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Tax Revenue versus Sectoral Economic Growth (Johanson Co-integration Approach)

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Abstract
A tax that is inclusive and becomes greater proportion of sectors income as the income from that sector rise is good for the sustainable development of each sector and identifying the incidence of a particular tax. Governments of all countries with no exception based on level of development and size of the economy or literacy rate of the population are struggling with the problem of appropriate tax policy formulation. The aim of this study is to analyze and figure out the determinants of the responsiveness of gross tax revenue to economic growth at a sectorial level. The result revealed that the share of service sector value added, import and over all government budget deficit to GDP affect buoyancy of gross tax revenue positively. Broadening the tax base and bringing new tax payers in to tax net, eliminating tax exemptions are some of the recommendations based on the findings of the present study.
Keywords: Tax and Co-integration.

1. Introduction

Taxes are the portion of the produce of land and the labors of a country placed at the disposal of the government and are always paid either from the capital or from the revenue of the country (David Ricardo, 1817). Being one of the earliest advocator of economic liberalism the French Economist Turgot (1770) also says that ‘ the expenses of government, having for their object the interest of all, should be borne by everyone, and the more a man enjoys the advantages of society, the more he ought to hold himself honored in contributing to those expenses’.

Gerald W. Scully (1991) argued that tax rates affect not only government revenue, but also economic efficiency and economic growth. Some government spending’s such as infrastructure may improve a country’s economic efficiency and stimulate economic growth. But beyond that level, higher tax rates divert resources from private sector, encourage wastes of resources through tax avoidance and channel resources into the less productive underground (informal) economy. Hence the optimality of the tax system should be kept in mind when a public finance employees or government officials try to adjust the tax system. One way to check this optimality is through estimating each sectors effect on the buoyancy of tax revenue.

Previous studies indicate that the magnitude of the change in tax revenue due the change in gross domestic product (tax buoyancy) is related with the share of the growth rates of different sectors to GDP (see Ahmed, et al, 2010, Thuto D. Botlhole, 2010). A nation with a greater share of the manufacturing sector could generate higher tax revenue as compared to the agricultural sector. Ethiopia is faced by the reality of a large share of agriculture in total output and employment, large informal sectors and occupations, many small establishments and informal (shadow) economies that are outside the formal tax structure which might result in a lower level of tax revenue.

In Sub-Saharan Africa, many tax reforms have been initiated from outside. International financial institutions (IMF and the World Bank) have strongly advised many sub-Saharan African countries, including Ethiopia, to carry out tax reform, (Tsegabirhan, 2010). Recently the looming fiscal shortfalls and borrowing requirements developing countries create are unprecedented. Restoring fiscal balance will demand a reworking of the fundamental, implicit, or explicit social contracts in these countries. More prosaically, the problem will be solved by some combination of spending reductions and revenue increases (Gali and Harris, 2011). In developing countries spending reduction is not an option since unemployment and poverty are rampant. As such manipulating the tax system and rising domestic revenue in a manner that does not hinder the sustainability of their development is an issue that should get strong emphasis. Analyzing the relationship between tax revenue and economic growth has a paramount role in this regard in monitoring, analyzing and forecasting tax revenue growth.

The tax effort approach to measuring tax performance is termed static, in that it gives the potential for tax increase at a given point in time through comparisons with other countries. However, in order to determine if a country has made efforts at increasing tax revenue over a period - tax performance in the dynamic sense which measures the sensitivity and response of the tax system with respect to income (GDP) such as tax buoyancy should be used. The buoyancy of a tax system reflects the total response of tax revenue to changes in national income as well as discretionary changes in tax policies over time.

Taking this fact into account the aim of this study is to figure out the factors that determine the buoyancy of gross tax revenue in the country based on Johanson maximum likelihood method using a time series data from 1974 to 2010.

2. Overview of the Ethiopian tax system

According to Eshetu (2004) the modern Ethiopian tax system is a product of more than a half century of experimentation in legislation and tax reform. It had neither the grand law giver to guide and direct it from behind nor a clear set of overarching policies to inform its directions.

Table 1 Personal Income Tax, Business Profit Tax and Custom Duties (% GTR)

Year	Personal income tax (% GTR)	Business profit tax (% GTR)	Custom duties (%GTR)
1975-1976	25.02	56.19	28.46
1980-1981	17.94	48.61	17.29
1985-1986	14.76	19.53	18.75
1990-1991	13.03	23.09	12.65
1995-1996	7.14	25.88	18.82
2000-2001	9.28	19.71	17.24
2005-2006	9.98	12.29	20.86
2010-2011	9.72	17.05	13.08
Average Growth rate	11.53	13.48	15.76

Source: author's computation based on EEA's data base

As it is presented in table 4.2 personal income tax, business profit tax and custom duties were growing at an average growth rate of 11.53, 13.48 and 15.76 percent per annum between 1974/75 and 2010/11. During the same period, gross tax revenue grew at an average annual rate of 14.64 percent (see figure 4.3). The annual growth rate of gross tax revenue had been declining sharply during the Derg regime (1974-1991). It declined from 39.54 percent in 1976/77 to -21.19 in 1991/92 and the average annual growth rate of the period was 6.87 percent per annum. The decline in the growth rate of gross tax revenue during this period was mainly attributed to the ineffectiveness of the economic and tax reform programs done by the military government in 1976, the presences of rampant corruption and the decline in tax morale of the population due to war monger government.

