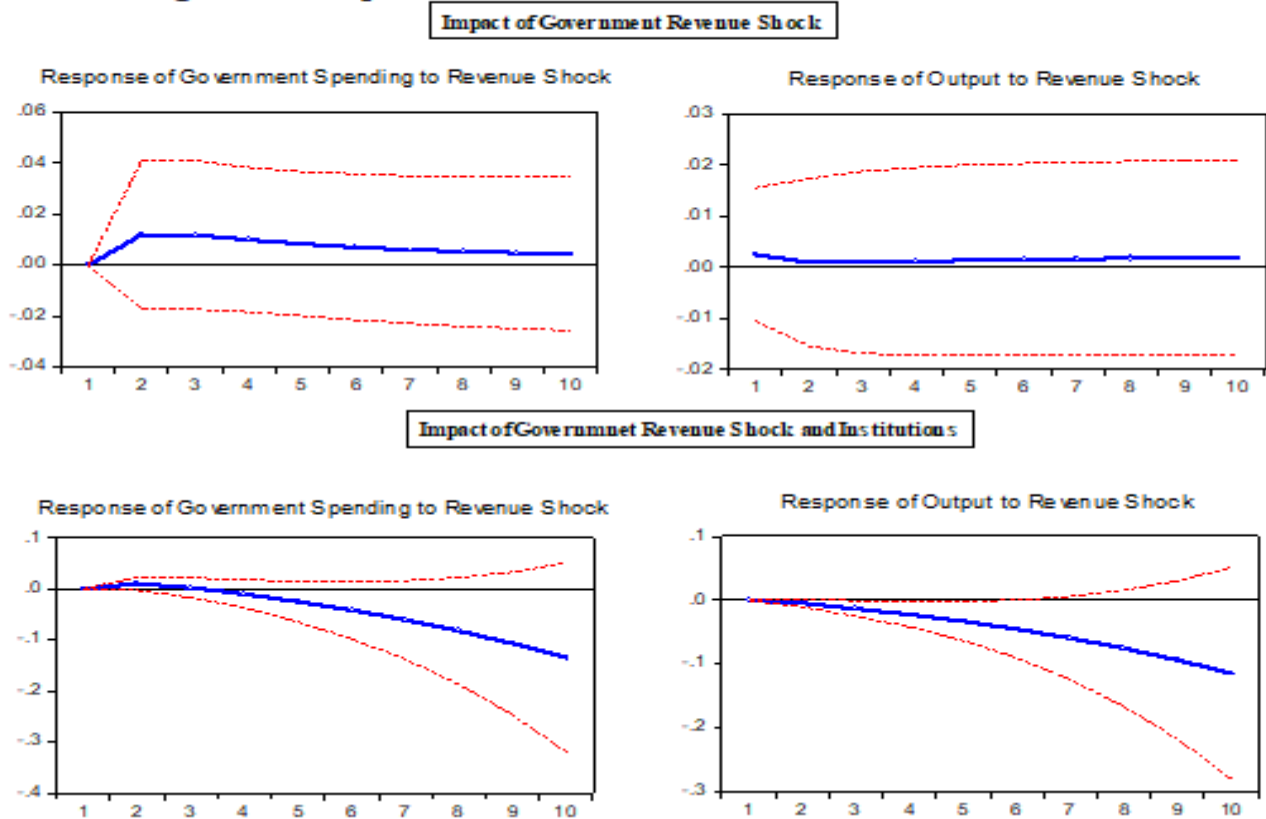
Figure 3.7: Response of Variables to Government Spending Shock



Government Spending Shock impact via Institutional Quality: In this SVAR framework institutional quality again plays significant role in determining the effectiveness of fiscal expansion via an increase in government spending. Output and revenue both are responsive to government spending shock. The response of output remains significant for two years then it dissipates. However, the response of government revenue to government spending shock via institutional quality remains positive and significant for five periods.

Revenue Shock Response: Responses of spending and output to one standard deviation shock of KPK government revenue are depicted in figure 3.8. Government spending and output both are irresponsive to government spending shock. Major reason behind these results is that the model has not captured the structural instabilities of the economy in this model.

Figure 3.8 Responses of Variables to Government Revenue Shock



Government Revenue Shock impact via Institutional Quality: Lower part of figure 3.8 shows the responses of government expenditure and output variables to one standard deviation shock of revenues in case of KPK. Spending increases as a response to positive revenue shock but it dissipates quickly at the end of second year. The revenue shock impact on output is negative. Output declines significantly, as a response to positive revenue shock and the effect prevails for six periods. This result shows non-Keynesian effect of fiscal policy. One justification for this

kind of result is that, by raising taxes and by shifting some of the tax burden to current generation the uncertainty about the future conduct of fiscal policy can be reduced. This will lead individuals to increase accumulated saving thus reducing aggregate demand. The second argument for this response can be given on the basis of revenue structure of Pakistan economy. As discussed in essay one, major share of revenue goes to finance non-development expenditures under the head of current and social economic expenditures and very less share of tax revenue go to finance development expenditures.

3.5.3.3.2 Variance Decomposition Analysis for KPK

Table 3.10 Variance Decomposition of Standard Error

Variance Decomposition of G				
Period	S.E.	Government Spending Shock	Output Shock	Revenue Shock
1	0.10	100.0	0.00	0.00
3	0.14	93.63	4.91	1.45
5	0.16	85.23	13.03	1.73
7	0.17	77.01	21.33	1.66
9	0.19	69.89	28.57	1.52
10	0.20	66.81	31.72	1.45
Variance Decomposition of Y				
Period	S.E.	Government Spending Shock	Output Shock	Revenue Shock
1	0.04	3.11	96.46	0.42
3	0.06	7.76	92.05	0.18
5	0.08	10.58	89.24	0.16
7	0.09	12.57	87.24	0.17
9	0.11	14.04	85.76	0.19
10	0.11	14.63	85.16	0.20
Variance Decomposition of R				
Period	S.E.	Government Spending Shock	Output Shock	Revenue Shock
1	0.09	28.16	0.00	71.83
3	0.15	62.09	1.67	36.23
5	0.17	65.56	7.57	26.86
7	0.20	62.85	15.26	21.87
9	0.22	58.78	22.72	18.49
10	0.22	56.74	26.09	17.16

In KPK the public spending own innovations are most leading source of encouraging variations in the public expenditure for short, medium and long term because hundred percent variations are explained by own innovation shock. However, output shock is respectively more important source of explaining the forecasted standard error of government spending in the medium and the long run as compared to revenue shock. In case of output, own innovation is most dominant in short medium and long run. Role of revenue shock is almost negligible in explaining variation in standard error of output. The role of own innovations is dominant in explaining standard error revenues in short, medium run. As far as the importance of the innovations of the remaining variables is concerned, the most significant innovation in describing variation in revenues is public spending in medium and long run.

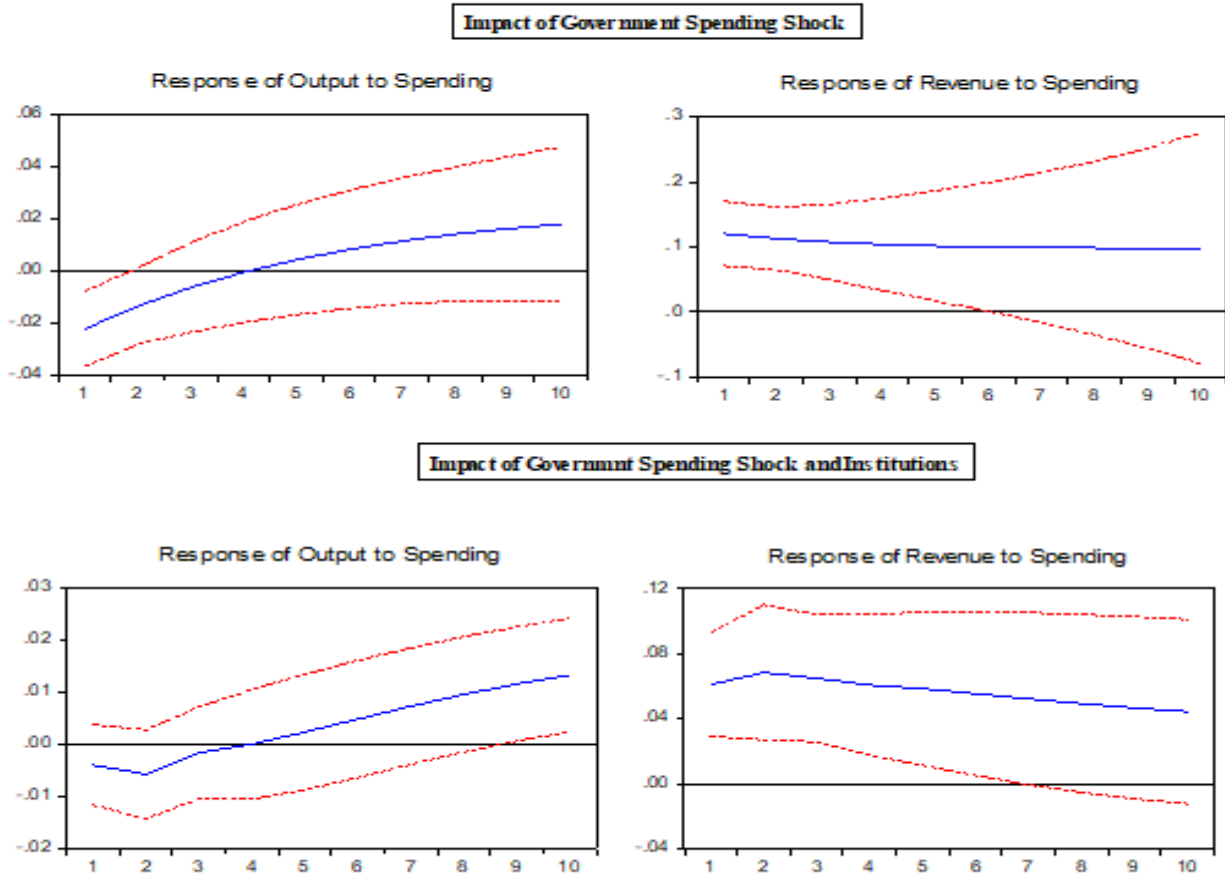
3.5.3.4 Dynamics of Fiscal Policy Shocks and Output level: Balochistan

3.5.3.4.1 Impulse Responses of Government Spending and Revenue Shock

Balochistan is no doubt the leading province of Pakistan in terms of land area and in contrast is the lowest by far in terms of population. Balochistan comprises 44% of the national territory constituting about 5% of the total country's population. It is the poorest and under developed province of Pakistan having multidimensional poverty. While, 70% of the population lives in scattered, sparsely populated settlements around water resources amid an arid and rugged terrain. Although Balochistan's share in divisible pool has increased after 18th Constitutional Amendment in 7th NFC Award but Balochistan economy is confronted with many challenges and it will take long time to stabilize the economy of Balocghisn. Chief Minister of Balochistan states some major issues of Balochistan economy in Balochistan Development Strategy Plan 2013-2020 as: "The, 'story of Balochistan' is unfortunately of a region which has lagged behind for too long with serious implication on the well-being of general population. Issues relating to

control over its resources; inadequate stream of funds; weak governing structures all accumulated into increased poverty; deprivation which eventually bred deep alienation of various sorts resulting in divisiveness; armed conflicts and insurgency-like situation. All this has kept the province on the fringes and has denied the people the development path similar to other regions in the country. In short, the new Government is confronted with complex law and order situation together with a huge gap on the development side.” Pasha (2018) study also reports Balochistan is by far the smallest economy with the only a share of 2.9 percent in overall size of economy. Balochistan share in agriculture sector is 4.1 percent, in industrial sector its share is 4.1 percent and a very small share in services sector, i.e 2.4 percent. Upper part of figure 3.9 indicates the endogenous variables response to one standard deviation positive unanticipated shock in Balochistan government spending and lower part of figure 3.9 indicates the responses of the endogenous variable to one standard deviation positive unanticipated shock in Balochistan government spending in the presence of institutional quality. Upper part of figure 3.10 shows the responses of the endogenous variables to one standard deviation positive unanticipated shock in Balochistan government revenue and lower part of figure 3.10 shows the responses of the endogenous variable to one standard deviation positive unanticipated shock in Balochistan government revenue in the presence of institutional quality. Although there are more than half of dozen structural breaks in case of Balochistan, the study has taken into account some major structural breaks. Dummies for capturing the effects of military takeover in Pakistan in FY1999, War against terrorism in FY2001, Akbar Bugatti Incident in FY2006, increase in federal transfers to province in FY2010 and Gwadar development strategy and CPEC project in FY2015 have been used in the model.

Figure 3.9: Response of Variables to Government Spending Shock

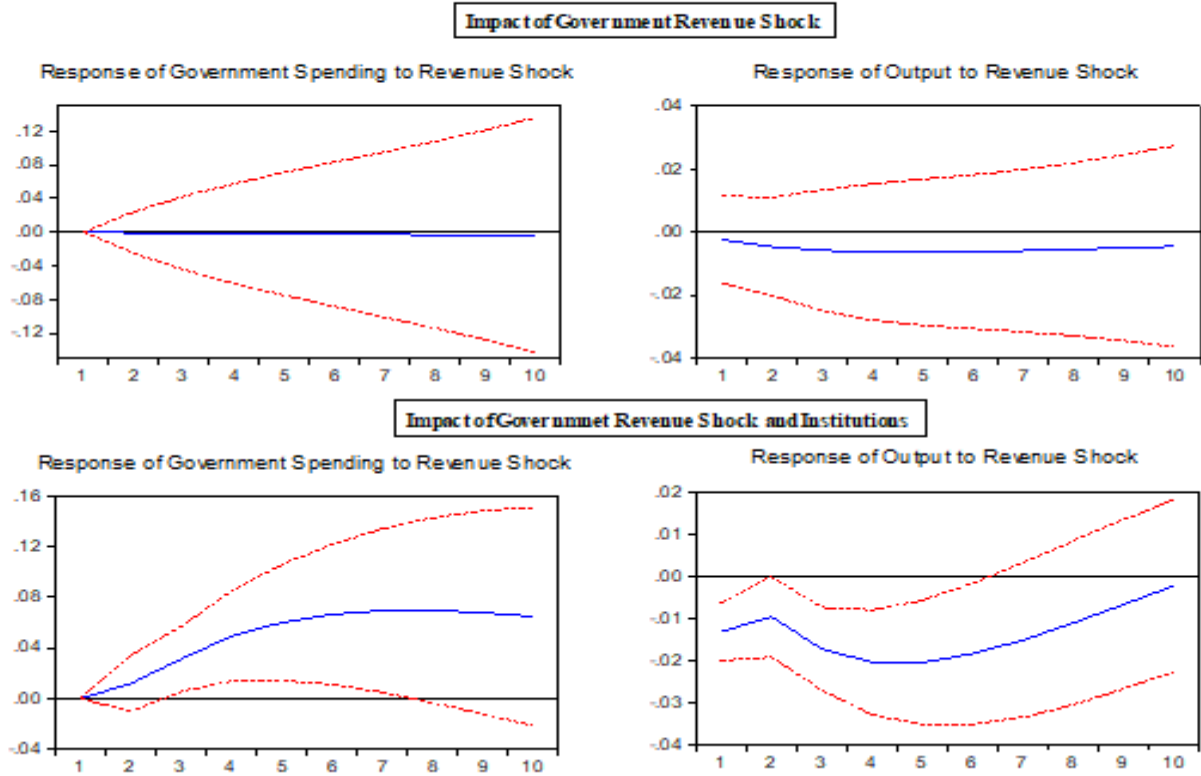


Spending Shock Impact: Output and revenues both are significantly responsive to government spending shock. The expansionary fiscal policy shock in the form of an increase in government expenditure induces the output to decrease and afterwards output starts increasing but the effect remains significant only for one and half years. However, revenues are positively responsive to government spending shock initially but affect remains persistent for consecutive six periods. It shows that there is no connection between government expenditure and public revenues in Balochistan.

Spending Shock Impact via Institutional Quality: The result of this SVAR framework shows that government-spending shock via institutional quality insignificantly affects output for consecutive eight years. In ninth year, the spending shock induces the output to increase significantly. The impulse response of government revenue to government spending shock shows that positive government spending shock has positive impact on government revenue. Government revenues increase due to spending shock for one year after that revenues start declining and effect remains significant for six years.

Revenue Shock Impact: Figure 3.10 represents the responses of spending and output variables to one standard deviation shock of revenues in case of Balochistan. The impact of revenue shock on spending and output is insignificant throughout the selected time period, it shows that public revenue has no effect on public spending and output.

Figure 3.10: Response of Variables to Government Revenue Shock



Government Revenue Shock impact via Institutional Quality: The response of government spending to government revenue shock via institutional quality becomes significant after lag of two years. Impulse response indicates that positive government revenue shock induces government spending to increase up to five years. Initial response of output to revenue shock is negative then output tends to increase for one year and then again start declining. Balochistan is the poorest province in every aspect and there are more chances for utilization of public revenues in fulfillment of current and social economic expenditures. Until fifth year, output is declining and then starts increasing but affect dissipate at the end of sixth year.

3.5.3.4.2 Variance Decomposition Analysis for Balochistan

Table 3.11: Variance Decomposition of Standard Error

Variance Decomposition of G				
Period	S.E.	Government Spending Shock	Output Shock	Revenue Shock
1	0.09	100.0	0.00	0.00
3	0.16	99.97	0.01	0.01
5	0.21	99.93	0.04	0.02
7	0.25	99.88	0.07	0.04
9	0.28	99.83	0.09	0.06
10	0.29	99.82	0.11	0.07
Variance Decomposition of Y				
Period	S.E.	Government Spending Shock	Output Shock	Revenue Shock
1	0.04	27.86	71.81	0.32
3	0.05	20.75	77.51	1.72
5	0.06	17.55	79.11	3.34
7	0.06	19.56	75.95	4.48
9	0.07	25.58	69.45	4.95
10	0.07	29.37	65.63	4.98
Variance Decomposition of R				
Period	S.E.	Government Spending Shock	Output Shock	Revenue Shock
1	0.15	58.59	0.00	41.40
3	0.24	66.76	0.07	33.16
5	0.28	73.03	0.18	26.78
7	0.31	77.62	0.27	22.10
9	0.34	80.97	0.33	18.68
10	0.36	82.32	0.35	17.32

It is evident from the Table 3.10 that the public spending own innovations are most leading cause of inducing variations in the public expenditure for short, medium and long term. However, output shock and public revenue shock role are negligible. In case of output shock, the output own innovations are most dominant source of inducing variations in short, medium and long run. However, public spending shock role is also significant in long run in explaining variation in standard error of output shock. The role of own innovations is not prominent in explaining

standard error of revenues in short, medium and long run. The most significant innovation in describing variation in revenue is spending shock.

