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The Revenue Implication of Trade Liberalisation in Sub-Saharan Africa: Some new evidence

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The Revenue Implication of Trade Liberalisation in Sub-Saharan Africa: Some New Evidence.

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Abstract

Despite the advent of trade liberalisation, trade taxes still remain a huge source of tax revenues in Sub-Saharan Africa. Further trade reforms in the form of the Economic Partnership Agreements (EPAs) could, however, hinder output growth in the region if these reforms lead to a decline in total tax revenues. Motivated by this conundrum, our paper adopts panel data estimators to investigate the impact of trade liberalisation on total tax revenue across 28 Sub-Saharan African countries from 1981 to 2010. We also analysed the impact of freer trade policies on trade and domestic tax revenues. The results indicate that trade liberalisation is associated with an increase in total tax revenues. Also, the reduction of trade tariffs significantly increases and decreases domestic and trade tax revenues, respectively. In addition, greater urbanisation is associated with an increase in total tax revenues while a higher inflation rate decreases tax revenues.

Keywords: Trade liberalisation, Generalised method of moments, Fixed effects, Tax revenue, Sub-Saharan Africa.

JEL Classification: C23, F13, F14, H20, O55.

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1. Introduction

In the last thirty years, Sub-Saharan African countries have made significant progress in liberalising their trade regimes. Quantitative restrictions have been abolished except those imposed for health, security and environmental reasons. In addition, the maximum tariff rate in most countries is less than or equal to forty per cent, while countries such as Madagascar, Malawi, Mauritius and Rwanda have completely eliminated their export taxes (World Trade Organisation, 2011). This drastic shift towards freer trade policies, possibly, stems from the theory and empirical evidence that trade liberalisation stimulates economic growth by increasing capital accumulation, foreign direct investment and productivity (See Greenaway et al 1998, 2002; Falvey et al 2012, Yimer 2011, Wacziarg and Welch 2008; Winters 2004). However, as shown by Kassim (2013), the adoption of trade reforms in Sub-Saharan Africa (SSA) has led to a faster growth of imports than exports which implies a deterioration of the trade balance. This deterioration, *ceteris paribus*, could lead to a worsening of the balance of payments (BOP); a situation that may constraint output growth in SSA. (See Thirlwall, 1979).

In this paper, we investigate another potential binding constraint on output growth as SSA countries adopt more trade liberalisation policies. If the net impact of adopting freer trade policies decreases total tax revenue, then governments may be forced to lower public investment in crucial areas such as infrastructure, education and health, to mention a few. This gradual decline in public spending could hinder long term economic growth and also lead to domestic social problems such as civil protests and riots (See Moore and Zanardi, 2008). Moreover, if the government borrows to finance its spending, output growth may not be stimulated as the public save in anticipation of future tax increases. This puzzle constitutes a significant concern for many SSA countries as they negotiate further trade reforms in the form of the Economic Partnership Agreements. In order to appropriately advise these countries, therefore, we investigate the empirical relationship between trade liberalisation and total tax revenue in Sub-Saharan Africa. Also, we assess the impact of adopting trade reform policies on domestic and trade tax revenues. This approach is employed to ascertain the link through which trade liberalisation increases or decreases total tax revenue. Lastly, we examine the sensitivity of our results to the index of trade liberalisation adopted and to the econometric methodology employed.

Our interest in SSA is motivated by the fact that countries in this region rely heavily on trade taxes as a major source of government revenue given that these taxes are easier to administer compared to domestic indirect taxes. In its publication on the fiscal implications of trade liberalisation, the African Trade Policy Centre (2004) highlights the significance of international trade taxes in SSA:

“Taxes on international trade are important in Africa because when tax administration is inefficient, governments tend to concentrate on easy to collect taxes such as trade taxes. In Africa as a whole, international trade taxes generated on average 28.2 per cent of total current revenues over the last decade; for Sub-Saharan Africa, the share goes up to 30.5 per cent. This compares to 0.8 per cent for high-income Organisation for Economic Cooperation and Development (OECD) countries, 18.42 per cent for lower medium-income countries, and 22.5 per cent for low income countries (African Trade Policy Centre, 2004:1)”

The impact of trade liberalisation on tax revenues is theoretically ambiguous because of the varying effects of different trade reform policies (See Blejer and Cheasty, 1988 and Tanzi, 1989). For instance, the tariffication of quantitative restrictions should increase tax revenues; however, tariff increases could adversely affect the volume of trade, thereby, lowering tax revenues. Also, the net effect of declining import and export duties on total tax revenue depends on the price elasticities of demand for imports and exports, respectively. In addition, a devaluation of the exchange rate makes imports more expensive which may lead to a fall in demand and a fall in trade tax revenues. On the other hand, there is an increase in the production import substitutes which increases income tax receipts. Thus, the overall effect of devaluation is unclear. This ambiguity explains why most studies on the revenue implications of trade liberalisation have been empirical. Khattry and Rao (2002) analysed the effects of trade liberalisation on trade and total tax revenues (as shares of GDP) across 80 developing and industrialised countries from 1970 to 1998. Their results, using a fixed effects estimator, showed a significant positive relationship between degree of urbanisation and total tax revenue-to-GDP ratio. More importantly, the authors found that the lowering of trade taxes significantly reduced both total and trade tax revenues. This finding is in contrast to Ebrill et al (1999) who show that tariff reforms are not necessarily associated with a fall in trade tax revenues across a panel data set of 105 countries from 1980 to 1995. Baunsgaard and Keen (2010) examined whether a panel of 117 countries have managed to replace their lost trade taxes by strengthening domestic revenues. Applying the difference generalised method of moments estimator, they found that for each dollar decline in trade tax revenue, domestic tax revenue increased by 50 cents and over \$1 in the short run and the long run, respectively. In addition, their

disaggregated analyses showed a significant short-run recovery of 20 to 25 cents for every \$1 of trade tax revenue lost in low income countries. Aizenman and Jinjark (2009) assessed the impact of globalisation on different categories of taxes collected by sixty developing countries from 1980 to 1999. Their result showed that trade openness is positively associated with income and value-added taxes but negatively related to tariffs and seignorage.

In Sub-Saharan Africa, most empirical studies on the relationship between trade liberalisation and tax revenues have been on individual countries. Matlanyane and Harmse (2002) examined the revenue implications of trade liberalisation in South Africa from 1974 to 2000. The authors found that the reductions in average tariff rates decreased trade tax revenues; a result similar to Epaphara (2014) who showed a positive significant relationship between tariff rates and import duty-to-GDP ratio in Tanzania. Nwosa et al (2012), on the other hand, did not find a significant relationship between trade liberalisation (measured as a liberalisation dummy) and trade tax revenue in Nigeria from 1970 to 2009. Zafar (2005) adopted a SMART partial equilibrium model to analyse the fiscal and trade implications of trade liberalisation in Niger. He found that further trade reforms in Niger will reduce tax revenues by more than 1 percent of GDP and increase trade by about 1.5 percent of GDP.

In a descriptive study, Keen and Mansour (2010) examined whether SSA countries have been able to use indirect taxes to offset trade tax losses from 1980 to 2005. Their results showed, on average, that the increase in indirect tax revenue was twice the loss in trade tax revenue. However, the lower income SSA countries experienced a decline in both trade tax revenue and total tax revenue after liberalisation. To the best of our knowledge, Agbeyebege et al (2004) is the only empirical cross-country study on the effect of trade liberalisation on tax revenues in Sub-Saharan Africa.¹ Using a panel data set of 22 countries from 1980 to 1996, the authors employed trade as a share of GDP and the ratio of import duties to the value of imports as measures of trade liberalisation. They found no significant relationship between these two measures and the share of total taxes in GDP.

The present study departs from the aforementioned empirical works by adopting a quantitative and qualitative measure of trade liberalisation. The quantitative measure is the ratio of trade

¹ Nashashibi and Bazzoni (1994); Ebeke and Ehrhart (2012); (Ghura (1998); and Adam et al (2001) have examined the fiscal revenue performance of Sub-Saharan African countries. However, how trade liberalisation affects this performance was not the focus of their studies.

taxes to international trade (that is, the sum of import and export duties) which captures changes in tariff rates as countries liberalise their trade regimes. On the other hand, the qualitative measure is denoted by a liberalisation dummy variable which takes the value of one when significant trade reforms began in a SSA country till the end of the sample period and zero beforehand.² This variable measures the impact of non-tariff barriers and potentially, the net effect of freer trade reforms. No other study in the tax revenue literature on Sub-Saharan Africa has employed this approach to measuring trade liberalisation. One main obstacle facing empirical studies of this kind is the paucity of data on different tax revenue indicators. We overcome this challenge by meticulously extracting data on different categories of tax revenues from the IMF Government Financial Statistics and the World Bank Development Indicators. There are missing values for some countries so that we, ultimately, end up with an unbalanced panel dataset of 28 Sub-Saharan African countries covering the period 1981 to 2010.

The remainder of the paper is as follows: Section 2 presents descriptive charts on total, trade and domestic tax revenues while section 3 examines the relationship between trade liberalisation and total tax revenue. Section 4 analyses the impact of trade reforms on domestic and trade tax revenues while section 5 is dedicated to discussions, interpretations and comparisons of empirical results. Section 6 assesses the impact of trade liberalisation on different categories of tax revenues at the country level while section 7 concludes.

2. Descriptive Statistics

We analyse some broad trends in total tax revenue, trade tax revenue and domestic tax revenue of Sub-Saharan African countries. The averages of the aforementioned variables are calculated for each country before (from 1981) and after (till 2010) trade liberalisation as shown in Tables (1), (2) and (3), respectively. Total tax revenue is simply the sum of domestic and trade tax revenues. Domestic tax revenue include revenue from income tax, profit tax, capital gains tax and taxes on goods and services. Trade tax revenue, on the other hand, is collected from import and export duties, exchange profits, exchange taxes and profits of export or import monopolies. The three revenues are expressed as percentages of Gross Domestic Product (GDP).

² The liberalisation dummy does not allow for trade policy reversals; however, to the best of our knowledge, we account for these reversals before estimating the liberalisation dates for our countries. For example, trade reforms in Burundi originally started in 1986 with the dismantling of quantitative restrictions on goods and rationalisation of the tariff structure. However, the civil war between 1993 and 2002 saw the maximum tariff rate rise to 100%. In January 2003, trade reforms resumed again in Burundi which saw the maximum tariff rate reduced to 40%; hence, 2003 was picked as the liberalisation date for Burundi. Togo, Democratic Republic of Congo and Kenya are also examples of countries that experienced trade policy reversals. Nonetheless, it is pertinent to note that any reversal in export and import tariffs will be captured by the second liberalisation measure which is the average import and export duties.

Table 1: Average Total tax revenue before and after liberalisation in Sub-Saharan Africa

Country	Liberalisation (Lib) year	Before Lib	After Lib	Change	t-test ¹ (p-value)
Botswana	1994	25.41	20.63	-4.78	0.002***
Burkina Faso	1991	8.55	11.94	3.39	0.000***
Cameroun	1989	17.19	10.14	-7.03	0.000***
Cote d'Ivoire	1994	20.92	15.66	-5.22	0.000***
DRC	2001	6.34	10.05	3.71	0.004***
Ethiopia	1992	9.27	8.53	-0.76	0.136
Gambia	1986	16.4	13.56	-2.84	0.205
Ghana	1983	4.46	13.4	8.94	0.007***
Kenya	1993	18.56	17.18	-1.40	0.011**
Lesotho	1994	35.88	45.97	10.09	0.001***
Malawi	1986	17.26	18.88	1.62	0.049**
Mali	1988	10.96	14.22	3.26	0.000***
Mauritius	1985	18.68	19.19	0.51	0.562
Namibia	1994	28.96	27.45	-1.51	0.159
Nigeria	1986	6.44	2.28	-4.16	0.172
Rwanda	1995	9.41	12.53	3.12	0.018**
Senegal	1986	15.27	16.03	0.76	0.401
Sierra Leone	1989	7.8	9.79	1.99	0.073*
South Africa	1994	22.56	25.66	3.1	0.002***
Swaziland	1994	25.64	24.7	-0.94	0.348
Togo	1994	23.24	15.17	-8.07	0.000***
Uganda	1987	6.75	11.46	4.71	0.000***
Zambia	1991	19.92	17.36	-2.56	0.000***
Zimbabwe	1990	25.84	24.72	-1.12	0.303
Average		16.76	16.94	0.18	0.935

The liberalisation dates are extracted from trade policy reviews of various countries while all values are the author's calculations. Four countries – Benin, Burundi, Gabon and Madagascar – are not included in the descriptive analysis due to data limitations. (1) This is the standard t-test for the difference in mean; p-value is reported.

