Tax Revenue Effects of Sectoral Growth in Developing Countries

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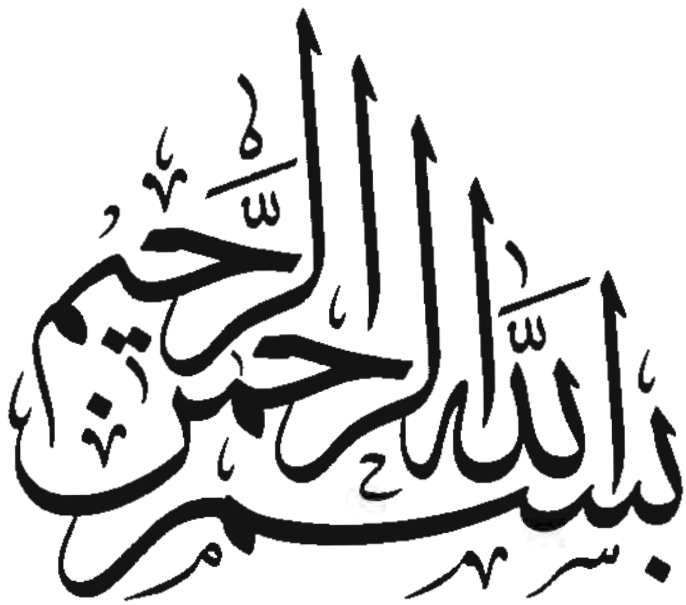

In the name of ALLAH, the Most Beneficent, the Most Merciful

Declaration

I hereby declare that this MS thesis entitled **"Tax Revenue Effects of Sectoral Growth in Developing countries"** has been composed solely by me. It is further declared that I have completed this thesis on the basis of my personal efforts under the guidance and help of my supervisor and that it has not been submitted, in whole or in part, in any previous application for a degree. Except where explicitly stated otherwise by reference or acknowledgment, the work presented is entirely my own. I am aware of and understand the university's policy on plagiarism and I certify that this thesis is my own work, expect where indicated by referencing, and the work presented in it has not been submitted in support of another degree or qualification from International Islamic University Islamabad or any other university or institute of learning.

Madiha Asma

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Abstract

The present study identifies the tax revenue effects of sectoral growth using balanced panel dataset of 94 countries over the period 2000-2015. Generalized Method of Moments (GMM) is used in analysis. Besides the analysis of the determinants of the tax revenue in overall developing countries, we further conduct the analysis by merging all countries in to two groups according ta their income levels i.e. high & upper middle income and low & lower middle income countries. A set of factors that can potentially influence tax revenues along with the sectoral growth such as, government expenditures, per capita income, trade openness, inflation, urbanization, voice and accountability and control of corruption are considered in econometric analysis. The results suggest that agricultural, industrial and services share, government expenditures, per capita income, trade openness, voice and accountability and control of corruption are positively associated with tax revenue while inflation and urbanization are negatively related to tax revenue in overall developing countries. The study also demonstrates negative signs for agricultural share, government expenditures and inflation whereas demonstrates a positive sign for per capita income, trade openness, voice and accountability and control of corruption in high and upper middle income countries. In case of low and lower middle income countries agricultural, industrial and services shares, inflation and voice and accountability have negative impact on tax revenue on the other hand government expenditures, per capita income, trade openness and control of corruption influence positively on tax revenue.

Chapter 1

Introduction

Tax revenue is a vital source of income for both developed and developing countries. The key purpose of a tax structure is to raise an adequate amount of revenue to finance necessary expenditures on the goods and services supplied by government. According to Kaldor (1963) "if a country wishes to become 'developed' it needs to collect in taxes an amount greater than the 10-15 percent found in many developing countries." A country's revenue generation mainly depends on its adequate capacity to tax (tax base).According to Schumpeter (1918), "Taxes not only helped to create the state, but they helped to form it". Tax revenues have a power to decide what a country can do, i.e. how efficiently it can allocate its resources to set its targets and how successfully it can take on its plans and policies at the domestic and global level, determined by political and economic concerns. Adam Smith (1776), in his book "The wealth of nations" chocked out four principles of a good tax system which are equity, certainty, convenience and economy. Smith concerns over taxation in his very early study of Economics highlights the importance of tax collection in the prosperity of an economy.

Developing economies normally get a very low amount of tax revenues because these economies face a number of problems in revenue generation process. There are many reasons of low tax revenues in developing countries, e.g. higher agricultural share, lower industrial and services share, narrow tax base, corruption, tax evasion, political instability, poor tax reforms, bad law and order situation and foreign aid. They can

significantly reduce tax revenues and seriously hurt economic growth and development (Mawejje and Munyambonera, (2016); Chaudhry and Munir, (2010) and Ajaz and Ahmed, (2010)).

As tax revenues are low in lower income countries which show signs of lower tax effort. Countries with lower tax effort indicate that they do not utilize their tax bases well, while a larger tax base is associated with larger tax potential (Addison and Levin, (2011)). According to Langford and Ohlenburg, (2016) a higher industrial and services shares to GDP, higher degree of trade openness and good governance contribute toward larger tax effort and hence tax potential . A summary of tax revenues by income wise group of countries (low income & lower middle income countries (L&LMIC) and High income & upper middle income countries (H&UMIC) is given below as evidence.

Table 1.1 Summary of tax revenues

Average, 1984- 2010				
Country Income group	**N**	**Tax to GDP ratio**	**Estimated tax capacity**	**Estimated tax effort**
Lower & Lower middle income	593	13.0%	23.02%	0.55
Higher & Upper middle income	1071	21.8%	31.6%	0.67
Latest year, (2008 onwards)				
Country Income group	**N**	**Tax to GDP ratio**	**Estimated tax capacity**	**Estimated tax effort**
Lower & Lower middle income	27	15.7%	26.4%	0.59
Higher & Upper middle income	55	22.5%	33.0%	0.68

Source: Langford and Ohlenburg, (2016)

Table 1.1 shows that tax revenues are lesser in lower & lower middle income countries as compared to upper & high income countries. Furthermore from 2008 onwards the

estimated tax effort of L&LMIC is approximately 60% as compared to H&UMIC whose estimated tax effort is closer to 70%.

The sector wise composition of an economy (e.g. shares of agriculture, industry and services sectors as percentage to GDP) plays a vital role in determination of tax revenues level. Agriculture sector is considered as a backbone of many developing economies, as it contributes largely to their GDPs. It may be difficult to tax agriculture sector, especially if it is dominated by a large number of subsistence farmers and subsistence activities are mostly informal (Gupta, 2007 and Addison and Levin, (2011)). Agbeyegbe *et al.*, (2004) states the same story that in lower income countries, where the largest part of agricultural sector is placed on a small scale basis, the contribution of the agriculture sector in tax yield remains low. Furthermore, a large agriculture sector may shrink the need to spend on public goods and services, which have a tendency to be urban-based (Gupta, 2007). However it may be easy to tax this sector where agriculture sector exports are dominant in nature (Agbeyegbe *et al.*, (2004) and Karagoz, (2013)).

However, it is easier to tax industry than agriculture sector. It is considered to be a good indicator for a structure of an economy. A higher industrial share tends to have higher tax revenue. A large number of businessmen own this sector, as they keep better records, which further lead to have more tax revenues from industrial sector (Ayenew, (2016) and Basirat *et al.,* (2014)). The growth in the industrial sector is an indication of further economic development. The more the countries develop economically, the more the domestic spending and imports boost, which further increases tax revenue (Basirat *et al.,* (2014)). Services sector is one of those sectors which are also easier to tax with certainty.

Tax revenue is higher in those countries where services and industrial sectors are developed (Karagoz, (2013)). In many developing countries, the services sectors are informal. Due to informal service sector, corruption and tax avoidance is also high, so revenue generation from this sector is low in most of the developing countries (Ahmed and Muhammad, (2010)). Tax to GDP ratio and sectoral composition of GDP in some developing economies is given below,

Table 1.2 Tax revenues to GDP and sectoral composition of GDP in developing countries

Countries	Rank	Tax revenues	Sectoral Composition of GDP		
			Agriculture	Industry	Services
Higher & upper middle income					
Algeria	114	25.4%	13.1%	38.7%	48.2%
Brazil	54	35.7%	6.3%	21.8%	72%
Costa Rica	195	14.1%	5.5%	18.6%	75.9%
Malaysia	174	17.4%	8.2%	37.8%	54%
Paraguay	161	19.1%	17.1%	27.3%	55.6%
Turkey	117	25.0%	8.6%	27.1%	64.3%
Uruguay	105	26.3%	6.3%	26.1%	67.6%
Lower & Lower middle income					
Cote d' Ivoire	156	19.7%	17.6%	19.5%	62.8%
Egypt	173	17.5%	11.3%	35.8%	52.9%
Morocco	124	24.0%	13.1%	29.8%	57.2%
Pakistan	186	15.4%	25.2%	19.2%	55.6%
Tunisia	128	23.3%	10.1%	28.3%	61.6%
Uganda	193	14.6%	24.5%	21.0%	54.4%
Ukraine	70	31.9%	14.4%	26.3%	59.3%

Source: The World Fact book, 2016

It is clearly seen that tax to GDP ratio is higher in those developing economies where industrial and services sectors are well developed. For example, in high & upper middle economies, Brazil's tax to GDP ratio is 35.7% because the share of services sector is 72%, industrial share is 21.8% and agricultural share is 6.3%. On the other hand, tax to GDP ratio is lower in those economies which are mainly independent upon agriculture sector as in the case of Pakistan tax revenues collection is low i.e. 15.4% because it is an agrarian economy and its agricultural share is 25.2% while industrial share is 19.2% and services share is 55%.

There are also other factors which affect tax revenues e.g. government expenditures (government size), per capita income, trade openness, inflation, urbanization and level of the governance in that economy. Many national and international studies have analyzed determinants of tax revenues e.g. Agbeyegbe *et al.,* (2004); Imam and Jacobs, (2007); Mahdavi, (2008); Chaudhary and Munir, (2010); Karagoz, (2013); Ayenew, (2016) and Mawejje and Munyambonera (2016).

Agbeyegbe *et al.,* (2004) explore the determinants of tax revenues which include GDP per capita, agricultural share, industrial share, government expenditures, aid, terms of trade, exchange rate and inflation. Gupta (2007) finds that per capita GDP, agriculture share, trade openness, foreign aid, foreign debt, corruption and political stability are statistically significant and strong determinants of revenue collection. Imam and Jacobs (2007) explain that per capita income, share of agriculture, trade openness, inflation and corruption are the most important determinants of tax revenue. Chaudhary and Munir (2010) analyze that agricultural share, manufacturing share, services share, per capita income, trade openness, monetization rate, exchange rate, inflation, external debt,

remittances, literacy rate, urbanization, foreign aid and political stability were strong and important determinants of tax revenue. Karagoz (2013) finds that agricultural share and industrial share, foreign debt, monetization rate of the economy and urbanization rate are strong determinants of tax revenues.

1.1 Significance of the Study

The impact of sectoral growth and other determinants on tax effort have long been studied in the literature. However, rare attention is paid to study the impact of sectoral growth on tax revenues specifically when these developing economies are having heterogeneous level of income. The significance of this study is to enfold the effect of sectoral growth on tax revenues of these countries. The impact of other structural and institutional factors on tax revenue in developing countries is also important to be analyzed, as it is argued that tax revenues can be enhanced through lower agriculture share and higher industrial and services share. There are also other factors which can enhance tax revenue e.g. higher per capita income, more trade openness, high urbanization rate and good governance.