3.6 Conclusion and Policy Recommendations

Keynesian school of thought argues that fiscal policy is used for maintaining growth and stabilization in the economy but there is no automatic mechanism to ensure the sufficient aggregate level of demand in the economy. Many lines of argument have been developed in the fiscal history to counteract this premise. This research is conducted to provide some evidence on the role of fiscal policy in macro-economic activities of Pakistan. We have tested four objectives in this study. First objective is to examine the effects of the fiscal policy shocks on macroeconomy of Pakistan at national level as the significance stems from the fact that revenue and expenditure shocks contribute significantly to bringing variation in key macroeconomic variables at national level. Second objective is to scrutinize the impact of fiscal policy shocks on macroeconomy of Pakistan via institutions, which is a new contribution in empirical literature of fiscal policy shocks, and macroeconomy of Pakistan. Third objective is to examine the impact of fiscal policy shocks on output level at provincial level because fiscal policy shocks favorably affect output level in four provinces of Pakistan. In last objective, the study is determining the effect of fiscal policy on output level via institutions at provincial level.

As the study presents evidence on impacts of discretionary fiscal policy on Pakistan's economy at national and provincial levels, it employs the SVAR approach using annual time series data for the period 1982 to 2017. A set of four endogenous variables e.g., government revenue, government expenditure, CPI and Output have been used for analysis at national level and a set of three endogenous variables e.g., each province public spending, public revenue and

output has been used for analysis at provincial level. Consolidated series of government revenues and expenditures have been used for representing national level government spending and revenues. Interest payments have been excluded from consolidated public spending. The data on institutional quality is taken from ICRG that is computed by the PRS Group. The political risk services category is comprised of twelve political risk components, however, the study uses six indicators from ICRG data to construct institutional quality index. These indicators include “Government stability, Control over Corruption, Law and Order, Military in Politics, Democratic Accountability and Bureaucracy Quality”. For construction of institutional quality index, the present study has used Principle Component Analysis (PCA). The institutional quality index is used in all the regressions to capture the impact of institutional quality. Before estimating SVAR, Augmented Dickey Fuller unit root statistics show that all the indicators are non-stationary at $I(0)$ and they become stationary at their $I(1)$. For lag length selection, the present study has employed the AIC, which is one of the most widely used measures of lag length selection. Based on AIC lag selection criterion, the lag length is selected at 1 for Sindh and 2 for National level, Punjab, KPK and Balochistan. Few more diagnostic tests are employed to approve the stability of models these include; Autocorrelation LM Test, Normality test and White Heteroskedasticity tests. After these preliminary analyses, it is confirmed that all the models are stable over lag length and time.

The main findings for the national level main analysis are: i) a shock to Government spending dissipates quickly have almost no effect on output but a positive effect on price level and affecting public revenues positively; and ii) a shock to government expenditure via institutional quality has a positive effect on output, inflation, and revenues; iii) a shock to revenue is persistent, has a slight positive significant impact on public spending but almost no

effect on output and price level (it is not inflationary); iv) a shock to revenue via institutional quality has positive effect on spending and output, however, it asserts negative effect on inflation. Briefly, it is postulated that fiscal policy shocks have limited stabilization impacts on economy. Government spending shocks need to be financed imposing serious strains on economic performance as an increase in public spending results in increasing inflationary pressure.

However, at the provincial level, the main results of this exercise can be summarized individually for each province. At the provincial level, price level is omitted from the system because it is determined at the national level (provinces cannot print money and their fiscal behavior should not affect inflation).

The main findings for Punjab are: i) a shock to Government expenditure asserts no effect on output but a positive effect on public revenues for seven periods; and ii) a shock to government expenditure via institutional quality has negative effect on output for six periods but positive significant effect on revenues for two years; iii) a shock to Revenue has no effect on spending and output; iv) a shock to revenue via institutional quality has positive effect on spending for six years and output for two and half years. Briefly, the result shows, fiscal policy works effectively in the presence of stable institutions and expansionary fiscal policy role is more dominant on output level as compare to revenue shock in the province. Meanwhile spending shock and revenue shock both are positively affecting each other.

The main findings for Sindh are: i) a shock to Government spending asserts no effect on output and public revenues; and ii) a shock to government spending via institutional quality has positive effect on output for the whole selected time period, however, spending shock has no impact on public revenues for initial four years after that public revenues start increasing and

effect remains significant for next six periods; iii) a shock to Revenue has no effect on output but it asserts positive effect on spending for only two periods; iv) a shock to revenue via institutional quality has positive effect on spending and output. In case of Sindh, both kinds of fiscal policies work effectively in the presence of stable institutions and spending shock and revenue shock both are positively affecting each other.

The main findings for KPK are: i) a shock to Government spending asserts no effect on output but a positive effect on public revenues for six periods; and ii) a shock to government expenditure via institutional quality has positive significant effect on output for two and half periods and positive effect on revenues for five years; iii) a shock to Revenue has no effect on spending and output; iv) a shock to revenue via institutional quality has positive effect on spending for two years and negative effect on output for six years. In short, both types of fiscal policies work effectively in the presence of stable institutions and spending shock and revenue shock both are positively affecting each other for two periods.

Lastly, the main findings for Balochistan are: i) a shock to Government spending asserts negative effect on output for one year and positive effect on public revenues for five periods; and ii) a shock to government spending via institutional quality has no effect on output for eight years after that output tends to increase significantly; iii) a shock to Revenue has no effect on spending and output; iv) a shock to revenue via institutional quality has no effect on spending for initial two years but after second period effect becomes positive and significant for next five periods. The small impacts are probably because provincial Government spending and Revenues are low in this poor province.

Overall, the results obtained from this exercise are weaker because of small number of observations and we have no choice to increase number of observations. As the data on output,

level is not available on a quarterly basis and provincial public spending and public revenue data is available on annual basis from 1982 onward. Following recommendations can be put forward based on empirical results obtained in this study. At national level, the inflationary effect of a shock to Government Spending suggests that seignorage (printing money) is used to finance the increased spending. This implies that the desired policy is to increase revenue to finance increases in spending. At the provincial level, the main policy implication is that provinces can benefit from central government transfers to finance development spending but central government requires sustained revenue to finance transfers. At national and provincial level, we find that the improvement in institutions increases the effectiveness of fiscal policy. The institutions being the central element of fiscal policy effectiveness, to achieve stabilization of economy, this means that institutional quality essentials to be strengthened. In most cases at national and provincial level, government spending has a positive significant effect on output level but this impact is not robust. Therefore, there is a need to direct the available public expenditures for making investment under development projects instead of consuming for current expenditures. As depicted by the results, government expenditures and government revenues both are causing each other but government expenditures impact is dominant, suggesting that the government can control the fiscal deficit by managing its expenditures. Hence, the government should follow expenditure regulated fiscal policy. Our analysis also suggests that government should not be trying to influence the macro economy by over-reliance on fiscal expansion. It should also focus on rationalization of tax rates and types along with accumulating capability of tax administration to manage and collect revenues is vital to upsurge tax collection that is crucial to control the chronic deficit of the Pakistan economy.

Chapter 4

Essay 3: FISCAL DECENTRALIZATION, INSTITUTIONAL QUALITY AND GOVERNMENT SIZE: EMPIRICAL ANALYSIS FOR PAKISTAN

4.1 Introduction

Due to a disastrous event throughout the world in the first half of the twentieth century, the need for fiscal decentralization and strong national governments increased. Two world wars and a great depression are major factors that lead to countries' increased dependence on central governments. The peak of decentralization came in the 1950's and then began to decline. A heavy trend toward decentralization began in the early 1970's which became commonly referenced as a "prescription for growth" for developing nations. After the collapse of the Soviet Union, decentralization's momentum accelerated across the globe, especially in China and Latin American nations. By the 1990's countries began to converge to mid-levels of decentralization (Thiessen 2003). Both developed and developing countries have been improving their public sector performance while turning towards the devolution of their responsibilities towards local governments (Oates, 1999). The question of whether fiscal responsibilities should be performed by a higher or lower tier of governments has long been discussed in the research issue of public economics. The discussion is based on the Oates (1972) Decentralization Theorem which states that "In the nonexistence of cost savings from centralization and inter-jurisdictional externalities, fiscal responsibilities should be spread out by the following decentralization." This statement assumes that the central government is unresponsive towards the diverse preferences of the general public and is only capable of implementing uniform policies for all communities irrespective of their partialities. Advocates of decentralization also tend to argue that democracy

supports effective development. Thus, decentralization of power and delivery and greater participation by the people tend to go together as development strategies.

Decentralization of powers most commonly refers to fiscal decentralization that is the transfer of fiscal powers to sub-national governments. In other words, it is the transfer of policymaking responsibilities from the federal government towards local governments regarding expenditure and revenue collection. It is believed that fiscal decentralization is an important instrument for policy makers to gain economic efficiency and ensure good governance as the local governments are given financial independence. Furthermore, fiscal devolution is the easiest dimension to quantify and compare. The most common measures of fiscal decentralization are sub-national shares of government revenue and expenditures. Decentralization is a method through which the resources and responsibilities are transferred to subnational governments in such a way that resources can be used in a better way, public living standards can be improved and workload can be shared among all levels of governments. In low-income countries, decentralization has been opted to eradicate poor governance and macroeconomic instability, however, in western countries it is opted to provide public goods in a more cost-effective manner. Decentralization originated in Latin American countries due to the political pressure of their citizens for pursuing democratization. In short, decentralization is thought to bring political authorities close to the general public and bring out equality in the donation of public goods to different localities of the same country.

Decentralization is beneficial because local governments are supposed to have a greater knowledge of public choices than that of the central government and it is noticed when local governments are involved in decision making it results in enhancing the overall efficiency of the government. Furthermore, tax collection increases in the decentralized setup of governments

because local governments have direct access to local community. It is expected that due to decentralization the relative size of government gets affected. The debate on this issue starts from “Leviathan hypothesis” formulated by Brennan and Buchanan (1980) which show that “government intrusion into the economy will be smaller when the public sector is decentralized”. Many researchers investigated this “Leviathan Hypothesis” empirically, as Brennan and Buchanan openly offered researchers to test this hypothesis, and partly because the validity of the hypothesis is based on a controversial view of government. The current search for the Leviathan is first carried by Oates’s (1985). Afterwards many researchers replicate it for different times, data sets and countries by applying different estimation techniques. Most of the research on this issue is done for Latin American countries and OECD economies. The existing empirical literature on fiscal decentralization effect on government size has two main strands: first one indicates negative association of fiscal decentralization on government size [see Marlow (1988), Ehdaie (1994), Rodden (2003), Cassette and Patty (2010) and Golem and Perovick (2014), among others]; the second asserts positive relationship between government size and fiscal decentralization [see Grossman (1989), Nelson (1986), Wu and Lin (2012), among others].

After careful investigation of literature, we found no empirical or theoretical study discussing the association between fiscal decentralization, institutional quality, and government size of Pakistan. In general perception, fiscal decentralization upsurges the size of sub-national governments while shrinking the size of the national government. Thus, there is a need to empirically analyze the direction of impact between fiscal decentralization, institutional quality, and size of government with specific emphasis on the query whether decentralization of fiscal resources leads to a decrease or an upsurge in the size of the public sector. The main motivation behind this chapter is to explore broadly the devolution and decentralization debate and

experience in the case of Pakistan. This study makes an effort to gauge the effects of expenditure and revenue decentralization on government size in Pakistan. The study also includes the quality of institutions in assessing the role of fiscal decentralization in determining the size of government. The present study is a fresh attempt to empirically analyze the link between government size, institutional quality, and fiscal decentralization in Pakistan.

The organization of this chapter is as follows: section 4.2 offers discussion on fiscal decentralization and National Finance Commission (NFC) awards; section 4.3 consists of survey of literature; section 4.4 describes the details of model and control variables. It also describes data construction in detail and econometric methodology, section 4.5 describes a detailed discussion of results; and finally section 4.6 gives the conclusion with some policy recommendations.

4.2 Decentralization and NFC Awards in Pakistan

NFC is started under Article 160(1) of the 1973 constitution and the fiscal system in Pakistan is governed by 1973 constitution and all its amendments thereafter. Government system in Pakistan includes three tiers i.e., federal government, provincial government and district government. Before the implementation of district government system in 2001, local governments were extensions of provincial governments and the former acted on behalf of the latter. In Pakistan, provincial governments receive some financial resources from federal government under the head of federal transfers to provinces. Federal government collect taxes and transfer a specific share to provinces under a proper mechanism. Under NFC award provincial governments are empowered to generate their own resources for expenditure making, however, major part of provincial budget revenues still consists of funds provided by the federal

government. The federating units under the constitutional mandate of the NFC are the four provinces of Pakistan these are: Punjab, Khyber Pakhtunkhwa (KPK), Sindh, and Balochistan. The Federally Administered Tribal Areas (FATA), although part of the federation is not covered under the formal arrangement of the federal transfer system; however, a system of special grants is in place and functional for FATA.

This section is further divided into four sub-section. Section 4.2.1 provides an overview of salient features of previous NFC awards, section 4.2.2 is discussing the Present 7th NFC Award and 18th Constitutional Amendment, section 4.2.3 provides an analysis of pre and post 7th NFC award expenditures and revenues analysis at federal and provincial level and lastly section 4.2.4 provides a comparison of composition of provincial expenditures and revenues of fiscal year 2010 with fiscal year 2019.

4.2.1 Overview and Salient Features of Previous NFC Awards

Table 4.1: Overview of NFC Awards in Pakistan

NFC Award number	NFC Award Name	Consensus of provinces
First	NFC Award 1974	Conclusive
Second	NFC Award 1979	Inconclusive
Third	NFC Award 1985	Inconclusive
Fourth	NFC Award 1991	Conclusive
Fifth	NFC Award 1995	Inconclusive
Sixth	NFC Award 1997	Conclusive
Presidential Order	Distribution Order 2006	-
Seventh	NFC Award 2010	Conclusive
Eighth	Constituted on 21st July, 2010, but it did not give any Award	Inconclusive
Ninth	NFC Award 2015	Inconclusive

Source: Reports on NFC Awards published by Ministry of Finance, Government of Pakistan

Table 4.1 shows, the Overview of NFC awards in Pakistan. Table 4.2 indicates the structures of numerous NFC awards after 1973. The NFCs 1974, 1991, 1997 and 2006 prepared their

recommendations, while NFCs constituted in 1979, 1985 and 1995 were unable to finalize their recommendations.

The NFC award 1974 through its unanimous recommendations provided certain shape to fiscal federalism in Pakistan in a democratic setup. The NFC Award 1979 and NFC award 1985 were unable to finalize their recommendations. In fourth NFC Award on the recommendation of Governments of NWFP, Sindh, and Balochistan excise duty on Tobacco was added in divisible pool and royalty on Crude Oil and Surcharge on Natural Gas (GDS) were made as straight transfers to the provinces. In addition, Federal Government also guaranteed the payment of profits from hydro-electric stations to provinces from the Water and Power Development Authority (WAPDA). The provincial portion was fixed at 80%. In NFC Award in 1995, divisible pool was enhanced by adding taxes on income, wealth, capital value, sales and purchase, export duties and custom duties. However, FED on Gas and Income tax paid out of the federal consolidated funds were not included in divisible pool. Royalty on Crude Oil and Surcharge on Natural Gas (GDS) was continued as straight transfers to the provinces. The provincial share in divisible pool taxes was fixed at 37.5%. The NFC Award 2000 could not finalize the recommendations. The intergovernmental revenue sharing was fulfilled through a presidential order. The provincial share in divisible pool was enlarged from 41.5 percent in 2006-07 to 46.25 percent in 2010-11. All the four provinces were made suitable for Grants-in-Aid in Award and 27.75 billion Grants-in-Aid were fixed for the year 2006-07 with annual increment according to growth in pool. The provincial share in grants was fixed as Punjab 11 percent, Sindh 21 percent, NWFP

Table 4.2 Salient Features of various NFC Awards

Award Year	Divisible Pool	Vertical Distribution	Horizontal Distribution Criteria	Grants and Aid Criteria	Straight Transfers
1974	1.Taxes on Income 2.Taxes on Sales and Purchase 3.Export duties on Cotton	Provincial Share 80 percent Federal Share 20 percent	Population	1.KP 100 million 2.Balochistan 50 million	
1990	1.Similar as 1975 + 2.FED on Tobacco and Tobacco manufacturers and Sugar	Provincial Share 80 percent Federal Share 20 percent	Population	1.Punjab one billion for 3 years 2.Sindh 700 million for five years 3.KpK 200 million for three years 4.Balochistan 100 million for three years	1.Share in total Crude Oil Royalties on the basis of a share in crude oil production 2.Share in National Gas Surcharges
1996	1.Taxes on Income 2.Wealth Tax 3.Capital Value Tax 4.Taxes on sales and Purchase 5.Exports Duties on Cotton 6.Custom Duties 7.FED excluding FED on Gas 8.Anyother Tax	Provincial Share 37.5 percent Federal Share 62.5 percent	Population	1.KPK 3.31 billion for five years 2.Balochistan 4.08 billion for five years 3.Additional grant to each province on achieving a growth of 14.2 percent in provincial receipts ^b	1.Share in total Crude Oil Royalties on the basis of a share in crude oil production 2.Share in National Gas Surcharges
2006*	Similar as 1997 NFC Award and Sales Tax on Services	Provincial Share 41.5 to 46.25 percent ^b	Population	27.750 billion ^c Grant will increase each year at same rate as growth in divisible pool	
2009	Similar as 1997 NFC ^d	Provincial Share 56 percent 2010-11 and 57.5 percent in 2011-12 onward	1.Population 82 % 2.Poverty and Backwardness 10.3% 3.Revenue Collection and Generation 5 % 4.Inverse Population Density 2.7%	0.66 percent in the share of each province in divisible pool	1.Share in total Crude Oil Royalties on the basis of a share in crude oil production 2.Share in National Gas Surcharges on the basis of average rate per MMBUT

Source: Reports on NFC Awards published by Ministry of Finance, Government of Pakistan

*Distribution of Revenues and Grants-in-Aid Order 2006

35 percent and Balochistan 33 percent. The vertical distribution and composition of divisible pool have been variable in every NFC award but the criteria of horizontal distribution remained the particular factor of population until 2010.