Table 2: Average Trade tax revenue before and after liberalisation in Sub-Saharan Africa

Country	Liberalisation (Lib) year	Before Lib	After Lib	Change	t-test ¹ (p-value)
Botswana	1994	8.76	7.82	-0.94	0.352
Burkina Faso	1991	3.59	2.23	-1.36	0.000***
Cameroun	1989	4.12	2.86	-1.26	0.014**
Cote d'Ivoire	1994	8.61	8.43	-0.18	0.809
DRC	2001	2.51	3.68	1.17	0.042**
Ethiopia	1992	2.52	4.11	1.59	0.000***
Gambia	1986	12.24	9.05	-3.19	0.142
Ghana	1983	1.15	4.57	3.42	0.002***
Kenya	1993	4.00	2.34	-1.66	0.000***
Lesotho	1994	23.88	28.42	4.54	0.037**
Malawi	1986	4.06	3.34	-0.72	0.096*
Mali	1988	2.98	2.23	-0.75	0.030**
Mauritius	1985	10.26	7.98	-2.28	0.409
Namibia	1994	10.2	9.58	-0.62	0.455

Nigeria	1986	1.53	0.55	-0.98	0.259
Rwanda	1995	3.28	1.39	-1.89	0.001***
Senegal	1986	6	5.35	-0.65	0.472
Sierra Leone	1989	3.59	4.44	0.85	0.167
South Africa	1994	1.13	0.94	-0.19	0.346
Swaziland	1994	15.11	13.12	-1.99	0.262
Togo	1994	8.62	3.59	-5.03	0.000***
Uganda	1987	4.46	2.27	-2.19	0.018**
Zambia	1991	3.76	3.20	-0.56	0.425
Zimbabwe	1990	4.12	5.35	1.23	0.003***
Average		6.27	5.70	-0.57	0.722

The liberalisation dates are extracted from trade policy reviews of various countries while all values are the author's calculations. Four countries – Benin, Burundi, Gabon and Madagascar – are not included in the descriptive analysis due to data limitations. This is the standard t-test for the difference in mean; p-value is reported.

Table 3: Average Domestic tax revenue before and after liberalisation in Sub-Saharan Africa

Country	Liberalisation (Lib) year	Before Lib	After Lib	Change	t-test¹ (p-value)
Botswana	1994	16.66	12.81	-3.85	0.024**
Burkina Faso	1991	4.97	9.71	4.74	0.000***
Cameroun	1989	13.08	7.28	-5.80	0.001***
Cote d'Ivoire	1994	12.3	7.24	-5.06	0.000***
DRC	2001	3.82	6.37	2.55	0.001***
Ethiopia	1992	6.75	4.43	-2.32	0.000***
Gambia	1986	4.16	5.53	1.37	0.234
Ghana	1983	3.31	8.83	5.52	0.056*
Kenya	1993	14.56	14.84	0.28	0.584
Lesotho	1994	12.00	17.54	5.54	0.000***
Malawi	1986	13.19	15.53	2.34	0.015**
Mali	1988	7.98	11.99	4.01	0.000***
Mauritius	1985	8.42	11.21	2.79	0.278
Namibia	1994	18.76	17.87	-0.89	0.359
Nigeria	1986	4.91	1.73	-3.18	0.150
Rwanda	1995	6.13	11.14	5.01	0.001***
Senegal	1986	9.27	8.88	-0.39	0.850
Sierra Leone	1989	4.21	5.36	1.15	0.111
South Africa	1994	21.43	24.72	3.29	0.000***
Swaziland	1994	10.53	11.58	1.05	0.472
Togo	1994	14.62	11.58	-3.04	0.000***
Uganda	1987	2.29	9.19	6.9	0.000***
Zambia	1991	16.16	14.19	-1.97	0.040**
Zimbabwe	1990	21.72	19.37	-2.35	0.024**
Average		10.47	11.21	0.74	0.650

The liberalisation dates are extracted from trade policy reviews of various countries while all values are the author's calculations. Four countries – Benin, Burundi, Gabon and Madagascar – are not included in the descriptive analysis due to data limitations. (1) This is the standard t-test for the difference in mean; p-value is reported.

Table (1) shows that twelve countries experienced a rise in total tax revenue following the adoption of trade liberalisation policies. These countries are Burkina Faso, Democratic Republic of Congo (DRC), Ghana, Lesotho, Malawi, Mali, Mauritius, Rwanda, Senegal, Sierra

Leone, South Africa, and Uganda. In contrast, there was a decline in total tax revenue in Botswana, Cameroon, Cote d'Ivoire, Ethiopia, Gambia, Kenya, Namibia, Nigeria, Swaziland, Togo, Zambia and Zimbabwe. In the liberalisation era, Lesotho recorded the biggest rise in average total tax revenue of 10.09 percentage points while the highest drop in revenue of about 8.1 percentage points occurred in Togo. Table (1) also indicates that the overall trade liberalisation effect for Sub-Saharan Africa (that is, calculating the average effect for all countries) is a marginal increase in total tax revenue from 16.76 per cent to 16.94 per cent. Lastly, the t-tests show that the difference before and after liberalisation is significant in all countries except Ethiopia, Gambia, Mauritius, Namibia, Nigeria, Senegal, Swaziland and Zimbabwe.

Furthermore, table (2) shows a post-liberalisation decline in trade tax revenue in all countries except DRC, Ethiopia, Ghana, Lesotho, Sierra Leone and Zimbabwe. Again, the biggest rise in average trade tax revenue of 4.54 percentage points occurred in Lesotho while Togo experienced the highest drop in revenue of 5.03 percentage points. The overall impact for SSA is a fall in trade tax revenue from 6.27 per cent in the pre-liberalisation era to 5.70 per cent after trade Liberalisation. Comparing tables (1) and (2) show that as trade tax revenue fell after liberalisation, total tax revenue increased in eight countries, namely, Burkina Faso, Malawi, Mali, Mauritius, Rwanda, Senegal, South Africa and Uganda. Four countries – DRC, Ghana, Lesotho and Sierra Leone – experienced an increase in both trade tax revenue and total tax revenue while there was a decrease in both revenues in ten countries namely Botswana, Cameroon, Cote d'Ivoire, Kenya, Namibia, Nigeria, Swaziland, Togo and Zambia. The average for Sub-Saharan Africa shows that while trade tax revenue decreased by almost 0.60 percentage point, total tax revenue increased by approximately 0.20 percentage point.

In table (3), the adoption of freer trade policies saw an increase in domestic tax revenue in all countries except Botswana, Cameroon, Cote d'Ivoire, Ethiopia, Namibia, Nigeria, Togo, Zambia and Zimbabwe. Uganda had the biggest increase in average domestic tax revenue from 2.29 per cent before trade liberalisation to 9.19 per cent after trade liberalisation. On the other hand, Cameroon recorded the highest drop of 5.8 percentage points in domestic tax revenue. Comparing tables (1) and (3) show that an increase in both domestic and total tax revenue occurred in twelve countries while both revenues decreased in Botswana, Cameroon, Cote d'Ivoire, Ethiopia, Namibia, Nigeria, Togo, Zambia and Zimbabwe. In Gambia, Kenya and Swaziland, domestic tax revenue increased but total tax revenue fell. The average for Sub-Saharan Africa shows a rise in both domestic and total tax revenues.

In addition, comparing tables (2) and (3) indicate that domestic tax revenue increased as trade tax revenue fell in eleven countries namely Burkina Faso, Gambia, Kenya, Malawi, Mali, Mauritius, Rwanda, Senegal, South Africa, Swaziland and Uganda. Also, five countries had a fall in both trade and domestic tax revenues while DRC, Ghana, Lesotho and Sierra Leone experienced a rise in both revenues. The average impact for Sub-Saharan Africa is a domestic tax revenue rise of approximately 1 percentage point (from 10.47 per cent to 11.21 per cent) in comparison to a fall of around 0.60 percentage point in trade tax revenue which indicates that SSA countries have more than offset the effect of declining trade tax revenues. This finding is similar to Keen and Mansour (2010) which shows that the decline in trade tax revenue has been largely offset by other domestic sources of revenue in Sub-Saharan Africa.

In summary, the findings of this descriptive analysis are inconclusive as the changes in tax revenues cannot be attributed to trade liberalisation alone. Other macroeconomic variables need to be accounted for in a full econometric framework as shown in section 4.3 below. Nonetheless, the three tables give a *prima facie* indication that while trade tax revenue fell, domestic and total tax revenues increased following the adoption of trade reforms in Sub-Saharan Africa.

3. Trade Liberalisation and Total tax revenue

3.1. Data Description

The impact of trade liberalisation on total tax revenue is examined using a panel dataset of 28 Sub-Saharan African countries. We employ static and dynamic panel estimators for econometric analysis. The variables adopted are explained below:

Dependent Variable

- The main dependent variable in this study is total tax revenue as a share of GDP. However, we will also examine the impact of trade liberalisation on domestic and trade tax revenue. Domestic tax revenue captures tax revenue generated from income, profits, capital gains, goods and services; while trade tax revenue measures revenue from taxes levied on imports and exports, to mention a few.

Independent Variables

The explanatory variables employed in this study are based on the detailed assessment of the determinants of tax revenue (as a share of GDP) by Tanzi (1987) and Stotsky and WoldeMariam (1997). We discuss the expected signs of these variables below:

- Share of Agriculture in aggregate value added (GDP): This variable is an important determinant of tax revenue share in GDP. It captures the difficulty in taxing the agricultural sector which is dominated by subsistence activities, especially in regions like Sub-Saharan Africa. It is, therefore, expected that an increase in the share of agriculture in GDP will be associated with a decrease in total tax revenue.
- Share of Industry in aggregate value added (GDP): Industrial activities such as mining and manufacturing are better organised and hence, easier to tax. Moreover, this sector generates larger taxable surpluses compared to the agricultural sector. Although countries where mining activities are dominant tend to give tax concessions to foreign investors which may hinder potential revenues, we still expect a positive relationship between this variable and total tax revenue.
- GDP per capita (PCI): This variable measures the overall level of development of an economy. Although related to the sectorial share variables, the explanatory power of the PCI is potentially better as it also reflects the administrative capacity and institutional quality of an economy. Per capita income is expected to have a positive impact on total tax revenue.
- Liberalisation dummy: This is the first index of trade liberalisation. The liberalisation dummy variable takes the value of one when significant trade reforms began in a SSA country till the end of the sample period and zero beforehand. It is supposed to capture the impact of non-tariff barriers and potentially, the overall net effect of trade reform policies. The sign on this variable will be determined by the regression results.
- Average trade tariffs: This is the second index of trade liberalisation and it captures the effect of declining import and export duties. The overall impact of this variable on total tax revenue will be determined by the regression results.
- Inflation and real exchange rate: These two variables capture the effect of macroeconomic policies on total tax revenue; however, it is hard to determine their signs *a priori*. For instance, nominal increases in income as a result of higher inflation move taxpayers to a higher income bracket and thus, generate higher tax revenues. On

the other hand, an inflationary environment can reduce the tax base as economic agents protect the real value of their wealth by investing in foreign capital. Furthermore, a devaluation of the exchange rate is expected to raise the currency value of imports, but if the price elasticity of demand is elastic, then customs receipts may fall.