This research work provides a comprehensive analysis of the impact of sectoral growth on the tax revenue in developing countries. Many research studies explore different significant determinants of tax revenues such as Agbeyegbe *et al.,* (2004) have used government expenditures in their analysis of 22 sub saharan African countries and found significant relationship between tax revenues and government expenditures. Hussain, (2014) have examined tax revenues in 55 developed and developing countries and they also found a significant relationship between government expenditures and tax revenues.

Similarly, Mawajjee and Munaymbonera (2016) have also investigated the effects of sectoral growth on tax revenues in Uganda by incorporating government expenditures in their study and found significant results regarding government expenditures.

1.2 Literature Gap

Gupta (2007) identifies tax effort in developing countries. Mahdavi (2008) explore the factors affecting tax revenues in selected developing countries. Chaudhary and Munir (2010) analyze the determinants of tax revenues in Pakistan. Addison and Levin (2011) investigate the determinants of tax revenues in Sub Saharan African countries. The contribution to the literature can be judged on the basis of the fact that there is no empirical study available to check the impact of sectoral growth in developing countries which are having a heterogeneous level of development/ national income. This work is not done so far.

In this study we extend the literature by using a larger number of countries and time period. Using a panel dataset of 94 developing countries over the period of 2000 to 2015, the effect of sectoral growth on tax revenues will be examined. In order to attain the goal of the study, Difference GMM estimation technique will be carried out in the study. The main difference between these studies and the present study is that we consider some additional variable drawn from literature that is government expenditures. The present study analyzes the relationship between tax to GDP ratio, sectoral composition of GDP along with government expenditures in developing countries which is generally ignored in cross country analysis however Mawejje and Munayambonera (2016) explored this relationship for Uganda only. By following this country specific study we are exploring

the same relationship across 94 developing economies analyze the tax revenue effects of sectoral growth in developing economies.

1.3 Objectives of the study

The main objective of the study is to explore the relationship between tax revenues and sectoral growth (value addition) in different composite parts of GDP i.e. agricultural, industrial and services sectors of developing economies having heterogeneous level of national income. However, level of development/ national income of an economy can play an important role in determination of tax efforts. Therefore following tertiary objectives are also included.

- To examine the relationship between tax revenues and sectoral growth of low & lower income economies.
- To examine the relationship between tax revenues and sectoral growth of higher & upper middle income economies.
- To determine the impact of other structural variables (government size, per capita income, trade openness, inflation and urbanization) and institutional variables (voice and accountability and control of corruption) on tax revenue.

1.4 Hypothesis

The hypotheses of the study are as under,

H_1: Developing economies with higher agriculture share in GDP have lower tax to GDP ratio.

H_2: Developing economies with higher industrial share in GDP have higher tax to GDP ratio.

H_3: Developing economies with services share in GDP have higher tax to GDP ratio.

H_4: Level of development/ national income has a significant role in tax revenue determination.

1.5 Structure of the Thesis

The thesis consists of five chapters. The first chapter introduces the topic. In second chapter we review the empirical background of the present study. The third chapter comprises of conceptual framework of the study, empirical model methodology, a detailed view of econometric specification, variables definitions, expected results of the study and estimation methodology. The fourth chapter provides estimated results of regression models and discussion of the findings. Chapter five deals with the conclusion, policy implications and with the study limitations.

Chapter 2

Literature Review

In this section we review the theoretical and empirical literature related to our study pointing out the effects of different variables on tax revenues in developing countries. The researchers several variables i.e. sectoral composition of GDP, per capita income, trade openness, urbanization, governance, corruption, foreign aid, foreign debt and inflation as strong determinants of tax revenue across different countries. The literature is reviewed starting from theoretical research work, empirical investigations and then narrow down towards recent studies relevant to our research work by exploring the potential gap in the literature.

2.1 Early Theoretical studies

Lotz and Morss (1967) formulated a theoretical base for the impacts of per capita income and foreign trade on tax efforts. They also empirically tested the model for tax effort in 72 countries from 1953 to 1964 by using ordinary least squares (OLS) in regression analysis. Their results suggested that per capita GNP and foreign trade sector share were the strong and significant determinants influencing the tax effort. Their results showed that both variables had strong positive impact on tax effort. Lotz and Morss (1969) in their later study used monetization rate and export share as variables and found that both variables significantly determine the tax to GDP ratio.

Shin (1969) added some more variables in the theoretical model like income distribution, industrial share, government expenditures, the degrees of urbanization and

industrialization, inflation, population growth, monetary development, institutional variables etc. He also tested the model to find the determinants of tax revenue in 47 countries over the period of 1963-1965. He used ordinary least square (OLS) regression and found that agricultural share, trade share, per capita income, population growth and inflation were strong and significant determinants of tax revenue. Estimation results showed that per capita income, trade openness, inflation had positive association with tax revenue while population growth and agricultural share had negative association with tax revenue.

Bahl (1971) followed Shin's model in his study and investigated the relationship between tax ratio and various factors in developing countries from 1966 to 1968. His findings revealed that agricultural share, mining share, export share and per capita income were strong determinants of tax revenues in developing countries. Per capita income, mining share and export share had positive association with tax revenues while agriculture share was negatively related to tax revenues.

Chelliah *et al.* (1975) followed Lots and Morss (1967) and added some more variables in the model and then they examined empirically the factors affecting tax revenue in 47 countries for the period of 1969-1971 by using regression analysis. The empirical results revealed that tax ratio was negatively and significantly affected by agriculture share while positively affected by mining share and export share. Similarly, Tait *et al.*, (1979) analyzed the determinants of tax revenue for 47 countries during the period of 1972-1976 and came across the same outcome.

2.2 Empirical Panel Studies

Using generalized least squares (GLS), Leuthold (1991) investigated tax revenue shares in 8 African countries over the period of 1973 to 1981. He suggested that agriculture share in income, mining share in income, trade openness, grants share in GDP and per capita income were strong determinants of tax revenue. His findings showed that agricultural share in GDP and per capita income were negatively associated with tax revenues whereas mining share in income, trade openness and grants share in GDP were positively associated with tax revenues.

Using a panel of 88 countries, Tanzi (1992) observed the determinants of tax revenues during 1978 to 1988. He employed ordinary least square (OLS) method and revealed that import share, foreign debt and per capita income were positively related to tax revenue. At the same time agriculture share was negatively related to tax revenue.

Like Leuthohold (1991), Stotsky and WoldeMariam (1997) examined the tax effort in 43 Sub Saharan African countries over the period of 1990 to 1995 by using ordinary least squares (OLS). They implied that agriculture share, mining share, per capita income, trade openness, foreign grants and loans share determined tax revenues significantly. They discovered that agricultural share had negative relation with tax revenue while mining share, trade openness, per capita income and foreign grants and loans share had positive and statistically significant relation with tax revenue.

Ghura (1998) analyzed tax revenue in 39 sub Saharan African countries over the period of 1985 to 1996 by using generalized least squares (GLS). He observed that tax revenue

was negatively related to per capita income, agricultural share in GDP, inflation, external grants. On the other hand it was positively related to trade openness, mining share in GDP, oil sector share in GDP, real exchange rate, structural reforms, human capital index, corruption external debt and terms of trade.

Piancastelli (2001) observed the determinants of tax revenue in 75 countries throughout the period of 1985 to 1995 by using ordinary least square (OLS) and fixed effect modeling technique (FEM). He suggested that agriculture share, industry share, services share, trade openness and per capita income were strong determinants of tax revenue. Estimation results show that tax revenue was negatively associated to agricultural share while positively related to industrial share, services share, trade openness and per capita income.

Eltony (2002) captured the effect of tax effort in 16 Arab countries over the period of 1994 to 2000 by using panel regression techniques and suggested that per capita income, agriculture share in GDP, mining share in GDP, share of imports and exports and foreign debt were important determinants of tax revenues. His findings revealed that per capita income, mining share in GDP, share of imports and exports and foreign debt were positively related to tax revenues while agricultural sector in GDP was negatively related to tax revenues in Arab countries.

Alm and Martinez-Vazquez, (2004) explored the factors affecting tax revenue in developed and developing countries by using ordinary least squares (OLS) regression from the period of 1991 to 2002. They found that agricultural share in GNP, international

trade in GNP, GNP per capita and shadow economy had negatively correlated with tax revenues while mining share in GNP was positively correlated with tax revenues.

Teera and Hudson (2004) examined the tax ratio in 116 developing and developed countries covering the period from 1975 to 1998 by using generalized least squares (GLS) regression. They suggested that GDP per capita, trade openness, aid share, population density, agriculture share in GDP, manufacturing share in GDP, external debt and shadow economy were strong and important determinants of tax revenue.

Agbeyegbe *et al.* (2004) studied the relationship between the tax revenue, trade liberalization and exchange rate using a panel of 22 Sub Saharan countries during 1980-1996. They used GMM regression and suggested that GDP per capita, agricultural share, industrial share, government expenditures, aid, terms of trade; exchange rate and inflation determine tax revenue. Their results showed positive effect for agriculture share, industry share, government expenditures and aid while at the same time strong negative effect for GDP per capita, inflation and exchange rate was also examined.

Ahsan and Wu (2005) explored tax revenues to GDP in developed and developing countries from 1979 to 2002 by using Ordinary least Squares (OLS) in regression analysis. Their study disclosed that agricultural share in GDP, per capita income, population growth and corruption were negatively and significantly related to tax revenues while trade openness was positively related to tax revenues.

Using a panel of 105 developing countries during 1980-2004, Gupta (2007) analyzed determinants of tax revenue and constructed a measure of tax effort. He utilized the

GMM regression in his analysis and observed that per capita GDP, agriculture share in GDP, aid share, debt share, corruption, political stability, law and order and economic stability were strong determinants of tax revenue in developing countries. His findings urged that agriculture share and corruption had strong negative and significant relationship with tax revenue. Moreover aid share, trade openness, and political stability positively influenced the tax revenue while law and order, government stability and debt share negatively influenced the tax revenue.

Davoodi and Grigorian (2007) examined factors affecting tax revenue collection in 141 countries from the period of 1990 to 2004. They employed panel regression techniques. Their results suggested that GDP per capita, institutional quality, inflation, share of agricultural sector in GDP, fuel exports, trade openness, urbanization and shadow economy were strong and significant determinants of tax revenue.

Lutfunnahar (2007) inspected the factors affecting tax revenues in 11 developing countries including Bangladesh in her analysis over the period from 1991 to 2005 by using panel estimation technique analysis. The findings implied that industrial share in GDP, trade openness, per capita income, monetization rate, external debt to GDP, population growth were strong and significant determinants of tax revenues in developing countries. The results showed a strong and positive impact between industrial share, trade openness, monetization rate, external debt and tax revenues while there was a negative association between per capita income, population growth and tax revenues.

Imam and Jacobs (2007) investigated the relationship between tax revenue and its determinants in 12 Middle East countries and used system GMM estimation. They

suggest that tax revenue was determined by per capita income, agriculture share, trade openness, inflation and corruption. Their results showed positive effect for inflation and agriculture share while negative effect for per capita income and trade openness. The variable corruption had insignificant impact on tax revenues.