4.2.2 The Present 7th NFC Award and 18th Constitutional Amendment

In Seventh NFC Award, the 18th Amendment to the 1973 Constitution of Pakistan added clause 3(A) and 3(B) to Article 160. Clause 3(A) gives protection to the province and specifies that the portion of the province in each award of the NFC shall not be less than the portion allocated to the province in the preceding award. Clause 3(B) is related to the provision of good governance which has now become an important feature of the Commission's stipulation. Table 4.3 provides awards wise horizontal distribution of federal transfers among provinces. For the first time it happened in 2010 NFC Award, the Federal government and provincial Governments of Sindh, NWFP, Punjab and acknowledged the needs of Balochistan. All these governments in this award consented to give Balochistan 9.09 percent share of provincial in the first year of the Award. Table further shows that Punjab was receiving 57.36 percent share of federal transfers in Presidential Distribution order of 2006 that has reduced to 51.74 percent in this award. However, the shares of NWFP, Balochistan, and Sindh have increased in federal transfers. Sindh was receiving 23.71 percent share in federal transfers according to Presidential Distribution Order of 2006, NWFP 13.82 percent and Balochistan 05.11 percent. In 7th NFC Award Sindh share in federal transfers has increased to 24.55 percent and NWFP share has increased to 14.62 percent. The most significant increase is in Balochistan share as it reached 9.09 percent of total federal transfers. In 7th NFC award, provincial share in divisible pool has increased from 47.5 percent to 56 percent in 2010-11 and 57.5 percent subsequently.

Table 4.3 Awards Wise Horizontal Distribution of Federal Transfers (%)

NFC Award	Punjab	Sindh	NWFP	Balochistan
1974	60.25	22.50	13.39	3.86
1982	57.57	23.34	13.39	5.30
1990	57.97	23.34	13.39	5.30
1996	57.88	23.28	13.54	5.30
2006*	57.36	23.71	13.82	5.11
2009	51.74	24.55	14.62	9.09

Source: Reports on NFC Awards published by Ministry of Finance, Government of Pakistan

4.2.3 Pre and Post 7th NFC Award Revenue and Expenditure Analysis

Table 4.4 presents Pre and Post NFC revenues and expenditures. For analysis purposes we are comparing annual growth of revenues and expenditures of 2009-10 with average annual growth of revenues and expenditures from 2010-11 to 2017-18. The annual growth rate of total revenue in 2009-10 was recorded as 12.26 percent, however, from 2010-11 to 2017-18, the average annual growth rate of total is recorded as 12.33 percent which is slightly higher than 2009-10. But the growth in tax revenue is quite small in a similar period. Tax revenue has revealed growth of 14.99 percent in the last eight years which is quite lower compared to the growth in 2009-10. There is a noteworthy upsurge in provincial tax revenue but federal tax revenue has decreased sharply as shown in table. Provincial tax revenue has shown average annual growth of 29.34 percent which was previously 19.57 percent in 2009-10. However, average annual growth of federal tax revenue has dropped from 22.35 percent to 14.19 percent in selected eight years. The decline in federal tax revenues is primarily because the GST on Services head has been transferred to the provinces under the 18th amendment of 7th NFC Award. Other reason is that the

Table 4.4 Pre and Post 7th NFC Award Expenditure and Revenue Analysis in (Rs. Billion)

	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	Growth 2009-10 (%)	Growth 2010-11 to 2017-18 (%)
Total Revenue(A+B)	1851	2078	2252	2566	2982	3637	3931	4446	4936	5228	12.26	12.33
A. Tax Revenue	1205	1472	1699	2052	2199	2564	3017	3660	3969	4467	22.15	14.99
Federal	1159	1418	1634	1945	2048	2374	2811	3377	3647	4066	22.34	14.19
(i) Provincial	46	55	64	107	151	189	205	283	321	401	19.56	29.34
B. Nontax Revenue	646	605	553	513	783	1072	913	786	967	761	-6.34	5.84
Federal	562	537	491	465	712	1023	837	693	887	614	-4.44	5.60
(ii) Provincial	84	67	62	48	71	49	75	93	79	147	-20.23	16.87
(iii) Federal Transfers to Provinces	526	633	999	1089	1214	1406	1538	1862	1965	2217	20.34	17.87
(iv) Federal Loans and Grants to Provinces	95	119	85	88	107	121	82	55	61	173	25.26	17.37
Provincial total revenue (i+ii+iii+iv)	751	874	1210	1332	1543	1765	1900	2293	2426	2938	16.37	16.75
Total Expenditure	2611	3178	3519	3968	4923	5377	5661	6073	6953	7665	21.71	11.76
Federal Expenditure	1845	2273	2442	2612	3441	3759	3762	3921	4362	4704	23.19	9.85
Current	1536	1841	2142	2209	2625	2885	3070	3178	3494	3814	19.85	9.66
Development	308	432	300	403	816	874	691	742	867	890	40.25	14.91
Provincial Expenditure	766	905	1077	1356	1482	1618	1899	2152	2591	2961	18.14	16.09
Current	564	646	831	981	1110	1187	1400	1560	1739	2081	14.53	15.91
Development	202	258	245	375	372	431	499	592	852	880	27.72	18.09
Federal Expenditure as % of total Expenditures	70.66	71.52	69.39	65.83	69.90	69.91	66.45	64.56	62.74	61.37		

Source: data is taken from Fiscal Operations (various issues). Growth rates are calculated by Author.

federal government is restricted to assemble additional resources in 7th NFC Award. Furthermore, provincial portion in divisible pool has increased from 47.5 percent to 57.5 percent in this award. It means 57.5 paisa out of each additional rupee collected by the federal government transfers to the budget of provinces. Another significant cause is the moderate development of the economy. Growth in nontax revenue both at federal and provincial level is positive which was recorded almost negative before 7th NFC Award. Nontax revenue during 2010-11 to 2017-18 increases on average at 5.84 percent per annum in which provincial nontax revenue has shown the growth of 16.87 percent in selected eight years viz-a-viz the growth of 5.6 percent in federal nontax revenue.

Seventeen ministries have been devolved to the provinces under 18th Constitutional Amendment in 7th NFC Award. The ministries devolved in provincial domain are ministry of education, health, water supply, law and order, environment, etc. The federal government expenditures share in total expenditures has declined by almost ten percentage in the last ten years. In 2009, the portion was 71.52 percent, but in 2017-18 it is recorded as 61.37 percent. The provincial expenditures in 2017-18 grew at average of 16.09 percent but federal expenditures grew at 9.85 percent per annum. The growth of provincial development expenses and current expenses is higher as compared to the federal level. At the provincial level, the average growth of development expenditure in selected eight years is 18.09 percent per annum and at federal level it is recorded as 14.91 percent per annum. Similarly, the average growth of current expenses at provincial level from 2010-11 to 2017-18 is 15.91 percent per annum and at federal level it is recorded as 9.66 percent per annum. In the post NFC period, provincial lower growth in development expenses as compared to current expenses specifies that a large share of further revenues went to current expenses as opposite to development expenses. Total expenditure

growth is less during 2010-11 to 2017-18 as compared to 2009-10, as in 2009-10 it was 21.72 percent annually but in selected post NFC period it is on average 11.76 percent per annum.

4.2.4 Comparison of Provincial Expenditures and Revenues of FY 2010 and FY 2019

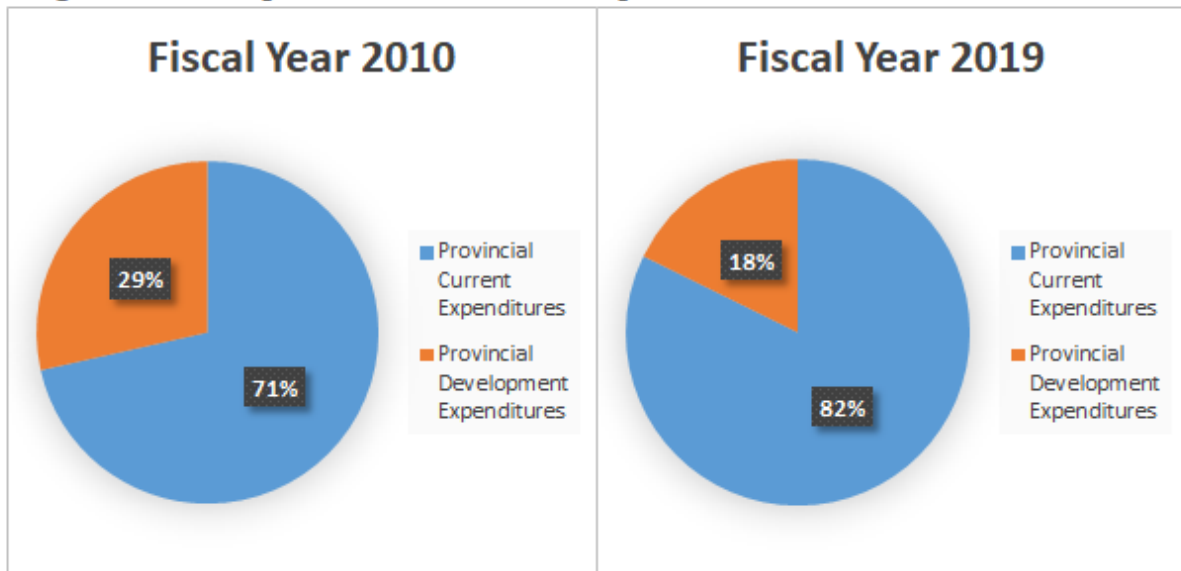
In figure 4.1 we are comparing the composition of provincial revenues of fiscal year 2009-10 with fiscal year 2019. In fiscal year 2009-10 total provincial revenues were 874 billion rupees in which provinces were generating 55 billion rupees from own-source tax revenues, 67 billion rupees were collected from provincial non-tax revenue sources, 119 billion rupees were collected from the heads of federal loan and grants to provinces and provinces were receiving 633 billion rupees under the head of federal transfers to provinces. Figure shows in fiscal year 2009-10 composition of provincial total revenues is as follows: 6 percent is collected from tax revenues head, 8 percent received from provincial non-tax revenue sources, 14 percent is received under the head of federal loans and grants to provinces and 72 percent is received under the head of federal transfers to provinces. However, in fiscal year 2018-19 provincial total revenues have reached 2996 billion. A significant increase can be noticed in provincial own-source tax revenues which is 402 billion rupees in FY19. Non-tax revenues have increased from 67 billion rupees in FY2010 to 86 billion rupees in FY2019. But federal loans and grants to provinces have reduced to 110 billion rupees in FY2019. Federal transfers to provinces have reached 2398 billion rupees. As shown in figure, in Fiscal year 2018-19 the composition of provincial total revenues has changed. In fiscal year 2018-19, provincial tax collection is recorded as 13 percent of total provincial revenues, 3 percent is nontax revenues, 4 percent of total revenues is received form government under the head of federal loans and grants to provinces and 80 percent is received from federal government under the head of federal transfers to provinces.

Figure 4.1: Composition of Provincial Revenues in FY 2010 and FY 2019



Source: Data is taken from Fiscal Operations published by Ministry of Finance

Figure 4.2: Comparison of Provincial Expenditures of FY 2010 and FY 2019



Source: Data is taken from Fiscal Operations published by Ministry of Finance

In figure 4.3 we are comparing the composition of provincial expenditures of FY 2009-10 with FY2018-19. In FY2009-10 total provincial expenditures were 905 billion rupees in which provinces are spending 646 billion rupees on current expenditures and 258 billion rupees on development expenditures. However, in FY2018-19 provincial total expenditures have reached

2857 billion rupees in which provincial governments are spending 2351 billion rupees on current expenditures and only 506 billion is spent on development expenditures. Figure 4.2 shows 82 percent share of total provincial expenditures is used to finance current expenditures and only 18 percent of total expenditures are left for financing development expenditures in fiscal year 2018-19.

4.3 Literature Review

Decentralization is a controversial topic whose merits have been debated by economists and policy makers for decades. Efficient provision of public goods is the predominant argument in favor of decentralization. This section delivers a review of literature relating to fiscal decentralization and size of government. In exploring the association of fiscal decentralization and size of government size, Brennan and Buchanan (1980) are the pioneer in originating the Leviathan hypothesis. Basically hypothesis is that “total government intrusion into the economy should be smaller, *ceteris paribus*, the greater the extent to which taxes and expenditures are decentralized”. Their study assumes the inseparability of expenditure decentralization and revenue decentralization. Furthermore, the study depicts that government plays the role of gigantic monster, which tries to achieve maximum revenues through money creation, increase in taxation and debt. This kind role of government leads to expanding government size in the economy. Under this strategy the centralized government tries to disguise and promote its selfish interests. Another issue is that the taxpayers do not have any access to control over such large and unfriendly government. Brennan and Buchanan (1980) suggest two ways to control this Leviathan. One way is provision of balanced budget and limitation of government access to tax and other fiscal instruments through constitutional constraints and other way is decentralization

of government's power through spending and revenue decentralization. The ongoing study for the Leviathan is carried by Oates's (1985). Afterwards it is replicated by many authors by incorporating different proxies for government size and fiscal decentralization for different economies on different data sets by applying various estimation methodology.

In the pioneering study, Oates (1985) investigates the association between size of government and fiscal decentralization for sample of 43 developing and developed countries and 48 states of United States. Tax receipts are used to measure relative government size. The study finds no significant relationship in both samples. By employing the same proxy for government size Nelson (1986) also reports nonexistence of Leviathan hypothesis for US. It is argued that instead of using tax receipts to measure government size, most studies are using the share of government expenditures in the economy as proxy to measure government size. It can be justified as expenditure-based measure of government size provides complete resource absorption of government as compared to revenue receipts. In another study for US, Marlow (1988) uses the ratio of total government spending to the gross national product as a proxy for measuring government size. The study measures decentralization as subnational spending as a portion of total government expenditures. Real disposable income and population have been used as control variables. The study reports a negative association between size of government and fiscal decentralization. Grossman (1989) investigates the Leviathan hypothesis for US by incorporating the role of grants. Government size is regressed on expenditure decentralization and vertical imbalance. The study reports positive relationship between fiscal decentralization and size of government. The study proposes that grants play a positive role in expansion of the public sector. Ehdai (1994) investigates Leviathan hypothesis on two samples. Sample one includes 26 countries in 1977 and sample two consists of 30 countries in 1987. The study reports

negative impact of fiscal decentralization on relative government size. Tanzi and Schuknecht (1997) argue in their study that probable social gains could be availed with smaller government size whose expenditure ranges between 30 to 40 percent of GDP.

Shadbegian (1999) also tries to examine the effect of fiscal decentralization on relative government size for US. Direct general expenditures relative to gross state products are used to measure government size. State government expenditure relative to total government expenditures and internal own-purpose expenditures relative to total government expenditures are used to measure fiscal decentralization. Results indicate positive association between government size and decentralization along with negative effect of collusion on fiscal discipline. Similarly, Stein (1999) makes an effort to explore the Leviathan hypothesis for 19 Latin American and Caribbean economies and OECD countries. The study highlights that allocation function of government is mostly related to decentralization. Along with expenditure decentralization the study also uses fiscal imbalance and some institutional variables in the analysis. The study concludes that decentralization tends to enlarge government size.

To scrutinize the effect of fiscal decentralization on the sub-national, national, and aggregate government size, Jin and Zou (2002) conducted panel analysis of thirty-two industrial and developing economies for the period of 1980-1994. The results conclude three things. First, expenditure decentralization results in reducing the size of national governments. Second, revenue decentralization results in increasing the size of subnational governments but that increase is less than reduction in size of national government, which leads towards smaller total government. Third, the vertical imbalance leads to an increase in sizes of subnational governments, national governments, and total number of overall governments. Similarly, Rodden (2003) investigates the association between government size and fiscal decentralization for 29

OECD countries. The study concludes that fiscal decentralization limit the growth of government size in decentralized countries. Stegarescu (2005) measured fiscal decentralization namely Stegarescu's variable for sub national tax autonomy, which efficiently counts the degree of sub-national autonomy which is further used by Fiva (2006) to investigate Leviathan hypothesis for 18 OECD countries. The study concludes that revenue decentralization decreases the government size, however, expenditure decentralization enlarger the size of government. Prohl and Schneider (2009) use portion of aggregate government spending and revenue given in GDP ratios to measure government size for sample of 29 countries. The study reports strong negative association between government size and decentralization.

Cassette and Paty (2010) investigate Leviathan hypothesis for a sample of 15 European Union countries. Aggregate, national and subnational governments levels are used to measure government size. Along with expenditure and revenue decentralization vertical imbalance is also used. The result shows decentralization decreases the size of central government but expands the size of sub national governments. Moreover, vertical imbalances lead to enlarge the subnational, national, and aggregate governments size. Wu and Lin (2012) work out for a panel of 30 provinces of China. The results indicate statistically insignificant association between fiscal decentralization and size of government. Ashworth *et al.* (2013) study report that expenditure decentralization enhances the government size but revenues rose by sub-national governments leads to a long-term decrease in government size. To measure the effect of revenue decentralization on government size Liberati and Sacchi (2013) disaggregate different categories of taxes for empirical analysis. The study concludes that only property tax is negatively and significantly affecting local government size. However, grants lead to expansion of government size. Golem and Perovick (2014) try to figure out Leviathan hypothesis for a sample of 23

OECD countries. The results show a negative link between government size and revenue decentralization. Most recently, Qiao et al (2019) investigate this relationship in seventy-six developing and developed countries for the period of 1972-2013. The study finds strong negative link between fiscal decentralization and government size.

We are unable to find a single study having focus on inspecting the effects of fiscal decentralization on government size in case of Pakistan. The present study is a move in this direction to fill the gap in the stock of literature pertaining to fiscal decentralization and government size debate.