- Degree of Urbanisation: This variable captures the ease of administering and monitoring taxes in urban areas. However, in developing countries where urbanisation is characterised by a large informal sector, the variable may be picking the difficulty in taxing this sector. Therefore, its overall impact on total tax revenue could be positive or negative.
- Government expenditure (as a percentage of GDP): This variable captures all government expenditure on goods and services but excludes military expenditures that are part of government capital formation. To the extent that tax payers are encouraged to pay their taxes when they see the benefits of their contribution, government expenditure is expected to have a positive impact on total tax revenue.
- Foreign aid (as a percentage of gross national income): This variable measures concessional loans and grants received by a SSA country. It has a theoretically ambiguous relationship with total tax revenue. On the one hand, a rise in foreign aid could stimulate an increase in total tax revenue to pay back the loan taken while on the other hand, it could depress revenue mobilization if the aid is in the form of a grant (see Gupta et al, 2003). The overall effect will be determined by the regression results.

3.2. Econometric Analysis and Empirical Results

Following the empirical study of Ghura (1998), we start with a base regression model as specified in equation (1) below. This model includes only variables relating to income, the tax base and trade liberalisation. Tanzi (1989) argued that macroeconomic policies also play an important role in determining tax revenue. In equation (2), therefore, macroeconomic- and structure-related variables are added to the base model while observing changes in the signs and significance of regressors.³

$$ttr_{it} = \alpha_i + \beta_1 asg_{it} + \beta_2 isg_{it} + \beta_3 libmeasure_{it} + \beta_4 lpc_{it} + \varepsilon_{it} \quad (1)$$

³ See appendix A2 for the scatter plots showing the pairwise correlation between the dependent variable and each independent variable.

$$ttr_{it} = \alpha_i + \beta_1 asg_{it} + \beta_2 isg_{it} + \beta_3 libmeasure_{it} + \beta_4 lpc_{it} + \beta_5 urb_{it} + \beta_6 lf_{it} + \beta_7 rer_{it} + \varepsilon_{it} \quad (2)$$

where α_i is the country-specific effect while ttr implies the total tax revenue-to-GDP ratio. asg and isg are the agricultural and industrial shares in GDP, respectively. $libmeasure$ denotes the different measures of trade liberalisation, namely, average trade tariffs (att) and a dummy variable ($libdum$). lpc is the log of per capita income while urb represent degree of urbanization. lf and rer denote log of inflation and change in the real exchange rate, respectively, while ε_{it} is the idiosyncratic error term. Government expenditure and foreign aid variables are not included in the two equations above because they have a simultaneous relationship with total tax revenue; hence, potentially endogenous. The impact of these variables will be tested in section 5.

We adopt the fixed effects (FE) and generalised method of moments (GMM) to estimate coefficients of the above models. All estimated coefficients of equations (1) and (2) are reported in Table (5) below:

Table 5: Trade Liberalisation and Total Tax Revenue

Dependent Variable : Total tax revenue as a percentage of GDP						
	FE (I)	FE (II)	Difference GMM (I)		Difference GMM (II)	
<i>l.ttr</i>	-	-	0.42 (3.49)***		0.60 (6.78)***	
			Short-run	Long-run	Short-run	Long-run
<i>asg</i>	-0.10 (-1.98)**	-0.11 (-1.91)*	-0.09 (-1.53)	-0.16	-0.08 (-1.60)	-0.2
<i>isg</i>	0.12 (4.15)***	0.11 (3.44)***	0.09 (1.70)*	0.16	0.07 (1.68)*	0.18
<i>lpc</i>	2.43 (2.80)***	5.98 (5.84)***	1.48 (0.84)	2.55	2.37 (1.35)	5.93
<i>libdum</i>	0.54 (0.76)	1.62 (1.71)*	1.00 (1.45)	1.72	1.40 (2.18)**	3.50
<i>att</i>	0.15 (2.91)***	0.20 (2.71)***	0.24 (2.54)**	0.41	0.20 (2.51)**	0.50
<i>urb</i>	-	1.04 (5.86)***	-	-	0.52 (2.02)**	1.30
<i>rer</i>	-	-0.003 (0.29)	-	-	0.01 (0.93)	0.03
<i>lf</i>	-	-0.43 (-3.15)***	-	-	-0.26 (-1.94)*	-0.65
			Diagnostic Statistics			
R-squared	0.17	0.30	-		-	
No of Obs	474	400	402		335	
F-stat	[0.000]	[0.000]	[0.000]		[0.000]	

Number of Instruments		58	87
A-B Serial Correlation Test	-	-	
		[0.372]	[0.476]
Sargan Test	-	-	
		[0.886]	[0.981]

***, ** & * indicate that a coefficient is statistically significant at 1%, 5% and 10% significance level, respectively. The figures in parenthesis () are absolute *t/z* ratios while figures in brackets [] are p-values. "A-B" is the serial correlation test proposed by Arellano and Bond. Standard errors are robust to heteroscedasticity, autocorrelation and cross-sectional dependency. In the GMM estimations, *att* and *rer* are treated as potentially endogenous variables.

FE (I) shows the result of the base model in which all coefficients are statistically significant except the liberalisation dummy. Specifically, a 10 percentage point decrease in the share of agriculture in GDP increases total tax revenue by 1 percentage point of GDP.⁴ Also, a 1 percentage point rise in industry-to-GDP ratio and per capita income increases total tax revenue share by 0.1 and 2.4 percentage points, respectively. In addition, a 10 percentage point decrease in import and export duties reduces total tax revenue by 1.5 percentage points while the elimination of non-tariff barriers is associated with a 0.54 percentage point increase in total tax revenue.

In FE (II), we control for the degree of urbanisation, rate of inflation and change in real exchange rate. The results of the other explanatory variables are similar to FE (I) with respect to signs and statistical significance. More importantly, the liberalisation dummy is statistically significant and it increases total tax revenue by 1.62 percentage points. The average trade tariff variable remains statistically significant with its coefficient increasing marginally. In addition, a one percentage point increase in the degree of urbanisation is associated with a 1.04 percentage point increase in total tax revenue. FE (II) also indicates that an inflationary environment reduces total tax revenue while there is no evidence of a statistically significant relationship between changes in real exchange rate and total tax revenue.

In the GMM, the short run impact of a variable is its beta coefficient. The long run effect is obtained by dividing the short run beta coefficient by the speed of adjustment (that is, 1 minus the coefficient of the lagged dependent variable). GMM (I) shows that the lagged dependent variable has a low coefficient of 0.42; which implies a moderate difference between short run and long run estimates. The removal of non-tariff barriers increases total tax revenue by 1.00 percentage point in the short run and by 1.72 percentage point in the long run, albeit statistically insignificant. Moreover, a 10 percentage point decline in average trade tariff decreases total tax

⁴ Total tax revenue and total tax revenue share are used interchangeable in this study

revenue by 2.4 and 4.1 percentage points in the short run and the long run, respectively. As expected, the share of agriculture in GDP is negatively related to total tax revenue while industry-to-GDP ratio positively affects total tax revenue.

In GMM (II), the coefficient of the lagged dependent variable shows a substantial difference short run and long run estimates. Specifically, a 1 percentage point rise in inflation lowers total tax revenue by 0.26 percentage point in the short run while revenue decreases by 0.65 percentage point in the long run. Also, a 1 percentage point lowering of trade tariffs is associated with an increase in total tax revenue share of 0.20 and 0.50 percentage points in the short run and the long run, respectively. Moreover, the liberalisation dummy indicates that the removal of non-tariff barriers increases total tax revenue by 1.40 and 3.50 percentage points in the short run and the long run, respectively. Again, there is no significant relationship between changes in real exchange rate and total tax revenue. The p-values of the serial correlation test shows that the error term is not serially correlated while the validity of instruments used is shown by the p-values of the Hansen Test.

4. Trade liberalisation, Domestic tax revenue and Trade tax revenue

In the preceding section, our results show that the net impact of adopting freer trade reforms has significantly increased total tax revenue in Sub-Saharan Africa. Since the total tax revenue is the sum of domestic and trade tax revenue, its post-liberalisation increase may be attributed to one of three distinct possibilities. First, trade liberalisation decreased trade tax revenue but domestic tax revenue increased more, hence raising total tax revenue. Second, the adoption of freer trade policies decreased domestic tax revenue but trade tax revenue increased more, thereby increasing total tax revenue. Third, total tax revenue rose in the post-liberalisation era because both domestic and trade tax revenues increased. We, therefore, examine which of the three possibilities occurred in SSA by estimating the impact of trade liberalisation on domestic and trade tax revenues as shares of GDP. We use the same data set, model and estimation approach adopted in the above section. All results are shown in tables (6) and (7) below:

Table 6: Trade Liberalisation and Trade tax revenue

	Dependent Variable : Trade tax revenue as a percentage of GDP			
	FE (I)	FE (II)	Difference GMM (I)	Difference GMM (II)
<i>l.ttr</i>	-	-	0.33 (4.37)***	0.47 (5.82)***

			Short-run	Long-run	Short-run	Long-run
<i>asg</i>	-0.08 (2.42)**	-0.10 (-2.38)**	-0.08 (1.86)*	0.12	-0.07 (-1.79)*	-0.13
<i>isg</i>	0.03 (2.73)***	0.04 (1.29)	0.04 (1.47)	0.06	0.04 (1.64)*	0.08
<i>lpc</i>	-0.46 (-0.53)	0.71 (0.85)	0.36 (0.36)	0.54	0.76 (0.94)	1.43
<i>libdum</i>	0.42 (1.11)	0.97 (1.79)*	0.98 (2.06)**	1.46	1.10 (2.30)**	2.08
<i>att</i>	0.21 (5.52)***	0.23 (4.74)***	0.29 (3.34)***	0.43	0.21 (2.68)***	0.40
<i>urb</i>	-	0.36 (2.29)**	-	-	0.20 (1.79)*	0.38
<i>rer</i>	-	-0.01 (-1.39)	-	-	-0.002 (-0.56)	0.004
<i>lf</i>	-	0.12 (1.55)	-	-	0.04 (0.56)	0.08
Diagnostic Statistics						
R-squared	0.31	0.36	-	-	-	-
F-stat/Wald test	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
No of Obs	481	407	410	410	343	343
Number of Instruments	-	-	58	58	87	87
A-B Serial Correlation Test	-	-	[0.511]	[0.511]	[0.435]	[0.435]
Sargan Test	-	-	[0.390]	[0.390]	[0.134]	[0.134]

***, ** & * indicate that a coefficient is statistically significant at 1%, 5% and 10% significance level, respectively. The figures in parenthesis () are absolute *t/z* ratios while figures in brackets [] are p-values. "A-B" is the serial correlation test proposed by Arellano and Bond. Standard errors are robust to heteroscedasticity, autocorrelation and cross-sectional dependency. In the GMM estimations, *att* and *rer* are treated as potentially endogenous variables.