Bird and Martinez-Vazquez (2008) examined tax effort in Latin American and high income countries over the period of 1990-1999 by using ordinary least squares methodology (OLS) and revealed that non agriculture share, control of corruption, voice and accountability were positively associated with tax effort whereas trade openness, GDP per capita and population growth were negatively associated with tax effort.

Le *et al.,* (2008) looked over tax effort in 104 countries from 1994 to 2003 by using panel modeling techniques. They found that tax effort was significantly measured by agriculture share, per capita income, population growth, trade openness, corruption and bureaucratic quality. Their results showed a negative relationship between agriculture sector, population growth corruption bureaucratic quality and tax revenues. On the other hand, estimation results illustrated that there was positive relationship between trade openness, per capita income and tax revenue collections.

Mahdavi (2008) inspected the effects of tax revenue and its determinants in 43 developing countries during 1973-2002 and employed GMM estimation technique. His results explained that external debt, non tax revenue share, agricultural share, trade openness, urbanization, literacy rate, real GDP per capita had positive correlation with tax revenues. At the same time aid, percentage of female workers in labor force,

population density, monetization rate, inflation, political regime had negative effect on tax revenues.

Ahmed and Mohammed (2010) investigated the determinants of tax effort of 25 developing countries during the period of 1998-2008 by using pooled least square method. They showed that import share, manufacturing sector share, services sector share, monetary growth and budget deficit exerted a strong and positive impact on tax buoyancy. However grants were negatively related to tax revenue.

Ajaz and Ahmed (2010) examined the effects of institutional variables on tax revenue for 25 developing countries for the period of 1990 to 2005 by using GMM regression. Their estimation results suggested that corruption and governance both were strong and significant determinants of tax revenue in developing countries. Their results enlightened that corruption had negative effect on tax revenue whereas governance had positive effect on tax revenue.

Utilizing GMM regression, Botlhole (2010) looked into the factors affecting tax effort in Sub Saharan Africa over the period of 1990 to 2007. He discovered that institutional quality, resource revenues and shadow economy were positively associated to tax revenues. However, per capita income, agriculture share, trade openness and urbanization had negative relationship with tax revenues while industry and services shares were negative and insignificant.

Pessino and Fenochietto (2010) analyzed the determinants of tax effort in 96 countries for the period of 1991 to 2006 by employing maximum likelihood method. They suggested

that per capita incomes, trade openness, public expenditure on education, agricultural share, inflation, corruption and income distribution were strong determinants of tax effort. Their findings exposed that tax effort was positively influenced by per capita income, trade openness and public expenditure on education while it was negatively influenced by agricultural share, inflation, corruption and income distribution.

Potanlar *et al.*, (2010) identified the effects of structural, institutional and political factors on tax revenue in 27 developing countries over the period of 2002 to 2006. They used panel estimation techniques in their analysis and found that inflation, GDP per capita and trade openness had a strong positive effect on tax revenue. At the same time, tax revenues were negatively affected by agriculture share, industrial and services shares.

Using panel of 39 countries, Addison and Levin (2011) investigated the determinants of tax revenue share in Sub Saharan Africa for the period of 1980-2005. They employed GMM methodology in their regression analysis. Their findings suggested that agricultural share, trade openness, per capita income, population growth, urbanization rate and aid share are strong and significant determinants of tax revenue in Sub Saharan Africa. However agricultural share, per capita income and aid share were negatively correlated with tax revenue, while urbanization had a strong positive impact on tax revenue.

Javid and Arif (2012) explored the effects of tax revenue effort in 11 developing Asian countries using data from 1984 to 2010. They utilized GMM estimation technique. Their study explained that agriculture sector share, inflation and population growth had negative impact on tax revenues whereas GDP per capita, trade openness, debt share and

institutional variables (control of corruption, law and order and bureaucratic quality) were negatively related to tax revenue.

Dioda (2012) examined the determinants of tax revenue in 32 Latin American countries during 1990 to 2009 by applying static panel econometric methods. He found that civil liberties, political regime, trade openness, GDP per capita, population density, education and female labor force participation exerted a positive influence on tax revenue. On the other hand, agriculture sector share and shadow economy had a strong negative impact on tax revenue.

Ghani (2012) conducted a study of tax revenue in 104 countries by including Pakistan from 1996 to 2005. Employing Panel Corrected Standard Error (PCSE) and generalized method of moments (GMM) his study revealed that agricultural share in GDP, per capita income, urbanization rate, trade openness and rule of law were strongly and significantly determined the tax revenues. The results enlightened that agriculture sector share was negatively related to tax revenues whereas per capita income, urbanization rate, trade openness, and rule of law were positively related to tax revenues.

Castro and Camarillo (2014) identified the determinants of tax revenue in 34 OECD countries for the period of 2001-2011 by using GMM regression technique. The estimation method results demonstrated that GDP per capita, industry share and education had positive influence on tax revenue while on the other hand; trade openness, foreign direct investment (FDI), agricultural share, civil liberties, political rights, infant mortality and life expectancy had negative impact on tax revenue.

Using a panel of 55 developed and developing countries, Hussain (2014) observed the effects of structural and institutional variables on tax effort from 2002 to 2012. He utilized static panel modeling techniques and explained that government expenditures, trade openness, urbanization, institutional quality and control of corruption were positively associated with tax revenue while monetization rate was negatively associated with tax revenue.

Tabari and Sooltantooyeh (2014) examined the effects of tax revenue in eleven oil exporting countries from 2005 to 2010 by employing generalized least squares (GLS). Their results disclosed that agriculture share in GDP, industry share in GDP, mining share in GDP, services share in GDP, per capita income, urbanization rate and inflation determined tax revenues significantly. Their findings showed that agriculture sector share in GDP had negative correlation with tax revenues while industry share in GDP, mining share in GDP, services share in GDP, per capita income, urbanization rate and inflation were positively associated with tax revenues in oil exporting countries.

Aizenman *et al.,* (2015) explored tax revenue trends in Asia and Latin America from 1993 to 2012. They used ordinary least squares (OLS). They found that tax revenue was positively influenced by per capita income, trade openness, GINI index and government effectiveness whereas it was negatively influenced by manufacturing sector share, population growth and urbanization.

Hussain *et al.,* (2015) examined tax effort in 26 countries during 2008- 2013 by using ordinary least squares (OLS). They found that voice and accountability, rule of law, government effectiveness, control on corruption, regulatory authority, political stability,

population growth, and import share affected tax revenues in a positive way whereas export share and economic growth affected tax revenues negatively.

Zarra *et al.,* (2016) investigated the factors influencing tax revenues in 83 countries over the period of 1990 to 2012 by using generalized method of moments (GMM). They suggested that GDP, agricultural share in GDP, trade openness, exchange rate, urbanization rate and democracy affected the tax revenues significantly. The findings showed that GDP, trade openness and democracy had positive correlation with tax revenues. On the other hand agricultural share in GDP, exchange rate and urbanization rate had strong negative correlation with tax revenues.

2.3 Empirical country Studies

Islam (1979) conducted a study of tax revenues and its factors in Bangladesh from 1968 to 1978. He utilizeed ordinary least squares methodology in analysis and suggested that tax ratio was significantly measured by agricultural sector share, per capita income, government expenditures and trade openness. Moreover, his results showed that degree of trade openness and agricultural sector share positively influenced the tax revenues. On the other hand tax ratio was negatively influenced by government expenditures and per capita income.

Teera (2003) explored the factors which affected tax revenues in Uganda during the period of 1970 to 2000 by utilizing time series analysis. His results put forward that per capita GDP, import ratio, aid, population density, agricultural share, manufacturing share, external debt and shadow economy affected tax revenues significantly. His results demonstrated that GDP per capita, agricultural share, import share and shadow economy

exerted a strong negative influence on tax revenue while aid share, external debt, population density and manufacturing sector exerted a positive influence on tax revenues.

Chaudhry and Munir (2010) examined the determinants of tax revenue in Pakistan by using time series analysis during 1973-2009. They found that agricultural share, manufacturing share, services share, per capita income, trade openness, monetization rate, exchange rate, inflation, external debt, remittances, literacy rate, urbanization, foreign aid and political stability were strong and important determinants of tax revenues in Pakistan. Their results showed negative effect for per capita income, foreign aid, exchange rate, urbanization and literacy rate while strong positive effect for agriculture share, manufacturing share, services shares, remittances, trade openness, monetization rate and inflation.

Oyetunji (2012) observed the determinants of tax revenue in Nigeria during 1986 to 2010 by employing co integration techniques. His results revealed that manufacturing share, services share, per capita income, exchange rate, broad money, inflation rate, and political stability exerted a positive sign on tax revenues. On the other hand, share of agriculture, trade openness, external debt, and foreign aid were negatively associated with tax revenues.

Karagoz (2013) examined the determinants of tax revenue in Turkey during 1970-2010 and uses time series regression analysis. He suggested that agricultural and industrial shares, foreign debt, monetization rate of the economy and urbanization rate were strong determinants of tax revenues. The estimation results explained that agricultural sector

was negatively related to tax revenue while industrial share, foreign debt, monetization rate of the economy and urbanization rate were positively related to tax revenues.

Muibi and Sinbo (2013) analyzed macroeconomic determinants of tax revenues in Nigeria over the period of 1970 to 2011 by employing vector error correction techniques. They recommended that real GDP, trade openness, exchange rate, inflation rate and external debt to GDP were significant determinants of tax revenues in Nigeria. Their findings showed that GDP and trade openness influenced the tax revenues positively, on the other hand exchange rate, inflation rate and external debt affected tax revenues negatively in Nigeria.

Employing Auto regression Distributed Lag (ARDL) model, Basirat *et al.,* (2014) investigated the effects of economic variables on total tax revenues in Iran for the duration of 1974 and 2011. They found that industry share, exchange rate and imports share had a positive relationship with total tax revenues whereas; the agriculture sector had a strong negative relationship with total tax revenues.

Murunga (2014) explored the effects of tax effort in Kenya during 1980-2012. He employed ordinary least squares (OLS) in regression analysis. The results showed that agricultural share, broad money, per capita income, imports share, external debt and agricultural share left a negative and significant impact on tax revenue while broad money and external debt were positively related to tax revenues.

Samimi *et al.,* (2014) analyzed tax effort in Iran by using ordinary least squares (OLS) regression covering data from 1990 to 2007. They implied that agriculture sector share in

GDP, industry sector share in GDP, oil sector share in GDP and GDP were strong and significant determinants of tax effort in Iran. Their findings revealed that agricultural share in GDP and oil share in GDP exerted a negative influence on tax effort whereas industrial share in GDP and GDP exerted a positive impact on tax effort.

Velaj and Prendi (2014) investigated the factors of tax revenue in Albania from 2001 to 2013. They used multiple regression analysis. They find that GDP growth, inflation rate, unemployment rate and annual imports of goods and services were strong and significant determinants of tax revenues. Their results found a positive and significant relationship between GDP growth, imports of goods and services and tax revenues while a negative relationship between inflation rate, unemployment rate and tax revenues.