4.4 Analytical Framework

The objective of the chapter is to search for Brennan and Buchanan (1980) “Leviathan Hypothesis”, for that purpose, we follow the standard approach of Oates (1985) that’s to regress government size on revenue or expenditure decentralization, institutional quality index and a vector of control variables. The econometric specification is given by:

$$GS_t = \alpha_0 + \alpha_1 FD_t + \alpha_2 IQ_t + \alpha_k (Z_k)_t + u_t \quad (1)$$

Where, time ranges from $t = 1, 2, \dots, T$; GS is government size measure, FD is for fiscal decentralization measure i.e., expenditure decentralization and tax revenue (own-source revenue) decentralization, decentralization through federal transfers to provinces, IQ is for institutional quality index and Z_k is a set of control variables that range from $K(k = 1, 2, \dots, K)$.

$$Z_k = LGDPPC, GGDPPC, TO, RP, PD, BD$$

where, LGDPPC is for natural log of real per capita GDP, GGDPPC is the measure of growth rate of real per capita GDP, TO is for trade openness, RP is measure of relative price of public to private goods, PD is for population density and BD is for Budget Deficit.

This section is divided into three sub-sections: section 4.4.1 provides details of selection of control variables to be used for analysis, section 4.4.2 discusses the causes of data and construction of all indicators and section 4.4.3 discusses the estimation technique.

4.4.1 Selection of Control Variables for Analysis¹¹

In this study, our main focus is on investigating the link between fiscal decentralization and size of government but we are also incorporating some control variables in analysis. The control variables have been identified based on comprehensive literature review.

Real per capita GDP is the most commonly used control variable in the literature. Oates (1985) justifies the reason for incorporating real per capita GDP as control variable on the basis of Wagner's Law. According to Wagner's Law government expenses as a portion of national income continues to increase the economic development. *A priori*, in the long run, it is expected that GDP per capita is positively linked with government size. Later on, Ehdaie (1994), Jin and Zou (2002), Prohl and Schneider (2009), Wu and Lin (2010), Baskaran (2011), Ashworth (2012) and Golem (2014) have used this variable in their analysis. Along with real per capita GDP, Jin and Zou (2002) and Prohl and Schneider (2009) have also used growth rate of per capita GDP as control variable. It is expected that growth rate of GDP has a positive effect on government size. Public sectors in developing countries are typically small for a number of theoretical reasons, and the link between government size and per capita GDP growth is positive. However, public

¹¹ Appendix 3A provides a list of all control variables used in literature.

sectors are typically large in rich countries, and the association between government size and growth of GDP per capita is less favourable and possibly negative as compared to poor countries.

Trade openness is another significant factor of government size that has been widely used in literature as control variable. The expected influence of this variable on government size is ambiguous because in literature there are two conflicting views, namely the “Compensation Hypothesis” and the “Efficiency Hypothesis”, on the influence of a country’s trade openness on the portion of economy. The Compensation Hypothesis assumes that positive influence stemming from higher demand for the risk-reducing role of government in more open economies, while the efficiency hypothesis assumes more open economies to have smaller size of governments due to more reasonable deregulation and better competition for mobile factors. Fiva (2006) and Jin & Zou (2002) report positive association between trade openness and government size, however, Stein (1999), Wu and Lin (2010), Baskaran (2011) and Golem (2014) studies report that trade openness may curtail government expansion. Golem (2014) study has used relative price of public to private goods as control variable. The use of this variable is justified on the basis of Baumol’s cost disease effect. Baumol’s cost disease effect is based on following assumptions i.e., slower public sector productivity growth relative to the private sector, equal wage across all sectors in the economy and price-inelastic government demand for deliveries. This variable is calculated as the ratio of the deflator for government final consumption spending to the deflator for private final consumption spending. If all the assumptions of Baumol’s cost disease effect hold in a country, then this indicator is expected to have a positive significant effect on government size and vice versa. In another study, Baskaran (2011) includes population density as control variable. Ashworth (2013) study has used budget

surplus as control variable it is measured as the size of the federal government's budget surplus normalized through GDP and expected sign for this variable is negative.

In keeping view, the data availability possibilities in Pakistan, real per capita GDP, growth rate of real per capita GDP, trade openness, relative price of public and private consumption, budget deficit and population density have been selected as control variables to be used in this study.

4.4.2 Data Source and Description of Variables¹²

The study uses the time series data from 1984 to 2017. All the data is collected from Pakistan Economic Survey, SBP, and Federal Bureau of Statistics, Government of Pakistan. Government size is measured as total government expenditures as a percentage. of GDP in the economy. It is computed as the ratio of total government expenditures (federal & provincial) minus interest payment to GDP, at market prices. The study has used three measures of fiscal decentralization (FD), tax revenue decentralization, revenue decentralization based on federal transfers to provinces and expenditure decentralization. Tax Revenue decentralization (own-source revenue decentralization) is measured as the percentage of provincial tax revenues of provinces in the total federal government revenue. Decentralization based on federal transfers to provinces is measured as the percentage share of federal government transfers to provinces in the total federal government tax revenue. Expenditure decentralization (ED) is measured as a percentage of provincial government expenditures to the total government expenditures (federal & provincial). For institutional quality index, the study uses six indicators from ICRG data to construct institutional quality index¹³. These indicators include "Government stability, Control

¹² Appendix 3B is discussing all possible proxies for measuring fiscal decentralization and government size in literature.

¹³ Construction of institutional quality index has been discussed in detail in chapter three.

over Corruption, Law and Order, Military in Politics, Democratic Accountability and Bureaucracy Quality”.

We estimate the impact of fiscal decentralization on government size in the presence of a set of control variables. As discussed in review of literature these control variables have a significant impact on government size. As discussed in section 4.4.1 we have selected a set of six control variables on the basis of data availability in Pakistan namely real per capita GDP, growth rate of real per capita GDP, trade openness, private consumption, relative price of public, budget deficit and population density. Real per capita GDP is measured as the per capita GDP at constant factor cost of 2005-06. We have used total trade (value of imports plus exports as percentage of GDP), which is the proxy for trade openness. Relative price of public to private goods (RP) is calculated as the share of the deflator for government final consumption spending to the deflator for private final consumption spending. growth rate of per capita GDP is measure as the annual percentage change in real GDP per capita, population density is measured as the population per sq. meter. Finally, budget deficit is measured as the consolidated budget deficit as percentage of GDP. All the time series are logarithmic.

4.4.3 Estimation Technique

We are using generalized method of moments (GMM) methodology for empirical analysis. This technique is developed by Hansen (1982). As we are dealing with time series data and the problem of autocorrelation is expected to arise in data. There are a number of situations where some of the right-hand side variables are correlated with disturbances, this implies that endogeneity problems exist in the model. We can apply the standard instrumental variables estimation techniques. The idea behind instrumental variables is that good instruments are correlated with the independent variables in the equation while uncorrelated with the error term.

These instruments are employed to remove the correlation between right-hand side variables and the error term. In this regard, GMM handles the problems of heteroscedasticity and autocorrelation efficiently, for that reason, we are using this method of estimation. In order to determine the endogeneity in the model, we apply endogeneity test. This test is performed to determine whether endogenous variables in the models are in fact exogenous. After GMM estimation, the Durbin Wu-Hausman test (difference in J-stats) is applied to check the endogeneity problem. If the statistics are significant, implies that variables are endogenous otherwise, they are treated as exogenous. In this test, under null hypothesis, the variables being tested are exogenous and under alternative hypothesis, the variables being tested are endogenous.

If instruments are more than parameters, it means that value of the optimized objective function will be greater than 0. Under this situation, the model is over-identified, advising that the number of extra instruments exceeds the number of endogenous variables. In GMM estimation, the J-statistic is employed to check the validation of instruments. A statistically significant test shows that the instrument may not be valid.

4.5 Empirical Results and Discussion

The objective of the present study is to explore the effects of expenditure and revenue decentralization on government size at national level in Pakistan. In this regard, the current section has been developed by applying the econometric model discussed in section 4.4. The empirical analysis contains the following sub-sections. Section 4.5.1 provides results of unit root properties of data, section 4.5.2 provides results of Durbin Wu-Hausman regressor endogeneity test, section 4.5.3 describes results for expenditure decentralization and government size

relationship along with the results of other control variables for Pakistan and section 4.5.4 describes results for revenue decentralization and government size.

4.5.1 Stationarity Properties of Data

As a first step to estimate the model, stationarity properties of data are analyzed using the Augmented Dickey Fuller (ADF) test. The results of this test for $I(0)$ and $I(1)$ of all the time series variables are summarized in table 4.5. The test statistics indicate that relative prices are stationary at level. While government size, revenue decentralization based on federal transfers to provinces, revenue decentralization based on provincial own-source revenue, expenditure decentralization, per capita GDP, trade openness and population density are non-stationary at $I(0)$ and become stationary at $I(1)$.

Table: 4.5. ADF Stationarity Test Results

Variables	Level	First Difference	Order of Integration
Government Size	-1.423 (0.559)	-6.214 (0.000)	$I(1)$
Expenditure Decentralization	-1.227 (0.651)	-7.634 (0.000)	$I(1)$
Revenue Decentralization based on Federal Transfers to Provinces (FRD)	-1.298 (0.619)	-6.856 (0.000)	$I(1)$
Provincial Own-source Revenue Decentralization (TRD)	0.103 (0.961)	-5.353 (0.001)	$I(1)$
Per capita GDP	-0.908 (0.773)	-4.771 (0.000)	$I(1)$
Trade Openness	-1.687 (0.428)	-6.137 (0.000)	$I(1)$
Relative Price	-2.959 (0.048)		$I(0)$
Population Density	-0.530 (0.873)	-5.035 (0.000)	$I(1)$
Budget Deficit	-2.498 (0.124)	-7.361 (0.000)	$I(1)$

Note: Probabilities are given in parenthesis.

4.5.2 Durbin Wu-Hausman Test: Endogeneity Test

After GMM estimation, this test is applied to confirm the presence of endogeneity among regressors. According to this test, if the test statistic is significant, then the indicators being tested

are endogenous otherwise, they are treated as exogenous. As in this study, we are using three proxies of fiscal decentralization to investigate the effect on government size. These are expenditure decentralization, provincial tax revenue or own-source revenue decentralization, and revenue decentralization based on federal transfers to provinces. Table 4.6 reports outcomes of Durbin Wu-Hausman test for three models. Model 1 reports results of endogeneity among expenditure decentralization, institutional quality and a set of six control variables. Model 2 reports endogeneity results of provincial own-source revenue decentralization (TRD) and in the end model 3 reports endogeneity among revenue decentralization based on federal transfers to provinces (FRD), institutional quality and all other control variables. Table 4.6 confirms the issue of endogeneity in all three models.

Table 4.6 Results of Durbin Wu-Hausman Test

Models	Endogenous variables to treat as exogenous	Difference in J-Stat
Expenditure Decentralization and government size: Model 1	ED, IQ, LGDPPC, GGDPPS, TO, RP, BD, PD	17.133 (0.000)
Provincial Own-Source Revenue Decentralization and government size: Model 2	TRD, IQ, LGDPPC, GGDPPS, TO, RP, BD, PD	14.309 (0.000)
Revenue Decentralization based on Federal transfers to provinces and government size: Model 3	FRD, IQ, LGDPPC, GGDPPS, TO, RP, BD, PD	13.769 (0.001)

Note: Probability is given in parenthesis.

4.5.3 Expenditure Decentralization and Government Size

The aim of this study is to investigate the impact of fiscal decentralization on relative size of government. We have used three proxies to measure fiscal decentralization, one of them is expenditure decentralization. It is measured as a percentage of provincial government expenditures to the total government expenditures (provincial & federal). Table 4.7 presents the regression results on how expenditure decentralization and institutional quality affects

government size using the GMM approach. We contain a set of six control indicators which might affect the size of the public sector such that GDP per capita, trade openness, growth rate of GDP per capita, relative prices, population density and budget deficit.

We begin our discussion of the results with the value of J test statistic that is given in the bottom of table 4.7. The value of the J test statistic is 11.988 having probability value 0.446 which confirms the validity of the instruments used in estimating the model consisting of equations (1) and this outcome also points towards the correct specification of the model. This finding tends to increase our confidence in the estimation strategy of the study. Expenditure Decentralization (ED) has a statistically positive significant effect on government size. This infers that higher expenditure decentralization expands the size of government. This finding indicates that Leviathan Hypothesis “that fiscal decentralization results in decreasing government size” is not correct in case of expenditure decentralization in Pakistan. This finding is consistent with the evidence documented by Ashworth *et al.* (2013), Baskaran (2009) for 18 OECD countries, Jin and Zou (2002) for 32 developing and industrial countries, Stein (1999) for Latin America and Wu and Lin (2010) for China. However, the coefficient of institutional quality is negative and statistically significant it means the good quality of institutions results in reducing the relative size of government.

Table 4.7: Expenditure Decentralization and Government Size: Model 1

Dependent Variable: Government Size		
Explanatory Variable	Coefficient	Probabilities
ED	0.689*	0.000
IQ	-0.043**	0.016
LGDPPC	0.440***	0.061

GGDPPC	0.105	0.792
TO	1.044*	0.001
RP	-0.588**	0.041
PD	-0.635*	0.001
BD	-0.058*	0.000
J-stat	11.988	0.446

Note: * indicates significance at 1%, ** at 5% and *** at 10 %.

All other control variables are also significant and carry expected signs except per capita growth rate of GDP (GGDPPC). The coefficient on per capita GDP (LGDPPC) is positive significant which shows that an upsurge in LGDPPC tends to increase the government size. This outcome is consistent with Wagner's Law, who noted that an upsurge in a country's income enhances the demand for government expenses by a greater amount. Ashworth (2012), Ehdaie (1994), Golem (2014) Jin and Zou (2002) and Rodden (2003) studies are supporting our findings, however, studies done by Baskaran (2011) and Wu and Lin (2012) do not support our findings. Per capita growth rate of GDP (GGDPPC) is positively linked with government size but it is statistically insignificant. Jin and Zou (2002) report negative association between per capita growth rate of GDP for panel of 32 developing and industrial economies.

A positive significant coefficient on the trade openness (TO), it infers that the influence predicated by the compensation hypothesis might be more applicable to clarify the impact of a country's trade openness on its size of government. Fiva (2006), Jin and Zou (2002) report positive association between trade openness and government size. Baskaran (2011), Golem (2014) Stein (1999) and Wu and Lin (2010) studies report that trade openness may curtail government expansion. Relative price (RP) is negatively affecting government size in case of

Pakistan. This result is consistent Baumol's cost disease description but the coefficient is statistically significant. Golem (2014) also reports negative relationship between government size and relative price for 28 OECD countries. Golem (2014) justifies that as this negative result could be a sign that same for Baumol's assumptions—slower production growth in the public sector compared to the private sector, equal wage across all sectors in the economy and price-inelastic demand for government deliveries—are not applicable for the economies and time period under study. While Population density (PD) is also negatively linked to the public sector size. Similarly, Baskaran (2011) infers that scale economies occur in the provision of public goods that leads to negative link between population density and public sector size. Budget deficit (BD) is also negatively related to size of government as budget deficit increases it leads to reduce the government size.

4.5.4 Revenue Decentralization and Government Size

Fiscal decentralization is also measured through revenue decentralization in this study. To measure revenue decentralization, we have used two proxies these are revenue decentralization based on provincial own-source revenue and revenue decentralization based on federal transfer to provinces. Tax Revenue decentralization (own-source revenue decentralization) is measured as the percentage of provincial tax revenues of provinces in the total federal government revenue (TRD). Decentralization based on federal transfers to provinces is measured as the percentage share of federal government transfers to provinces in the total federal government tax revenue (FRD).

Table 4.8 presents the regression results on how revenue decentralization affects government size using the GMM approach. We regressed two models for catching the influence of revenue decentralization on relative size of public sector. We include the same set of six

control variables which might affect the size of the public sector such that GDP per capita, trade openness, growth rate of GDP per capita, relative prices, population density and budget deficit.

Before analyzing the results of both models it is important to point out that these models are correctly specified as shown by the J test statistics and their associate probabilities given at the bottom of table 4.8. Value of J test statistic in model 2 is 18.82 and its associated probability value is 0.172 and value of J stat in model 3 is 75.27 and its associated probability value is 0.821 which indicates that instruments used in the study are usable and hence, the estimated models are correctly specified.

Table 4.8 Revenue Decentralization and Government Size: Model 2 & 3

Dependent Variable: Government Size		
Explanatory Variable	Model 2	Model 3
TRD	-0.081** (0.046)	
FRD		-0.496* (0.000)
IQ	-0.068* (0.003)	-0.059* (0.003)
LGDPPC	1.021* (0.001)	-1.064* (0.000)
GGDPPC	0.049 (0.934)	1.389** (0.032)
TO	1.027* (0.004)	1.461* (0.000)
RP	-0.628*** (0.052)	-0.278*** (0.027)
PD	-1.678* (0.000)	0.9583* (0.001)
BD	-0.054* (0.000)	-0.052* (0.000)
J-stat	18.82 (0.172)	75.27 (0.821)

Note: Probabilities are in Parenthesis.

The coefficients on Revenue Decentralization (RD) in model 2 and model 3 are negative and statistically significant. This implies that higher degree of revenue decentralization reduces the size of government. This finding indicates that Leviathan Hypothesis “that fiscal decentralization results in decreasing government size” is correct in case of Pakistan. Golem (2014) reports the same finding for sample of 28 OECD countries and justifies this finding as fiscal decentralization brings more competition among provincial governments that decreases the fiscal illusion and upsurges the transparency of the public sector by making the small spending on resources. For instance, Jin and Zou (2002) find that revenue decentralization leads to larger provincial governments, but it decreases national size of government by more than it upsurges subnational government size, and therefore it leads to a smaller aggregate government. A similar kind of relationship is reported in the studies done by Rodden (2003) and Fiva (2006). Cassette and Petty (2010), Wu and Lin (2010) and Baskaran (2011) findings report positive association between revenue decentralization and government size. The coefficient of institutional quality is negative significant in both models which indicate that overall government size reduces when institutional are of good quality and work efficiently.