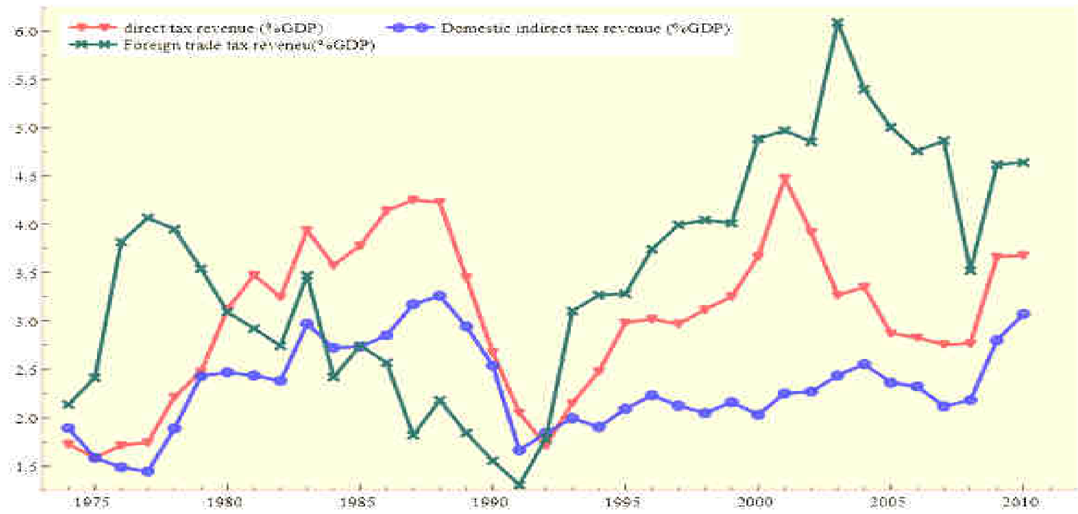

Figure 1. Trends of Direct, Domestic indirect and foreign trade tax revenue (% GDP) in Ethiopia (1974-2010)

Source: Author's computation based on National Bank of Ethiopia's data

Figure 1 shows that during the early stages of the Derg regime and after 1992 to 2010 the Ethiopian tax revenue has shown significantly more reliance on foreign trade taxes. Between 1975 and 1980 and after 1992 the share of foreign trade tax revenue to GDP dramatically exceeds the share of direct tax revenue and domestic indirect tax revenue. However, between 1980 and 1992 the share of foreign trade tax revenue had been continuously declining and dominated by direct tax revenue and even after 1985 by domestic indirect tax revenue. After 1991 up to 2004 foreign trade tax shows a continuous up swing, but between 2004 and 2008 it was shrinking. Moreover, Figure 1 shows that after 1985 till 1991 the performance of government in tax collection through direct, indirect and foreign trade tax was weakening. This down swings in resource mobilization through tax was probably attributed to the intensifications of domestic conflict to put down the then ruling party (Derg), non-buoyant macro-economic environment, shrink in the coverage of large taxpayers etc.

The relative decline in foreign trade tax revenue as a percentage of GDP during the Derg regime probably attributed to the fierce control over import licenses, foreign exchange and the huge tariff rate that hinders importers initiation during the period. For instance, in 1974, the NBE was not granting foreign exchange for the import of passenger cars with engine's over 1300 cc. In 1978, the granting of foreign exchange was forbidden for the importation of some food stuffs, alcoholic beverages, and other consumer goods. In the same period, the granting of foreign exchange was also denied for an additional 16 imported consumer goods. In 1987, granting of foreign exchange for importation of goods from South Africa was denied. In sum, in this period, there was a strict foreign exchange licensing system for private use.

After the fall of Derg in 1991, and the subsequent reforms on Ethiopia's trade regime the government reduced import tax and introduced new tax systems. The ad valorem tariff rates on import of raw materials, capital goods, pharmaceuticals and chemicals were ranging from 0-20 percent. It was reduced from the maximum tariff rate of 50 to 20 percent in this period. Similarly, the maximum tariff rates on import of durable and non-durable consumer goods which was 100 percent in the previous period were reduced to 50 percent. In the previous period, the maximum tariff rate was that on luxury goods imports, which were 230 percent, reduced to 80 percent in this period[1]. The decrease in the tariff rates and the relaxation of foreign exchange control undoubtedly result a magical increase in the share of foreign trade tax revenue to GDP in Ethiopia after 1992.

3. Methodology and Model specification

3.1 Data Source

In order to examine the stated objectives and to test the empirical validity of the hypotheses of the present study the required time serious data on total tax revenue, direct tax revenue, domestic indirect tax revenue, foreign trade tax revenue, GDP, Service value and industry value added, import, budget deficit and official development assistance domestic product, were collected from the central statistical authority of Ethiopia (CSA), Ministry of finance and economic development of Ethiopia (MOFED), from the African Development Indicators, various publications of the World Bank, IMF and national bank of Ethiopia for the period from 1974 to 2010.

In this study buoyancy of gross tax revenue is expressed as a linear-log function form (to capture the nonlinear relationship between the dependent variable and the independent variables) of the percentage share of service value added, import, budget deficit, industry value added and official development assistance to GDP.

Mid–point Buoyancy ($BGTR_t$) $=\frac{(\mathrm{GTR_t}-\mathrm{GTR_{t-1}})}{(\mathrm{GDP_t}+\mathrm{GDP_{t-1}})} \times \frac{(\mathrm{GDP_t}+\mathrm{GDP_{t-1}})}{(\mathrm{GTR_t}+\mathrm{GTR_{t-1}})}$ [1]

$where,$

$BGTR_t$- The actual buoyancies of gross tax revenue between two points of time i.e.'t' (current year) and period 't-1' (previous year)

GTR_t- Actual Gross tax revenue in year 't' (current year)

GTR_{t-1} - Actual gross tax revenue in year '$t-1$' (previous year)

GDP_t- Nominal Gross domestic product in year 't' (current year)

GDP_{t-1}- Nominal Gross Domestic product in $year$'$t-1$' (previous year)

The second step is the empirical model in which the calculated tax buoyancies for each period (BGTR) i.e., the dependent variable will be regressed over the number of explanatory variables stated in equation 2 below.

$$(\mathrm{BGTB})_t = \beta_0 + \beta_1 \log\left(\frac{\mathrm{Serv}}{\mathrm{GDP}}\right)_t + \beta_2 \log\left(\frac{\mathrm{IMP}}{\mathrm{GDP}}\right)_t + \beta_3 \log\left(\frac{\mathrm{BD}}{\mathrm{GDP}}\right)_t + \beta_4 \log\left(\frac{\mathrm{IND}}{\mathrm{GDP}}\right)_t + \beta_5 \log\left(\frac{\mathrm{ODA}}{\mathrm{GDP}}\right)_t + \varepsilon_t \quad [2]$$