Amin *et al.* (2015) observed the factors affecting tax revenues in Pakistan from 1980 to 2010 by applying Autoregressive distributed (ARDL) model. They implied that tax revenue is significantly determined by corruption, inflation, political stability, trade openness and per capita income. Their results concluded that tax revenue was negatively affected by corruption, political stability and inflation while it was positively associated with trade openness and per capita income.

Belay, Z. (2015) examined the determinants of tax revenues in Ethiopia by using ordinary least squares (OLS) during 1992-2013. His results suggested that GDP, foreign direct investment, trade openness, external debt, inflation and foreign aid are important determinants of tax revenues. The findings show that there was a strong negative correlation between foreign aid and tax revenues whereas a positive association was

found between GDP, foreign direct investment, trade openness, external debt, inflation and tax revenues.

Tesfaye (2015) studied the factors which affect tax revenue performance in Ethiopia from 1999 to 2014 by using ordinary least squares (OLS) regression technique. His results suggested that industrial share, foreign direct investment, inflation rate, interest rate, and per capita income are significant determinants of tax revenues. The findings revealed that foreign direct investment and inflation negative affected tax revenues negatively whilst per capita income and industrial share and interest rate had positive association with tax revenues in Ethiopia.

Gaalya (2015) analyzed the determinants of tax revenue in Uganda for the period of 1994-2012 using random and fixed effect modeling technique and found that agriculture share, industry share, exchange rate, aid and trade openness were strong and significant determinants of tax revenue performance. The estimation results suggested that tax revenue was positively affected by trade openness, exchange rate and industry share. At the same time it was negatively affected by agricultural share and aid share.

Jaffri *et al.,* (2015) explored the factors affecting tax revenues in Pakistan over the period from 1982 to 2013. They employed auto regressive distributed lag (ARDL) model approach in their regression analysis and found that trade openness, per capita income and government expenditures had positive impact on tax revenues while agricultural share in GDP exerted a negative impact on tax revenues.

Masiya *et al.,* (2015) evaluated the determinants of tax revenue in Malawi from 2003 to 2012 by using ordinary least squares (OLS) regression. They showed that tax revenues were positively influenced by GDP per capita, inflation, broad money and real exchange rate. Their results also revealed that exchange rate and inflation were insignificant in spite of having positive signs.

Using panel regression estimation, Syadullah and Wibowo (2015) analyzed the relationship between tax revenue and governance in 7 Asean countries over the period of 2003 to 2012. Their results explained that there was a strong negative correlation between voice and accountability, political stability, rule of law, control of corruption and tax revenue while government effectiveness and regulatory quality were positively associated with tax revenue.

Ayenew (2016) analyzed tax revenue determinants in Ethiopia during the period of 1975 to 2013 by utilizing Johansen maximum likelihood method. He found that GDP per capita, industrial share, inflation and foreign aid were strong and significant determinants of tax revenue. The estimation results show that industry share, GDP per capita and foreign aid have positive relationship with tax revenue, whereas inflation had negative relationship with tax revenue in long run.

Mawejje and Munyambonera (2016) explored the effects of tax revenue to sectoral growth and government expenditure in Uganda during 1999-2013. They utilized Auto Regressive Distributed Lag (ARDL) model. Their findings revealed that tax revenue was negatively affected by agriculture sector and informal sector whereas industrial sector, trade openness and development expenditures had positive relationship with tax revenue.

2.4 Conclusion

This chapter provides an overview of the literature on the effect of tax revenue of sectoral growth in developing countries along with other structural and institutional factors. From the above literature we can conclude that the tax revenue is normally low in most of the developing countries due to different factors like higher agricultural share, vast informal sector, political instability, corruption etc. While countries having higher industrial and services shares, higher per capita income, political stability and good governance may tend to have higher tax revenue collection. Many studies have captured the effect of different variables on tax to GDP ratio through cross country analysis for selected regions of developing countries. This study is analyzing the same research issue across the whole available dataset of developing economies. Furthermore, we also explore the role of development level in total tax yields.

Chapter 3

Model, Methodology and Data Source

In this chapter a theoretical framework is developed on the basis of prominent theoretical literature related to our research problem. Furthermore, an empirical model is established based on these theoretical lines. An appropriate methodology is sorted for the analysis.

3.1 Theoretical framework

The theoretical model is adopted form Lotz and Morss (1967). According to Lotz and Morss (1967), "Taxes are defined as compulsory levies necessarily related to particular benefits received. They distinguished from fees, prices, grants, and other sources revenue that are either voluntary or are more akin to proprietary income" (page no.480). According to their model tax returns are based on per capita income and foreign trade shares of an economy. Both variables had strong and significant association with tax to GDP ratio. The relationship between per capita income, trade openness and tax to GDP ratio was captured linearly.

The relationship between per capita income and tax to GDP ratio was,

$$\frac{T}{Y} = a_1 + b_1 Y_p \qquad (1)$$

$\frac{T}{Y}$ = Tax to GDP ratio

a_1 and b_1= the resulting estimates and Y_p = per capita income.

By taking per capita income into account, Lotz and Morss (1967) were capable of estimating tax to GDP ratio of developing countries.

The relationship between trade openness and tax to GDP ratio was

$$\frac{T}{Y} = a_2 + b_2 Y_p + c_2 \frac{F}{Y} \qquad (2)$$

Here $\frac{F}{Y}$ = foreign trade share (ratio of exports + imports as a percentage to GNP) while c_2 explained that how much tax to GDP ratio increased/decreased with an increase in trade openness.

In order to introduce progressivity in tax effort formulation they selected equation (1) to express the association between tax to GDP ratio and per capita income,

By taking differential on both sides of equation (1) implying that

$$\frac{dT}{dY} = a_1 + 2b_1 Y_p \qquad (3)$$

They further assumed that incremental tax ratio is growing at a constant rate with per capita income. Hence progressivity can also be increased further if incremental tax ratio grows at an increasing rate with per capita income. As equation (2) has the variable trade openness. To check the above relationship following equation was utilized.

$$\frac{T}{Y} = a_3 + b_3 \frac{F}{Y} + c_3 Y_p$$

Thus the incremental tax ratio will get the following form,

$$\frac{\partial T}{\partial Y} = a_3 + 3c_3 Y_p \qquad (4)$$

When c_3 is positive tax to GDP ratio also grows at an increasing rate with Y_p. *They further concluded that tax effort in developing countries is significantly influenced by taxable bases.*

Later on Shin (1969) followed Lots and Morss (1967) and proposed a new model by incorporating some more variables in the model. According to him tax to GDP ratio as a function can be incorporated as,

$$\frac{T}{Y} = F(Y; \frac{F}{Y}; \frac{A}{Y}; \frac{\Delta P}{P}; \frac{\Delta N}{N}) \qquad (5)$$

$\frac{T}{Y}$= tax ratio, Y = per capita income

$\frac{F}{Y}$ = foreign trade ratio, $\frac{A}{Y}$ = agricultural share

$\frac{\Delta P}{P}$ = inflation rate and $\frac{\Delta N}{N}$ = population growth rate.

Furthermore, he also explained the variables by their partial regression coefficients i.e.

$$\frac{\partial(T/Y)}{\partial Y}, \frac{\partial(T/Y)}{\partial(F/Y)}, \frac{\partial(T/Y)}{\partial(\Delta P/P)} > 0 \text{ and}$$

$$\frac{\partial(T/Y)}{\partial(A/Y)}, \frac{\partial(T/Y)}{\partial(\Delta N/N)} < 0$$

He concluded that from higher per capita income, foreign trade share and inflation rate, a higher level of tax collection can be generated while agriculture share and population growth can decline the level of tax yields.

Chelliah (1971), Bahl (1971), Islam (1979) extended the model adopted by Lotz and Morss (1967) by adding different tax handles (agricultural share in GDP, mining share in GDP, per capita income and export ratio). Musgrave (1987) applied model in linear form and found relationship between tax to GDP ratio and its various tax handles. According to his study, agricultural sector share in GNP, industrial sector share in GNP, exports share in GNP and per capita GNP are strong and significant determinants of tax revenues. Muruga (2014) carried out the pattern similar to the above mentioned studies. According to them tax to GDP ratio which is also called as tax effort is affected by numerous factors.

3.1.1 Theoretical considerations of the variables

These are the variables being considered on theoretical grounds to be included in empirical investigation.

*i) **Sectoral composition of an economy*** matters significantly because some sectors of the economy are easier to tax than others. It is obvious that in most of developing countries *agricultural sector* is difficult to tax as it is subjugated by a large number of subsistence farmers who are practicing it on small scale basis. Therefore a negative relationship between agricultural sector share and tax to GDP ratio is expected (Gupta, (2007)). However, its sign can be positive for countries that are heavily dependent on agricultural sector and dominant in agricultural exports (Agbeyegbe *et al.,* (2004)).

Industrial sector is considered to be a good indicator of an economy because it enhances tax revenue share as it is easier to tax. The positive sign is anticipated in those countries where industrial share in their GDP is dominant. *Services Sector* is also easy to be taxed. Tax revenue collection from this sector is high in those countries in which services sector is well developed (Mawejje and Munaymbonera (2016)). Due to large informal sector in many developing countries tax avoidance is high so a negative association between tax ratio and services sector share could be expected.

ii) ***Total government expenditures*** are used as a proxy for government size. In earlier cross country studies Marlow, (1986) and Saunders, (1988) used total expenditure and social expenditure as a measure of government size. In recent panel data studies Dar and Ahmad Khalkhali, (2002); Agell *et al.,* (2006) and Colombier (2009) use total government expenditure and total tax revenue as a measure of government size. Higher the government expenditure, higher will be the tax revenue. A positive relationship could be expected between government expenditure and tax revenue (Agbeyegbe *et al.*, (2004)). However, a negative relationship between government expenditure and tax revenue could be expected where government consumption is low.

iii) ***Per capita income (PCI)*** induces economy to a higher level of growth which further results in a higher capacity to pay taxes as well as a greater potential to levy and to collect them (wider tax base). The expected sign of this variable should be positive if the country is documented. It can also take negative sign where per capita income is low.

iv) ***Trade openness*** trade openness is generally shown to be positively linked with tax collection, possibly due to the ease of revenue collection (Gupta 2007,Gaalya,

(2015)). Although it is quite difficult to assess the direct impact of openness on tax revenues, openness may influence taxation indirectly by affecting many economic variables which in turn affect tax revenue. Tax revenues of low income developing countries, particularly from a trade tax point of view, tend to have high reliance on the international trade sector. A rise in trade openness is expected to get higher tax revenue.

*v) **Inflation*** is measured as a percentage change in Consumer price Index (CPI). It captures the outcome of macroeconomic policies. Higher the inflation rate of an economy, lower will be the tax revenue. Hence a negative sign could be expected between inflation and tax revenue. Changes in macroeconomic policies environment also play an important role in raising tax revenue, inflation is a good proxy used to measure the economic policy environment. It captures the effect of macroeconomic policy. The literature regarding the impact of inflation on taxation is extensive and it may be difficult to describe this phenomenon. Some past literature shows that high inflation increases the rate of tax, but recent literature shows that this dilemma depends on collection lags. Tanzi (1977) explains that the combination of high inflation, a relatively long average lag in tax collection, and a low elasticity of the tax system leads to a drastic fall in real revenues when inflation occurs.