All other control variables in both models are also statistically significant and carry expected signs except per capita growth rate of GDP (GGDPPC) in model 2. The coefficient on per capita GDP (LGDPPC) is positive significant which shows that an increase in LGDPPC tends to increase the size of government. This result is consistent with Jin and Zou (2002) and Rodden (2003) and Golem (2014), however, studies done by Baskaran (2011) and Wu and Lin (2010) do not support our findings. Per capita growth rate of GDP (GGDPPC) is positive associated with government size in model 3. Jin and Zou (2002) report a negative association between per capita growth rate of GDP for panel of 32 developing and industrial countries. Trade

openness (TO) is positively related to size of government and the coefficient is statistically significant. Fiva (2006), Jin and Zou (2002) and Rodden (2003) report positive association between trade openness and government size. However, Baskaran (2011), Cassette and Patty (2010), Golem (2014) and Wu and Lin (2010) studies report that trade openness may curtail government expansion. Relative price (RP) is negatively affecting government size in case of Pakistan. A similar finding has been reported in the study done by Golem (2014). Population density (PD) association with government size is negative in both models; however, budget deficit association with the size of the public sector is negative in model 2 and positive in model 3.

4.6 Conclusion and Policy Recommendations

Since the last few decades, it has been realized that decentralized governments are more accountable and their performance is more welfare enhancing. Decentralization is fundamentally the transfer of powers from federal government to sub national governments. Under fiscal decentralization, central governments perform their stabilization and redistributions functions more efficiently and allocative efficiency is improved when subnational governments are allowed to generate their own resources to collect taxes and govern their own expenditures. In this context, the issue arises how decentralization is affecting the size of central and sub-national government. In exploring the association between fiscal decentralization and government size Brennan and Buchanan (1980) originate the idea of Leviathan Hypothesis. The mainframe of hypothesis is that “total government intrusion into the economy should be smaller, *ceteris paribus*, the greater the extent to which taxes and expenditures are decentralized”. Later on,

many researchers investigate this relationship by using different proxies for government size and fiscal decentralization for different samples.

This essay is the first study, of which we are aware, examining the effects of fiscal decentralization on government size in the case of Pakistan. Government size is measured as government expenditures as a percentage of GDP. It is computed as the ratio of total government expenditures (federal & provincial) minus interest payment to GDP, at market prices. The study has used three measures of fiscal decentralization (FD), revenue decentralization based on federal transfers to provinces, tax revenue decentralization, and expenditure decentralization. Tax Revenue decentralization (own-source revenue decentralization) is measured as the percentage of provincial tax revenues of provinces in the total federal government revenue. Decentralization based on federal transfers to provinces is measured as the percentage share of federal government transfers to provinces in the total federal government tax revenue. Expenditure decentralization is measured as a percentage of sub-national government expenditures to the total government expenditures (provincial & federal).

We estimate the impact of fiscal decentralization on government size in the presence of a set of six control variables. As discussed in the review of literature these control variables have a significant impact on government size. These control variables are real per capita GDP at constant factor cost of 2005-06, trade openness measured as value of exports plus value of imports as percentage of GDP, relative price of public to private goods (RP) measured as the ratio of the deflator for government final consumption spending to the deflator for private final consumption spending, growth rate of per capita GDP measured as the annual percentage change in real GDP per capita, population density measured as the population per sq. meter and budget deficit measured as the consolidated budget deficit as percentage of GDP.

To carry out the empirical task generalized method of moment (GMM) estimation technique has been used for annual data from 1982 to 2017. Before estimating GMM, Augmented Dickey Fuller (ADF) unit root test has been used and results show that government size, expenditure decentralization, revenue decentralization based on federal transfers to provinces, revenue decentralization based on provincial own-source revenue, per capita GDP, trade openness and budget deficit are non-stationary at $I(0)$ and they become stationary at $I(1)$, however, relative price and growth rate of per capita GDP are stationary at $I(0)$.

For the empirical investigation, three models have been estimated. In model one expenditure decentralization is regressed on government size along with all other control variables. In model 2 revenue decentralization based on own-source revenue is used as an independent variable along all other control variables to access the effect on government size. In model 3 revenue decentralization based on federal transfers to provinces is used as independent variable along with all other control variables to access the effect on relative size of government. The results of model one show that Expenditure Decentralization (ED) has a positive significant impact on government size. This infers that higher expenditure decentralization expands the size of government. However, the results of model 2 and model 3 show that the coefficient on revenue decentralization (RD) is negative significant. This implies that higher degree of revenue decentralization reduces the demand for total government expenditure or in other words reduces the overall size of government. The results indicate that Leviathan hypothesis is correct in case of revenue decentralization, however, it is incorrect in case of expenditure decentralization in Pakistan. In all three models, coefficients on the control variables are significant and hold expected signs.

On the base of the results of the study, following implications can be put forward. Firstly, expenditure decentralisation (ED, ratio of provincial government expenditures to total government expenditures) is positively linked with government size this implies that relative growth in provincial spending has been associated with an increasing share of total government expenditure, and may be expected if provinces are responsible for social spending (the demand for which has increased). Secondly, federal transfer based Revenue decentralisation (FRD, federal-provincial transfers to total federal tax revenue) and own-source revenue decentralization (TRD, provincial tax revenues to total federal government revenue) is negatively associated with government size, suggesting that transfers share in federal revenue and provincial own source tax revenue generation effort have been declining although provincial spending has been growing. This implies that although provinces are increasing their own revenue but they are borrowing more. Another implication is that federal government is happy to see spending increase as long as it does not have to pay, so provincial social spending increases faster than transfers to provinces. If provinces are able to raise the revenue to pay for spending, especially if provincial revenue collection is more efficient than federal tax collection, this seems fiscally quite sensible.

Chapter 5

CONCLUSION

In this dissertation we address three fiscal issues of Pakistan economy. In essay one we dealt with the issue of fiscal response of foreign aid. We have identified methodological deficiencies of the existing literature on Pakistan¹⁴. Due to methodological and data issues, the existing relevant studies fail to yield convincing outcomes and policy recommendations for the donors and the policy makers in Pakistan to better utilize foreign aid. In this study, we make an effort to fill the gap of these shortcomings to provide reliable evidence and recommendations to the policy makers.

We try to examine the response of project aid and program aid on fiscal behaviour and to what extent foreign aid is fungible in Pakistan. For investigation purposes we developed three models to examine the effect of foreign aid on fiscal behavior in Pakistan. These models are based on following features: Quadratic and symmetric utility function is used, targeted values are directly obtained from annual budget statements, Model B and Model C assume that domestic borrowing can be used to finance public investment expenditure for development purposes and non-development purposes, target level borrowing is assumed zero in model A and B, however, this assumption is relaxed in Model C, and final assumption is that program aid and project aid are exogenous variables in the models. For measuring fiscal response, we use variables on recurrent government expenditure, development expenditure, tax revenue and domestic borrowing. Time series data has been used from 1972 to 2017. For empirical analysis, three stage least square (3SLS) estimation technique has been used. As we know structural parameters

¹⁴ Discussed in detail in section 2.3.2.

measure only the direct effect, the reduced-form parameters measure the whole effect, direct and indirect, of a change in the predetermined variables on the endogenous variables. So we have estimated reduced form parameters along with structural parameters. Results obtained from fiscal response models show that major portion of project aid and program aid is utilized in financing current and socio-economic expenditures due to which Pakistan remained unable to get full productive use of foreign aid for development purposes. Foreign aid is discouraging tax collecting efforts as shown by negative association between foreign aid and tax revenue. Results also show that major portion of tax revenue and internal borrowing is utilized in financing non-development expenditures which indicates that our government remained unsuccessful in utilizing tax revenue for productive purposes.

In essay two we make an effort to analyze what happens to macro-economy of Pakistan if a sudden exogenous shock occurs to fiscal policy instruments in the existence of institutional quality at national and provincial level. A set of four endogenous variables e.g., government revenue, government expenditure, CPI, and output have been used for analysis at national level and set of three endogenous variables e.g., each province public spending, public revenue and output has been used for analysis at provincial level. At the provincial level, price level is omitted from the system because it is determined at the national level (provinces cannot print money and their fiscal behaviour should not affect inflation). Overall the results obtained from this exercise are weaker because of small number of observations and we have no choice to increase number of observations. As the data on output level is not available on quarterly basis and provincial public spending and public revenue data is available on annual basis from 1982 onward. The results obtained from national level SVAR analysis are: i) a shock to Government spending dissipates quickly, has almost no effect on output but a positive effect on price level

and affecting public revenues positively; and ii) a shock to revenue is persistent, has a small positive effect on output and public spending but almost no effect on price level (it is not inflationary). However, at provincial level core outcomes of this exercise can be precised as in Punjab, KPK and Sindh, shocks to Revenue have negligible impacts but a shock to Government spending has a slight positive output impact, suggesting some benefits of increased spending. In Balochistan, although a shock to Government spending has a persistent positive influence on Government spending and revenue, a shock to revenue has no effect on government spending, dissipates quickly and has a very small negative effect on output. The small impacts in Balochistan are probably because provincial government spending and revenues are low in this poor province.

In last essay, we are dealing with problem of fiscal decentralization, institutional quality and government size in Pakistan. To measure fiscal decentralization three proxies have been used i.e., expenditure decentralization and revenue decentralization based on provincial own-source revenue and revenue decentralization based on federal transfers to provinces. Government expenditures as percentage of GDP is used to measure the size of the government sector in the economy. Tax revenue decentralization (own-source revenue decentralization) is measured as the percentage of tax revenues of provinces in the total federal government revenue. Decentralization based on federal transfers to provinces is measured as the percentage share of federal government transfers to provinces in the total federal government tax revenue. Expenditure decentralisation (ED) is measured as a percentage of provincial government expenditures to the total government expenditures (federal & provincial). For empirical analysis, GMM estimation technique has been used with a set of six control variables. These control variables are per capita GDP, trade openness, relative price, growth rate of per capita GDP,

budget deficit and population density. Real per capita GDP is measured as the per capita GDP at constant factor cost of 2005-06. Trade openness is measured as total trade as percentage of GDP, as proxy for trade openness. Relative price of public to private goods is measured as the ratio of the deflator for government final consumption expenditure to the deflator for private final consumption expenditure. Growth rate of per capita GDP is measured as the annual percentage change in real GDP per capita. Population density is measured as the population per sq. meter and budget deficit are measured as the consolidated budget deficit as percentage of GDP. Results show that expenditure decentralisation is positively associated with government size. This implies that relative growth in provincial spending has been associated with an increasing share of total government expenditure. Tax revenue decentralisation and federal transfers to province revenue decentralization are negatively linked with size of government, suggesting that transfers share in federal revenue has been declining although provincial spending has been growing. This implies that provinces are increasing their own revenue and/or are borrowing more. All other control variables are significant and carry expected signs.

Following recommendations can be put forward on the basis of results obtained in this study. Firstly, as the larger portion of foreign economic assistance is used to finance the budgetary heads of public spending under current and socio-economic expenditures and smaller share of aid flows to the public investment under development spending head that's why there is a need to revise the current foreign aid utilization policy in Pakistan so that major share of foreign aid should be allocated for development purposes in the country. Secondly, foreign aid is playing an active role in reducing tax collection as shown by negative association between aid and tax revenue variables which suggests that there is a need to revise current fiscal management stance in such a manner that tax to GDP can be increased so that the reliance of government on

foreign aid may come down. Thirdly, it is apparent from results that tax revenue is used to finance public spending under current and socio-economic expenditures heads as compared to public investment under development expenditures in this regard there is a need for such fiscal strategy that leads to better utilization of tax revenue in financing public sector investment efficiently. Fourthly, domestic borrowing is mostly used for non-development expenditures that's why there is a need to formulate such rules and regulations that limit the government to sustain the specified public expenditure and make more production-oriented uses of domestic resources. Fifthly, the government should increase tax revenue collection effort so that extent of domestic borrowing can be reduced. For this purpose, the government should introduce some reforms in taxation system such that all the sectors of the economy come under income tax net so that tax base gets widen. Sixthly, in case of fiscal policy shocks at national level, the inflationary effect of a shock to Government Spending suggests that seignorage (printing money) is used to finance the increased spending. This implies that the desired policy is to increase revenue to finance increases in spending. Seventhly, at the provincial level, the main policy implication is that provinces can benefit from central government transfers to finance development spending but central government requires sustained revenue to finance transfers. However, expenditure decentralisation is positively associated with government size this implies that relative growth in provincial spending has been associated with an increasing share of total government expenditure, and may be expected if provinces are responsible for social spending. Finally, revenue decentralisation is negatively associated with government size, suggesting that transfers share in federal revenue and provincial own source tax revenue generation effort have been declining although provincial spending has been growing. This implies that although provinces are increasing their own revenue they are borrowing more. Another implication is that federal

government is happy to see spending increase as long as it does not have to pay, so provincial social spending increases faster than transfers to provinces. If provinces are able to raise the revenue to pay for spending, especially if provincial revenue collection is more efficient than federal tax collection, this seems fiscally quite sensible.

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Appendix

1A Derivation of Fiscal Response Model A

$$U = \beta_0 - \frac{\beta_1}{2}(D - D^*)^2 - \frac{\beta_2}{2}(T - T^*)^2 - \frac{\beta_3}{2}(S - S^*)^2 - \frac{\beta_4}{2}(C - C^*)^2 - \frac{\beta_5}{2}(B - B^*)^2$$

$$D = B + \rho_{11}T + \rho_{21}P_j + \rho_{31}P_m$$

or

$$D = B + (1 - \rho_{12})T + (1 - \rho_{22})P_j + (1 - \rho_{32})P_m$$

$$S + C = \rho_{12}T + \rho_{22}P_j + \rho_{32}P_m$$

$$L = \beta_0 - \frac{\beta_1}{2}(D - D^*)^2 - \frac{\beta_2}{2}(T - T^*)^2 - \frac{\beta_3}{2}(S - S^*)^2 - \frac{\beta_4}{2}(C - C^*)^2 - \frac{\beta_5}{2}(B - B^*)^2 + \lambda_1(D - B - \rho_{11}T - \rho_{21}P_j - \rho_{31}P_m) + \lambda_2(S + C - \rho_{12}T - \rho_{22}P_j - \rho_{32}P_m)$$

Apply first order condition and put equal to zero:

$$\frac{\partial L}{\partial D} = -\beta_1(D - D^*) + \lambda_1$$

$$-\beta_1(D - D^*) + \lambda_1 = 0 \tag{1.1}$$

$$\frac{\partial L}{\partial T} = -\beta_2(T - T^*) - \rho_{11}\lambda_1 - \rho_{12}\lambda_2$$

$$-\beta_2(T - T^*) - \rho_{11}\lambda_1 - \rho_{12}\lambda_2 = 0 \tag{1.2}$$

$$\frac{\partial L}{\partial S} = -\beta_3(S - S^*) + \lambda_2$$

$$-\beta_3(S - S^*) + \lambda_2 = 0 \tag{1.3}$$

$$\frac{\partial L}{\partial C} = -\beta_4(C - C^*) + \lambda_2$$

$$-\beta_4(C - C^*) + \lambda_2 = 0 \quad (1.4)$$

$$\frac{\partial L}{\partial B} = -\beta_5(B - B^*) - \lambda_1$$

$$-\beta_5(B - B^*) - \lambda_1 = 0 \quad (1.5)$$

$$\frac{\partial L}{\partial \lambda_1} = D - B - \rho_{11}T - \rho_{21}P_j - \rho_{31}P_m$$

$$D - B - \rho_{11}T - \rho_{21}P_j - \rho_{31}P_m = 0 \quad (1.6)$$

$$\frac{\partial L}{\partial \lambda_2} = S + C - \rho_{12}T - \rho_{22}P_j - \rho_{32}P_m$$

$$S + C - \rho_{12}T - \rho_{22}P_j - \rho_{32}P_m = 0 \quad (1.7)$$

S Equation

From equation (1.3)

$$\lambda_2 = \beta_3(S - S^*)$$

$$\beta_3 S = \lambda_2 + \beta_3 S^*$$

From equation (1.4)

$$\lambda_2 = \beta_4(C - C^*)$$

$$\beta_3 S = \beta_4(C - C^*) + \beta_3 S^*$$

$$C = \rho_{12}T + \rho_{22}P_j + \rho_{32}P_m - S$$

$$\beta_3 S = \beta_4 (\rho_{12} T + \rho_{22} P_j + \rho_{32} P_m - S - C^*) + \beta_3 S^*$$

$$\beta_3 S + \beta_4 S = \beta_4 (\rho_{12} T + \rho_{22} P_j + \rho_{32} P_m - C^*) + \beta_3 S^*$$

$$S = \left(\frac{\beta_4}{\beta_3 + \beta_4} \right) (\rho_{12} T + \rho_{22} P_j + \rho_{32} P_m - C^*) + \left(\frac{\beta_3}{\beta_3 + \beta_4} \right) S^*$$

$$\left[\begin{array}{l} \text{Assume} \\ 1 - \frac{\beta_3}{\beta_3 + \beta_4} \Rightarrow \frac{\beta_3 + \beta_4 - \beta_3}{\beta_3 + \beta_4} \\ \text{so} \\ 1 - \frac{\beta_3}{\beta_3 + \beta_4} \Leftrightarrow \frac{\beta_4}{\beta_3 + \beta_4} \end{array} \right]$$

$$S = \left(1 - \frac{\beta_3}{\beta_3 + \beta_4} \right) (\rho_{12} T + \rho_{22} P_j + \rho_{32} P_m - C^*) + \left(\frac{\beta_3}{\beta_3 + \beta_4} \right) S^*$$

$$S = (1 - \phi_1) (\rho_{12} T + \rho_{22} P_j + \rho_{32} P_m - C^*) + \phi_1 S^*$$

$$S = (1 - \phi_1) (\rho_{12} T + \rho_{22} P_j + \rho_{32} P_m) - (1 - \phi_1) C^* + \phi_1 S^*$$

$$S = (1 - \phi_1) (\rho_{12} T + \rho_{22} P_j + \rho_{32} P_m) - \left(\frac{\beta_4}{\beta_3 + \beta_4} \right) C^* + \phi_1 S^*$$

$$S = -\phi_2 C^* + \phi_1 S^* + (1 - \phi_1) (\rho_{12} T + \rho_{22} P_j + \rho_{32} P_m)$$