Table 7: Trade Liberalisation and Domestic tax revenue

	Dependent Variable : Domestic tax revenue as a percentage of GDP					
	FE (I)	FE (II)	Difference GMM (I)	Difference GMM (I)	Difference GMM (II)	Difference GMM (II)
<i>l.ttr</i>	-	-	0.69 (5.70)***	0.69 (5.70)***	0.50 (5.57)***	0.50 (5.57)***
			Short-run	Long-run	Short-run	Long-run
<i>asg</i>	-0.03 (-0.75)	-0.03 (-0.73)	-0.01 (-0.46)	-0.03	-0.03 (-0.64)	-0.02
<i>isg</i>	0.08 (2.73)***	0.06 (2.15)**	0.03 (0.92)	0.10	0.03 (0.65)	0.10
<i>lpc</i>	2.81 (4.47)***	4.85 (7.93)***	-0.04 (-0.04)	0.13	1.69 (1.70)*	4.51
<i>libdum</i>	0.02 (0.03)	0.41 (0.68)	-0.18 (-0.49)	-0.58	0.05 (0.08)	0.08
<i>att</i>	-0.06 (-3.02)***	-0.04 (-1.29)	-0.04 (-1.68)*	-0.13	-0.03 (-1.00)	-0.08

<i>urb</i>	-	0.62 (4.46)***	-	-	0.35 (2.30)**	0.63
<i>rer</i>	-	0.01 (1.16)	-	-	-0.01 (0.78)	-0.02
<i>lf</i>	-	-0.47 (-3.13)***	-	-	-0.25 (-1.93)*	-0.48

Diagnostic Statistics

R-squared	0.17	0.26	-	-
F-stat/Wald test	[0.000]	[0.000]	[0.000]	[0.000]
No of Obs	474	400	402	335
Number of Instruments	-	-	29	45
A-B Serial Correlation Test	-	-	[0.737]	[0.375]
Sargan Test	-	-	[0.922]	[0.852]

***, ** & * indicate that a coefficient is statistically significant at 1%, 5% and 10% significance level, respectively. The figures in parenthesis () are absolute *t/z* ratios while figures in brackets [] are p-values. "A-B" is the serial correlation test proposed by Arellano and Bond. Standard errors are robust to heteroscedasticity, autocorrelation and cross-sectional dependency. In the GMM estimations, *rer* is treated as potentially endogenous variables.

In Table (6), FE (I) shows that a 10 percentage points decrease (increase) in agricultural (industrial) share in GDP raises (reduces) trade tax revenue share by 0.8 (0.3) percentage points. Also, a 10 percentage point decrease in average trade tariff decreases trade tax revenue ratio by 2.1 percentage points, while the net impact of adopting freer trade policies in Sub-Saharan Africa is an increase in trade tax revenue ratio by 0.42 percentage points. In FE (II), a 1 percentage point increase in per capita income raises trade tax revenue share by 0.71 percentage point. The two indexes of trade liberalisation do not change with respect to sign and significance; although, the liberalisation dummy coefficient doubled while the average trade tariff coefficient remains more or less the same. FE (II) also indicates that greater urbanisation is associated with an increase in trade tax revenue share while no significant relationship exists between inflation rate and trade tax revenue. The GMM results are similar to the RE results with respect to the signs and significance of the agricultural share, liberalisation dummy, average trade tariff and urbanisation variables. For instance, GMM (I) shows that a 10 percentage point decrease in average trade tariffs reduces trade tax revenue share by 2.9 percentage points in the short run and approximately 4.3 percentage points in the long run. Also, the liberalisation dummy indicates that the adoption of freer trade policies has increased trade tax revenue share by approximately 0.98 and 1.46 percentage points in the short run and the long run, respectively. A 10 percentage point increase in the degree of urbanisation raises trade tax revenues by 2.0 and 3.8 percentage points in the short run and long run respectively.

In addition, Table (6) shows that additional instruments are valid and that there is no serial correlation of the error term in the GMM regressions.

Table (7) reports the results on the impact of trade liberalisation on the share of domestic tax revenue in GDP. Similar results are produced across estimators. A 1 percentage point increase in the degree of urbanisation increases domestic tax revenue share by around 0.4 and 0.6 percentage points in the short and the long run, respectively. Inflation rate, on the other hand, decreases domestic tax revenue by 0.25 percentage point in the short run and by 0.48 percentage point in the long run. The liberalisation dummy do not have any significant effect on domestic tax revenue share across the estimators adopted; however, a 10 percentage decrease in average trade tariff increases domestic tax revenue by approximately 0.5 and 0.7 percentages points in the short and the long run respectively. We also found a positive significant relationship between industrial share and domestic tax revenue while the negative relationship between agriculture-to-GDP ratio and domestic tax revenue is statistically insignificant.

In summary, the lowering of trade tariffs have increased domestic tax revenue but trade tax revenue decreased more which explains the fall in total tax revenue. The liberalisation dummy shows that the dismantling of non-tariff barriers such as quantitative restrictions increases trade and total tax revenues but has no significant effect on domestic tax revenue. According to these results, therefore, the impact of trade tax revenue is greater than that of domestic tax revenue in determining the net effect of trade liberalisation on total tax revenue.

5. Discussion, Interpretations and Comparisons of Empirical Results

The regression analyses in section 3 show that industrial share in GDP, degree of urbanisation, and per capita income all have a significant positive relationship with the share of total tax revenue in GDP. On the other hand, there is a significant negative relationship between agricultural share in GDP, inflation rate and total tax revenue share. These results are not farfetched as they are in accordance with *a priori* expectations as explained in section 4.3.1. Also, there are similar results in the literature: for instance, Agbeyegbe et al (2004) study on 22 SSA countries found that industrial share and inflation have a positive and negative impact on the share of total tax revenue in GDP, respectively. In addition, Ghura (1999) did not find a significant relationship between real exchange rate and tax revenue ratio in Sub-Saharan Africa

while Khattry and Rao (2002) found that greater urbanisation is associated with an increase in total tax revenue ratio across 80 developing and industrialised countries.⁵

With respect to urbanization, it is plausible that its relationship with total tax revenue is non-linear. Perhaps, at early stages of urbanization, total tax revenue increases; however, as the informal sector begins to expand, it becomes increasingly difficult to mobilize revenue so that total tax revenue starts to fall. To test this hypothesis, the urbanization variable and its square are added to the equation (2) and results in appendix (A5) show a negative sign on the squared variable, albeit statistically insignificant. In addition, we examine the impact of GDP growth on total tax revenue given that increases in output growth tends to raise the tax revenues for countries with progressive income tax rates. However, it is plausible for this variable not to be statistically significant because only a small share of tax revenue is derived from income in Sub-Saharan African countries. Nevertheless, the regression results (see appendix A6) show a positive and significant impact of GDP growth on tax revenue.

Furthermore, the results in section 4 indicate that agriculture-to-GDP ratio has a negative effect on trade tax revenue while greater urbanisation is associated with a rise in trade tax revenue. Conversely, higher inflation rates decrease domestic tax revenue while an increase in industrial share in GDP raises domestic tax revenue-to-GDP ratio. The only similar result in the literature with respect to SSA is by Agbeyegbe et al (2004). The authors found that a 10 percentage point increase in inflation rate significantly reduces tax revenue from goods and services (which is part of domestic tax revenue) by 0.1 percentage point.

The average trade tariffs variable has a significant positive impact on total tax revenue in Sub-Saharan Africa. A 10 percentage point decrease in trade tariffs will decrease total tax revenue by 2 percentage points in the short run and 5 percentage points in the long run. Put differently, trade liberalisation characterised by the lowering of export and import duties have decreased tax revenue by almost half. This strongly indicates that a substantial share of total tax revenue can be attributed to revenue from trade tariffs. More importantly, the result implies that the price elasticity of demand for imports and exports in the region is inelastic. If the demand for exports and imports were price elastic, then it is expected that the price fall from the reduction in taxes should bring about a more than proportion increase in demand so that the overall impact will be an increase in revenues. Moreover, the rise in demand will mean increase in the

⁵ We also adding times dummies to our different specifications and results in appendix A7 shows that the liberalisation dummy loses its significance.

production of exportables which will increase income tax revenue and ultimately, total tax revenue. Besides, Kassim (2013) found that the price elasticity of demand for imports and exports in SSA is inelastic.

On disaggregating the total tax revenue into domestic tax revenue and trade tax revenue, we found that a 10 percentage point decrease in the average trade tariffs decreased trade tax revenue by 4.3 percentage points but increased domestic tax revenue by only 0.7 percentage point. This result shows that SSA countries are still struggling to mobilise domestic revenue to offset the effect of falling trade tariffs. The finding also reflects the study by Baunsgaard and Keen (2010) which shows that low income countries (including twenty-one countries from our sample size) have only been able to recover \$25c per dollar of lost trade tax revenues through domestic revenues. When trade taxes are reduced, consumers tend to switch from domestic non-tradables to imports/import substitutes because of the decline in the relative price of importables to non-tradables. This should increase domestic tax revenue from the production of import substitutes. However, since substitutes to imports are quite limited in SSA, the increase in domestic tax revenue tend to be small, thus explaining the low coefficient.

The liberalisation dummy shows a significant positive effect on total tax revenues. This means that the replacement of quotas and other quantitative restrictions with tariffs increases trade tax revenue and ultimately, total tax revenue. Since the liberalisation dummy variable takes the value of one from the year significant reforms began in a SSA country, it potentially picks the effect of other significant trade reforms that could increase tax revenues. For example, trade liberalisation is usually accompanied by the introduction of consumption taxes such as the VAT which is meant to mitigate the effect of lost trade taxes, thereby increasing domestic indirect taxes. The introduction of consumption taxes may cause consumers to switch from non-tradables to tradables goods; however, if the tax is applied to tradables goods, then there is an increase in total tax revenues. Also, privatisation of state-owned enterprises is another key liberalisation reform that occurred in countries such as Ghana, Madagascar, Malawi, Mali and Senegal, to mention a few. This usually translate to maximum profits for companies and better organisation of tax returns which increases income tax revenues and thus, total tax revenues. In addition, the unification of the exchange is another potential effect that is being picked up by the liberalisation dummy. This unification tends to lower the incentives to engage in illegal activities such as smuggling or move to the informal sector, thereby boosting tax revenues. What's more, trade reforms involves the removal of exchange rate misalignment which tends to increase the value of revenues on tradable goods as shown in Adams et al (2001).

Furthermore, we examine the effect of government expenditure and foreign aid on total tax revenue. These two variables are endogenous due to their simultaneous relationship with total tax revenue. In other words, changes in either variable may also be a response to changes in total tax revenue. Therefore, we employ only the difference GMM for regression analysis as this estimator uses internal instrument to address endogeneity problems. The two variables are added to the base model and results are shown in table (8) below:

Table 8: GMM results with government expenditure and foreign aid

Independent Variable : Total tax revenue as a percentage of GDP								
	Difference GMM (I)		Difference GMM (II)		Difference GMM (III)		Difference GMM (IV)	
<i>l.ttr</i>	0.57 (5.87)***		0.46 (4.10)***		0.49 (5.44)***		0.65 (8.94)***	
	Short run	Long run	Short run	Long run	Short run	Long run	Short run	Long run
<i>asg</i>	-0.09 (-1.76)*	-0.21	-0.06 (-1.06)	-0.11	-0.04 (-0.70)	-0.08	-0.03 (-0.77)	-0.09
<i>isg</i>	0.08 (1.67)*	0.19	0.10 (1.83)*	0.19	0.08 (1.81)*	0.16	0.06 (1.79)*	0.17
<i>lpc</i>	1.07 (0.66)	2.49	1.54 (0.80)	2.85	1.67 (1.06)	3.27	1.22 (0.96)	3.49
<i>libdum</i>	1.19 (2.44)**	2.77	0.77 (1.06)	1.43	0.30 (0.38)	0.59	0.34 (0.61)	0.97
<i>att</i>	0.27 (3.67)***	0.63	0.16 (1.78)*	0.30	0.09 (1.16)	0.18	0.10 (1.50)	0.29
<i>gxp</i>	0.01 (0.17)	0.02	-	-	-	-	0.003 (0.07)	0.009
<i>aid</i>	-	-	0.0001 (0.01)	0.0002	0.11 (1.96)**	0.22	0.13 (3.44)***	0.37
<i>aid²</i>	-	-	-	-	-0.001 (-2.44)**	-0.002	-0.001 (-4.34)***	-0.003
Diagnostic tests								
Wald test	[0.000]		[0.000]		[0.000]		[0.000]	
No of Obs	401		385		385		384	
Number of Instruments	85		85		112		139	
A-B Serial Correlation Test	[0.315]		[0.530]		[0.593]		[0.557]	
Sargan Test	[0.958]		[0.975]		[0.973]		[0.928]	

***, ** & * indicate that a coefficient is statistically significant at 1%, 5% and 10% significance level, respectively. The figures in parenthesis () are absolute *t/z* ratios while figures in brackets [] are p-values. "A-B" is the serial correlation test proposed by Arellano and Bond. Standard errors are robust to heteroscedasticity and autocorrelation.

