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Analysis of Tax Buoyancy and Its Determinants in Ethiopia (Cointegration Approach)

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Abstract
Tax revenue in Ethiopia has been low throughout the study period (1974 to 2010). As a percentage of GDP it was below the average sub Saharan African countries. Since buoyancy reflect the ability of a tax structure to generate revenues during economic growth, in this study attempt was made to estimate the buoyancies of direct, domestic indirect, foreign trade and gross tax revenues in Ethiopia using annual data from 1974 to 2010. Double-logarithmic functions relating tax receipts to GDP were estimated for each of stated tax categories. The results reveal that gross, direct and domestic indirect tax revenues were non-buoyant both in short run and in the long run. Even though, foreign trade tax revenue was found non buoyant in the short run, it was buoyant in the long run. Moreover, factors that affect the buoyancy of gross tax revenue were also identified. The finding indicates that the share of service sector value added, import and over all government budget deficits to GDP affects positively, whereas the share of official development assistance to GDP affects it negatively. Even though the share of industry value added to GDP has positive effect on the buoyancy of gross tax revenue, statistically it was found insignificant. As the findings of the present study revealed, tax revenues are non-buoyant in Ethiopia, this points the need for enhancing the efficiency of revenue administration in bringing new customers in to the tax net.
Keywords: Taxation, Buoyancy of tax revenue, Cointegration

1. Introduction

The responsiveness of tax revenue to the change in the economic activity of the country is a crucial factor for the development of the country. This responsiveness, i.e. the percentage change in tax revenue due to the percentage change in the base, usually GDP is known as Buoyancy of tax revenue. Making a fiscal policy decision without having the knowledge of the magnitude of the percentage change of tax revenues with its base (buoyancy) will undermine or over exaggerate the expectation of policy makers about the capacity of the economy to generate revenue. This will result fiscal imbalance. As matter of fact, fiscal deficit is the core issue of most of the developing countries over the past several decades. The reason behind the large increase in fiscal imbalance is the rapid expansion in expenditure and low revenue collection (Ahmed *et al*, 2010). Recently all donor countries advise developing countries to concentrate on domestic revenue mobilization. The issues of tax revenue have a paramount role in inland resource augmentation in these countries.

In Ethiopia taxation was one of the largest sources of government budgetary resources throughout the study period. For example, in 2002 tax revenue constituted 59.6% of the total revenue. Relatively, the importance of non-tax revenue is also significant in sustaining the public budget, although its importance is much less than the role of taxation given that it's share over the same period was 28.2% of the total revenue. Capital revenue and foreign grants play a minimal role as they have averaged only 8.1 % and 4.1% of the total revenue respectively (CIA, 2002)[1].

The overall economic performance of Ethiopia , measured by growth in real GDP, between 2003/04-2010/11, registered an average annual growth rate of 11.4%. During the same period, the average growth rates in the value added of agricultural, industrial and service sectors were 10.2%, 10.8% and 12.8%, respectively. In recent years, the fiscal policy measures of the government focused on strengthening domestic revenue mobilization accordingly, tax revenue was 11.5% of GDP in 2010/11 relatively better than what it was in 2009/10 (11.3%). As a share of GDP, the total domestic revenue collection accounted for 13.5% which was lower than that of 2009/10 (14.1%)[2].This ratio is low compared to the ratio achieved by many developing countries in the world. For instance Botswana 35.2%, Djibouti 20.0 %, Kenya 18.4 %, etc. are some of the countries better equipped in tax to GDP ratio (Heritage Foundation, 2012)[3]. Altogether, however, here what matters is not only how high taxes are (revenue adequacy), but also how the tax level has been chosen, how the taxes are imposed, and from where the taxes were collected.

This is because how taxes are raised and spent shapes the legitimacy of governments by promoting their accountability to taxpaying citizens and by encouraging effective administration and good public financial

[1] http://www.nationsencyclopedia.com/Africa/Ethiopia-PUBLIC-FINANCE.html
[2] Ministry of finance and economic development annual report , 2010
[3] http://www.heritage.org/index/Ranking.aspx)

management (Mukarram, 2001)[1]. In this regard the concept of tax buoyancy is a crucial factor in assessing the effectiveness of a certain tax system. If the tax buoyancy exceeds unity there is no need to manipulate the tax rate frequently, as frequent and ad hoc changes in tax rates distort consumption and investment decisions thereby creating uncertainty. The application of many different taxes in different ways by different levels of government overly complicates the system (leading to increased compliance costs) and makes it very difficult to assess the competitive impact of specific taxes.