C Equation

From equation (1.4)

$$\lambda_2 = \beta_4 (C - C^*)$$

$$\lambda_2 = \beta_4 C - \beta_4 C^*$$

$$\beta_4 C = \lambda_2 + \beta_4 C^*$$

From equation (1.3)

$$\lambda_2 = \beta_3 (S - S^*)$$

$$\beta_4 C = \beta_3(S - S^*) + \beta_4 C^*$$

From equation (1.7)

$$S = \rho_{12}T + \rho_{22}P_j + \rho_{32}P_m - C$$

$$\beta_4 C = \beta_3(\rho_{12}T + \rho_{22}P_j + \rho_{32}P_m - C - S^*) + \beta_4 C^*$$

$$(\beta_3 + \beta_4)C = \beta_3(\rho_{12}T + \rho_{22}P_j + \rho_{32}P_m - S^*) + \beta_4 C^*$$

$$C = \frac{\beta_3}{\beta_3 + \beta_4}(\rho_{12}T + \rho_{22}P_j + \rho_{32}P_m - S^*) + \frac{\beta_4}{\beta_3 + \beta_4}C^*$$

$$C = \phi_1(\rho_{12}T + \rho_{22}P_j + \rho_{32}P_m - S^*) + \phi_2 C^*$$

$$C = \phi_1 \rho_{12}T + \phi_1 \rho_{22}P_j + \phi_1 \rho_{32}P_m - \phi_1 S^* + \phi_2 C^*$$

T Equation

From equation (1.2)

$$\beta_2(T - T^*) = -\lambda_1 \rho_{11} - \lambda_2 \rho_{12}$$

$$\beta_2 T = -\lambda_1 \rho_{11} - \lambda_2 \rho_{12} + \beta_2 T^*$$

From equation (1.3)

$$\lambda_2 = \beta_3(S - S^*)$$

From equation (1.5)

$$\text{Put } B^* = 0$$

$$\lambda_1 = -\beta_5 B$$

$$\beta_2 T = \beta_5 \rho_{11} B - \beta_3(S - S^*) \rho_{12} + \beta_2 T^*$$

From equation (1.6)

$$B = D - \rho_{11}T - \rho_{21}P_j - \rho_{31}P_m$$

$$\beta_2 T = \beta_5 \rho_{11}(D - \rho_{11}T - \rho_{21}P_j - \rho_{31}P_m) - \beta_3(S - S^*) \rho_{12} + \beta_2 T^*$$

$$(\beta_2 + \beta_5 \rho_{11}^2)T = \beta_5 \rho_{11}(D - \rho_{21}P_j - \rho_{31}P_m) - \beta_3 \rho_{12}(S - S^*) + \beta_2 T^*$$

$$T = \frac{\beta_5 \rho_{11}}{\beta_2 + \beta_5 \rho_{11}^2}(D - \rho_{21}P_j - \rho_{31}P_m) - \frac{\beta_3 \rho_{12}}{\beta_2 + \beta_5 \rho_{11}^2}(S - S^*) + \frac{\beta_2}{\beta_2 + \beta_5 \rho_{11}^2}T^*$$

$$T = \rho_{11}\phi_4(D - \rho_{21}P_j - \rho_{31}P_m) - \rho_{12}\phi_5(S - S^*) + \phi_3 T^*$$

D Equation

From equation (1.1)

$$\lambda_1 = \beta_1(D - D^*)$$

$$\beta_1 D = \lambda_1 + \beta_1 D^*$$

From equation (1.5) when $B^* = 0$

$$\lambda_1 = -\beta_5 B$$

$$\beta_1 D = -\beta_5 B + \beta_1 D^*$$

From equation (1.6)

$$B = D - \rho_{11}T - \rho_{21}P_j - \rho_{31}P_m$$

$$\beta_1 D = -\beta_5(D - \rho_{11}T - \rho_{21}P_j - \rho_{31}P_m) + \beta_1 D^*$$

$$\beta_1 D = -\beta_5(D - \rho_{11}T - \rho_{21}P_j - P_m) + \beta_1 D^*$$

$$(\beta_1 + \beta_5)D = \beta_5(\rho_{11}T + \rho_{21}P_j + \rho_{31}P_m) + \beta_1 D^*$$

$$D = \left(\frac{\beta_5}{\beta_1 + \beta_5} \right) (\rho_{11}T + \rho_{21}P_j + \rho_{31}P_m) + \left(\frac{\beta_1}{\beta_1 + \beta_5} \right) D^*$$

$$D = \left(1 - \frac{\beta_1}{\beta_1 + \beta_5} \right) (\rho_{11}T + \rho_{21}P_j + \rho_{31}P_m) + \left(\frac{\beta_1}{\beta_1 + \beta_5} \right) D^*$$

$$D = (1 - \phi_6)(\rho_{11}T + \rho_{21}P_j + \rho_{31}P_m) + \phi_6 D^*$$

$$\phi_1 = \frac{\beta_3}{\beta_3 + \beta_4}$$

$$\phi_2 = \frac{\beta_4}{\beta_3 + \beta_4}$$

$$\phi_3 = \frac{\beta_2}{\beta_2\beta_5\rho_{11}^2}$$

$$\phi_4 = \frac{\beta_5}{\beta_2 + \beta_5\rho_{11}^2}$$

$$\phi_5 = \frac{\beta_3}{\beta_2 + \beta_5\rho_{11}^2}$$

$$\phi_6 = \frac{\beta_1}{\beta_1 + \beta_5}$$

1B Derivation of Fiscal Response Model B

$$U = \beta_0 - \frac{\beta_1}{2}(D - D^*)^2 - \frac{\beta_2}{2}(T - T^*)^2 - \frac{\beta_3}{2}(S - S^*)^2 - \frac{\beta_4}{2}(C - C^*)^2 - \frac{\beta_5}{2}(B - B^*)^2$$

$$D = \rho_{11}T + \rho_{21}P_j + \rho_{31}P_m + \rho_{41}B$$

or

$$D = (1 - \rho_{12})T + (1 - \rho_{22})P_j + (1 - \rho_{32})P_m + (1 - \rho_{42})B$$

$$S + C = \rho_{12}T + \rho_{22}P_j + \rho_{32}P_m + \rho_{42}B$$

$$L = \beta_0 - \frac{\beta_1}{2}(D - D^*)^2 - \frac{\beta_2}{2}(T - T^*)^2 - \frac{\beta_3}{2}(S - S^*)^2 - \frac{\beta_4}{2}(C - C^*)^2 - \frac{\beta_5}{2}(B - B^*)^2 + \lambda_1(D - B - \rho_{11}T - \rho_{21}P_j - \rho_{31}P_m - \rho_{41}B) + \lambda_2(S + C - \rho_{12}T - \rho_{22}P_j - \rho_{32}P_m - \rho_{42}B)$$

$$\frac{\partial L}{\partial D} = -\beta_1(D - D^*) + \lambda_1$$

$$-\beta_1(D - D^*) + \lambda_1 = 0$$

(2.1)

$$\frac{\partial L}{\partial T} = -\beta_2(T - T^*) - \rho_{11}\lambda_1 - \rho_{12}\lambda_2$$

$$-\beta_2(T - T^*) - \rho_{11}\lambda_1 - \rho_{12}\lambda_2 = 0 \quad (2.2)$$

$$\frac{\partial L}{\partial S} = -\beta_3(S - S^*) + \lambda_2$$

$$-\beta_3(S - S^*) + \lambda_2 = 0 \quad (2.3)$$

$$\frac{\partial L}{\partial C} = -\beta_4(C - C^*) + \lambda_2$$

$$-\beta_4(C - C^*) + \lambda_2 = 0 \quad (2.4)$$

$$\frac{\partial L}{\partial B} = -\beta_5(B - B^*) - \rho_{41}\lambda_1 - \rho_{42}\lambda_2$$

$$-\beta_5(B - B^*) - \rho_{41}\lambda_1 - \rho_{42}\lambda_2 = 0 \quad (2.5)$$

$$\frac{\partial L}{\partial \lambda_1} = D - \rho_{11}T - \rho_{21}P_j - \rho_{31}P_m - \rho_{41}B$$

$$D - \rho_{11}T - \rho_{21}P_j - \rho_{31}P_m - \rho_{41}B = 0 \quad (2.6)$$

$$\frac{\partial L}{\partial \lambda_2} = S + C - \rho_{12}T - \rho_{22}P_j - \rho_{32}P_m - \rho_{42}B$$

$$S + C - \rho_{12}T - \rho_{22}P_j - \rho_{32}P_m - \rho_{42}B = 0 \quad (2.7)$$

C Equation

From equation (2.4)

$$\lambda_2 = \beta_4 C - \beta_4 C^*$$

$$\beta_4 C = \lambda_2 + \beta_4 C^*$$

From equation (2.3)

$$\lambda_2 = \beta_3 (S - S^*)$$

$$\lambda_2 = \beta_3 S - \beta_3 S^*$$

From equation (2.7)

$$S = -C + \rho_{12}T + \rho_{22}P_j + \rho_{32}P_m + \rho_{42}B$$

$$\lambda_2 = \beta_3 (-C + \rho_{12}T + \rho_{22}P_j + \rho_{32}P_m + \rho_{42}B) - \beta_3 S^*$$

$$\beta_4 C = \beta_3 (-C + \rho_{12}T + \rho_{22}P_j + \rho_{32}P_m + \rho_{42}B) - \beta_3 S^* + \beta_4 C^*$$

$$\beta_3 C + \beta_4 C = \beta_3 (\rho_{12}T + \rho_{22}P_j + \rho_{32}P_m + \rho_{42}B) - \beta_3 S^* + \beta_4 C^*$$

$$(\beta_3 + \beta_4)C = \beta_3 (\rho_{12}T + \rho_{22}P_j + \rho_{32}P_m + \rho_{42}B) - \beta_3 S^* + \beta_4 C^*$$

$$C = \frac{\beta_3}{(\beta_3 + \beta_4)} (\rho_{12}T + \rho_{22}P_j + \rho_{32}P_m + \rho_{42}B) - \frac{\beta_3}{(\beta_3 + \beta_4)} S^* + \frac{\beta_4}{(\beta_3 + \beta_4)} C^*$$

$$C = \phi_1 (\rho_{12}T + \rho_{22}P_j + \rho_{32}P_m + \rho_{42}B) - \phi_1 S^* + \phi_2 C^*$$

S Equation

From equation (2.3)

$$\beta_3 S = \lambda_2 + \beta_3 S^*$$

From equation (2.4)

$$\lambda_2 = \beta_4 (C - C^*)$$

$$\lambda_2 = \beta_4 C - \beta_4 C^*$$

From equation (2.7)

$$C = -S + \rho_{12}T + \rho_{22}P_j + \rho_{32}P_m + \rho_{42}B$$

$$\lambda_2 = \beta_4 (-S + \rho_{12}T + \rho_{22}P_j + \rho_{32}P_m + \rho_{42}B) - \beta_4 C^*$$

$$\beta_3 S = \beta_4 (-S + \rho_{12}T + \rho_{22}P_j + \rho_{32}P_m + \rho_{42}B) - \beta_4 C^* + \beta_3 S^*$$

$$\beta_3 S + \beta_4 S = \beta_4 (\rho_{12}T + \rho_{22}P_j + \rho_{32}P_m + \rho_{42}B) - \beta_4 C^* + \beta_3 S^*$$

$$(\beta_3 + \beta_4)S = \beta_4 (\rho_{12}T + \rho_{22}P_j + \rho_{32}P_m + \rho_{42}B) - \beta_4 C^* + \beta_3 S^*$$

$$S = \frac{\beta_4}{(\beta_3 + \beta_4)} (\rho_{12}T + \rho_{22}P_j + \rho_{32}P_m + \rho_{42}B) - \frac{\beta_4}{(\beta_3 + \beta_4)} C^* + \frac{\beta_3}{(\beta_3 + \beta_4)} S^*$$

$$S = \left(1 - \frac{\beta_4}{\beta_3 + \beta_4}\right) (\rho_{12}T + \rho_{22}P_j + \rho_{32}P_m + \rho_{42}B) - \frac{\beta_4}{(\beta_3 + \beta_4)} C^* + \frac{\beta_3}{(\beta_3 + \beta_4)} S^*$$

$$S = (1 - \phi_1) (\rho_{12}T + \rho_{22}P_j + \rho_{32}P_m + \rho_{42}B) - \phi_2 C^* + \phi_1 S^*$$

T Equation

From equation (2.2)

$$\beta_2 T = \beta_2 T^* - \rho_{11}\lambda_1 - \rho_{12}\lambda_2$$

From equation (2.1)

$$\lambda_1 = \beta_1 D - \beta_1 D^*$$

$$\lambda_1 = \beta_1 (\rho_{11}T + \rho_{21}P_j + \rho_{31}P_m + \rho_{41}B) - \beta_1 D^*$$

From equation (2.3)

$$\lambda_2 = \beta_3 S - \beta_3 S^*$$

$$\lambda_2 = \beta_3 (-C + \rho_{12}T + \rho_{22}P_j + \rho_{32}P_m + \rho_{42}B) - \beta_3 S^*$$

$$\lambda_2 = -\beta_3 C + \beta_3 \rho_{12}T + \beta_3 \rho_{22}P_j + \beta_3 \rho_{32}P_m + \beta_3 \rho_{42}B - \beta_3 S^*$$

$$\begin{aligned} \beta_2 T &= \beta_2 T^* - \beta_1 \rho_{11}^2 T - \beta_1 \rho_{11} \rho_{21} P_j - \beta_1 \rho_{11} \rho_{31} P_m - \beta_1 \rho_{11} \rho_{41} B + \beta_1 \rho_{11} D^* + \beta_3 \rho_{12} C - \beta_3 \rho_{12}^2 T \\ &- \beta_3 \rho_{12} \rho_{22} P_j - \beta_3 \rho_{12} \rho_{32} P_m - \beta_3 \rho_{12} \rho_{42} B + \beta_3 \rho_{12} S^* \end{aligned}$$

$$\begin{aligned} \beta_2 T + \beta_1 \rho_{11}^2 T + \beta_3 \rho_{12}^2 T &= \beta_2 T^* - (\beta_1 \rho_{11} \rho_{21} + \beta_3 \rho_{12} \rho_{22}) P_j - (\beta_1 \rho_{11} \rho_{31} + \beta_3 \rho_{12} \rho_{32}) P_m - (\beta_1 \rho_{11} \rho_{41} + \beta_3 \rho_{12} \rho_{42}) B \\ &+ \beta_1 \rho_{11} D^* + \beta_3 \rho_{12} S^* + \beta_3 \rho_{12} C \end{aligned}$$

$$\begin{aligned} (\beta_2 + \beta_1 \rho_{11}^2 + \beta_3 \rho_{12}^2) T &= \beta_2 T^* - (\beta_1 \rho_{11} \rho_{21} + \beta_3 \rho_{12} \rho_{22}) P_j - (\beta_1 \rho_{11} \rho_{31} + \beta_3 \rho_{12} \rho_{32}) P_m - (\beta_1 \rho_{11} \rho_{41} + \beta_3 \rho_{12} \rho_{42}) B \\ &+ \beta_1 \rho_{11} D^* + \beta_3 \rho_{12} S^* + \beta_3 \rho_{12} C \end{aligned}$$

$$\begin{aligned} T &= \frac{\beta_2}{(\beta_2 + \beta_1 \rho_{11}^2 + \beta_3 \rho_{12}^2)} T^* - \frac{(\beta_1 \rho_{11} \rho_{21} + \beta_3 \rho_{12} \rho_{22})}{(\beta_2 + \beta_1 \rho_{11}^2 + \beta_3 \rho_{12}^2)} P_j - \frac{(\beta_1 \rho_{11} \rho_{31} + \beta_3 \rho_{12} \rho_{32})}{(\beta_2 + \beta_1 \rho_{11}^2 + \beta_3 \rho_{12}^2)} P_m - \frac{(\beta_1 \rho_{11} \rho_{41} + \beta_3 \rho_{12} \rho_{42})}{(\beta_2 + \beta_1 \rho_{11}^2 + \beta_3 \rho_{12}^2)} B \\ &+ \frac{\beta_1 \rho_{11}}{(\beta_2 + \beta_1 \rho_{11}^2 + \beta_3 \rho_{12}^2)} D^* + \frac{\beta_3 \rho_{12}}{(\beta_2 + \beta_1 \rho_{11}^2 + \beta_3 \rho_{12}^2)} S^* + \frac{\beta_3 \rho_{12}}{(\beta_2 + \beta_1 \rho_{11}^2 + \beta_3 \rho_{12}^2)} C \end{aligned}$$

$$T = \phi_3 T^* - \phi_5 P_j - \phi_6 P_m - \phi_4 B + \phi_{16} \rho_{11} D^* + \phi_7 \rho_{12} S^* + \phi_7 \rho_{12} C$$

Where

$$\phi_3 = \frac{\beta_2}{(\beta_2 + \beta_1 \rho_{11}^2 + \beta_3 \rho_{12}^2)}$$

$$\phi_4 = \frac{(\beta_1 \rho_{11} \rho_{41} + \beta_3 \rho_{12} \rho_{42})}{(\beta_2 + \beta_1 \rho_{11}^2 + \beta_3 \rho_{12}^2)}$$

$$\phi_5 = \frac{(\beta_1 \rho_{11} \rho_{21} + \beta_3 \rho_{12} \rho_{22})}{(\beta_2 + \beta_1 \rho_{11}^2 + \beta_3 \rho_{12}^2)}$$

$$\phi_6 = \frac{(\beta_1 \rho_{11} \rho_{31} + \beta_3 \rho_{12} \rho_{32})}{(\beta_2 + \beta_1 \rho_{11}^2 + \beta_3 \rho_{12}^2)}$$

$$\phi_7 = \frac{\beta_3}{(\beta_2 + \beta_1 \rho_{11}^2 + \beta_3 \rho_{12}^2)}$$

$$\phi_{16} = \frac{\beta_1}{(\beta_2 + \beta_1 \rho_{11}^2 + \beta_3 \rho_{12}^2)}$$

