Pakistan Economic and Social Review
Volume 57, No. 2 (Winter 2019), pp. 199-219

HETEROGENEOUS EFFECTS OF SECTORAL GROWTH ON TAX YIELDS IN DEVELOPING ECONOMIES

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Abstract. Sectoral composition of the economy is taken as a major determinant of tax revenues in the analytical framework of this study. The impact of sectoral growth on tax yields is explored using panel dataset of 94 countries for the period of 2000-2015. The panel estimation technique of Generalized Method of Moments (GMM) is used for analysis. Moreover, besides the main model of estimation two more models are introduced to assess the role of level of development in the economy in tax revenue collection. Other than sectoral growth, some control variables which can potentially influence tax revenues like government expenditures, per capita income, trade openness, inflation, urbanization, voice and accountability and control of corruption are also added in the model. The study finds that the growth of agriculture, industry and services sectors has positive and significant impact over the tax collection of the economy in our main model of all developing economies. However, an interesting result is found when we bifurcated our dataset into further two categories i.e. low income and high income developing economies. In low income economies, the sectoral growth of all three sectors has a negative impact over the tax yields. However, in high income developing

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economies, industry and services sector contributes positively while agriculture sector contributes negatively in tax revenue collection.

Keywords: Tax Revenue, Sectoral growth, Tax determinants, Panel data, GMM

JEL Classification: H2, O1, O12, O13, O14

I. INTRODUCTION

Tax revenue is a vital source of income for both developed and developing economies. 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 an amount in taxes 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). Tax revenues have a power to decide what a country can do, i.e. how efficiently it can allocate it's 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.

The studies of Gupta, (2007), Chaudhry and Munir, (2010), Ajaz and Ahmed, (2010) and Addison and Levin, (2011), Mawejje and Munyambonera, (2016) explored that the 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 with substantial low income of the farmers, lower industrial and services share, narrow tax base, corruption, tax evasion, political instability, poor tax reforms, bad law and order situation and foreign aid. These factors can significantly reduce tax revenues and seriously hurt economic growth and development.

The sector wise composition of an economy plays a vital role in determination of tax revenues. 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). On the other hand, 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. 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 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)).

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.

Secondly, the objective of this study is also to explore the impact of sectoral growth on tax revenue collection of developing economies having heterogeneous level of development as it can be hypothesized that sectoral growth is contributing positively in tax yields in some developing economies and not in others due to their heterogeneous structure of development. This work is not done so far. In this study we

have also added few control variables drawn from literature like government expenditures, per capita income, trade openness, inflation, urbanization rate and some governance indicators.

The remainder of the paper is structured as follows. Section II presents an overview of the theoretical as well as empirical literature. Section III provides a brief discussion of model, data and econometric methodology. Section IV includes results, discussion and interpretation. The last section concludes the study.

II. LITERATURE REVIEW

Theoretical and empirical literature is reviewed in this section. 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 and found that per capita GNP and foreign trade sector share had strong positive impact on tax effort. In their later study in 1970, they used monetization rate and export share as variables and found that both variables significantly improve the tax to GDP ratio.

Later on Shin (1969) followed Lotz and Morss (1967) and proposed a new model by incorporating some more variables (agriculture share, inflation rate and population growth rate) in the model. 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) and Chelliah (1975) extended the model adopted by Lotz and Morss (1967) by adding more variables (agriculture share in GDP, mining share in GDP, per capita income and export ratio). Piancastelli (2001) followed the same model and incorporated new variables like industry share and services share.

Bahl (1971) 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. Similarly, Chelliah et al., (1975) came across the same outcome.

Islam (1979) conducted a study of tax revenues and its factors in Bangladesh from 1968 to 1978. 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.

Ghura (1998) analyzed tax revenue in 39 sub Saharan African countries over the period of 1985 to 1996. He observed that tax revenue was negatively related to per capita income, agricultural share in GDP, inflation, external grants. While, 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). Estimation results showed that tax revenue was negatively associated to agricultural share whereas, positively related to industrial share, services share, trade openness and per capita income.

Using a panel of 105 developing countries during 1980-2004, Gupta (2007) analyzed the determinants of tax revenue and constructed a measure of tax effort. He used the GMM regression in his analysis. 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.

Karagoz (2013) examined the determinants of tax revenue in Turkey during 1970-2010 and used 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.

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.

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.

Ayenew (2016) analyzed the tax revenue determinants in Ethiopia during the period of 1975 to 2013. He found that GDP per capita, industrial share, inflation and foreign aid were strong and significant determinants of tax revenue. The estimation results showed that industry share, GDP per capita and foreign aid had 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.Their findings discovered 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.

Through the empirical investigation of the above mentioned studies we have learned that the sectoral growth of different sub sectors of the economy is having a heterogeneous impact over the tax yields. It implies that there is some factor within developing economies which is a strong cause in heterogeneity of outcome. This study is an effort to explore that the level of development of a developing economy can be a cause of this outcome.