Where: BGTB- is buoyancy of gross tax revenue derived from equation (6). $\log\left(\frac{\mathrm{Serv}}{\mathrm{GDP}}\right)$ Represents the percentage share of service value added to nominal GDP, $\log\left(\frac{\mathrm{IMP}}{\mathrm{GDP}}\right)$ is the percentage share of import to nominal GDP, $\log\left(\frac{\mathrm{BD}}{\mathrm{GDP}}\right)$ is the percentage share of overall government budget deficit to nominal GDP, $\log\left(\frac{\mathrm{IND}}{\mathrm{GDP}}\right)$ is the percentage share of industry value added to nominal GDP and $\log\left(\frac{\mathrm{ODA}}{\mathrm{GDP}}\right)$ is the percentage share of official development assistance to GDP. In dealing with tax responsiveness (buoyancy and elasticity) to get the actual dynamic tax effort (measured by buoyancy) magnitude scholars of the field advise to use nominal data instead of real data (Ariyo, 1997). β_0 - is the intercept and $\beta_1 \ldots = \beta_5$ are slope coefficients of respective variables. ε_t is the stochastic error term.

[1] See , Sewasew Pawlos,(2002), The Relationship Between Import And GDP Growth In Ethiopia: An Empirical Analysis, available at http://etd.aau.edu.et/dspace/bitstream/123456789/1011/1/SEWASEW%20PAWLOS.pdf

The Johansen Maximum Likelihood Approach

The Johansen (1988) procedure enables estimating and testing for the presence of more than one co-integrating vector. Moreover, it permits to estimate the model without priory restricting the variables as endogenous and exogenous. Under this procedure, the variables of the model are represented by a vector of potentially endogenous variables.

Defining a vector z_t of n potentially endogenous variables (in our six i.e., BGTR, log[$\frac{Serv}{GDP}$], log[$\frac{IMPo}{GDP}$], log[$\frac{BD}{GDP}$], log[$\frac{INDU}{GDP}$] and log[$\frac{ODA}{GDP}$]), it is possible to specify the following data-generating process (d.g.p.) and model z_t as an unrestricted vector autoregression (UVAR) involving up to k lags of z_t,:

$$z_t = A_1 Z_{t-1} + \cdots + A_k Z_{t-k} + U_t \qquad U_t \sim (0, \sigma) \qquad [3]$$

Where z_t is $(n \times 1)$ and each of A_i is an $(n \times n)$ matrix of parameters. This type of VAR model has been advocated mostly by Sim (1980) as a way to estimate dynamic relationships among jointly endogenous variables without imposing strong priori restrictions (such as particular structural relationships for the exogeniety of some of the variables). The system is in a reduced form with each variable in z_t regressed on only lagged values of both itself and all the other variables in the system. Thus, ordinary least-squares (OLS) is an efficient way to estimate each equation comprising [3] since the right-hand side of each equation in the system comprises a common set of (lagged and thus predetermined) regressors.

Equation [3] can be reformulated in to a vector error correction form (VECM)

$$\Delta z_t = \Gamma_1 \Delta z_{t-1} + \cdots + \Gamma_{k-1} \Delta z_{t-k+1} + \pi z_{t-k} + u_t \qquad [4]$$

Where $\Gamma_i = -(I - A_1 - \cdots - A_i), (i = 1 \ldots., k-1) and$

$$\pi = -(I - A_1 - \cdots - A_i)$$

This system contains information on both the short and long-run adjustment to changes in z_t, through the estimates of $\hat{\Gamma}_i$, and $\hat{\pi}$, respectively. The matrix, $\hat{\pi} = -\alpha\beta'$, where α represents the speed of adjustment to disequilibrium and β is a matrix of long-run coefficients such that the term $\beta' z_{t-k}$embedded in [4] represents up to (n - 1) cointegration relationships in the multivariate model, which ensures that z_t converge with their long-run steady state solutions.

Short Run Dynamic Modeling -Vector Error Correction Model (VECM)

Since the presence of cointegration between variables suggests a long term relationship among the variables under consideration the VEC model can be applied.

$$\Delta[BGTR]_t = \beta_0 + \sum_{i=1}^{p} \beta_{1i} \Delta[BGTR]_t + \sum_{i=0}^{p} \beta_{2i}\, \Delta[\log\left(\frac{\text{Serv}}{\text{GDP}}\right)_t + \sum_{i=0}^{p} \beta_{3i} \Delta[\log\left(\frac{\text{IMP}}{\text{GDP}}\right)_t] + \sum_{i=0}^{p} \beta_{4i} \Delta[\log\left(\frac{\text{BD}}{\text{GDP}}\right)_t] + \sum_{i=0}^{p} \beta_{5i} \Delta[\log\left(\frac{\text{IND}}{\text{GDP}}\right)_t] + \sum_{i=0}^{p} \beta_{6i} \Delta[\log\left(\frac{\text{ODA}}{\text{GDP}}\right)_t] - \delta ECM_{t-1} + \mu_t$$

Where P represents the lag length $\Delta -$ represents change and ECM_{t-1} denotes the error correcting term, δ-measures the speed of adjustment of short run deviations; β_0 is short run intercept and $\beta_{1i \ldots}$ β_{6i} (where the subscript i- indicates lags, i=0…=p) are respective short run slope coefficients.

To identify the number of cointegrating vectors in the system, the Lambda max (λ_{max}) and Lambda trace (λ_{trace}) statistics are used. They are obtained from the following formulas.

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{n} \ln(1 - \hat{\lambda}) \qquad [5]$$

$$\lambda_{max}(r, r+1) = -T \ln(1 - \hat{\lambda}) \qquad [6]$$

Where: r= 0, 1, and 2…n-1: where $\hat{\lambda}$ are estimated Eigen values obtained from estimated Π matrix. T = is the sample size.

λ_{max}Statistics tests the null hypothesis that there are 'r' cointegrating vectors against the alternative of 'r+1'. The trace statistics, on the other hand, tests the hypothesis of less than or equal to 'r' cointegrating vectors against the alternative of 'r+ 1’. The distributions of both test statistics follow Chi-square distributions (Enders, 1995).