GMM (I) indicates a positive relationship between government expenditure and total tax revenue, albeit statistically insignificant. Specifically, a 10 percentage point increase in government spending increases total tax revenue ratio by 0.1 and 0.2 percentage points in the short run and the long run, respectively. GMM (II) indicates that foreign aid exerts a positive and statistically insignificant impact on total tax revenue ratio. GMM (III), however, shows a significant relationship between foreign aid and total tax revenue. Precisely, a 10 percentage point increase in foreign aid decreases total tax revenue share by 1.1 percentage point. This result does not conform with Benedek et al (2012) who found that net official development assistance negatively affects total tax revenue across a panel of 118 countries from 1980 to 2009. The intuition behind our result is that most foreign aid received by Sub-Saharan African countries consists of concessional loans which tends to stimulate an increase in revenue mobilisation as countries need to pay back loans received. In a disaggregated analysis, Benedek et al (2012) found that aid in the form of loans had a statistically significant negative effect on total tax revenues of African countries.

Furthermore, GMM (III) tests whether the relationship between total tax revenue and foreign aid is quadratic; that is, foreign aid increases revenue up to a certain threshold after which tax revenue begins to decrease. Our results show a statistically significant evidence of an “inverted U” relationship between the two variables. In other words, foreign aid increases total tax revenue up until 55 percent of gross national income; any foreign aid received after this point will lead to a fall in total tax revenue. We include both the government expenditure and foreign aid variable in the same regression model as shown in GMM (IV). We observe that the foreign aid variable maintains its significance while government expenditure remains insignificant. Also, there is a significant positive relationship between industry-to-GDP ratio, per capita income and total tax revenue. Lastly, it is pertinent to note that the two indexes of trade liberalisation have the expected sign across the four GMM results; though, only in GMM (I) are the two variables both statistically significant.

6. Impact of Trade Liberalisation at the Country Level

Thus far, we have examined the impact of lowering trade taxes and the elimination of non-tariff barriers in Sub-Saharan Africa, implicitly taking the coefficients of results to represent all countries in our sample. However, country experiences may differ as seen in the descriptive analysis. In this penultimate section, therefore, we use the beta coefficients of the liberalisation dummy and average trade tariffs to predict the total effect of trade liberalisation on trade,

domestic and total tax revenues in each country. The equations representing the predicted values of the three types of tax revenues are shown below:

$$\hat{Y}_{trade} = 2.08libdum + 0.40att * (\text{Change in average trade tariff}) \quad (3)$$

$$\hat{Y}_{domestic} = 0.08libdum - 0.08att * (\text{Change in average trade tariff}) \quad (4)$$

$$\hat{Y}_{total} = 3.50libdum + 0.50att * (\text{Change in average trade tariff}) \quad (5)$$

Equations (3), (4) and (5) are taken from the long run GMM (II) results in the tables representing the impact of trade liberalisation on total, trade and domestic tax revenues. The predicted results are seen below:

Table 9: Predicted impact of trade liberalisation at the country level.

Average Trade Tariffs							
Country	Liberalisation year	Before Lib	After Lib	Change	\hat{Y}_{trade}	$\hat{Y}_{domestic}$	\hat{Y}_{total}
Botswana	1994	16.97	20.75	3.78	3.59	-0.22	5.39
Burkina Faso	1991	12.34	7.9	-4.44	0.30	0.44	1.28
Cameroon	1989	16.88	16.84	-0.04	2.37	0.02	3.86
Cote d'Ivoire	1994	28.99	20.87	-8.12	-1.24	0.74	-0.65
DRC	2001	4.92	10.61	5.69	4.36	-0.38	6.35
Ethiopia	1992	27.91	17.49	-10.42	-2.13	0.92	-1.76
Gambia	1986	20.19	16.75	-3.44	0.70	0.36	1.78
Ghana	1983	20.07	18.02	-2.05	1.26	0.24	2.48
Kenya	1993	13.91	6.37	-7.54	-0.82	0.66	-0.13
Lesotho	1994	19.32	27.36	8.04	5.11	-0.53	7.29
Malawi	1986	14.48	9.97	-4.51	0.28	0.44	1.25
Mali	1988	10.81	6.12	-4.69	0.20	0.46	1.16
Mauritius	1985	20.6	12.86	-7.74	-1.02	0.70	-0.37
Namibia	1994	17.99	20.68	2.69	3.16	-0.14	4.85
Nigeria	1986	12.02	2.57	-9.45	-1.70	0.84	-1.23
Rwanda	1995	24.49	4.41	-20.08	-5.95	1.69	-6.54
Senegal	1986	12.41	6.44	-5.97	-0.31	0.56	0.52
Sierra Leone	1989	17.23	15.91	-1.32	1.55	0.19	2.84
South Africa	1994	4.87	3.1	-1.77	1.37	0.22	2.62
Swaziland	1994	16.52	13.94	-2.58	1.05	0.29	2.21
Togo	1994	13.51	6.25	-7.26	-0.82	0.66	-0.13
Uganda	1987	31.62	7.52	-24.1	-7.56	2.01	-8.55
Zambia	1991	10.11	7.86	-2.25	1.12	0.27	2.31

Zimbabwe 1990	24.04	13.01	-11.03	-2.33	0.96	-2.02
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The liberalisation dates are extracted from trade policy reviews of various countries while all values of average trade tariffs are the author's calculations.

The result from table 9 shows that the impact of trade liberalisation is to decrease trade tax revenue in all sampled SSA countries except Botswana, Burkina Faso, Cameroon, DRC, Gambia, Ghana, Lesotho, Malawi, Mali, Namibia, Sierra Leone, South Africa, Swaziland and Zambia. In other words, fourteen countries experienced an increase in trade tax revenue in the post-liberalisation era compared to only six countries in the descriptive analysis. Furthermore, domestic tax revenue decreased only in four countries (Botswana, DRC, Lesotho and Namibia) in comparison to 9 under the descriptive analysis. More importantly, only two countries (Rwanda and Uganda) had an increase in domestic tax revenue above 1 percentage point following the adoption of freer trade reforms which implies that efforts to mobilise domestic tax revenue in Sub-Saharan Africa is still low. Furthermore, trade liberalisation has increased total tax revenue in all countries except Cote d'Ivoire, Ethiopia, Kenya, Mauritius, Nigeria, Rwanda, Togo, Uganda and Zimbabwe. Interestingly, these aforementioned countries experienced an increase in domestic tax revenue, but this was not enough to offset the more than proportionate decrease in trade tax revenue. In contrast, countries that had a decrease in domestic tax revenue still witnessed an increase in total tax revenue because trade tax revenue increased. One main drawback of the country level results is the rather loose restriction that all sampled countries have the same intercept and slope coefficient.

7. Conclusion

This paper has examined the relationship between trade liberalisation and total tax revenue as a share of GDP across 28 Sub-Saharan African countries from 1981 to 2010. We have also analysed the impact of freer trade policies on trade and domestic tax revenues. The results show that the reduction of trade taxes has significantly decreased trade and total tax revenue, but increased domestic tax revenue. Also, the net effect of the adoption of different trade policies (as indicated by the liberalisation dummy) is to increase total tax revenue in SSA. In addition, greater urbanisation is associated with an increase in total tax revenues while a higher inflation decreases revenues. These results are robust to different estimation techniques employed.

Furthermore, we found that the effect of foreign aid in the liberalisation era is quadratic; that is, it initially increases trade tax revenue but later reduces revenues. It is important to note that the foreign aid variable used in this study is a sum of both concessional loans and grants. Further research could, hence, examine the separate impact of loans and grants on total tax revenue in the liberalisation era. Also, our country level results show that about 70 per cent of SSA countries experienced an increase in total tax revenue following the adoption of freer trade policies. This is an encouraging result for SSA countries as they negotiate further trade reforms in the form of the Economic Partnership Agreements with the European Union. Since trade tax revenue still has a significant influence on total tax revenue, however, policies should be directed at improving the administrative capacity to mobilize domestic tax revenues. Also, policies that increase industrial share in GDP and urbanisation together with those that lower inflation are recommended.

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APPENDIX A

A1: Definition and Sources of Variables

Tax Revenue (as a share of GDP): This is the sum of taxes on income, international trade and goods and services, expressed as a percentage of GDP. Source: *IMF Government Financial Statistics, 2012 and World Development Indicators, 2012*.

Average trade tariffs: These are taxes levied on imports expressed as a percentage of total imports plus taxes levied on exports expressed as percentage of total exports. Source: *IMF Government Financial Statistics, 2011 and World Development Indicators 2012*.

Industry value added (as a share of GDP): This comprises of value added in mining, manufacturing, construction, electricity, water and gas, expressed as a percentage of GDP. Source: *World Development Indicators 2012*.

Agriculture value added (as a share of GDP): Agriculture includes forestry, hunting, fishing, cultivation of crops and livestock production. Source: *World Development Indicators 2012*.

GDP per capita (in Log): This is gross domestic product divided by midyear population, expressed in constant 2000 US dollars.

Real Exchange rate: The real exchange rate is defined as the nominal exchange rate adjusted for relative prices between a SSA country and the US. The nominal exchange rate is measured as the domestic price of foreign currency. Source: *African Development Bank Statistics, 2011*

Degree of Urbanization: This is the growth rate of people living in urban areas. Source: *World Development Indicators 2012*.

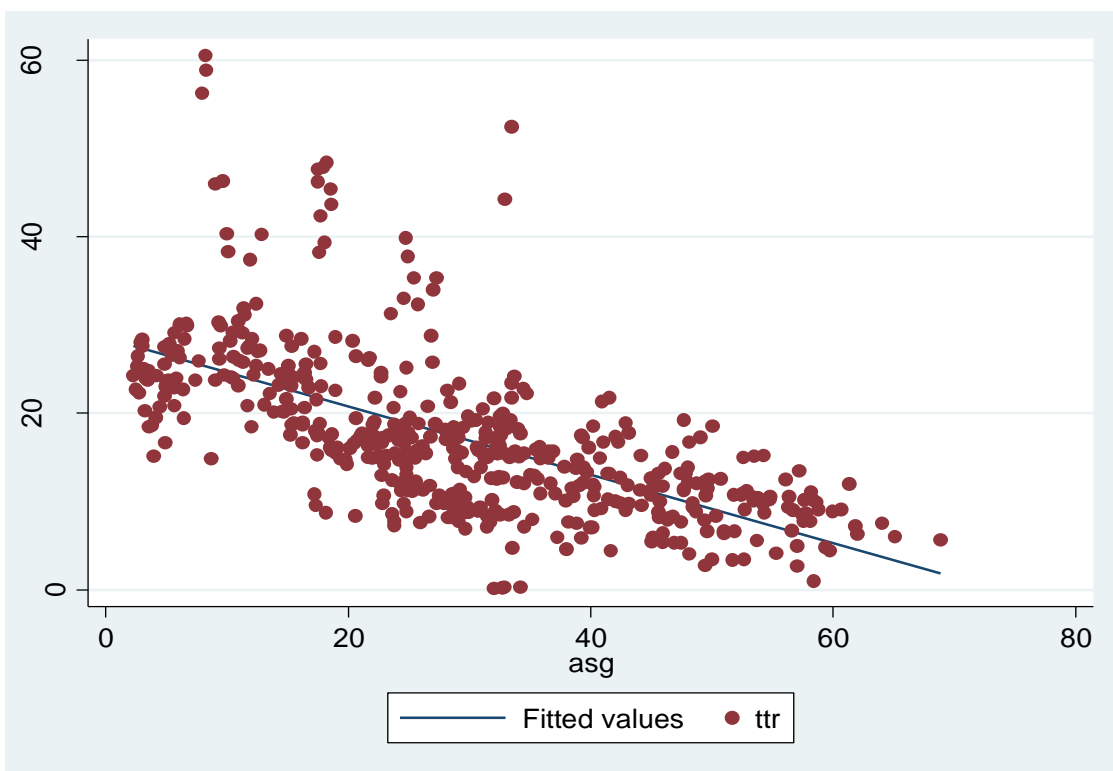
Inflation rate (in Log): This is the annual percentage change in consumer price index. Source: *World Development Indicators 2012*.