Therefore, we are exploring the same relationship across 94 developing economies in our first model and then dividing the same dataset in two categories according to their income level to analyze the heterogeneous effects of sectoral growth on tax yields in developing economies. The contribution of this study 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.

III. MODEL, METHODOLOGY AND DATA

THEORETICAL FRAMEWORK

The theoretical model is adopted from Lotz and Morss (1967). 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.

$$Tax/GDP_{it} = f(PCI_{it}, TO_{it})$$

Later on, Shin (1969) followed Lotz and Morss (1967) and proposed a new model by incorporating some more variables (agriculture share, inflation rate and population growth rate) in the model. Bahl (1971) and Chelliah (1975) extended the model adopted by Lotz and Morss (1967) by adding more variables (agriculture share in GDP, mining share in GDP, per capita income and export ratio). Piancastelli (2001) followed the same model and incorporated new variables like industry share and services share.

MODEL SPECIFICATION

In the light of above discussion we now propose the following models for estimation of study. Three different econometric models are tested to investigate the relationship. First model explores an overall relationship between tax revenues and sectoral growth for the whole available dataset of developing economies. Next two models are formulated through the division of these developing economies into two further groups i.e. higher & upper Middle Income in model 2 called as

Higher Income developing economies and Lower & lower Middle Income in model 3 called as lower income economies. 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 all models takes the following form.

$$Tax/GDP_{it} = a_0 + a_1 \ln AGRR_{it} + a_2 \ln IND_{it} + a_3 \ln SERV_{it} + a_4 \ln GE_{it} + a_5 \ln PCI_{it} + a_6 \ln TO_{it} + a_7 \ln INF_{it} + a_8 URB_{it} + a_9 VA_{it} + a_{10} CORR_{it} + \mu_{it} \quad \text{(ii)}$$

Notations/Abbreviations used in above equation are defined as follows: -

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 rate, CORR = Control of Corruption, VA = Voice and Accountability.

SOURCES OF DATA

This study is based on the panel data set of 94 developing countries from 2000-2015 (Appendix A, TABLE, A-1). The countries are chosen on the basis of availability of data. These countries are classified as the developing countries by the World Bank[1]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). But because of less observation in each group we have merged these economies into two categories as mentioned above.

The data of dependent variable (Tax to GDP ratio), and independent variables (Agricultural sector share in GDP, Industrial sector share in GDP, Services sector share in GDP, Per Capita Income, Trade Openness, Inflation and Urbanization rate) is collected from Worldwide Development Indicators (WDI)[2].While data on governance indicators like

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

[2] http://data.worldbank.org/data-catalog/world-development-indicators.

Voice and Accountability and Control of Corruption is collected from Worldwide Governance Indicators (WGI)[3].

ESTIMATION METHODOLOGY

Panel estimation technique is required for estimation of this model. Pooled OLS estimation is rejected due to the presence of heteroscedasticity indicated by B&P (Breusch & Pagan) Lagrangian test as the $p \leq 0.05$ in all three models. Then, we move towards Fixed and Random effect estimations, Hausman test suggests us Fixed model is suitable. 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 heterscedasticity is used. This test suggests that p-value is less than 0.05 which is the clear indication of presence of group wise heteroscedsticity. In next step, Wooldridge test for autocorrelation in panel data is used. The test implies that p- value is less than 0.05 which rejects null hypothesis statement of no first order autocorrelation (results attached in appendices, Table: A-2).

These econometric problems like heteroscedasticty, endogeneity and serial autocorrelation in panel data analysis make model a dynamic panel model. However, for this study, we have crossed through various estimation techniques in search of the most appropriate technique for this model, *i.e*. Pooled OLS, Fixed and Random effects Modeling technique and finally we selected Difference GMM on the basis of appropriate diagnostic tests.

Generalized Method of Moments (GMM) is selected for estimation of this model as the model seems dynamic in nature on theoretical grounds and moreover, GMM estimation is a best practice in order to resolve the issues of model uncertainty, endogeniety, heterogeneity and serial correlation. According to Arellano-Bond (1991), GMM estimator is the most popular choice for estimating dynamic panels with unseen

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

heterogeneity and predetermined regressors (Moral Benito et al., 2017). GMM is very useful when we have less time span and more cross country observations (Roodman, 2006; Perera and Lee, 2003).

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 checks 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.

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.

IV. RESULTS AND DISCUSSION

In this section, we will discuss the regression results of the model 1 (all developing countries), model 2 (Higher income developing economies) and model 3 (lower income developing economies) based on the methodology discussed previously. The results are reported in Table 1 as under: -

TABLE 1

Results of Difference GMM (Dynamic Panel Data Specification)

Variables	Model 1 (All Developing Countries)	Model 2 (High Income)	Model 3 (Low Income)
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)

Variables	Model 1	Model 2	Model 3
	(All Developing Countries)	(High Income)	(Low Income)
Sargan test	154.8345 (0.000)	161.2013 (0.000)	118.1603 (0.040)
AR(1)	-4.7431 (0.000)	- 3.1713 (0.001)	-2.417 (0.015)
AR(2)	-.073 (0.941)	1.0727 (0.283)	-.22924 (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.