The other important thing in the cointegration analysis is the issue of identifying endogenous and exogenous variables in the system. This is required because the Johansen procedure do not restrict the variables behavior a priori. If a variable is weakly exogenous, it implies that its error correction term (i.e., the corresponding α coefficient) does not enter in the error correction model. This implies that the dynamic equation for that variable contains no information concerning the long run relationship in the system. Hence, variables that are weekly exogenous should appear in the right hand side of the VECM. This restricts the exogenous variables to be contemporaneous with the dependent variable (Harris, 1995). The first step in the test is formulation of the null hypothesis which states that the variable is weakly exogenous against the general alternative. That is,

$H_0: \alpha_{ij} = 0$, for $j = 1, \ldots\ldots, r$ (r being the number of cointegrating vectors)

$H_0: \alpha_{ij} \neq 0$

The test (for weak exogeniety) is conducted using the following formula.

$$-2\log(Q) = T\sum_{i=1}^{r}\log\frac{(1-\lambda^{*}{}_{i})}{(1-\hat{\lambda}_{i})} \quad [7]$$

Where $Q = \frac{\text{(restricted maximum likelihood)}}{\text{(unrestricted maximum likelihood)}}$

T = the number of observations, r = the number of rank, and $\lambda^{*}{}_{i}$ and $\hat{\lambda}_{i}$ represents Eigen values for unrestricted and restricted models respectively. If the result obtained from the above formula is less than the Chi-squared distribution, then the null hypothesis will not be rejected. This implies that the variable is weakly exogenous[1].

4. Empirical Results and Discussions

4.1 Unit Root and Cointegration Tests

Table 1 shows that all variables are non-stationary at level since the computed ADF and PP t-value values are less than the critical values (in absolute terms) given both at 1% and 5% level of significances. This necessitates differencing the variables until it becomes stationary. Table 2 shows that all of the variables are stationary after first differencing as the computed ADF and PP t-values are greater than the critical values (in absolute terms) at both 1% and 5% level of significance. Thus, we conclude that all of our variables are integrated of order one or I (1) series.

Table 1 ADF and PP unit root test results at level

Variables	Test statistics			
	ADF Test		PP Test	
	Constant	Constant +Trend	Constant	Constant + Trend
$\log\left(\frac{\text{Serv}}{\text{GDP}}\right)$	-0.743	-2.965	-0.527	-3.044
	(0.821)	(0.156)	(0.873)	(0.135)
$\log\left(\frac{\text{IMP}}{\text{GDP}}\right)$	-1.237	-1.907	-1.237	-1.845
	(0.646)	(0.629)	(0.646)	(0.660)
$\log\left(\frac{\text{BD}}{\text{GDP}}\right)$	-2.723	-2.802	-2.604	-2.709
	(0.080)	(0.206)	(0.101)	(0.239)
$\log\left(\frac{\text{IND}}{\text{GDP}}\right)$	-2.487	-2.581	-1.6439	-1.796
	(0.127)	(0.290)	(0.450)	(0.684)
$\log\left(\frac{\text{ODA}}{\text{GDP}}\right)$	-1.404	-1.845	-1.405	-1.879
	(0.568)	(0.660)	(0.568)	(0.643)
Critical values:1%	3.632	-4.243	-3.632	-4.243
5%	-2.948	-3.544	-2.948	-3.544
10%	-2.612	-3.204	-2.612	-3.204

Values in the bracket are MacKinnon (1996) one-sided p-values and (D) represents first difference.

[1] See Richard Harris and Robert Sollis (2003), Applied Time series Modelling and Forecasting page 123

Table 2 ADF and PP unit root test results at first difference

Variables	Test statistics			
	Augmented Dickey Fuller Test		Philips –Parron Test	
	Constant	Constant +Trend	Constant	Constant +Trend
$D[\log\left(\frac{Serv}{GDP}\right)]$	-6.475 (0.000)	-6.365 (0.000)	-7.700 (0.000)	-7.501 (0.000)
$D[\log\left(\frac{IMP}{GDP}\right)]$	-6.489 (0.000)	-6.387 (0.000)	-6.489 (0.000)	-6.387 (0.000)
$D[\log\left(\frac{BD}{GDP}\right)]$	-7.939 (0.000)	-8.151 (0.000)	-8.166 (0.000)	-9.598 (0.000)
$D[\log\left(\frac{IND}{GDP}\right)]$	-4.485 (0.0011)	-4.447 (0.0062)	-4.441 (0.0012)	-4.395 (0.007)
$D[\log\left(\frac{ODA}{GDP}\right)]$	-6.078 (0.000)	-6.104 (0.0001)	-6.080 (0.000)	-6.111 (0.0001)
Critical values:1%	-3.639	-4.252	-3.639	-4.252
5%	-2.951	-3.548	-2.951	-3.548
10%	-2.614	-3.207	-2.614	-3.207

Values in the bracket are MacKinnon (1996) one-sided p-values and (D) represents first difference.

4.2 Estimation of the reduced form VAR and Test for cointegration

In order to perform the Johansen test for cointegration among the variables, the researcher first runs the VAR model to determine the appropriate lag length to be included in the cointegrating equation. Table 3 presents the general to specific lag reduction test.

Table 3 Model Reduction Test

Progress to date

Model	T	p		log-likelihood	SC	HQ	AIC
SYS(4)	**33**	**6**	**OLS**	**-27.755944**	**2.3179**	**2.1374**	**2.0458**
SYS(3)	**33**	**42**	**OLS**	**95.031891**	**-1.3094**	**-2.5732**	**-3.2141**
SYS(2)	**33**	**78**	**OLS**	**135.15210**	**0.073436**	**-2.2736**	**-3.4638**
SYS(1)	**33**	**114**	**OLS**	**183.40233**	**0.96355**	**-2.4667**	**-4.2062**

Tests of model reduction (please ensure models are nested for test validity)
SYS(3) --> SYS(4): F(36,94) = 11.726 [0.0000]**
SYS(2) --> SYS(3): F(36,68) = 1.4102 [0.1110]
SYS(1) --> SYS(2): F(72,54) = 1.2751 [0.1757]

**** denotes rejection of the null hypothesis at 1% level of significance and Values in the parentheses are F-statistics probability values**

The result from table 3 shows that the reduction from both lags 3 to lag 2 and from lag 2 to lag 1 is not rejected. That is, model reduction from SYS (1) --> SYS (2) and from SYS (2) --> SYS (3) is not rejected both at 1% level of significance. The result shows that both lags can be dropped without any loss of information. However, the restriction on lag 1 is rejected. Thus, the appropriate specification of our system is VAR of order 1. This result is also in line with SC and HQ lag length determination procedure.