*vi) **Urbanization rate*** also affects tax revenue. Its expected sign is ambiguous. An increase in urbanization will lead tax revenue performance to increase especially in terms of income tax. More urbanized the countries are, more will be the tax revenues resulting a positive sign. It may have negative relationship because most of the low income developing economies are non documented with high urbanization resulting in low tax

revenue collection. Hence a negative sign could be expected between tax revenue and urbanization (Davoodi and Grigorian, (2007).

vii) Good governance contributes positively to tax revenues (Ajaz and Ahmad, 2010). *Control of Corruption* and *Voice & Accountability* are being used as a proxy of governance in our study. In previous studies (Bird et al., (2008) and Syadullah and Wibowo, (2015)) used control of corruption and voice and accountability as a proxy of governance. These two variables could be expected as strong and significant determinant of tax revenue (Bird *et al.,* (2008)). According to Kaufman *et al.,* (2011),

"Voice and Accountability[1] *reflects perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media."*

"Control of Corruption[2] *reflects perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests."*

3.2 Econometric Specification

In the light of above discussion we now propose the following empirical model of the tax revenue. Our key concern is to investigate the relationship between tax revenue, sectoral growth in developing countries.

Three different econometric models will be tested to investigate the relationship. The first model will explore an overall relationship between tax revenues and sectoral growth for

[1] http://info.worldbank.org/governance/wgi/#home
[2] http://info.worldbank.org/governance/wgi/#home

the whole available dataset of developing economies. Then the countries will be divided into two further groups (*Higher & Upper Middle Income and Lower & lower Middle Income countries*) according to their level of development/national income, so that the role of development level can be explored through changing behavioral relationship of the same variables. Functional equation of the model is given below,

$$Tax/GDP_{it} = f(AGR_{it}, IND_{it}, SERV_{it}, GE_{it}, PCI_{it}, TO_{it}, INF_{it}, URB_{it}, CORR_{it}, VA_{it}) \quad \text{(i)}$$

The econometric specification of the model takes the following form.

3.2.1 Model 1 (Overall Developing Countries)

$$Tax/GDP_{it} = \alpha_0 + \alpha_1\ AGR_{it} + \alpha_2 IND_{it} + \alpha_3 SERV_{it} + \alpha_4\ GE_{it} + \alpha_5 PCI_{it} + \alpha_6 TO_{it} + \alpha_7 INF_{it} + \alpha_8 URB_{it} + \alpha_9\ VA_{it} + \alpha_{10}\ CORR_{it} + \mu_{it} \quad \text{(ii)}$$

3.2.2 Model 2 (High and Upper Middle Income Countries)

$$Tax/GDP_{it} = \beta_0 + \beta_1\ AGR_{it} + \beta_2 IND_{it} + \beta_3 SERV_{it} + \beta_4\ GE_{it} + \beta_5 PCI_{it} + \beta_6 TO_{it} + \beta_7 INF_{it} + \beta_8 URB_{it} + \beta_9\ VA_{it} + \beta_{10}\ CORR_{it} + \mu_{it} \quad \text{(iii)}$$

3.2.3 Model 3 (Low and Lower Middle Income Countries)

$$Tax/GDP_{it} = \gamma_0 + \gamma_1\ AGR_{it} + \gamma_2 IND_{it} + \alpha_3 SERV_{it} + \gamma_4\ GE_{it} + \gamma_5 PCI_{it} + \gamma_6 TO_{it} + \gamma_7 INF_{it} + \gamma_8 URB_{it} + \gamma_9\ VA_{it} + \gamma_{10}\ CORR_{it} + \mu_{it} \quad \text{(iv)}$$

Notations used in above equations ii, iii and iv are defined as follow,

Tax/GDP = Tax to GDP ratio

AGR = Agriculture sector share as percentage of GDP

IND = Industry sector share as percentage of GDP

SERV = Service sector share as percentage of GDP

PCI = Per Capita Income

TO = Trade Openness

INF = Inflation

URB = Urbanization

CORR = Control of Corruption

VA = Voice and Accountability and

μ_{it} = Error term

i= Countries t= Time period.

Whereas α, β and γ are the coefficients of variables in equations ii, iii and iv respectively.

3.3 Variables description and data sources

This study is based on the panel data set of 94 developing countries from 2000-2015. The countries are chosen on the basis of availability of data. These countries are classified as the developing countries by the World Bank[3] and are divided into four categories because of their Gross National Income (GNI) Per Capita. They are high- income ($12,476 or more GNI per capita), upper middle income ($4,036 and $12,475 GNI per Capita), lower middle- income ($1,026 and $4035) and low-income economies ($1,025 or less GNI per capita).

[3] http://data.worldbank.org/about/country-classifications.

But because of less observation in each group we have subdivided these countries into two categories of High Income & Upper Middle Income countries (HI and HMIC) and Low Income & Lower Middle Income countries (LI and LMIC).

The definitions and data sources of the variables are presented in following table.

Table 3.1: Summary and Data Sources of Variables

Sr. No	Variables Explanation		Notations	Data Sources
1.	**Tax /GDP**	"It is our dependent variable which represents tax revenue ratio to GDP which is obtained by dividing total tax revenue by GDP."	TaxGDP	World Development Indicators (WDI)
2.	**Agricultural Output**	"It represents value added agriculture sector share as Percentage in GDP."	AGR	World Development Indicators (WDI)
3.	**Industry Output**	"It measures value added industry sector share as percentage of GDP."	IND	World Development Indicators (WDI)
4.	**Services Output**	"It represents value added Services sector share as percentage of GDP."	SERV	World Development Indicators (WDI)
5.	**Government Expenditures**	"It represents annual government expenditures as percentage of GDP."	GE	World Development Indicators (WDI)

6.	**Per Capita Income**	"Per capita income is used as a proxy for the level of development of a country (measured in constant US$)."	PCI	Worldwide Development Indicators (WDI)
7.	**Trade Openness**	"It represents the ratio of exports plus imports to GDP."	TO	Worldwide Development Indicators (WDI)
8.	**Urbanization**	"Urbanization represents the percentage of total population living in areas defined as urban areas."	URB	Worldwide Development Indicators (WDI)
9.	**Voice and Accountability**	"It is used as a proxy of governance. Its estimates ranges from -2.5 (means weak governance) to 2.5 (means strong governance)."	VA	Worldwide Governance Indicators (WGI)
10.	**Control of Corruption**	"It is used as a proxy of governance. Its estimates ranges from -2.5 (means weak governance) to 2.5 (means strong governance)."	CORR	Worldwide Governance Indicators (WGI)

3.4 Estimation Methodology

In order to estimate the effect of sectoral growth on tax revenues, this study employs a panel of 94 developing countries from 2000 to 2015. In addition to this model, two more models are formulated according to income levels of these countries i.e. lower & lower middle income countries, and high & upper middle income countries. Panel estimation is

considered as an efficient and effectual technique because of its several advantages, which includes: (i) for larger sample size it gives efficient and precise estimates; (ii) it is used to control those variables that cannot be measurable or observable; (iii) it is used to capture heterogeneity problem across samples; (iv) it handles with omitted variable bias problem.

Model uncertainty i.e. omitted variable bias occurs when we cannot completely identify the model and endogeneity arises when variables of the right hand side depend on the left hand side variables and they are correlated with error term as well. There are also chances of serial correlation and heteroscedasticity. Serial correlation occurs when error terms from different time period and cross section observations are correlated. Heteroscedasticity mostly occurs when we have cross sectional data. Previous studies on this research problem (Gupta (2007), Ahmed and Ajaz, (2010), Addison and Levin, (2011) and Imam and Jacobs (2014)) indicate the existence of endogeneity.

To avoid the problem of model uncertainty, endogeneity, serial correlation and heteroscedasticity, Generalized Method of Moment (GMM) is a good choice. GMM is very useful when we have less time span and more cross country observations (Roodman, (2006)). Caselli *et al.,* (1996) and Bond e*t al.,* (2001) find that GMM estimation is the best practice in order to resolve issues of model uncertainty, endogeniety, heterogeneity and serial correlation. GMM gives consistent and efficient estimates even in the existence of heteroscedasticity (Perera and Lee, (2003).

To handle the above mentioned estimation issues, Difference GMM is opted. This concept of Difference GMM was first proposed by Holtz-Eakin, Newly and Rosen

(1988). It is further modified by Arellano – Bond (1991). This technique works via taking lag value of the dependent variables, which is regression with one step. Arellano-Bond (1991) GMM estimator is the most popular choice for estimating dynamic panels with unseen heterogeneity and predetermined regressors (Benito *et al.*, 2017).

Furthermore, Sargan test is executed to check the validity of restrictions. The null hypothesis of this test is about the validity of over identifying restrictions which check whether the instruments used in regression analysis are exogenous or not. The probability value of Sargan test should be less than 5%, ($\alpha = 0.05$) because only in this case null hypothesis will be rejected.

After applying Sargan test, estimation will be done through two step estimator method of Arellano-Bond (1991) instead of one step estimator method. Windmeijer, (2005) finds that two step method works very well than one step method. Lag value of dependent variables creates problem of autocorrelation (Mileva, (2009)). To get rid of autocorrelation problem, Arellano-Bond test for zero autocorrelation is used. The null hypothesis of this test is that there is no autocorrelation. Normally, at AR (1) null hypothesis is rejected. Whereas at AR (2) if the probability value is greater than 0.05, the autocorrelation problem will be removed automatically.

Chapter 4

Analysis and Discussion

This chapter deals with analysis, findings and their interpretation. The first section consists upon descriptive analysis of the study followed by the second section based upon regression analysis of three models i.e. model 1 is for overall analysis of 94 developing countries, whereas model 2 is about regression analysis of 45 high and upper middle income developing countries and model 3 is about 36 lower and low middle income developing countries respectively.

4.1 Descriptive Analysis

Descriptive statistics of tax revenue and its determinants is given in this section which consists of observations, mean, standard deviation, minimum and maximum values of variables. The results of descriptive statistics are presented below in table 4.1.

Table 4.1(a): Descriptive Analysis

Variables	Obs.	Mean	Std.Dev.	Min	Max
TaxGDP	1146	15.84516	6.272324	.7797023	95.16069
AGR	1470	15.20294	12.2186	.035365	61.33473
IND	1469	29.78725	15.78558	4.764321	213.6904
SERV	1469	54.86137	12.6739	13.25032	93.11522
GE	1450	14.21861	4.891229	2.05759	47.19156
PCI	1499	6113.794	9289.917	194.169	74686.62
TO	1480	90.24392	56.83838	22.10598	455.4151
INF	1443	90.60628	33.54702	6.798738	730.0414
URBAN	1504	50.32007	21.69902	8.445	100
VA	1410	-.2424043	.7266086	-2	1.41
CORR	1410	-.2811773	.7452658	-1.91	2.42

In table 4.1, First column shows all variables, second column shows their total observations, third column gives their mean values, fourth column demonstrates standard deviation of all variables which tells about the spread of values and it is also used for comparison purposes, while fifth and sixth column explains their minimum and maximum values. The minimum and maximum values of variables give range.

Our data shows that per capita income (*PCI*) has comparatively larger spread than other variables with minimum value of 194.169 of Ethiopia in 2003 and maximum of 74686.62 US $ Qatar in 2015 with mean value of 6113.794. The range of tax revenue to GDP, agriculture share in GDP, industry share in GDP, services share in GDP, government expenditures, per capita income, trade openness, inflation, urbanization, voice and

accountability and control of corruption is 94.3809877, 61.299365, 208.926079, 79.8649, 45.13397, 74492.451, 433.30912, 723.26152, 91.555, 3.41 and 4.33 correspondingly.