Government expenditure (as a share of GDP): This includes expenditures on the purchases of goods and services, national defence and security. It excludes government military expenditures that are part of government capital formation. Source: *World Development Indicators 2012*.

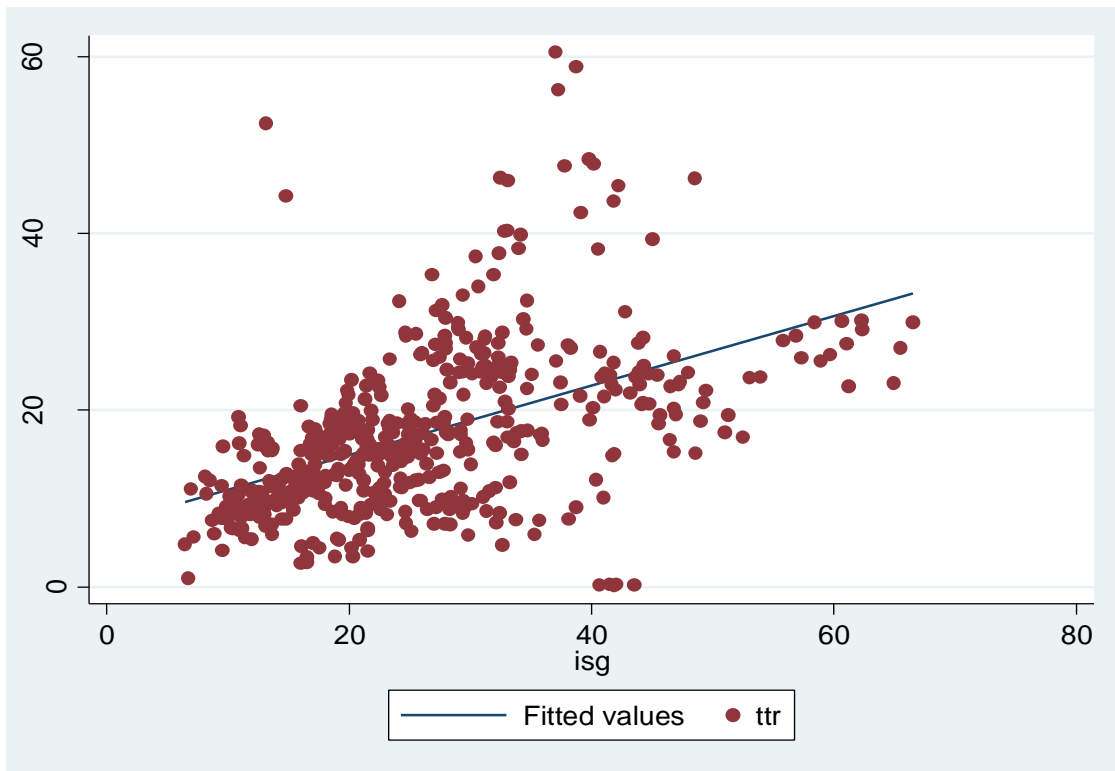
Foreign Aid: This is the amount of net official development assistance (grants plus concessional loans) expressed as a percentage of gross national income. Source: *World Development Indicators 2012*

A2: SCATTER PLOTS BETWEEN TOTAL TAX REVENUE AND EXPLANATORY VARIABLES

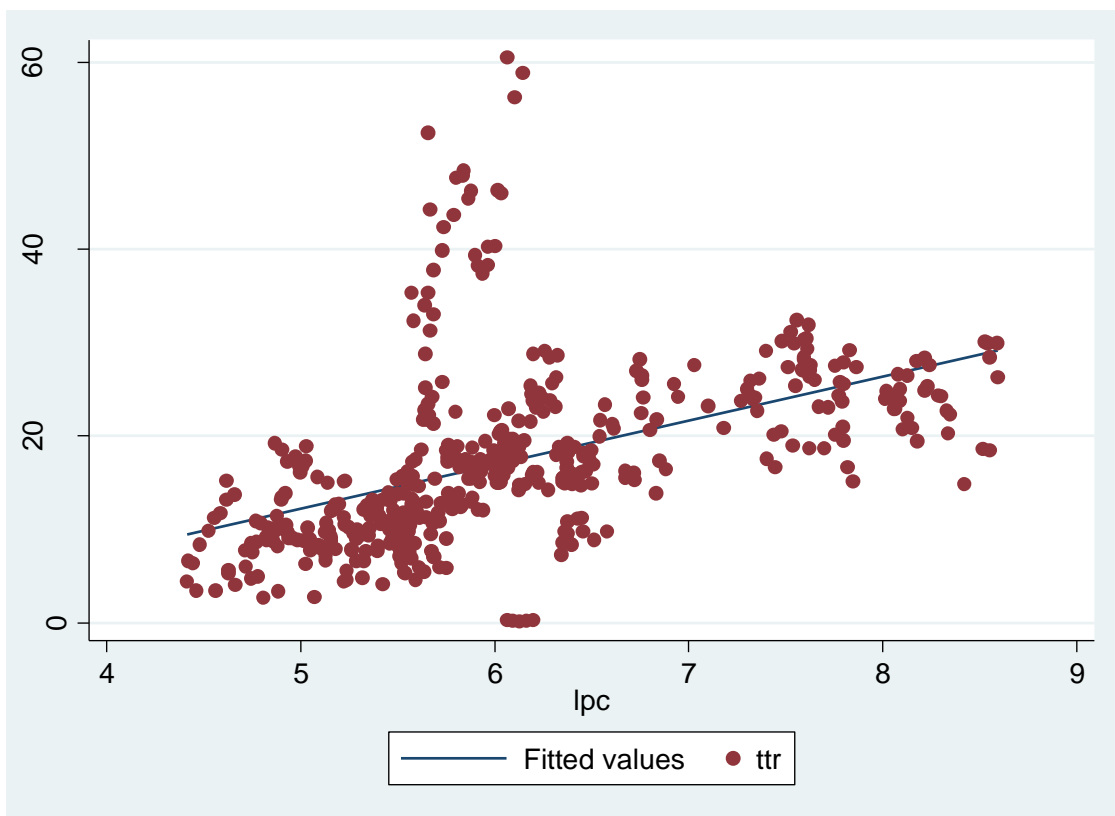
Strong negative correlation between share of agriculture and Total tax revenue [r=-0.63]



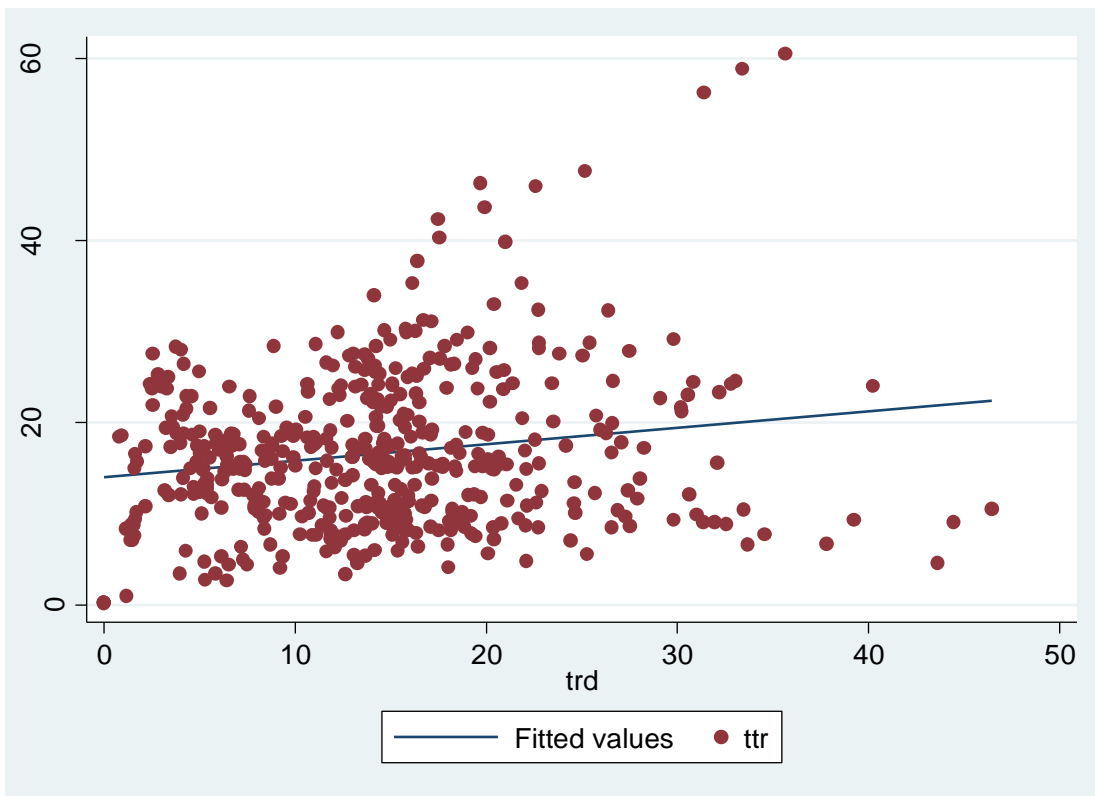
Moderate positive correlation between Industrial share and Total tax revenue [r=0.50]



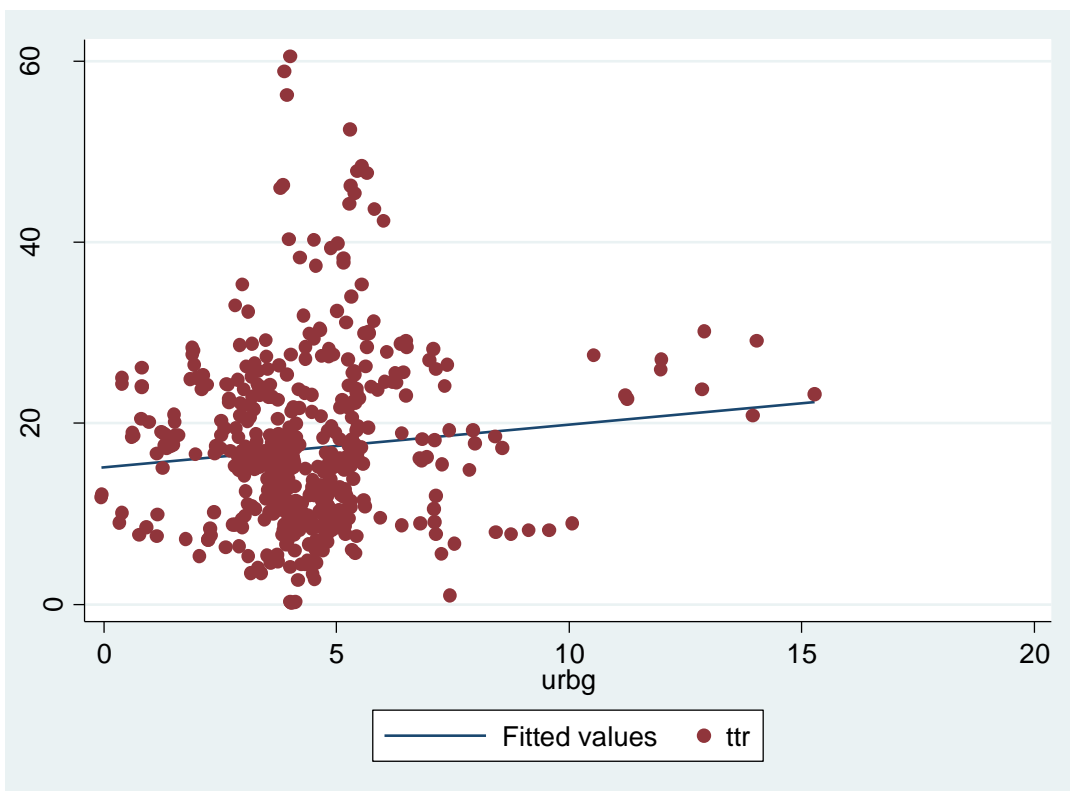
Moderate positive correlation between log of per capita GDP and Total tax revenue [r=0.49]