Once we have determined the appropriate lag length, we do diagnostic tests on residuals of the model for any misspecification. The test result shows that the residuals are not auto correlated with Vector AR 1-2 test: F (72, 54) = 1.3423 [0.1294] and no problem of heteroskedasticity was observed as the Vector hetero test is Chi^2(252) = 254.42 [0.4455]. Hence we can safely proceed to testing for cointegration. Accordingly the Johansson cointegration test result is presented in Table 4 below.

Table 4 Johansson cointegration test result for the determinants of the Buoyancy of tax revenue equation

Rank	Trace test	Prob.	Max test	Prob.	Trace test	(T-nm)	Max test	(T-nm)
0	117.40	0.001**	57.31	0.000**	96.68	0.041*	47.19	0.004**
1	60.10	0.233	24.64	0.423	49.49	0.661	20.29	0.738
2	35.46	0.429	16.19	0.656	29.20	0.759	13.34	0.858
3	19.26	0.495	12.04	0.556	15.86	0.727	9.92	0.755
4	7.22	0.559	4.47	0.803	5.95	0.705	3.68	0.883
5	2.75	0.097	2.75	0.097	2.26	0.132	2.26	0.132

****, * denotes significance at 1%, and 5% level of significance.**

Table 5.8 shows that the presence of one cointegration vector in the system. The null of no cointegration vector (r≤ 0) is rejected by λ_{trace} and λ_{max} at 1% level of significance. On the other hand, the null that there exists at most one cointegrating vector (r≤ 1) was accepted. Since, the rank is equal to 1 which is more than zero and less than the number of variables; the series are cointegrating among the variables. Hence, we will proceed to estimate the VECM model. The cointegration test reports the eigen values, trace statistics, beta and alpha coefficients.

Hence the next process imposes a cointegration rank of 1 and produces the reduced beta coefficients from the reduced rank regression under the rank restriction. The standardized Beta and Alpha coefficients extracted from OxMetrics are presented in table 5 and table 6.

Table 5 Estimated Standardized Beta Coefficients

BGTR	$\log\left(\frac{Serv}{GDP}\right)$	$\log\left(\frac{IMP}{GDP}\right)$	$\log\left(\frac{BD}{GDP}\right)$	$\log\left(\frac{IND}{GDP}\right)$	$\log\left(\frac{ODA}{GDP}\right)$
1.0000	-38.833	-4.3256	-5.9382	-1.0213	6.5283
-0.2852	1.0000	0.17582	0.65217	-0.07175	-0.22912
-0.00885	1.7423	1.0000	1.0092	-5.4095	-0.69273
0.010722	-4.6974	-3.1423	1.0000	-3.9244	2.5792
-0.00109	-11.514	1.1992	1.4517	1.0000	1.2033
0.45117	67.06	-1.4151	-3.4746	-18.234	1.0000

Table 6 Estimated Alpha Coefficients

BGTR	-0.29923	2.6736	-0.059432	0.041198	-0.13436	0.010083
$\log\left(\frac{Serv}{GDP}\right)$	-0.0019738	-0.020893	0.016350	-0.0030570	0.012696	0.010083
$\log\left(\frac{IMP}{GDP}\right)$	0.0028367	-0.053716	0.097766	0.037232	-0.017105	0.010083
$\log\left(\frac{BD}{GDP}\right)$	-0.049780	-0.074489	0.011226	-0.032895	-0.081799	-0.0067545
$\log\left(\frac{IND}{GDP}\right)$	-0.0020856	-0.0055637	0.062379	-0.0081321	-0.011482	0.00056086
$\log\left(\frac{ODA}{GDP}\right)$	0.043970	0.028325	0.11770	0.0057159	-0.018100	-0.0058051

As the Johansen procedure only determines the number of stationary vectors that span the cointegration space, and any linear combination of stationary vectors is also stationary vector, the estimated β coefficients are not unique. As a result, once the cointegration rank is determined and the cointegrating relations are motivated based on our theory, we can impose a rank restriction in the cointegration space to obtain a unique relationship. In other words, it a procedure to determine the variable that is endogenously determined and the one that is conditional up on the other variables in the vector auto regressive (VAR). This is what we call a test for weak exogeniet. This test requires imposing zero restriction on the reduced form alpha coefficients presented in table 6. The results, using the likelihood ratio test, presented in the Table 7 confirm that only the dependent variable rejects the null at 1% level of significance while all the explanatory variables did not reject at 5% and 10 percent level of significance. Therefore, other than BGTR all the explanatory variables are exogenous to the system. In other words endogeneity is not a problem in our model.

Table 7: Weak Exogeniety Test (Test for Zero Restriction on $\boldsymbol{\alpha}$ Coefficients)

α coefficients	LR test of restrictions Chi^2(1)	Probability Value
BGTR	7.0421	[0.0080]**
$\log\left(\frac{Serv}{GDP}\right)$	0.46459	[0.4955]
$\log\left(\frac{IMP}{GDP}\right)$	0.066569	[0.7964]
$\log\left(\frac{BD}{GDP}\right)$	0.5064	[0.6110]
$\log\left(\frac{INDU}{GDP}\right)$	0.19012	[0.6628]
$\log\left(\frac{ODA}{GDP}\right)$	0.0814	[0.8971]

**** denotes rejection of the null at 1% level of significance**

Since the existence of a unique cointegrating vector is statistically supported in the Johansson cointegration test, only the first row of Beta (β) and the first column of Alpha (α) in Table 5 and 6 respectively are happen to be the relevant entries. The values of Alpha obtained from the cointegration result in table 6 show the speed of adjustment of the long run parameters towards the steady state and the deviation from long run equilibrium. Accordingly, the speed of adjustment coefficients ($\alpha's$) of service value added to GDP ratio, budget deficit to GDP ratio and industry value added to GDP ratio indicates that $\log\left(\frac{\text{Serv}}{\text{GDP}}\right), \log\left(\frac{\text{BD}}{\text{GDP}}\right)$ and $\log\left(\frac{\text{IND}}{\text{GDP}}\right)$ adjust to their long run equilibrium by 0.19, 4.9 and 0.21 percent respectively. However, the α coefficients of the share of import to GDP $\log\left(\frac{\text{IMP}}{\text{GDP}}\right)$ and the share of ODA to GDP $\log\left(\frac{\text{ODA}}{\text{GDP}}\right)$, are positive, which indicates the extent to which those variables deviate from their long run steady state path after a certain shock.