Here, *TaxGDP* is tax revenue to GDP which is dependent variable. In our analysis its mean is 15.8456 whereas its standard deviation is 6.272324. The minimum and maximum values of tax revenue to GDP are .7797023 and 95.16069 respectively. The remaining variables include sectoral composition of GDP and other explanatory variables.

According to descriptive statistics, the average mean for value added agriculture share in GDP (*AGR*) is 15.20294 while stand deviation, minimum and maximum values are 12.2186, .035365 and 61.33473 correspondingly. For value added industry sector the mean contribution is 29.78725 whereas standard deviation is 15.78558, the minimum value is 4.764321 and maximum value is 213.6904. Mean value of value added services sector is 54.86137, standard deviation is 12.6739, minimum value is 13.25032 and maximum value is 93.11522 respectively.

There are also other explanatory variables e.g. government expenditures (*GE*) having mean value of 14.21861, standard deviation of 4.891229, minimum and maximum values of 2.05759 and 47.19156. For per capita income (*PCI*), the mean value is 6113.794, the standard deviation is 9289.917, minimum value is 194.169 and maximum value is 74686.62. The mean value of trade openness (*TO*) is 90.24392, having standard deviation of 56.83838, minimum and maximum values of 22.10598 and 455.4151 respectively.

Inflation (*INF*) has mean value of 90.60628, standard deviation of 33.54702, minimum value is 6.798738 and the maximum value is 730.0414. For urbanization level (*URBAN*),

its mean value is 50.32007, standard deviation is 21.69902, minimum and maximum values are 8.445 and 100. The average share of voice and accountability (*VA*) is -.2424043, standard deviation is .7266086 minimum and maximum values are -2 and 1.41 correspondingly. Control of corruption (*CORR*) has mean value of -.281177, standard deviation of .7452658, minimum value of -1.91 and maximum value of 2.42.

Table: 4.1 (b) Maximum and Minimum values of variables

Variables	Min value with country and year	Max value with country and year
Tax to GDP ratio	0.77% in Congo, Dem, Rep. (2000)	95.16 % in El Salvador (2000)
Agricultural sbare in GDP	0.035% in Singapore (2012)	61.33 % in Sierra Leone (2015)
Industrial share in GDP	4.764 % in Sierra Leone (2015)	213.69% in Qatar (2001)
Services share in GDP	13.25% in Sierra Leone (2000)	93.11% in Hong Kong (2011)
Government Expenditures	2.05% in Congo, Dem, Rep. (2000)	47.19% in Seychelles (2002)
Per Capita Income	194.1% in Ethiopia (2003)	74686.62% in Qatar (2015)
Trade Openness	22.10 % in Brazil (2009)	455.4% in Hong Kong (2013)
Inflation	6.79% in Congo, Dem, Rep. (2000)	730.4% in Venezuela (2014)
Urbanization	8.4 % in Trinidad & Tobago (2015)	100% in Singapore (2000-2015)
Voice & accountability	-2.00% in Equatorial Guinea (2015)	-1.41 in Swaziland (2000)
Control on Corruption	-1.91 in Afghanistan (2000)	2.42% in Singapore (2004)

Now after the descriptive analysis and the maximum and minimum values of variables, the regression analysis of each model is given below.

4.2 Regression Analysis

Panel estimation technique for this study is Difference GMM (generalized methods of moments) of Arellano Bond (1991). Researchers normally select GMM technique for dynamic panel estimation especially in the presence of model uncertainty and endogeneity. Therefore, Difference GMM of Arellano and Bond (1991) is suggested for estimation in this study.

Model uncertainty i.e. omitted variable bias occurs when we cannot completely identify the model and endogeneity arises when variables of the right hand side depend on the left hand side variables and they are correlated with error term as well. In this study, there is two way causation between right hand side variables (Per Capita income (PCI) and government expenditure (GE)) and left hand side variable (Tax to GDP ratio (TaxGDP)). These variables are also correlated with error term.

GMM can be applied directly with the theoretical evidence of presence of endogeneity in the model because it makes sure that the panel is dynamic in nature. However, for this study, we cross through various estimation techniques in search of the most appropriate technique for this model i.e. Polled OLS, Fixed & Random effect and finally we selected Difference GMM on the basis of appropriate diagnostic tests. Pooled OLS estimation is rejected due to the presence of heteroscedasticity indicated by B&P (Breusch & Pagan) Lagrangian test (results attached in appendix C, Table: C.2). Then we move towards fixed and random effect estimations, Hausman test suggests us fixed model is appropriate

(results attached in appendix C, Table: C.2). In case of fixed effect, heterogeneity problem may not exist in cross sections but group wise heteroscedasticity may exist (Baum *et al.*, 2003).

So after Hausman test, Modified Wald test for group wise heteroscedasticity is used. This test puts forward that p- value is less than 0.05 which is the clear indication of presence of group wise heteroscedasticity rejecting null hypothesis which states that there is no group wise heteroscedasticity (results attached in appendix C, Table: C.2). In next step, Wooldridge test for autocorrelation in panel data is used. This test implies that p- value is less than 0.05 which rejects null hypothesis statement of no first order autocorrelation (results attached in appendix C, Table: C.2). These econometric problems like heteroscedasticity, endogeneity and serial autocorrelation in panel data analysis make model a dynamic panel model. The most appropriate and best technique, Difference GMM (Arellano Bond dynamic panel data estimation technique) is used in order to tackle these econometric problems.

In this section, we will discuss the regression results of the model 1, model 2 and model 3 based on the methodology discussed in previous chapter in detail. By using Difference GMM impact of sectoral growth and other factors are regressed on tax revenue for model 1, 2 and 3. The results are reported in Table 4.2 as under.

Table 4.2 Results of Difference GMM (Dynamic Panel data Specification)

Variables	Model 1	Model 2	Model 3
lnTaxGDP L1.	.3329772	.2551344	.2657181
	(.02923)	(.02227)	(.08408)
lnAGR	.0141353***	-.0955217***	-.1226184**
	(.00407)	(.01079)	(.05406)
lnIND	.1244597***	.0249026**	-.2105607**
	(.00846)	(.01176)	(.10511)
lnSERV	.3419922***	.3417036***	-.1924192*
	(.00958)	(.05363)	(.14260)
lnGE	.0757499***	-.1200953***	.1576161***
	(.00425)	(.01646)	(.03781)
lnPCI	.3564642***	.2949552***	.5333341***
	(.01430)	(.05833)	(.14335)
lnTO	.2188344***	.189374***	.2630391***
	(.00467)	(.00904)	(.03572)
lnINF	-.0612209***	-.1407293***	-.1605495***
	(.00634)	(.02538)	(.06792)
URBAN	-.0020002***	.0054954***	--------
	(.00083)	(.00200)	
VA	.025592***	.0069279	-.0557236**
	(.00418)	(.01243)	(.02733)
CORR	.0086237***	.0331683***	.0172366
	(.00275)	(.00898)	(.04703)
R^2	0.46	0.38	0.54
F-stat	84.30	23.34	46.79
	(0.000)	(0.000)	(0.000)
Sargan test	154.8345	161.2013	118.1603
	(0.000)	(0.000)	(0.040)
AR(1)	-4.7431	- 3.1713	-2.417
	(0.000)	(0.001)	(0.015)
AR(2)	- .073	1.0727	-.22924
	(0.941)	(0.283)	(0.8187)
Observations	**993**	**498**	**398**
Countries	**94**	**45**	**36**

Note: (1) Standard errors are in parentheses. ***, **, * denotes 1%, 5%, 10% level of significance respectively. (2) AR (1) and AR (2) are tests for first order and second order serial correlation with p-values in parentheses. (3) Sargan test of the over-identifying restrictions of each model is given with p-value in parentheses.

4.3 Results and interpretations

In this section results and interpretations of all models are discussed. First of all R-squared R^2 and F- statistics are obtained by using Pooled OLS estimation to GMM as R-squared shows total variations in dependent variables are explained by independent variables in model whereas F-statistics tells about the overall significance of the model. After this, Difference GMM is used. In Difference GMM by incorporating the lag of dependent variable in model, Arellano Bond panel data estimation is carried out with one step estimator results.

Sargan test is used in order to check the validity of over identifying restrictions. It is observed that p value is less than 5% (0.05) indicating the rejection of null hypothesis of over identifying restrictions. Sargan test further leads towards Arellano Bond panel data estimation with two step estimator results. Significant results of all variables are found in the regression. To check autocorrelation problem, Arellano Bond panel data estimation with two step estimators is used in the analysis. Finally we examine Arellano Bond test for autocorrelation. The problem of autocorrelation is removed at order 2.

Variable wise results and interpretations of each model is given below,

i) Sectoral Composition of GDP

a) Agricultural sector share in GDP

Table 4.2 shows that in model 1 which consists of all 94 developing countries variables are statistically significant at probability value $p \leq 0.05$. The regression coefficient of share of *agricultural sector in GDP* of model 1 is positive and significant. The result is

interpreted as a 1% increase in share of agriculture sector to GDP results in a raise in tax revenue percentage of GDP by .0141 percent. The positive relationship between agriculture share and tax revenue is supported by theory that countries in which share of agriculture sector is large and depend more on international trade taxes e.g. agriculture exports are dominant. These results are consistent with the findings of Agbeygbe *et al.*, (2004), Imam and Jacobs, (2007) and Mahdavi, (2008).

While the regression coefficient of agricultural sector share in GDP is negative and significant in model 2 (H&UMIC) and Model 3 (L&LMIC). The value of regression coefficient of model 2 shows that one percent increase in agriculture sector share to GDP results in decrease of tax revenue by .095 and the regression coefficient of model 3 demonstrates that one percent increase in agriculture sector share in GDP results in decrease of .122 percent in tax revenues to GDP.

The negative relationship between agriculture sector share and tax revenue is supported by theory that the tax revenues are low in those countries where agriculture sector is dominated by a large number of subsistence farmers and where its activities are typically free from taxes in order to generate tax structures more progressive to the poor. The result regarding agricultural sector share to GDP is consistent with the findings of Gupta, (2007); Karagoz, (2013); Gaalya, (2015); and Mawejje and Munaymbonera, (2016).Our results are very much consistent with our first hypothesis i.e. countries with large agricultural share having lower tax to GDP ratio.

b) Industrial sector share to GDP

The regression coefficient of *industrial share to GDP* is positive and significant in both model 1 and 2. The result of model 1 is interpreted as a one percent increase in industrial sector share in GDP causes an increase of .124 in tax revenue and the result of model 2 is interpreted as a one percent increase in industrial sector share in GDP, tax revenue to GDP increases by .024 percent points. Industrial sector is easier to tax than any other sector as it contributes comparatively more to tax. Higher the industrial sector share in GDP higher will be the tax to GDP ratio. A number of studies (Piancastelli, (2001); Ahmed and Muhammed, (2010); Chaudhary and Munir, (2010); Basirat *et al.,* (2013); Karagoz, (2013) Gaalya, (2015) and Mawejje and Munaymbonera, (2016)) have found positive relationship between industrial share and tax revenues and our findings are also consistent with them. The results are in line with our 2nd hypothesis.