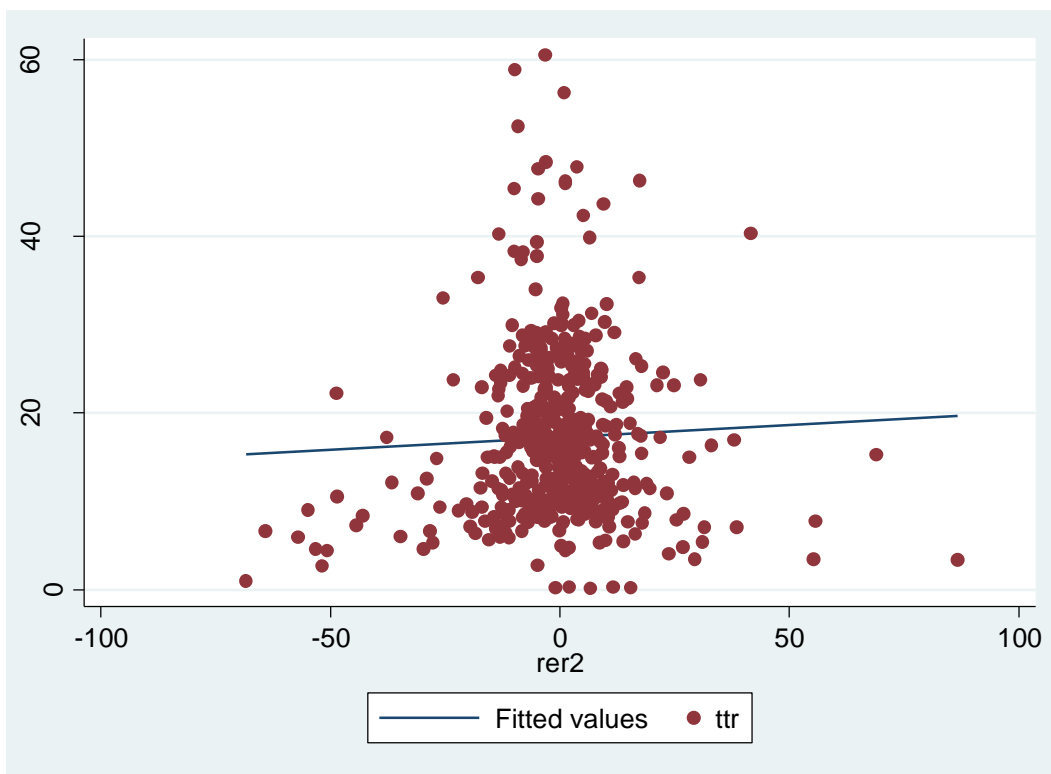
Weak positive correlation between average trade tariffs and Total tax revenue [r=0.17]



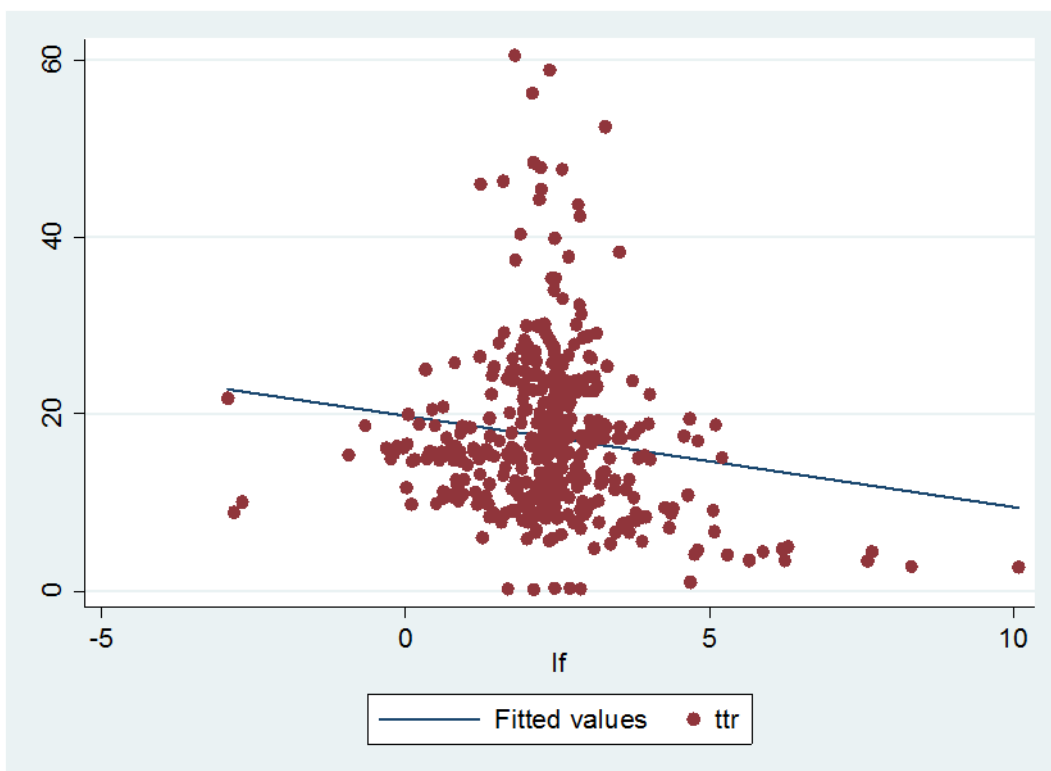
Weak positive correlation between urbanization and Total tax revenue [r=0.10]



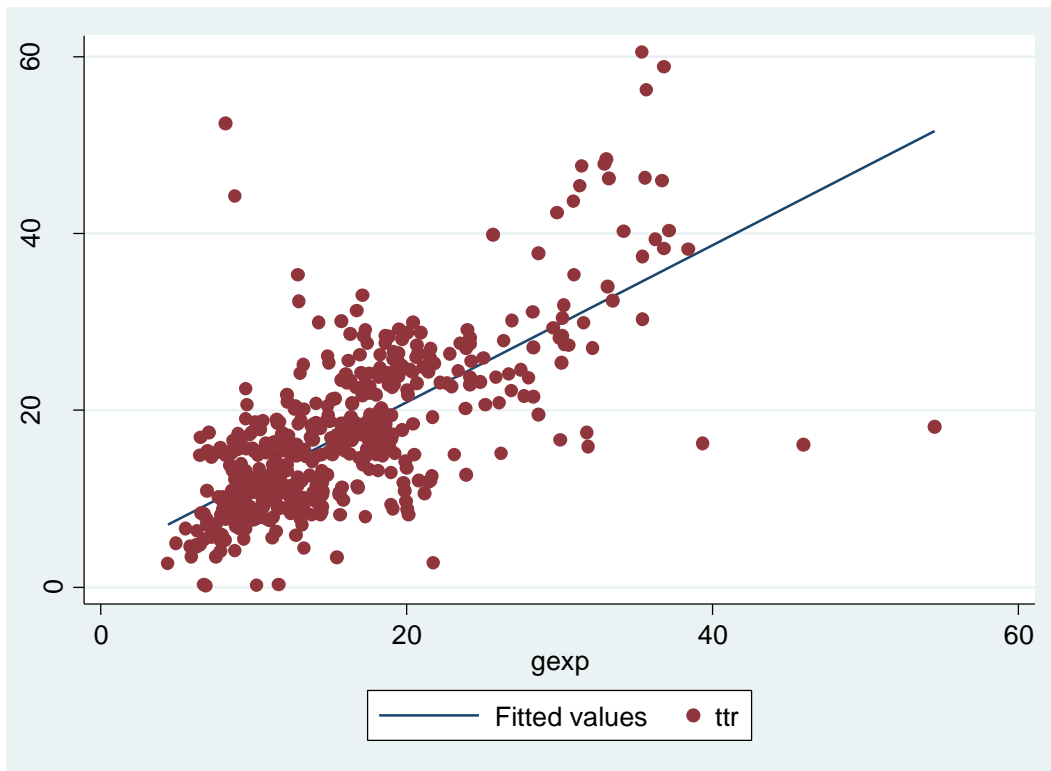
Near zero correlation between real exchange rate and Total tax revenue [$r=0.04$]



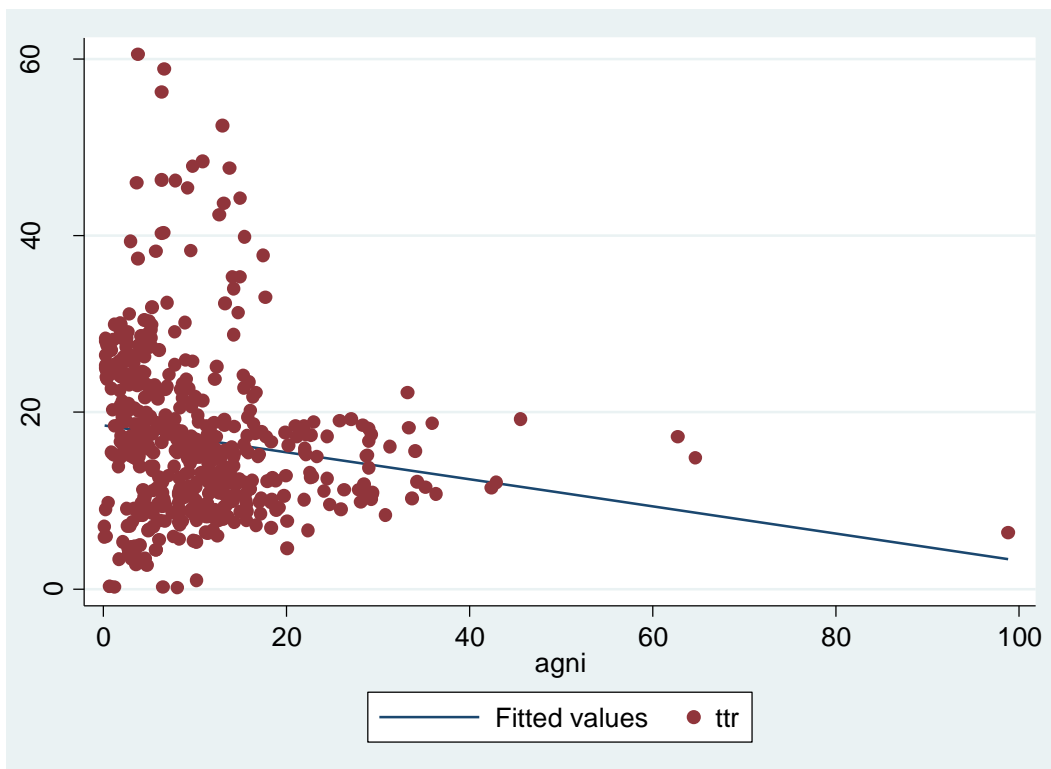
Weak negative correlation between log of inflation and Total tax revenue [$r=-0.14$]