Once the rank of the VAR is determined the next procedure imposes zero restriction on each variable and estimates the reduced form cointegrating relationship without any of the variables alternatively. In other words, it is possible to test the importance of each variable by dropping them one by one (or imposing zero restrictions on beta coefficients) from the reduced form cointegrating vectors and testing the validity of these restrictions. This can also be considered as a hypothesis testing on the significance of the variables in the long run structural equation (Exclusion test). So the test generate is a likelihood ratio (LR) based test on the validity of the restriction. The test results in Table 8 show, the exclusion test or zero restrictions on $\log\left(\frac{\text{Serv}}{\text{GDP}}\right), \log\left(\frac{\text{IMP}}{\text{GDP}}\right), \log\left(\frac{\text{BD}}{\text{GDP}}\right)$, and $\log\left(\frac{\text{ODA}}{\text{GDP}}\right)$ are rejected implying that they are important variables spanning in the cointegration space. In terms of the long run structural relationship it means that they are significant variables in explaining Buoyancy of gross tax revenue. However, the coefficient of $\log\left(\frac{\text{IND}}{\text{GDP}}\right)$ was found insignificant to explain tax buoyancy individually in the long run.

Table 8 Exclusion Test
(Significance of long run Coefficients)

β coefficients	**LR test of restrictions Chi^2(1)**	**Probability Value**
BGTR	**4.6125**	**[0.0317]***
$\log\left(\frac{\text{Serv}}{\text{GDP}}\right)$	**14.996**	**[0.0001]****
$\log\left(\frac{\text{IMPO}}{\text{GDP}}\right)$	**8.0845**	**[0.0045]****
$\log\left(\frac{\text{BD}}{\text{GDP}}\right)$	**9.4549**	**[0.0021]****
$\log\left(\frac{\text{INDU}}{\text{GDP}}\right)$	**0.047488**	**[0.8275]**
$\log\left(\frac{\text{ODA}}{\text{GDP}}\right)$	**14.452**	**[0.0001]****

***, ** denotes rejection of the null hypothesis at 5% and 1% respectively (rejection of the null implies that the variable is statistically significant)**

The derived long run equation is therefore;

$$BGTR = 38.83\log\left(\frac{\text{Serv}}{\text{GDP}}\right) + 4.33\log\left(\frac{\text{IMPO}}{\text{GDP}}\right) + 5.94\log\left(\frac{\text{BD}}{\text{GDP}}\right) + 1.02\log\left(\frac{\text{INDU}}{\text{GDP}}\right) - 6.53\log\left(\frac{\text{ODA}}{\text{GDP}}\right)$$

[0.0001]** [0.0045] ** [0.0021] ** [0.8275] [0.0001] ** [8]

Other diagnostic tests for the long run equation indicate that serial correlation, normality and heteroskedasticity are not a problem to the model at any conventional level of significance. Hence equation [8] is reasonably acceptable. And the coefficients will have a percentage interpretation when they are divided by 100 as the equation is in level log form.

The results suggest that the share of the service sector value added to gross domestic product of the country has statistically positive significant effect on the buoyancy of gross tax revenue. Statistically speaking the VAR result in equation [8] predicts that a 1% increase/decrease in the percentage share of service value added to gross domestic product of the makes gross tax buoyancy to increase/decrease by 0.388 percent in the long run; other factors remain constant. This is mainly due to its positive effect on direct and indirect tax revenues. Several factors contribute to this result: Firstly, a large part of the service sector especially after 2002 has become VAT registered, which expands the number of tax payers through indirect tax, even though it doesn't attain its optimal customer .Secondly, tax exemption in the sector is relatively too limited, unlike in the case of agriculture and industry throughout the study period. Moreover, the cost of verification of actual income relatively (relative to agriculture) is low in the sector as it is mostly located in the urban areas at least in the long run.

log(IMPO/GDP) and log(BD/GDP) have also statistically significant positive impact on buoyancy of gross tax revenue at 1% level of significance. This result is in line with the initial hypothesis and the finding of others researchers such as Bhattacharya *et al*., (2009)[1] in Bangladesh.

The percentage share of import to GDP is positively significant due to the fact that trade related taxes are easier to impose, since the goods enter and leave the country at a specified location. The positive contribution of import tariff and import duties to the total tax revenue in developing countries is relatively large as compared to the contribution of direct tax revenue Addison (2010)[2]. The share of budget deficits to GDP has a positive effect on the buoyancy of gross tax revenue primarily due to the reason that during a period of high budget deficit frequent changes in the tax rates and fierce enforcement policies are always intensified. This will have a tendency to increase the responsiveness of gross tax revenue to the economic activities of the country (buoyancy) as panic of low budget to sustain routine government expenditures forced officials to look for new ways, new technique and new rules to raise tax revenue, other things remain constant. The coefficient on the percentage share of industry value added to GDP has the expected positive sign, but individually this variable is statistically insignificant. The insignificant effect of industry on buoyancy of gross tax revenue is not a surprise as industry in Ethiopia was at its nascent stage throughout the study period and hence its contribution to the gross tax revenue was minimal, which results a negligible impact on the buoyancy of gross tax revenue.

The other point that merits explanation is the effect of percentage share official development assistance to GDP on the buoyancy of gross tax revenue. The sign of this coefficient is as it was initially hypothesized, i.e., negative and significant. This result is congruent to the views of Gupta, Clements, *et.al* (2003) [3]. In developing countries, a higher level of ODA is generally associated with a lower tax effort, which exerts a down ward pressure on the buoyancy of gross tax revenue. Gupta *et.al* (2003*)*, from the data of 107 countries which benefited from ODA between 1970 and 2000, found that an increase in total ODA translates into a decline in fiscal receipts in the beneficiary country. Official development assistance as a percentage of Gross Domestic Product (GDP) is indicative of the level of dependence of the country on foreign assistance. A higher dependence should imply lower inclination towards mobilization of internal resources and hence low buoyancy of gross tax revenue.