D Equation

From equation (2.1)

$$\beta_1 D = \beta_1 D^* + \lambda_1$$

From equation (2.5)

$$\rho_{41} \lambda_1 = -\beta_5 B - \rho_{42} \lambda_2$$

From equation (2.3)

$$\lambda_2 = \beta_3 (S - S^*)$$

From equation (2.6)

$$\rho_{41} B = D - \rho_{11} T - \rho_{21} P_j - \rho_{31} P_m$$

$$B = \frac{1}{\rho_{41}} D - \frac{\rho_{11}}{\rho_{41}} T - \frac{\rho_{21}}{\rho_{41}} P_j - \frac{\rho_{31}}{\rho_{41}} P_m$$

$$\rho_{41} \lambda_1 = -\beta_5 \left(\frac{1}{\rho_{41}} D - \frac{\rho_{11}}{\rho_{41}} T - \frac{\rho_{21}}{\rho_{41}} P_j - \frac{\rho_{31}}{\rho_{41}} P_m \right) - \rho_{42} (\beta_3 (S - S^*))$$

$$\lambda_1 = -\frac{\beta_5}{\rho_{41}^2} D + \frac{\beta_5 \rho_{11}}{\rho_{41}^2} T + \frac{\beta_5 \rho_{21}}{\rho_{41}^2} P_j + \frac{\beta_5 \rho_{31}}{\rho_{41}^2} P_m - \frac{\beta_3 \rho_{42}}{\rho_{41}} (S - S^*)$$

$$\beta_1 D = \beta_1 D^* - \frac{\beta_5}{\rho_{41}^2} D + \frac{\beta_5 \rho_{11}}{\rho_{41}^2} T + \frac{\beta_5 \rho_{21}}{\rho_{41}^2} P_j + \frac{\beta_5 \rho_{31}}{\rho_{41}^2} P_m - \frac{\beta_3 \rho_{42}}{\rho_{41}} (S - S^*)$$

$$\beta_1 D + \frac{\beta_5}{\rho_{41}^2} D = \beta_1 D^* + \frac{\beta_5 \rho_{11}}{\rho_{41}^2} T + \frac{\beta_5 \rho_{21}}{\rho_{41}^2} P_j + \frac{\beta_5 \rho_{31}}{\rho_{41}^2} P_m - \frac{\beta_3 \rho_{42}}{\rho_{41}} (S - S^*)$$

$$\left(\beta_1 + \frac{\beta_5}{\rho_{41}^2} \right) D = \beta_1 D^* + \frac{\beta_5 \rho_{11}}{\rho_{41}^2} T + \frac{\beta_5 \rho_{21}}{\rho_{41}^2} P_j + \frac{\beta_5 \rho_{31}}{\rho_{41}^2} P_m - \frac{\beta_3 \rho_{42}}{\rho_{41}} (S - S^*)$$

$$\left(\frac{\beta_1 \rho_{41}^2 + \beta_5}{\rho_{41}^2} \right) D = \beta_1 D^* + \frac{\beta_5 \rho_{11}}{\rho_{41}^2} T + \frac{\beta_5 \rho_{21}}{\rho_{41}^2} P_j + \frac{\beta_5 \rho_{31}}{\rho_{41}^2} P_m - \frac{\beta_3 \rho_{42}}{\rho_{41}} (S - S^*)$$

$$D = \frac{\beta_1 \rho_{41}^2}{\beta_1 \rho_{41}^2 + \beta_5} D^* + \frac{\beta_5 \rho_{11} \rho_{41}^2}{\beta_1 \rho_{41}^2 + \beta_5} T + \frac{\beta_5 \rho_{21} \rho_{41}^2}{\beta_1 \rho_{41}^2 + \beta_5} P_j + \frac{\beta_5 \rho_{31} \rho_{41}^2}{\beta_1 \rho_{41}^2 + \beta_5} P_m - \frac{\beta_3 \rho_{42} \rho_{41}}{\beta_1 \rho_{41}^2 + \beta_5} (S - S^*)$$

$$D = \phi_8 \rho_{41}^2 D^* + \phi_9 \rho_{41}^2 (\rho_{11} T + \rho_{21} P_j + \rho_{31} P_m) - \phi_{10} \rho_{42} \rho_{41} (S - S^*)$$

Where

$$\phi_8 = \frac{\beta_1}{\beta_1 \rho_{41}^2 + \beta_5}$$

$$\phi_9 = \frac{\beta_5}{\beta_1 \rho_{41}^2 + \beta_5}$$

$$\phi_{10} = \frac{\beta_3}{\beta_1 \rho_{41}^2 + \beta_5}$$

B Equation

From equation (2.1)

$$\lambda_1 = \beta_1 D - \beta_1 D^*$$

$$\lambda_1 = \beta_1 \rho_{11} T + \beta_1 \rho_{21} P_j + \beta_1 \rho_{31} P_m + \beta_1 \rho_{41} B - \beta_1 D^*$$

From equation (2.3)

$$\lambda_2 = \beta_3 (S - S^*)$$

From equation (2.5)

$$\beta_5 B = -\rho_{41} \lambda_1 - \rho_{42} \lambda_2$$

From equation (2.6)

$$D = \rho_{11} T + \rho_{21} P_j + \rho_{31} P_m + \rho_{41} B$$

From equation (2.7)

$$S = -C + \rho_{12} T + \rho_{22} P_j + \rho_{32} P_m + \rho_{42} B$$

$$\lambda_2 = \beta_3 (-C + \rho_{12} T + \rho_{22} P_j + \rho_{32} P_m + \rho_{42} B - S^*)$$

$$\lambda_2 = -\beta_3 C + \beta_3 \rho_{12} T + \beta_3 \rho_{22} P_j + \beta_3 \rho_{32} P_m + \beta_3 \rho_{42} B - \beta_3 S^*$$

$$\begin{aligned} \beta_5 B = & -\beta_1 \rho_{11} \rho_{41} T - \beta_1 \rho_{21} \rho_{41} P_j - \beta_1 \rho_{31} \rho_{41} P_m - \beta_1 \rho_{41}^2 B + \beta_1 \rho_{41} D^* + \beta_3 \rho_{42} C - \beta_3 \rho_{12} \rho_{42} T \\ & - \beta_3 \rho_{22} \rho_{42} P_j - \beta_3 \rho_{32} \rho_{42} P_m - \beta_3 \rho_{42}^2 B + \beta_3 \rho_{42} S^* \end{aligned}$$

$$\begin{aligned} \beta_5 B + \beta_1 \rho_{41}^2 B + \beta_3 \rho_{42}^2 B = & -\beta_1 \rho_{11} \rho_{41} T - \beta_1 \rho_{21} \rho_{41} P_j - \beta_1 \rho_{31} \rho_{41} P_m + \beta_1 \rho_{41} D^* + \beta_3 \rho_{42} C - \beta_3 \rho_{12} \rho_{42} T \\ & - \beta_3 \rho_{22} \rho_{42} P_j - \beta_3 \rho_{32} \rho_{42} P_m + \beta_3 \rho_{42} S^* \end{aligned}$$

$$\begin{aligned} (\beta_5 + \beta_1 \rho_{41}^2 + \beta_3 \rho_{42}^2) B = & -(\beta_1 \rho_{11} \rho_{41} T + \beta_3 \rho_{12} \rho_{42}) T - (\beta_1 \rho_{21} \rho_{41} + \beta_3 \rho_{22} \rho_{42}) P_j - (\beta_1 \rho_{31} \rho_{41} + \beta_3 \rho_{32} \rho_{42}) P_m \\ & + \beta_3 \rho_{42} C + \beta_3 \rho_{42} S^* + \beta_1 \rho_{41} D^* \end{aligned}$$

$$\begin{aligned} B = & -\frac{(\beta_1 \rho_{11} \rho_{41} + \beta_3 \rho_{12} \rho_{42})}{(\beta_5 + \beta_1 \rho_{41}^2 + \beta_3 \rho_{42}^2)} T - \frac{(\beta_1 \rho_{21} \rho_{41} + \beta_3 \rho_{22} \rho_{42})}{(\beta_5 + \beta_1 \rho_{41}^2 + \beta_3 \rho_{42}^2)} P_j - \frac{(\beta_1 \rho_{31} \rho_{41} + \beta_3 \rho_{32} \rho_{42})}{(\beta_5 + \beta_1 \rho_{41}^2 + \beta_3 \rho_{42}^2)} P_m \\ & + \frac{\beta_3 \rho_{42}}{(\beta_5 + \beta_1 \rho_{41}^2 + \beta_3 \rho_{42}^2)} C + \frac{\beta_3 \rho_{42}}{(\beta_5 + \beta_1 \rho_{41}^2 + \beta_3 \rho_{42}^2)} S^* + \frac{\beta_1 \rho_{41}}{(\beta_5 + \beta_1 \rho_{41}^2 + \beta_3 \rho_{42}^2)} D^* \end{aligned}$$

$$B = \phi_{11} \rho_{41} D^* + \phi_{12} \rho_{42} C + \phi_{12} \rho_{42} S^* - \phi_{13} T - \phi_{14} P_j - \phi_{15} P_m$$

Where

$$\phi_{11} = \frac{\beta_1}{(\beta_5 + \beta_1 \rho_{41}^2 + \beta_3 \rho_{42}^2)}$$

$$\phi_{12} = \frac{\beta_3}{(\beta_5 + \beta_1 \rho_{41}^2 + \beta_3 \rho_{42}^2)}$$

$$\phi_{13} = \frac{(\beta_1 \rho_{11} \rho_{41} + \beta_3 \rho_{12} \rho_{42})}{(\beta_5 + \beta_1 \rho_{41}^2 + \beta_3 \rho_{42}^2)}$$

$$\phi_{14} = \frac{(\beta_1 \rho_{21} \rho_{41} + \beta_3 \rho_{22} \rho_{42})}{(\beta_5 + \beta_1 \rho_{41}^2 + \beta_3 \rho_{42}^2)}$$

$$\phi_{15} = \frac{(\beta_1 \rho_{31} \rho_{41} + \beta_3 \rho_{32} \rho_{42})}{(\beta_5 + \beta_1 \rho_{41}^2 + \beta_3 \rho_{42}^2)}$$

1C Derivation of Fiscal Response Model C

$$U = \beta_0 - \frac{\beta_1}{2}(D - D^*)^2 - \frac{\beta_2}{2}(T - T^*)^2 - \frac{\beta_3}{2}(S - S^*)^2 - \frac{\beta_4}{2}(C - C^*)^2 - \frac{\beta_5}{2}(B - B^*)^2$$

$$D = \rho_{11}T + \rho_{21}P_j + \rho_{31}P_m + \rho_{41}B$$

or

$$D = (1 - \rho_{12})T + (1 - \rho_{22})P_j + (1 - \rho_{32})P_m + (1 - \rho_{42})B$$

$$S + C = \rho_{12}T + \rho_{22}P_j + \rho_{32}P_m + \rho_{42}B$$

When $DB \neq 0$

$$L = \beta_0 - \frac{\beta_1}{2}(D - D^*)^2 - \frac{\beta_2}{2}(T - T^*)^2 - \frac{\beta_3}{2}(S - S^*)^2 - \frac{\beta_4}{2}(C - C^*)^2 - \frac{\beta_5}{2}(B - B^*)^2 + \lambda_1(D - \rho_{11}T - \rho_{21}P_j - \rho_{31}P_m - \rho_{41}B) + \lambda_2(S + C - \rho_{12}T - \rho_{22}P_j - \rho_{32}P_m - \rho_{42}B)$$

$$\frac{\partial L}{\partial D} = -\beta_1(D - D^*) + \lambda_1$$

$$-\beta_1(D - D^*) + \lambda_1 = 0$$

(3.1)

$$\frac{\partial L}{\partial T} = -\beta_2(T - T^*) - \rho_{11}\lambda_1 - \rho_{12}\lambda_2$$

$$-\beta_2(T - T^*) - \rho_{11}\lambda_1 - \rho_{12}\lambda_2 = 0 \quad (3.2)$$

$$\frac{\partial L}{\partial S} = -\beta_3(S - S^*) + \lambda_2$$

$$-\beta_3(S - S^*) + \lambda_2 = 0 \quad (3.3)$$

$$\frac{\partial L}{\partial C} = -\beta_4(C - C^*) + \lambda_2$$

$$-\beta_4(C - C^*) + \lambda_2 = 0 \quad (3.4)$$

$$\frac{\partial L}{\partial B} = -\beta_5(B - B^*) - \rho_{41}\lambda_1 - \rho_{42}\lambda_2$$

$$-\beta_5(B - B^*) - \rho_{41}\lambda_1 - \rho_{42}\lambda_2 = 0 \quad (3.5)$$

$$\frac{\partial L}{\partial \lambda_1} = D - \rho_{11}T - \rho_{21}P_j - \rho_{31}P_m - \rho_{41}B$$

$$D - \rho_{11}T - \rho_{21}P_j - \rho_{31}P_m - \rho_{41}B = 0$$

(3.6)

$$\frac{\partial L}{\partial \lambda_2} = S + C - \rho_{12}T - \rho_{22}P_j - \rho_{32}P_m - \rho_{42}B$$

$$S + C - \rho_{12}T - \rho_{22}P_j - \rho_{32}P_m - \rho_{42}B = 0 \quad (3.7)$$

D Equation

From equation (3.1)

$$-\beta_1(D - D^*) + \lambda_1 = 0$$

$$\beta_1 D^* + \lambda_1 = \beta_1 D \quad (A)$$

From equation (3.5)

$$-\beta_5(B - B^*) - \rho_{41}\lambda_1 - \rho_{42}\lambda_2 = 0$$

$$\rho_{41}\lambda_1 = -\beta_5 B + \beta_5 B^* - \rho_{42}\lambda_2$$

From equation (3.3)

$$-\beta_3(S - S^*) + \lambda_2 = 0$$

$$\lambda_2 = -\beta_3(S - S^*)$$

From equation (3.6)

$$D - \rho_{11}T - \rho_{21}P_j - \rho_{31}P_m - \rho_{41}B = 0$$

$$\rho_{41}B = D - \rho_{11}T - \rho_{21}P_j - \rho_{31}P_m$$

$$B = \frac{1}{\rho_{41}} D - \frac{\rho_{11}}{\rho_{41}} T - \frac{\rho_{21}}{\rho_{41}} P_j - \frac{\rho_{31}}{\rho_{41}} P_m$$

$$\rho_{41}\lambda_1 = -\beta_5 \left(\frac{1}{\rho_{41}} D - \frac{\rho_{11}}{\rho_{41}} T - \frac{\rho_{21}}{\rho_{41}} P_j - \frac{\rho_{31}}{\rho_{41}} P_m \right) + \beta_5 B^* - \rho_{42} (\beta_3 (S - S^*))$$

$$\lambda_1 = -\frac{\beta_5}{\rho_{41}^2} D + \frac{\beta_5 \rho_{11}}{\rho_{41}^2} T + \frac{\beta_5 \rho_{21}}{\rho_{41}^2} P_j + \frac{\beta_5 \rho_{31}}{\rho_{41}^2} P_m + \frac{\beta_5}{\rho_{41}} B^* - \frac{\beta_3 \rho_{42}}{\rho_{41}} (S - S^*)$$

From equation (A)

$$\beta_1 D = \beta_1 D^* + \lambda_1$$

$$\beta_1 D = \beta_1 D^* - \frac{\beta_5}{\rho_{41}^2} D + \frac{\beta_5 \rho_{11}}{\rho_{41}^2} T + \frac{\beta_5 \rho_{21}}{\rho_{41}^2} P_j + \frac{\beta_5 \rho_{31}}{\rho_{41}^2} P_m + \frac{\beta_5}{\rho_{41}} B^* - \frac{\beta_3 \rho_{42}}{\rho_{41}} (S - S^*)$$

$$\left(\beta_1 + \frac{\beta_5}{\rho_{41}^2} \right) D = \beta_1 D^* + \frac{\beta_5 \rho_{11}}{\rho_{41}^2} T + \frac{\beta_5 \rho_{21}}{\rho_{41}^2} P_j + \frac{\beta_5 \rho_{31}}{\rho_{41}^2} P_m + \frac{\beta_5}{\rho_{41}} B^* - \frac{\beta_3 \rho_{42}}{\rho_{41}} (S - S^*)$$

$$\left(\frac{\beta_1 \rho_{41}^2 + \beta_5}{\rho_{41}^2} \right) D = \beta_1 D^* + \frac{\beta_5 \rho_{11}}{\rho_{41}^2} T + \frac{\beta_5 \rho_{21}}{\rho_{41}^2} P_j + \frac{\beta_5 \rho_{31}}{\rho_{41}^2} P_m + \frac{\beta_5}{\rho_{41}} B^* - \frac{\beta_3 \rho_{42}}{\rho_{41}} (S - S^*)$$

$$D = \left(\frac{\beta_1}{\beta_1 \rho_{41}^2 + \beta_5} \right) \rho_{41}^2 D^* + \frac{\beta_5}{\beta_1 \rho_{41}^2 + \beta_5} \rho_{11} T + \frac{\beta_5}{\beta_1 \rho_{41}^2 + \beta_5} \rho_{21} P_j + \frac{\beta_5}{\beta_1 \rho_{41}^2 + \beta_5} \rho_{31} P_m$$

$$+ \frac{\beta_5}{\beta_1 \rho_{41}^2 + \beta_5} \rho_{41} B^* - \frac{\beta_3}{\beta_1 \rho_{41}^2 + \beta_5} \rho_{41} \rho_{42} (S - S^*)$$

$$D = \left(\frac{\beta_1}{\beta_1 \rho_{41}^2 + \beta_5} \right) \rho_{41}^2 D^* + \frac{\beta_5}{\beta_1 \rho_{41}^2 + \beta_5} (\rho_{11} T + \rho_{21} P_j + \rho_{31} P_m + \rho_{41} B^*) - \frac{\beta_3}{\beta_1 \rho_{41}^2 + \beta_5} \rho_{41} \rho_{42} (S - S^*)$$

$$D = \gamma_1 \rho_{41}^2 D^* + \gamma_2 (\rho_{11} T + \rho_{21} P_j + \rho_{31} P_m + \rho_{41} B^*) - \gamma_3 \rho_{41} \rho_{42} (S - S^*)$$