RESULTS OF MODEL 1

Agricultural sector share in GDP is positive and significant. 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) and Mahdavi, (2008).

Industrial sector share to GDP, the regression coefficient of the share of industrial sector in GDP is positive and significant, indicating that the composition of GDP matters and industrial sector contributes relatively more to tax. Higher the industrial sector share in GDP higher will be the tax to GDP ratio. A large number of businessmen own this sector, as they keep better records, which further lead to have more tax revenues from industrial sector. A number of studies 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. Our findings are also consistent with them.

Services sector share in GDP sign is positive and is supported by theory that the countries in which this sector is highly developed have more tax revenue collection. The results regarding this variable confirms

the findings of Piancastelli, (2001); Ahmed and Muhammed (2010) and Mawejje and Munaymbonera, (2016).

Government expenditures positively influence the tax revenues. According to Friedman (1978) the level of spending adjusts to the level of tax available and causality runs from tax to expenditure. This hypothesis defines a positive relationship between government spending and taxation. If tax revenue is increased government spending will also increase and will decrease with the decrease in tax revenue. As Government want to spend whatever is available for spending. The result regarding this variable 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).

Per Capita income is positively associated with tax revenues. 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).

Trade openness sign is positive. 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, (2012) and Gaalya, (2015).

Inflation impact on tax revenues is negative. 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).

Urbanization rate and tax revenues are negatively related to each other. 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) and Aizanman et al., (2015).

Voice & Accountability and Control of corruption both have positive and significant impact on tax revenue in model 1. This means that improved institutions raise total tax revenue collection. Good governance contributes to better tax administration leading to high tax revenue generation. 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.

RESULTS OF MODEL 2

Agricultural sector share in GDP is negative and this correlation 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).

The results regarding Industrial Sector share in GDP and Services Sector share in GDP are same as of model 1.

Government expenditures are negatively and significantly related to tax revenues in model 2. Lower government expenditures tend to have lower tax revenue collection. The result regarding this variable is inconsistent with the above mentioned studies.

The results of Per Capita Income, Trade Openness and Inflation are same as of model 1.

Urbanization rate is positively linked with 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).

In case of higher income developing economies, the variable, Voice and Accountability is insignificant whereas Control of corruption is positive. From the results it is clear that "Control of corruption" is positively contributing in tax revenues collection.

RESULTS OF MODEL 3

Agriculture Sector Share in GDP has a same impact as of model 2. Industrial Sector share in GDP is negative and significant in case of model 3. It means that industrial sector is not contributing well in expansion of tax yields of the low income developing countries and it is generally due to tax evasion, corruption and tax avoidance. The result regarding this variable confirms the findings of Botlhole, (2010) and Potanlar et al., (2010).

Services Sector share in GDP is negatively linked with tax revenues. It is clear from the result that Services sector share to GDP in low income countries is not much developed as in the case of overall developing and high income economies. In many developing economies, the services sectors are informal. Due to informal service sector, corruption and tax evasion is high. So revenue generation from this sector is low in mostly low income economies (Ahmed and Muhammad, (2010)).

The result regarding this variable is consistent with the findings of Botlhole, (2010) and Potanlar, (2010). The results regarding Per Capita Income, Trade openness and Inflation are same as of model 1 and 2 except Government Expenditures whose results are same as of model 1. The coefficient of Voice & Accountability is negative and significant while "control of corruption" is insignificant in model 3.

V. CONCLUSION

Main focus of our study is to investigate the contribution of value addition in sectoral composites of GDP (agriculture, industry and services sectors) in total tax yields of developing economies. In our overall model of 94 developing economies, we found that growth in all three sectors plays a significantly positive role in tax effort. Along with these factors, government expenditures, per capita income, trade openness and governance indicators also played a positive role in

contribution to total tax collection, while, Inflation and Urbanization rate contributed negatively.

Surprisingly, the agriculture sector is not contributing positively when we bifurcated our sample which is clearly indicating that this sector needs much attention in per capita income generation and expansion of tax base while industrial and services sectors showed us a mixed result, however, in low income economies these two sectors are still unable to contribute positively in total tax collection. We can conclude that low income developing economies, the sectoral growth is playing a negative role in determining the tax effort which clearly indicates toward stagnation in tax yield of these countries. Government expenditures, per capita income, trade openness, inflation, 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 inevitable in order to improve tax collection.

POLICY RECOMMENDATIONS

Developing countries 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. As far as tax reforms are concerned, the governments in developing countries should invest in research which will facilitate them to come up with effective policy reforms and initiatives. These policies 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. 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 and to broaden the tax base so that these sectors could be brought into tax net.

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APPENDICES

TABLE A-1

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
Hong Kong	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	

HIC	UMIC	LMIC	LIC
	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

TABLE A-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 (0.0000)
Modified Wald test for Group wise Heteroscedasticity	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 % ($p \leq 0.05$)