4.3 Result of the VECM

From the short run dynamic equation for buoyancy of gross tax revenue function eliminating insignificant variables from the specification through the general to specific modeling strategy (based on lag/model reduction test in order to not to lose important variables), the parsimonious result that satisfy both theory and the classical regression assumptions are reported in table 9.

Table 9 Estimated Error Correction Model For $\Delta[BGTR]$
Method: Ordinary Least Square
Sample Period: 1977-2010 (adjusted for lags)

Variables	**Coefficients**
Constant	**0.124** **(0.345)**
$\Delta[\log\left(\frac{IMP}{GDP}\right)]$	**0.744*** **(0.330)**
$\Delta[\log\left(\frac{BD}{GDP}\right)]$	**0.413*** **(0.165)**
$\Delta[\log\left(\frac{ODA}{GDP}\right)]$	**-2.098*** **(0.693)**
ECM_{t-1}	**-0.487**** **(0.1941)**
R^2= 0.58	
F (4, 27) = 2.861 [0.043]*	
DW=2.09	
AR 1-2 test: F (2, 25) = 0.34233 [0.7134]).	

****, *denotes significance at 1% and 5% level of significance and value in the brackets are standard errors**

[1] Debapriya Bhattacharya, Md. Ashiq Iqbal and Towfiqul Islam Khan (2009) : Delivering On Budget Fy2009-10: A Set Of Implementation Issues: Center for policy dialogue (CPD), Bangladesh
[2]Tony Addison and Jörgen Levin: The Determinants of Tax Revenue in Sub-Saharan Africa
[3] Gupta, S., B. Clements, E. Baldacci and C. Mulas-Granados, „The Persistence of Fiscal Adjustments in Developing Countries‟ (2004) Applied Economics Letters 11, 209-12.

Our diagnostic test results for the above short run model shows that none of the classical assumptions are violated in statistical terms. The F- statistics rejects the null hypothesis that all the coefficients in the model are jointly insignificant (F (4, 27) = 2.861 [0.043]*). The test does not reject the null of white noise error term, suggesting no problem of error autocorrelation. In addition, the test for autoregressive conditional heteroskedasticity (ARCH) points that no ARCH structure in the error term is detected. Failure to reject the null of no ARCH indicates the existence of constant variance. The AR 1-2 test also tells us no information useful for predicting BGTR has been left in the residual(AR 1-2 test: F(2,25) = 0.34233 [0.7134]). Hence we have no omitted variable problem. So, estimated results are statistically viable.

The estimated VECM result indicates that in the short run the share of import value added and overall government budget deficit to GDP have positive and significant effect on the responsiveness of gross tax revenue to GDP (Buoyancy). This is in line with what we have seen while we discuss long run buoyancy coefficients i.e. import taxes are easier to impose and collect and government of developing countries usually relay heavily on import taxes and whenever they face shortage to finance expected expenditures with budget deficit, they increase their effort to collect more tax revenue, which exerts an upward pressure on the buoyancy of gross tax revenue. On the other hand, official development assistance as it was initially hypothesized has a negative effect on the buoyancy of gross tax revenue in the short run. This is primarily the fact that availability of alternative sources of fund will make government to relax its endeavor of mobilizing domestic revenue in the form of tax, which exerts downward pressure on the buoyancy of gross tax revenue.

The percentage share of service value added to GDP which had a substantial positive and significant impact on the buoyancy of gross tax revenue in the long run from our previous discussion is unable to span in our VECM. The enormous informal activities within the service sector, productive types of indirect taxes such as VAT being a recent phenomenon and the capacity of revenue authorities being limited in developing countries like Ethiopia to bring informal activities into the tax net at least in the short run might be the reason behind this melancholy result during the study period. Moreover, as the billing habit of both customers and business owners when transaction is carried out is limited, fraud and understatement of taxable income is a common phenomenon in this sector. Hence its effect on the Buoyancy of gross tax revenue in the short run, even though its contribution to GDP was high next to Agriculture, was negligible in the study period. The percentage share of industry value added to GDP which had individually positive but statistically insignificant effect on the long run responsiveness of gross tax revenue to GDP also found to have a negligible influence on the buoyancy of gross tax revenue in the short run too. This is essentially, due to the infancy of the sector in the country and the associated tax exemptions to encourage investors in the area.

The short run deviation adjustment term, ECM_{t-1} has the right sign and it is also statistically significant at 1% level of significance. It points out that about half (48.74 %) of the disequilibrium from the long run path will be corrected within one year.

5. Conclusions and policy recommendations

The present study furnishes empirical evidence on the determinants of the buoyancy of tax revenue in Ethiopia. The result from the Johansson cointegration approach shade light on the statistical relationship between buoyancy of gross tax revenue and a set of explanatory variables including service value added, industry value added, import, budget deficit and official development assistance as a percentage of GDP. The signs of the estimated coefficients are consistent with the expectations of theory.

Firstly, the share of the service sector value added to gross domestic product of the country has statistically positive significant effect on the buoyancy of gross tax revenue in the long run and negligible effect on the short run. Secondly, the coefficient on the percentage share of industry value added to GDP has the expected positive sign, but individually this variable was found statistically insignificant both in the short run and in the long run. Thirdly, the effect of import to GDP ratio on the buoyancy of gross tax revenue was positive and significant both in the short run and long run. This could be attributed to the substantial increase in the volume of import in the study period, removal of quantity restrictions and increase in the efficiency of custom authority to control revenue leakages (especially, after 1992) increases gross tax revenue directly and indirectly, which exerts an upward pressure on the buoyancy of gross tax revenue. Fourthly, the result reveal that the effect of the change in the overall budget deficit as share of gross domestic product of the country on the buoyancy of gross tax revenue was positive both in the short run and long run. This is primarily due to the need to finance routine government expenditures will force officials’ to increase their endeavor to collect more tax revenue when there is high budget deficit than when there is a fiscal balance or a surplus.