Where

$$\gamma_1 = \frac{\beta_1}{\beta_1 \rho_{41}^2 + \beta_5}$$

$$\gamma_2 = \frac{\beta_5}{\beta_1 \rho_{41}^2 + \beta_5}$$

$$\gamma_3 = \frac{\beta_3}{\beta_1 \rho_{41}^2 + \beta_5}$$

B Equation

From equation (3.5)

$$-\beta_5(B - B^*) - \rho_{41}\lambda_1 - \rho_{42}\lambda_2 = 0$$

$$-\beta_5B + \beta_5B^* - \rho_{41}\lambda_1 - \rho_{42}\lambda_2 = 0$$

$$\beta_5B = \beta_5B^* - \rho_{41}\lambda_1 - \rho_{42}\lambda_2 \tag{B}$$

From equation (3.1)

$$\lambda_1 = \beta_1D - \beta_1D^*$$

From equation (3.6)

$$D = \rho_{11}T + \rho_{21}P_j + \rho_{31}P_m + \rho_{41}B$$

$$\lambda_1 = \beta_1(\rho_{11}T + \rho_{21}P_j + \rho_{31}P_m + \rho_{41}B) - \beta_1D^*$$

$$\lambda_1 = \beta_1\rho_{11}T + \beta_1\rho_{21}P_j + \beta_1\rho_{31}P_m + \beta_1\rho_{41}B - \beta_1D^*$$

From equation (3.3)

$$\lambda_2 = \beta_3(S - S^*)$$

$$\lambda_2 = \beta_3S - \beta_3S^*$$

From equation (3.7)

$$S = -C + \rho_{12}T + \rho_{22}P_j + \rho_{32}P_m + \rho_{42}B$$

$$\lambda_2 = \beta_3(-C + \rho_{12}T + \rho_{22}P_j + \rho_{32}P_m + \rho_{42}B) - \beta_3S^*$$

$$\lambda_2 = -\beta_3C + \beta_3\rho_{12}T + \beta_3\rho_{22}P_j + \beta_3\rho_{32}P_m + \beta_3\rho_{42}B - \beta_3S^*$$

From equation B

$$\beta_5B = \beta_5B^* - \rho_{41}\lambda_1 - \rho_{42}\lambda_2$$

$$\beta_5B = \beta_5B^* - \rho_{41}(\beta_1\rho_{11}T + \beta_1\rho_{21}P_j + \beta_1\rho_{31}P_m + \beta_1\rho_{41}B - \beta_1D^*) - \rho_{42}\left(\begin{array}{l} -\beta_3C + \beta_3\rho_{12}T + \beta_3\rho_{22}P_j \\ + \beta_3\rho_{32}P_m + \beta_3\rho_{42}B - \beta_3S^* \end{array}\right)$$

$$\beta_5 B = \beta_5 B^* - \rho_{41} \beta_1 \rho_{11} T - \rho_{41} \beta_1 \rho_{21} P_j - \rho_{41} \beta_1 \rho_{31} P_m - \rho_{41} \beta_1 \rho_{41} B + \rho_{41} \beta_1 D^* + \rho_{42} \beta_3 C - \rho_{42} \beta_3 \rho_{12} T - \rho_{42} \beta_3 \rho_{22} P_j - \rho_{42} \beta_3 \rho_{32} P_m - \beta_3 \rho_{42}^2 B + \beta_3 \rho_{42} S^*$$

$$\beta_5 B + \rho_{41} \beta_1 \rho_{41} B + \beta_3 \rho_{42}^2 B = \beta_5 B^* - (\rho_{41} \beta_1 \rho_{11} + \rho_{42} \beta_3 \rho_{12}) T - (\rho_{41} \beta_1 \rho_{21} + \rho_{42} \beta_3 \rho_{22}) P_j - (\rho_{41} \beta_1 \rho_{31} P_m + \rho_{42} \beta_3 \rho_{32}) P_m + \rho_{41} \beta_1 D^* + \rho_{42} \beta_3 C + \beta_3 \rho_{42} S^*$$

$$(\beta_5 B + \rho_{41} \beta_1 \rho_{41} B + \beta_3 \rho_{42}^2 B) B = \beta_5 B^* - (\rho_{41} \beta_1 \rho_{11} + \rho_{42} \beta_3 \rho_{12}) T - (\rho_{41} \beta_1 \rho_{21} + \rho_{42} \beta_3 \rho_{22}) P_j - (\rho_{41} \beta_1 \rho_{31} P_m + \rho_{42} \beta_3 \rho_{32}) P_m + \rho_{41} \beta_1 D^* + \rho_{42} \beta_3 (C + S^*)$$

$$B = \frac{\beta_5}{(\beta_5 B + \rho_{41} \beta_1 \rho_{41} B + \beta_3 \rho_{42}^2)} B^* - \frac{(\rho_{41} \beta_1 \rho_{11} + \rho_{42} \beta_3 \rho_{12})}{(\beta_5 B + \rho_{41} \beta_1 \rho_{41} B + \beta_3 \rho_{42}^2)} T - \frac{(\rho_{41} \beta_1 \rho_{21} + \rho_{42} \beta_3 \rho_{22})}{(\beta_5 B + \rho_{41} \beta_1 \rho_{41} B + \beta_3 \rho_{42}^2)} P_j - \frac{(\rho_{41} \beta_1 \rho_{31} P_m + \rho_{42} \beta_3 \rho_{32})}{(\beta_5 B + \rho_{41} \beta_1 \rho_{41} B + \beta_3 \rho_{42}^2)} P_m + \frac{\beta_1}{(\beta_5 B + \rho_{41} \beta_1 \rho_{41} B + \beta_3 \rho_{42}^2)} \rho_{41} D^* + \frac{\beta_3}{(\beta_5 B + \rho_{41} \beta_1 \rho_{41} B + \beta_3 \rho_{42}^2)} \rho_{42} (C + S^*)$$

$$B = \delta_1 B^* - \delta_3 T - \delta_5 P_j - \delta_6 P_m + \delta_4 \rho_{41} D^* + \delta_2 \rho_{42} (C + S^*)$$

Where

$$\delta_1 = \frac{\beta_5}{(\beta_5 B + \rho_{41} \beta_1 \rho_{41} B + \beta_3 \rho_{42}^2)}$$

$$\delta_2 = \frac{\beta_3}{(\beta_5 B + \rho_{41} \beta_1 \rho_{41} B + \beta_3 \rho_{42}^2)}$$

$$\delta_3 = \frac{(\rho_{41} \beta_1 \rho_{11} + \rho_{42} \beta_3 \rho_{12})}{(\beta_5 B + \rho_{41} \beta_1 \rho_{41} B + \beta_3 \rho_{42}^2)}$$

$$\delta_4 = \frac{\beta_1}{(\beta_5 B + \rho_{41} \beta_1 \rho_{41} B + \beta_3 \rho_{42}^2)}$$

$$\delta_5 = \frac{(\rho_{41} \beta_1 \rho_{21} + \rho_{42} \beta_3 \rho_{22})}{(\beta_5 B + \rho_{41} \beta_1 \rho_{41} B + \beta_3 \rho_{42}^2)}$$

$$\delta_6 = \frac{(\rho_{41} \beta_1 \rho_{31} P_m + \rho_{42} \beta_3 \rho_{32})}{(\beta_5 B + \rho_{41} \beta_1 \rho_{41} B + \beta_3 \rho_{42}^2)}$$

The derivation of other equations such as equations of C, S and T are similar as derived in model

B.

3A List of Control Variables Used in Literature

Variables	Study
GDP Per Capita	Ashworth et al (2012), Baskaran (2011), Cassette and Paty (2010), Ehdaie (1994), Golem and Perovic (2014), Jin and Zou (2002), Prohl and Schneider (2009), Rodden (2003), Wu and Lin (2010)
Budget Surplus	Ashworth et al (2012)
CPI with one year lag	Jin and Zou (2002)
Dependency Ratio	Ashworth et al (2012), Baskaran (2011), Cassette and Paty (2010), Fiva (2006), Prohl and Schneider (2009), Rodden (2003), Stein (1999)
General Government Employment	Golem and Perovic (2014)
Growth Rate of Real Per Capita GDP	Jin and Zou (2002)
Herfindahl index of government concentration	Baskaran (2011)
Labor Force	Cassette and Paty (2010)
Literacy Rate	Adil and Anwar (2015)
Minority Density	Wu and Lin (2010)
Political Variables. Different proxies have been used in literature like Democracy, System, Veto, Election, Partisan, Political Orientation, Plurality Systems, Party fragmentation, Share of Cabinet from left and center parties, Majoritarian System, Presidential System.	Ashworth et al (2012), Cassette and Paty (2010), Fiva (2006), Prohl and Schneider (2009), Rodden (2003)
Population Density	Baskaran (2011), Cassette and Paty (2010)
Private Investment	Adil and Anwar (2015)

Public Debt	Stein (1999)
Rate of Inflation	Adil and Anwar (2015)
Real Per Capita Income	Grossman (1989), Marlow (1988), Shadbegian (1999)
Relative Price of Public to Private goods	Golem and Perovic (2014)
Rural Population	Fiva (2006)
Total population	Ashworth et al (2012), Baskaran (2011), Fiva (2006), Grossman (1989), Marlow (1988), Prohl and Schneider (2009), Rodden (2003), Shadbegian (1999)
Trade Openness	Adil and Anwar (2015), Ashworth et al (2012), Baskaran (2011), Cassette and Paty (2010), Fiva (2006), Golem and Perovic (2014), Jin and Zou (2002), Prohl and Schneider (2009), Rodden (2003), Stein (1999), Wu and Lin (2010)
Unemployment Rate	Baskaran (2011), Cassette and Paty (2010)
Urbanization	Ehdaie (1994), Jin and Zou (2002)

3B Measures of Fiscal Decentralization and Government Size in Literature

Study	Measure of Government Size	Measure of Fiscal Decentralization
Oates (1972)	"Government size is calculated as Total government revenue as share of national income."	"Fiscal decentralization is calculated as Central government revenue as share of total government revenue."
DiLorenzo (1983)	"Government size is measured as Local government spending per capita on general expenditure, police, fire protection, highway, sanitation and welfare."	"Expenditure decentralization is measured as total county government expenditure divided by government expenditure in the four largest jurisdictions." "Revenue decentralization is measured as total county government revenue) divided by government revenue in the four largest jurisdictions."
Oates (1985)	Two models have been estimated. In model 1 "Government size is measured as: Total government revenue as share of GDP" In model 2 "Government size is measured as: State government revenue divided by personal income"	In model 1 "Fiscal decentralization is measured as Central government revenue (expenditure) as share of total government revenue (expenditure)." In model 2 "Fiscal decentralization is measured as State government revenue (expenditure) as share of State and local government revenue (expenditure) and total number of governmental units in a state. "
Nelson (1986)	"State and local taxes per capita (per personal income)"	Two proxies have been used for fiscal decentralization: 1. "State share of total state and local taxes" 2. "Population of a state as share of the total number of counties."
Schneider (1986)	"Growth of local governments is used to measure government size"	"Fiscal decentralization is measured as Total number of suburban municipal governments"
Nelson (1987)	"State and local government revenue (expenditure)/ personal income"	"Total number of general purpose governments and total number of special purpose governments"
Eberts and Gronberg (1988)	"State and local expenditure / personal income"	"Total number of general purpose governments and total number of special purpose governments"
Marlow	"Government size is	"Expenditure decentralization is taken as share of state

(1988)	measured as total government expenditure as a share of GNP”	and local expenditure in total government expenditure”
Wallis and Oates (1988a)	“State revenue (expenditure) / personal income”	“State revenue (expenditure) / state and local revenue (expenditure)”
Wallis and Oates (1988b)	“State and local revenue (expenditure) / per capita income”	“State revenue (expenditure) / state and local revenue (expenditure)”
Forbes and Zampelli (1989)	“County government revenue per capita/per personal income County government own revenue per capita/per personal income”	“Total number of county governments in a Standard Metropolitan statistical area (SMSA)”
Grossman (1989)	“Total government expenditure as share of GNP”	“State and local expenditure / Total government expenditure”
Raimondo (1989)	“State and local government expenditure as share of personal income for six expenditure categories (education, welfare, hospital, highways, all other)”	“Central government expenditure as share of state and local expenditure” “local government expenditure as share of state and local expenditure”
Zax (1989)	“County government share of local total revenue as share of personal income”	“Total number of general purpose governments per square mile and total number of special purpose governments per square mile and County government share of local total revenue as share of total government revenue”
Joulfaian and Marlow (1990)	“Total government expenditure as share of gross state product”	“State and local expenditure as share of total government expenditure and total governmental units in a state”
Joulfaian and Marlow (1991)	“Total government expenditure as share of gross state product and total government expenditure per capita”	Two measures have been used for fiscal decentralization 1. “Local government expenditure as share of state and local government expenditure” 2. “State and local government expenditure as share of Total government expenditure and total number of

		local governments in SMSA”
Ehdaie (1994)	“Government size is defined as the total general government expenditures share of gross domestic products”	“Fiscal decentralization is defined as the ratio of total subnational governments own-source revenues used to finance their expenditures to total subnational-national government expenditures”
Grossman and West (1994)	“Total government expenditure as share of GNP”	“State and local government expenditure as share of total government expenditure”
Shadbegian (1999)	“The study has estimated five models by using five measures of government size: 1. local government own-purpose expenditures as a share of gross state product (GSP); 2. state government own-purpose expenditures as a share of GSP 3. state and local government own-purpose expenditures as a share of GSP 4. federal government own-purpose expenditures as a share of GSP 5. total government expenditures as a share of GSP”	“Expenditure decentralization is state and local own-purpose expenditures as a share of total government expenditures”
Stein (1999)	“Government size is taken as size of the consolidated public sector as a share of GDP”	“Expenditure decentralization, measured as the percentage of total government spending executed by state and local governments.”
Moesen and van Cauwenberge (2000)	“Total government expenditure / GDP”	“Local government expenditure minus transfers received / total government expenditure”
Schaltegger (2001)	“State and local government	“Local government expenditure / State and local government expenditure (all expenditure categories)

	expenditure per capita (all expenditure categories)"	and total number of local governments"
Jin and Zou (2002)	"National, subnational or aggregate expenditure in percent of GDP"	Three measures have been used 1. "Ratio of subnational to total government expenditure" 2. "Ratio of subnational to total government revenue" 3. "Percentage of subnational expenditure financed by central transfers"
Kirchgassner (2002)	"State and local government expenditure per capita (total expenditure and total revenue)"	"Local government expenditure (revenue) / State and local government expenditure (revenue) and number of local governments divided by the cantonal population."
Rodden (2003)	"sum of expenditures of the central, state, and local governments dividing by GDP"	Three measures have been used for revenue decentralization 1. "Own-source sub-national revenue divided by total revenue" 2. "Autonomous taxes divided by sub-national revenue" 3. "Autonomous taxes divided by total revenue"
Schaltegger et.al (2003)	"Government size is measured as real per capita revenue of the cantonal and local level as well as at the revenue categories, namely income, property, profit and capital tax revenue as well as user charges"	"Decentralization as the local fiscal autonomy is proxied by the ratio of local revenue on the aggregated state and local revenue."
Yilmaz et.al (2004)	"Ratio of aggregate government current Expenditures excluding capital expenditures over GDP"	"Ratio of subnational governments revenue to aggregate government revenue." "Ratio of subnational governments spending to aggregate government spending."
Fiva (2006)	"Government spending as a share of GDP"	"Tax revenue decentralization measures the revenue share of sub-central government relative to general government." "Expenditure decentralization is measured as the share of sub-central to general government expenditure."

Baskaran (2009)	“Logistic transformation of public expenditures/GDP”	“Expenditure decentralization is measured as Subnational share of total government Expenditures” “Revenue decentralization is measured as Subnational share of total government revenues”
Martinez Vazquez and Yao (2009)	“Public sector employees as a share of population/labor force General government employees as a share of population”	“Sub-national expenditures/revenues as a share of general government expenditures” “Sub-national revenues as a share of general government revenues”
Schneider and Prohl (2009)	“Government size is measured by two proxies 1. aggregate of central and subnational government expenditures as a ratio of GDP. 2. aggregate of central and subnational government revenue as a ratio of GDP”	“Expenditure decentralization defined as the share of subnational government expenditure to aggregate total government expenditure.” “Revenue decentralization defined as the share of subnational government revenue to total government revenue.”
Cassette and Paty (2010)	“Three measures have been used for government size 1. total public sector expenditure as percent of GDP 2. sub-national public sector expenditure as percent of GDP 3. national public sector expenditure as percent of GDP”	Two measures have been used 1. “Revenue decentralization is a measure of which accounts for autonomous own taxes of subnational governments in the case that subnational governments have total or significant control over their taxes.” $TD_{ec} = \frac{\text{sub-national gov. own tax revenues}}{\text{consolidated general gov. total tax revenues}}$ 2. “Vertical Imbalance (VI) is measured by intergovernmental transfers as a share of subnational expenditures.”
Lin and Wu (2010)	“government size is measured by the ratio of local budgetary expenditure to the GDP of each province”	“The ratio of provincial budgetary expenditure to total budgetary expenditure is taken as the measure of expenditure decentralization.” “The ratio of local revenue to total government revenue evaluates the degree of revenue decentralization.” “Vertical imbalance is measured by the ratio of central transfers to subnational expenditure. ”

Baskaran (2011)	“Logistic transformation of public expenditures /GDP”	“Expenditure decentralization is measured as Subnational share of total government expenditures” “Revenue decentralization is measured as Subnational share of total government revenues”
Ashworth et.al (2012)	“Size of government is measured as the total public expenditures over GDP”	“Decentralization is a vector of dummy variables that capture the degree of decentralization of public expenditures. The percentage of total spending supplied by sub-central government levels is divided into quartiles, ranging from high decentralized spending (lowest quartile), to highly centralized spending (highest quartile), with two middle categories reflecting medium decentralized and medium centralized. The variable takes the value of one when the country falls within that quartile and zero otherwise.”
Cantarero and Perez (2012)	“Total regional government expenditure as share of GDP”	“Expenditure decentralization is measured as sub-national government expenditures as share of total government expenditures” “Revenue decentralization is measured as sub-national government revenues as share of total government revenues”
Liberati and Secchi (2013)	“Total local government Spending as share of GDP.”	“Revenue decentralization is measured as 1. “local income tax/local revenues” 2. “local property tax/local revenues” 3. “local taxes on goods and services/local revenues”
Golem and Perovic (2014)	“share of government expenditure in total expenditures or outputs, approximated by GDP.”	“Fiscal decentralization is measured as Revenue decentralization. The variable on revenue decentralization is measured as the revenue share of sub-national government relative to general government, but only includes revenues where the sub-national government has discretion over the tax rate, tax base or both, i.e. the share of sub-national government autonomous own revenue in the total revenue of general government.” $DEC_{REV} = \frac{\text{sub-national autonomous revenues}}{\text{general government revenues}}$