The coefficient of *industrial sector share to GDP* is negative and significant in case of model 3. The result shows that due to one percent increase in industrial sector share, tax revenues decrease by .210 percent. It is quite surprisingly that industrial sector is not contributing well in development of economy in low developing countries. The result regarding this variable confirms the findings of Botlhole, (2010) and Potanlar *et al.,* (2010).The results of model 3 are also confirming our fourth hypothesis i.e. level of development/ national income has a significant role in tax revenue determination as the industrial share has changed behavior in the case of lower income countries.

c) Services sector share in GDP

There is a strong positive and significant relationship between tax revenue collection and *services sector share in GDP* which is supported by theory that the countries in which this sector is highly developed have more tax revenue collection. The result of model 1 and 2 are interpreted as a one percent increase in services sector share to GDP results in rise of tax revenue by .341 percent and a one percent increase in services sector share to GDP results in rise of tax revenue by .342 percent. The results regarding this variable confirms the findings of Piancastelli, (2001); Ahmed and Muhammed (2010); Chaudhary and Munir, (2010) and Mawejje and Munaymbonera, (2016). The results support our 3rd hypothesis.

While in model 3 the regression coefficient of services sector share in GDP is negative which implies that a one percent increase in services share causes a reduction in tax revenues by .192 percent. It is clear from the result that services sector share to GDP in low & lower middle income countries is not much developed as in the case of overall developing countries and high & upper middle income countries. The results of the third model are entirely changed from first and second model as the services sector is negatively related to tax to GDP share. The result regarding this variable is consistent with the findings of Botlhole, (2010) and Potanlar, (2010). It clearly supports our 4th hypothesis i.e. level of development/ national income has a significant role in tax revenue determination as the services share has changed its behavior in the case of lower income countries and affecting tax to GDP ratio negatively.

ii) Government Expenditures

The results of model 1 and model 3 indicate that there is a strong positive and significant association between *government expenditures* and tax revenues. This result is supported by the theory that high government expenditures lead to higher tax revenue which can further increase economic growth. The results are consistent with the findings of Agbeygbe *et al.*, (2004), Hossain, (2014) and Mawejje and Munaymbonera, (2016). The value of regression coefficients in both models show that, for example, as government expenditures increase by 1 percent, tax revenue collection as a percentage of GDP increases by .075 percent and a one percent increase in government expenditures causes an increase of .157 percent in tax revenues. The findings are also in line with our 5th hypothesis that government size does matter positively in tax revenue collection.

Whereas government expenditures are negatively and significantly related to tax revenues in model 2. The value of regression coefficient shows that due to one percent increase in government expenditures, tax revenues decrease by .120 percent. Lower government expenditures tend to have lower tax revenue collection. The result regarding this variable is inconsistent with the above mentioned studies. Our 4th hypothesis is still valid that variables are changing their behavior when we sorted the countries according to their level of development.

iii) Per Capita Income

The results of all models show that there is a strong positive association between tax revenues and per capita income. The positive sign shows that with the increasing level of

income growth the demand for public goods increases hence it smooth the ways for government to impose and collect more taxes. The result of this variable is well matched with the findings of Davoodi and Grigorian, (2007); Pessino and Fenochietto, (2010); Gaalya (2015) and Ayenew, (2016). The value of regression coefficients in model 1, 2 and 3 show that a one percent increase in per capita income causes an increase of .356 percent in tax revenue, a rise in per capita income by one percent rises tax revenues by .294 percent and one percent increase in per capita income increase tax revenues by .533 percent respectively.

iv) Trade Openness

The regression coefficient of *trade openness* and tax revenue is positive and significant in all models. In most of developing countries the contribution of foreign trade is very important in tax revenue collection through exports duties, import duties, tariffs etc. The result regarding this variable is similar to the findings of Gupta, (2007); Chaudhary and Munir, (2010); Addison and Levin, (2011); Amin *et al.,* (2014) and Gaalya, (2015). The results of model 1, 2 and 3 are interpreted as e.g. a one percent increase in trade openness increases tax revenue by .218 percent, due to one percent increase in trade openness tax revenues increase by .189 percent and a one percent increase in trade openness leads to an increase of tax revenues by .263 percent correspondingly.

v) Inflation

The coefficient of *inflation* is negative and significant in case of model 1, 2 and 3. It is justified from theory that the demand for goods and services decreases as prices increase which further decreases the purchasing power of consumer and hence the tax revenue

collection falls. The result of inflation is similar to the findings of Agbeygebe *et al.*, (2004); Mahdavi, (2008); Fenochietto and Pessino, (2010) and Gaalya, (2015).The value of regression coefficient of model 1 shows that as inflation increases by one percent, tax revenue decrease by .061 percent. The regression coefficient of model 2 and 3 demonstrates that tax revenues decrease by .140 percent with an increase of one percent and due to increase of one percent in inflation tax revenues decrease by .160 percent points.

vi) Urbanization

The relationship between urbanization rate and tax revenues is negative and significant in model 1. The result of urbanization is interpreted as one percent increase in urbanization results in decrease of tax revenue by .002 percent. The negative association between urbanization and tax revenue is justified by the theory that in most of the developing countries urbanization is associated with underground economy. The regression result regarding urbanization is compatible with the findings of Davoodi and Grigorian, (2007); Addison and Levin, (2011); Ghani and Levin, (2012) and Aizanman *et al.*, (2015). While in model 2 the results show a positive association between tax revenue to GDP ratio and urbanization rate. It can be interpreted as that one percent increase in urbanization level results in an increase of .005 percent in tax revenues. In most of developing countries the higher level of urbanization is linked with the large informal sector as it brings new needs and demand for public services which further enhance government's ability to collect taxes. The result regarding this variable confirms the findings of Botlhole, (2010); Karagoz, (2013) and Hossain, (2014).

vii) Governance

Both *voice & accountability* and *control of corruption* have positive and significant impact on tax revenue in model 1. Good governance contributes in collection of more tax revenue. The value of regression coefficients of voice & accountability and control of corruption in model 1 shows that a one percent increase in voice accountability increases tax revenue by .025 percent while regression coefficient of control of corruption explains that a one percent rise in control of corruption results in an increase of .008 percent in tax revenues. The results of these variables are justified by the work of Bird *et al.*,(2008) and Hossain, (2014) who argue that tax revenue collection can be increased by improving voice and accountability and control of corruption.

In model 2 the variable voice and accountability is insignificant whereas control of corruption is positive and significant having interpretation of due to one percent increase in control of corruption there is an increase of .033 percent points. The coefficient of voice & accountability is negative and significant while "control of corruption" is insignificant in model 3. The variable ''Voice & accountability'' is negative and significant and shows that a one percent increase in voice & accountability tax revenues reduce by .055 percent. This finding is similar to the study of Syadullah and Wibowo (2015). From the results it is clear that "voice & accountability" and "control of corruption" are not contributing in tax revenues collection as much as they should. Hence tax revenues collection are low in low & lower middle income economies.

From F-test it is clear that our all three models are overall statistically significant.

The probability value of Sargan test in model 1, 2 and 3 is 0.000 which is less than 0.05. It moves toward clear rejection of null hypothesis stating that over identifying restrictions are valid. Hence, Sargan test shows that in case of Arellano Bond with one step estimator the over identifying restrictions are invalid so it moves towards Arellano Bond dynamic panel data estimation with two step estimators.

After carrying out Arellano Bond dynamic panel data estimation with two step estimators the results are set under the analysis in order to tackle autocorrelation problem. The probability values in all models at order 1 is less than 0.05 which is clear indication of rejecting null hypothesis stating that there is no autocorrelation. Whereas at order 2 the probability value is greater than 0.05 i.e. 0.941 in model 1, 0.283 in model 2 and 0.818 in model 3 respectively. Probability value greater than 0.05% at AR (2) is in the favor of null hypothesis (No Autocorrelation). Autocorrelation problem is removed at order 2. Now the estimates are unbiased and consistent which we obtain from Arellano Bond dynamic panel data estimation with two step estimators.

4.4 Summary Statement of Regression Analysis

Main focus of our study is to investigate the relationship of value addition in sectoral composites of GDP (agricultural sector share, industrial sector share and services sector share in GDP) with tax yields in developing economies. We found that growth in all three sectors plays a very important role in tax effort. Surprisingly when we divided the countries into high & upper middle income countries (H&UMIC) and low & lower middle income countries (L&LMIC) the behavior of these sectoral composites changes. Industrial sector and services sector growth played a positive role in overall growth of the

economy while the role of agricultural sector was negative in tax effort. In low and lower middle income countries (L&LMIC) sectoral growth is clearly playing a negative role in determining the tax effort which clearly indicates toward stagnation in tax yield of low and lower middle income countries. Government expenditures, per capita income, trade openness, inflation, urbanization voice & accountability and control of corruption are also playing a significant role in determining tax effort. As far as the significance of voice & accountability and control of corruption is concerned it is clearly seen that good governance is unable to contribute in tax revenue collection in low and lower middle income countries as compared to overall developing and high & upper middle income countries.

Chapter 5

Conclusion and Policy Recommendations

5.1 Conclusion

In this study we have analyzed the effects of sectoral growth and other structural variables (government expenditures, per capita income, trade openness, inflation and urbanization) and institutional variables (voice & accountability and control of corruption) on tax revenues in developing countries using panel data for 94 developing countries over the period of 2000 to 2015. Furthermore, we have conducted the analysis by separating all countries into two groups according to their income levels i.e. high & upper middle income and low & lower middle income countries. All estimates are based on difference generalized method of moments (GMM) applied to dynamic panel models.

Although all variables play an important role in determining tax effort but different variables have different effects in overall developing countries, high & upper middle income countries and low & lower middle income countries. The empirical estimates suggest that agricultural, industrial and services share, government expenditures, per capita income, trade openness, voice and accountability and control of corruption are positively associated with tax revenues while inflation and urbanization are negatively related to tax revenues in overall developing countries.

The study also demonstrates negative signs for agricultural share, government expenditures and inflation whereas a positive sign for per capita income, trade openness,

voice and accountability and control of corruption in high and upper middle income countries. In case of low and lower middle income countries agricultural, industrial and services shares, inflation and voice and accountability have negative impact on tax revenue on the other hand government expenditures, per capita income and trade openness influence positively on tax revenue.

The study concludes that overall sectoral growth have positive and significant impact on tax revenue in developing countries. Although agricultural sector share contributes in tax revenue collection but industrial and services sectors are more effective contributors of tax efforts in developing countries. While in high income & upper middle income countries the situation is same as in developing countries. But the scenario is totally different in low income & lower middle income countries agricultural sector, industrial sector and services sector lower the tax revenue.

5.2 Policy Recommendations

Our results suggest several policy recommendations which are as under.

- Agro based industries are suggested so that agricultural sector could be brought into tax net. Developing countries like Pakistan should move towards intensive farming and commercialization of agricultural sector from substantial farming so that income of the farmer may increase and can be brought into tax net.
- The influence of each variable on tax yield in developing countries varies in signs. Almost all variables are statistically strong enough to capture the effect of tax

effort in developing countries. As a result such findings provide a pool of information which may be a vital tool for policy makers in developing countries.

- The governments of developing countries like Pakistan should focus on maintaining those factors that affect tax to GDP ratio in a positive way. As far as tax reforms are concerned, the governments in developing countries should invest in research which will facilitate them to come up with such policy reforms which will further make tax revenue collection more efficient and effective.