Last, the result elucidates that the more the country relies on foreign assistance for its development the lesser the responsiveness of gross tax revenue with respect to the change in overall economic activity over time, all else equal. A statistically significant negative coefficient on ODA (official development assistance as a percentage of GDP) entails a higher dependence should lead to a lower inclination towards mobilization of internal resources and a lower buoyancy of gross tax revenue.

To sum up, the existing persistent budget deficits in Ethiopia suggest that the tax system is not revenue productive, and in such situations increasing revenue should be the main objective of tax policy. The fact that tax-to-GDP ratio remained around 10 percent on average during the study period exhibits the need of pragmatic approach of policy makers to raise the tax revenue level.

References

[1] A. Smith:An Inquiry into the nature and causes of the Wealth of nations , ElectronicClassics Series, 2005

[2] A. Geda And A.Shimeles (2005):Taxes and Tax Reform In Ethiopia,1990-2003,United Nations University World Institute For Development Research (ResearchPaper No. 2005/65)

[3] Amin Abdella And John Clifford (2010):The Impact of Tax Reform On Private Sec-tor Development , Addis Ababa Chamber of Commerce and Sectoral Associations,

[4] Bahmani-Oskooee (1998): Cointegration Approach to Estimate the Long-Run Trade Elasticities in LDCs ,International Economic Journal ,Volume 12, Issue 3, 1998

[5] Begum Lutfunnahar (2007): A Panel Study on Tax Effort and Tax Buoyancy with Special Reference to Bangladesh. Working Paper Series: Research Department, Bangladesh Bank

[6] Bonga Wellington Garikai(2010):The Effect of Monetization on Tax Buoyancy: Ev-idence From COMESA, using a Panel Data Analysis, unpublished,

[7] Christopher Heady (2002): Tax Policy In Developing Countries: What Can Be Learned From OECD Experience? , prepared for presentation at the seminar Taxing

Perspectives: A Democratic Approach to Public Finance in Developing Countries,at the Institute of Development Studies, University of Sussex on 28-29 October 2002.

[8] David Ames Wells (1900): The Theory And Practice Of Taxation,D. Appleton and Company,1900

[9] Ethiopian Chamber of Commerce:Taxation in Ethiopia (Direct and Indirect Taxes - Categories of tax payers declaration of income and assessment of tax incentives),Addis Ababa 1/2005

[10] Farooq Rasheed(2006):An Analysis of The Tax Buoyancy Rates In Pakistan , vol.2 No. 3

[11] Fauzia Mukarram(2001): Elasticity and buoyancy of major taxes in Pakistan ,Pak-istan Economic and Social Review

[12] Gerald W. Scully (1991): Tax rates , tax revenues and economic growth ,National Center For Policy Analysis Policy Report No. 159 ,March 1991

[13] Gregory Mankiw(2003):Principles Of Macroeconomics ,Third Edition , South-western Cengage Learning , 2003 ,page 132 86

[14] Guiding Principles of Good Tax Policy: A Framework for Evaluating Tax Proposals Issued by the Tax Division of the American Institute of Certified Public Accountants (AICPA), Issued March 2001

[15] Ian T.G. Lambert (1992): Some Modern Principles of Taxation ,Adam Smith Revisited ,A paper delivered at the Third Annual Convention of the Congress of Political Economists in Rio de Janeiro, Brazil, in January ,1992

[16] Imran Sharif Chaudhry And FarzanaMunir (2010): Determinants Of Low Tax Revenue In Pakistan , Pakistan Journal Of Social Sciences (Pjss) Vol. 30, No. 2 (December 2010), Pp. 439-452

[17] Ithiel MunyaradziMavesere, W.Garikai Bonga (2011): Determinants Of Tax Buoy-ancy, Lambert Academic Publishing, 2011

[18] Ministry Of Finance and Economic Development of Ethiopia (MoFAED):Growth and Transformation Plan, 2010

[19] Ministry of Finance and Economic Development of Ethiopia (MoFAED: Annual Report, 2010

[20] Nehemiah E. Osorio (1993): Revenue Productivity Implications of Tax Reform In Tanzania , African Economic Research Consortium

[21] Pesaran, M. Hashem Shin, Y. Smith, R.J. (1999): Bounds Testing Approaches to the Analysis of Long-run Relationships, Cambridge Working Papers in Economics

[22] QasiMasood Ahmed and Sulaiman D. Mohammad(2010): Determinant of Tax Buoyancy: Empirical Evidence from Developing Countries , European Journal of Social Sciences, Vol. 13, No. 3, pp. 408-418, 2010

[23] Revenue Administration in Sub-Saharan Africa International Tax Dialogue Com-parative Information Series No 1/ 2010

[23] Ricardo Sabates and Aaron Schneider (2003:Taxation Perspective – Democratic Approach To Public Finance In Developing Countries, seminal report , institute of development studies ,2003

[24] Richard M. Bird , Jorge Martinez-Vazquez and BennoTorgler,Societal Institutions and Tax Effort in Developing Countries ,International Studies Program Public Fi-nance Conference,

[25] Richard M. Bird and Eric M. Zolt (2003): Introduction to tax policy design and development ,April 2003 87

[26] Richard Startz (2005): Partial Adjustment as Optimal Response in a Dynamic Brainard Model

[27] Teera J. M (2000):Tax Performance: A Comparative Study, University of Bath, Department of Economics,

[28] Tsegabrihan Weldegiorgis (2010): Domestic Resource Mobilization In Sub Saharan Africa

[2] Twerefou, Assibey Asmah(2010):Buoyancy And Elasticity Of Tax: Evidence From Ghana ,West African Journal Of Monetary And Economic Integration ,2010
[30] Upender, M (2008): Degree Of Tax Buoyancy In India: An Empirical Study, ,International Journal Of Applied Econometrics And Quantitative Studies,2008
[31] Vito TanziHowel H.zee (2000): Tax Policy For Emerging Markets ,developing coun-tries : IMF working paper, 2000
[32] William G. Gale and Benjamin H. Harris (2011), Reforming Taxes and Raising Revenue (Part of the Fiscal Solutio, Oxford Economic Review , Revised May 2011
[33] World Economic Outlook, Ethiopia in 2012, Country Note