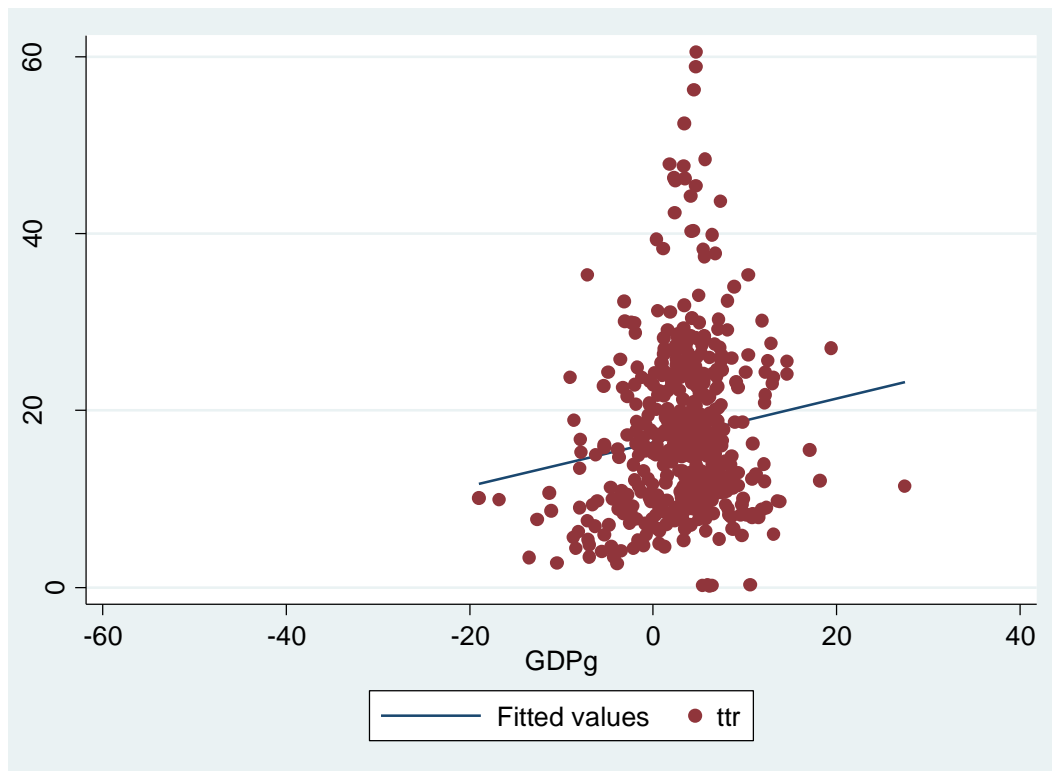
Strong positive correlation between government expenditure and Total tax revenue [r=0.70]



Weak negative correlation between foreign aid and Total tax revenue [r=-0.16]



Weak positive correlation between GDP growth and Total tax revenue [$r=0.13$]



A3: Correlation Matrix

	<i>ttr</i>	<i>dom</i>	<i>ttax</i>	<i>att</i>	<i>isg</i>	<i>asg</i>	<i>lpc</i>	<i>urb</i>	<i>lf</i>	<i>libdum</i>	<i>rer</i>	<i>gexp</i>	<i>agni</i>	<i>gdp</i>
<i>ttr</i>	1.00													
<i>dom</i>	0.75	1.00												
<i>ttax</i>	0.78	0.19	1.00											
<i>att</i>	0.17	-0.17	0.44	1.00										
<i>isg</i>	0.50	0.52	0.25	-0.13	1.00									
<i>asg</i>	-0.63	-0.66	-0.32	0.15	-0.70	1.00								
<i>lpc</i>	0.49	0.60	0.16	-0.06	0.67	-0.86	1.00							
<i>urb</i>	0.10	0.03	0.13	0.21	-0.14	0.25	-0.24	1.00						
<i>lf</i>	-0.14	-0.16	-0.05	-0.06	-0.00	0.19	-0.23	0.02	1.00					
<i>libdum</i>	-0.06	-0.05	-0.04	-0.20	-0.07	-0.06	0.01	-0.26	-0.21	1.00				
<i>rer</i>	0.04	0.10	-0.03	-0.03	0.04	-0.04	0.03	-0.04	0.01	-0.02	1.00			
<i>gexp</i>	0.70	0.54	0.55	0.12	0.32	-0.43	0.28	0.11	-0.00	-0.16	0.06	1.00		
<i>agni</i>	-0.16	-0.24	0.002	-0.03	-0.36	0.43	-0.51	0.18	0.10	0.07	-0.09	-0.01	1.00	
<i>gdp</i>	0.13	0.10	0.10	-0.04	0.004	-0.03	0.06	0.23	0.21	0.19	-0.06	0.04	-0.01	1.00

A4: Summary Statistics

Variable	Mean	Standard dev	Minimum	Maximum
<i>ttr</i>	17.18	9.33	0.12	60.48
<i>dom</i>	11.04	5.91	0.12	27.04
<i>ttax</i>	6.15	6.16	0	41.53
<i>att</i>	14.66	8.37	0	46.45
<i>isg</i>	26.16	12.17	6.47	66.53
<i>asg</i>	28.36	15.13	2.03	68.88
<i>urb</i>	4.31	2.06	-0.05	19.73
<i>lf</i>	2.21	1.32	-3.31	10.08
<i>libdum</i>	0.66	0.47	0	1
<i>rer</i>	-0.67	14.04	-75.14	86.68
<i>gexp</i>	15.27	6.69	2.05	54.52
<i>lpc</i>	6.15	1.03	4.41	8.59
<i>agni</i>	10.46	9.83	-0.25	98.81
<i>gdpg</i>	3.28	5.30	-50.25	35.22

A5: Trade Liberalisation and Tax revenue with urbanisation squared

Dependent Variable : Total tax revenue as a percentage of GDP			
	Fixed Effects	Difference GMM	
<i>l.ttr</i>	-	0.60 (7.03)***	
		Short run	Long run
<i>asg</i>	-0.12 (-1.87)*	-0.08 (-1.52)	-0.2
<i>isg</i>	0.11 (3.57)***	0.07 (1.49)	0.18
<i>lpc</i>	5.88 (5.46)***	2.43 (1.39)	6.08
<i>libdum</i>	1.68 (1.76)*	1.34 (1.93)*	3.35
<i>att</i>	0.19 (2.73)**	0.20 (2.46)**	0.50
<i>rer</i>	0.003 (0.29)	-0.01 (-0.94)	0.03
<i>lf</i>	0.43 (-3.27)***	-0.27 (1.97)**	0.68
<i>urb</i>	1.35 (2.49)**	-0.24 (0.51)	-0.60
<i>urb²</i>	-0.02 (-0.66)	0.02 (0.09)	-0.05
		Diagnostic Tests	
R-squared	0.31	-	
No of Obs	400	335	
F-stat	[0.000]	[0.000]	

Number of Instruments	-	88
A-B Serial Correlation Test	-	[0.463]
Sargan Test	-	[0.983]

***, ** & * indicate that a coefficient is statistically significant at 1%, 5% and 10% significance level, respectively. The figures in parenthesis () are absolute t/z ratios while figures in brackets [] are p-values. "A-B" is the serial correlation test proposed by Arellano and Bond. Standard errors are robust to heteroscedasticity, autocorrelation and cross-sectional dependency.

A6: Trade Liberalisation and Tax revenue with GDP growth

Dependent Variable : Total tax revenue as a percentage of GDP						
	FE (I)	FE (II)	Difference GMM (I)		Difference GMM (II)	
<i>l.ttr</i>	-	-	0.45 (4.28)***		0.61 (6.84)***	
			Short-run	Long-run	Short-run	Long-run
<i>asg</i>	-0.10 (-1.98)**	-0.11 (-1.92)*	-0.10 (-1.48)	-0.18	-0.08 (-1.63)*	-0.21
<i>isg</i>	0.12 (5.47)***	0.11 (3.47)***	0.09 (2.04)**	0.16	0.07 (1.67)*	0.18
<i>lpc</i>	2.20 (2.87)***	5.89 (5.81)***	1.28 (0.83)	2.33	2.15 (1.23)	5.51
<i>libdum</i>	0.40 (0.60)	1.58 (1.65)	0.99 (1.54)	1.80	1.34 (1.98)**	3.44
<i>att</i>	0.17 (2.98)***	0.20 (2.71)***	0.27 (2.81)***	0.49	0.20 (2.43)**	0.51
<i>gdp</i>	0.13 (4.41)***	0.02 (0.62)	0.10 (2.65)***	0.18	0.03 (0.83)	0.08
<i>urb</i>	-	1.02 (5.37)***	-	-	0.48 (1.82)*	1.23
<i>rer</i>	-	0.004 (0.34)	-	-	-0.01 (-0.83)	0.03
<i>lf</i>	-	-0.40 (-2.98)***	-	-	-0.23 (-1.63)*	0.59
Diagnostic Statistics						
R-squared	0.19	0.30	-		-	
No of Obs	473	399	401		334	
F-stat	[0.000]	[0.000]	[0.000]		[0.000]	
Number of Instruments	-	-	59		88	
A-B Serial Correlation Test	-	-	[0.430]		[0.482]	
Hansen Test	-	-	[0.780]		[0.971]	

***, ** & * indicate that a coefficient is statistically significant at 1%, 5% and 10% significance level, respectively. The figures in parenthesis () are absolute t/z ratios while figures in brackets [] are p-values. "A-B" is the serial correlation test proposed by Arellano and Bond. Standard errors are robust to heteroscedasticity, autocorrelation and cross-sectional dependency.

A7: Trade Liberalisation and tax revenue (adding time dummies)

Difference GMM regressions						
	Total tax revenue		Domestic tax revenue		Trade tax revenue	
	0.53 (7.92)***		0.50 (4.39)***		0.45 (6.99)***	
	Short-run	Long-run	Short-run	Long-run	Short-run	Long-run
<i>asg</i>	-0.02 (-0.49)	0.04	-0.01 (-0.33)	0.02	-0.03 (-1.13)	-0.05
<i>isg</i>	0.11 (2.74)***	0.23	0.03 (0.87)	0.06	0.07 (2.66)***	0.13
<i>lpc</i>	3.79 (2.20)**	8.06	1.99 (0.83)	3.98	1.68 (1.84)*	3.05
<i>libdum</i>	-0.70 (-0.88)	1.49	-0.53 (-1.09)	1.06	0.45 (1.01)	0.82
<i>att</i>	0.17 (2.19)**	0.36	-0.02 (-0.68)	0.04	0.20 (3.06)***	0.36
<i>urb</i>	0.73 (2.90)***	1.55	0.02 (1.17)	0.04	0.32 (2.37)**	0.58
<i>rer</i>	-0.02 (-2.10)**	0.04	0.40 (2.20)**	0.80	-0.01 (-1.05)	0.02
<i>lf</i>	-0.31 (-2.19)**	0.66	-0.23 (-1.79)*	0.46	-0.003 (-0.05)	0.01
Diagnostic Statistics						
No of Obs	335		335		343	
F-stat	[0.000]		[0.000]		[0.000]	
Number of Instruments	115		73		115	
A-B Serial Correlation Test	[0.430]		[0.378]		[0.482]	
Hansen Test	[0.780]		[0.646]		[0.971]	

***, ** & * indicate that a coefficient is statistically significant at 1%, 5% and 10% significance level, respectively. The figures in parenthesis () are absolute t/z ratios while figures in brackets [] are p-values. "A-B" is the serial correlation test proposed by Arellano and Bond. Standard errors are robust to heteroscedasticity and autocorrelation.

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