- As the agricultural sector holds the largest impediment in way of tax revenue collection in many developing countries, policy makers should focus on structural transformation of agricultural sector so that this sector may develop in better ways. The development in agriculture sector can further bring development in industrial and services sectors for example by providing raw materials in industrial sector and through trade in agricultural products, support to banking, telecoms, and agricultural-support services in services sector.

- Industrial and services sectors are not well developed and organized in most of the developing countries, policy makers should also focus on working with these sectors to improve tax revenue performance. Strong policies should be designed to broaden the tax base so that industrial and services sectors could be brought into the tax net.

- If the governments of developing countries like Pakistan start to invest more in development projects, it will increase economic activities in those countries which

will further enhance tax revenues. Moreover, this study also recommends measures that boost per capita income, trade openness, control over inflation and introduction of new tax bases have to be considered to bring efficient tax administration and enhance revenues in developing countries.

- The government and policy makers should facilitate those policies and strategies that will boost economic growth in more appropriate ways. Furthermore those factors which decrease the tax effort in developing countries should be checked in order to enhance tax revenues.

- As degree of openness is a vital source of determining tax effort in developing countries by giving trade facilities and removing trade barriers will open up avenues of trade taxes in order to stimulate tax revenue collection.

- Good governance enhances tax revenue collection so it is suggested that efforts should be made by governments and institutions to overcome the problem of bad governance. By improving and placing a greater emphasis on policy reforms regarding voice and accountability and control of corruption loopholes in tax revenues collection in developing countries like Pakistan should be identified and removed hence tax revenues could also be increased in this way.

5.3 Limitations and Future Work of the Study

There are various avenues on which future research can be conducted to further explore the factors determining tax revenues in developing countries. Other researchers can

extend the research by taking a larger time span and by including more structural and institutional variables. The structural variables such as external debt, broad money, exchange rate and literacy rate and institutional factors like political stability, bureaucratic quality, law and order and many more factors which have not been analyzed in our study can give more opportunities to researchers to do further research on tax revenue performance.

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Appendices

Appendix A. List of countries

Afghanistan	Ethiopia	Nicaragua
Albania	Fiji	Pakistan
Algeria	Georgia	Paraguay
Antigua and Barbuda	Ghana	Peru
Armenia	Grenada	Philippines
Bahrain	Guatemala	Qatar
Bangladesh	Honduras	Romania
Barbados	Hongkong	Russian Federation
Belize	India	Rwanda
Benin	Indonesia	Senegal
Bhutan	Iran	Serbia
Bolivia	Jamaica	Seychelles
Bosnia and Herzegovina	Jordon	Sierra Leone
Botswana	Kazakhstan	Singapore
Brazil	Kenya	South Africa
Burkina Faso	Korea, Republic	Sri Lanka
Cabo Verde	Kyrgyz Republic	St. Lucia
Cambodia	Lao Pdr	Suriname
Central African Republic	Lebanon	Swaziland
Chile	Macedonia	Thailand
China	Madagascar	Togo
Colombia	Malawi	Trinidad and Tobago
Congo, Dem, Republic.	Malaysia	Tunisia
Congo, Republic.	Maldives	Turkey
Costa Rica	Mali	Uganda
Cote d' Ivoire	Mauritius	Ukraine
Croatia	Moldova	Uruguay
Dominica	Mongolia	Venezuela, RB
Dominican Republic	Morocco	Veitnam
Egypt, Arab Rep.	Mozambique	Zambia
El Salvador	Namibia	
Equatorial Guinea	Nepal	

Appendix B. List of countries according to income level

HIC	UMIC	LMIC	LIC
Antigua and Barbuda	Albania	Armenia	Afghanistan
Bahrain	Algeria	Bangladesh	Benin
Barbados	Belize	Bhutan	Burkina Faso
Chile	Bosnia & Herzegovina	Bolivia	Central African, Rep.
Croatia	Botswana	Cabo Verde	Congo, Dem. Rep
Hongkong	Brazil	Cambodia	Ethiopia
Korea, Republic	China	Congo, Rep.	Madagascar
Qatar	Colombia	Cote d' Ivoire	Malawi
Seychelles	Costa Rica	Egypt, Arab Rep.	Mali
Singapore	Dominica	El Salvador	Mozambique
Trinidad and Tobago	Dominican Republic	Ghana	Nepal
Uruguay	Equatorial Guinea	Guatemala	Rwanda
	Fiji	Hondurus	Senegal
	Georgia	India	Sierra Leone
	Grenada	Indonesia	Togo
	Iran, Islamic Rep.	Kenya	Uganda
	Jamaica	Kyrgyz Republic	
	Jordon	Lao PDR	
	Kazakhstan	Moldova	
	Lebanon	Mongolia	
	Macedonia, FYR	Morocco	
	Malaysia	Nicaragua	
	Maldives	Pakistan	
	Mauritius	Philippines	
	Namibia	Sri Lanka	
	Paraguay	Swaziland	
	Peru	Tunisia	
	Romania	Ukraine	
	Russian Federation	Veitnam	
	Serbia	Zambia	
	South Africa		
	St. Lucia		
	Suriname		
	Thailand		
	Turkey		
	Venezuela, RB		

Note: HI = High Income countries, UMIC= Upper middle income countries, LMIC= Lower middle income countries and LI= Lower income countries.

Appendix C

Table C.1: OLS estimates of determinants of tax to GDP ratio

Variables (lnTaxGDP)	Model 1	Model 2	Model 3
lnAGR	.1042176***	-.0230537	.3253381***
	(.01629)	(.02268)	(.09791)
lnIND	.1401526***	.0344823	.0688248
	(.03673)	(.06028)	(.07930)
lnSERV	.277252***	-.2763763***	.4196405***
	(.05850)	(.11042)	(.15035)
lnGE	.3595305***	.4436658***	.2446834***
	(.02903)	(.05085)	(.03419)
lnPCI	.1276902***	-.1287423***	.2721767***
	(.02076)	(.04069)	(.03862)
lnTO	.204667***	.0524743	.2838054
	(.02259)	(.03634)	(.02829)
lnINF	.1399079***	.0841628	.1191593***
	(.03256)	(.05609)	(.03713)
URBAN	-.0037269***	-.0026999***	-.0013955*
	(.00058)	(.00077)	(.00126)
VA	.1456951***	.1744865***	.1131354***
	(.01904)	(.03054)	(.02579)
CORR	-.0223796	.0022372	-.0745499**
	(.02063)	(.03083)	(.03336)

Note: t-statistics in parentheses
*** 1%, ** 5% and * 10%.

Table C.2: Statistical tests

Statistical tests	Model 1	Model 2	Model 3
Breusch and Pagan test	1927.13 (0.0000)	492.69 (0.0000)	862.04 (0.0000)
Hausman test	53.85 (0.0000)	44.80 (0.0000)	16.13 (0.0501)
Modified Wald test for Groupwise Heteroskedasticity	11128.51 (0.0000)	5745.06 (0.0000)	5211.40 (0.0000)
Panel data Wooldridge test for autocorrelation	82.200 (0.0000)	20.168 (0.0000)	47.414 (0.0000)

Note: The probability values of all tests are less than 5 % ($p \leq 0.05$).

Table C.3: Fixed Effect estimates of determinants of tax to GDP ratio: 2000-2015

Variables (lnTaxGDP)	Model 1	Model 2	Model 3
lnAGR	-.0446086	-.0607216	-.0887768
	(.03509)	(.04118)	(.09762)
lnIND	.0926641*	.0612889	.0192009
	(.05190)	(.06774)	(.10115)
lnSERV	.0158449	.1002012	-.3075757*
	(.08714)	(.15445)	(.16677)
lnGE	.3918504***	.1077598*	.4262***
	(.03625)	(.06229)	(.05136)
lnPCI	.3140998***	.2965856***	.2796982***
	(.05747)	(.08410)	(.08293)
lnTO	.3221627***	.193487***	.3255215***
	(.03269)	(.05416)	(.04261)
lnINF	.0700592***	-.0802468**	.129345***
	(.02567)	(.04060)	(.03609)
URBAN	-.0122899***	-.0040557	-.0151819***
	(.00267)	(.00345)	(.00478)
VA	.0612594**	-.0100859	.0711273*
	(.02720)	(.04349)	(.03932)
CORR	.0245301	.0251134	-.0096691
	(.02702)	(.03614)	(.04727)
No. of Observations	**993**	**498**	**398**
Countries	**94**	**45**	**36**

Note: t-statistics in parentheses
*** 1%, ** 5% and * 10%.

Table C.5: Random Effect estimates of determinants of tax to GDP ratio: 2000-2015

Variables (lnTaxGDP)	Model 1	Model 2	Model 3
lnAGR	.0484492*	.0213496	-.0630354
	(.02923)	(.03633)	(.09342)
lnIND	.1250324***	.0698329	.0017391
	(.04797)	(.06615)	(.08983)
lnSERV	.1096554	.0801274	-.239055
	(.08148)	(.14950)	(.15382)
lnGE	.3733787 ***	.1418718**	.4009968***
	(.03498)	(.05926)	(.04569)
lnPCI	.1744378***	.221228***	.216752***
	(.04126)	(.07640)	(.06212)
lnTO	.2919861***	.1699314***	.3157607***
	(.03066)	(.05125)	(.03889)
lnINF	.1328801***	-.0058845	.115679***
	(.01982)	(.03702)	(.02763)
URBAN	-.0091788***	-.0072424***	-.0063674**
	(.00171)	(.00246)	(.00289)
VA	.0922234***	.0207717	.087897*
	(.02551)	(.04122)	(.03565)
CORR	.0293461	.0064649	-.0289176
	(.02582)	(.03517)	(.04369)
No. of Observations	993	498	398
Countries	94	45	36

Note: z-statistics in parentheses
*** 1%, ** 5% and * 10%.

Table C.5:One-step Difference GMM estimates of determinants of tax to GDP ratio: 2000-2015

Variables	Model 1	Model 2	Model 3
lnTaxGDP.L1	.3352358	.2534679	.3245685
	(.06764)	(.06632)	(.06846)
lnAGR	.0183453	-.0800162**	-.0865042
	(.03530)	(.03480)	(.08152)
lnIND	.125441**	.0484997	-.0395504
	(.05461)	(.06032)	(.08560)
lnSERV	.3303528***	.3635317***	-.1179693
	(.08125)	(.09974)	(.14077)
lnGE	.0803699**	-.1238394***	.1736769***
	(.03600)	(.04772)	(.04770)
lnPCI	.3677244***	.2376052***	.5381989***
	(.07613)	(.08425)	(.10135)
lnTO	.2164288***	.1914442***	.2439191***
	(.03369)	(.04323)	(.03908)
lnINF	-.0601029***	-.1107779***	-.1094278***
	(.03115)	(.03835)	(.04226)
URBAN	-.0027135	.00731***	-.0109394**
	(.00288)	(.00273)	(.00492)
VA	.0236271	.0250241	-.0306323
	(.02859)	(.03527)	(.04089)
CORR	.0078427	.0447641*	-.0637282
	(.02621)	(.02475)	(.04148)
No. of Observations	**805**	**412**	**324**
Countries	**94**	**45**	**36**

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