It is evidenced 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 (Ahmed, *et al*, 2010). For example, a study by Botlhole (2010) has an implication that 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.

Empirical analysis of the concept of the buoyancy of tax revenue is therefore a crucial factor in assessing the effectiveness of the prevailing tax system and for the designing of future tax policy. Accordingly, to improve tax revenue performance of the country first there is a need to know how much responsive the different tax categories are to the overall economic activity in the country, and what factors determine that magnitude. This is because the size of the tax cost for businesses matters for investment and growth. Where taxes are high, businesses are more inclined to opt out of the formal sector. Thus imposing high tax costs on businesses of small size might not add much to government tax revenue, but it might cause businesses to become informal or, in the worst case, to never exist at all.

Believing that a tax system is at the heart of effective state building and taxes that raised in the way that encourage economic growth and promote political accountability, as crucial for eventual exit strategy from aid dependency syndrome, the aim of this study is to analyze the buoyancy of the Ethiopian tax revenue and to figure out its determinants by estimating its numerical value for direct , domestic indirect ,foreign trade and the overall tax system and to examine the extent to which these indices are explaining tax revenue performance in terms of adequacy and resource allocation in the country.

2. Statement of the problem

Scholars in the field of public finance argue that an adequate noninflationary revenue mobilization effort is critical for the financing of government's social and economic expenditure obligations. Unfortunately, in Sub-Saharan Africa, the tax efforts in two thirds of the countries has been disappointingly low, with tax revenue as a percent of GDP at or below 15 percent; indeed, almost one third have ratios below 10 percent of GDP. Equally disturbing, many countries have witnessed a decline in their tax effort in recent years.

According to Alemayehu and Abebe (2005) in Ethiopia various efforts aimed at obtaining optimal fiscal policies with emphasis on the role of taxation as an instrument of economic development has been implemented. Although it is too early to draw firm conclusions, tax revenue as the share of GDP shows a rising trend. Notwithstanding this positive trend, the actual figure, which is about 10.86 per cent of GDP for the year 2000/01, is far below the corresponding figure for other developing countries. This modest result has made government financing of investments dependent on loans and grants (total revenue and grants for the same year were about 24 per cent). For the decade as a whole, the average shares of tax revenue, direct taxes, indirect taxes, taxes on international trade, non-tax revenue and total revenue and grants in GDP were 11.2, 3.8, 2.9, 4.3, 5.4 and 19.6 per cent, respectively. This is indicative of the low level of tax collection in the country[2]. Even the actual variations from time are marginally small. The question remains, why so little change? Two alternative explanations are possible. Either, somewhat improbably, 'supply' ('capacity') factors have altered over the period in such a way as to offset all attempts to raise tax ratios or, perhaps more plausibly, ideas as to what the 'proper' tax level should be have altered over time. In Ethiopia, no real consensus on the 'right balance' appears yet to have been achieved. In this regard the issue of tax buoyancy has a profound implication both at a micro and a macro level. Optimal tax theories expect buoyancy rates to be high and significant. Even though, Understanding the magnitude of the instantaneous growth of tax revenue and figuring out the determinant of that magnitudes (magnitude of tax buoyancy) is the key issue to examine which sector is relatively generating high tax revenue and which sector needs a subsidy for sustainable growth of the economy earlier works on tax focused only in the areas of tax reform without taking elasticity concept in to account.

Even Studies conducted so far on the determinants of buoyancy of tax revenue for developed and developing countries were focusing on using panel data methodology, yet country wise study through time series

[1] Fauzia Mukarram (2001): Elasticity and Buoyancy of Major Taxes In Pakistan, Pakistan Economic and Social Review, Volume XXXIX, No. 1 (Summer 2001), pp. 75-86

[2] Ministry Of Finance And Economic Development annual report ,2010

method is rare in the literature. Taking this fact in to account this paper tried to estimate and analyze buoyancy of direct, domestic indirect, foreign trade and gross tax revenues in Ethiopia. Moreover, a part from the estimation, enquiry on the determinants of the buoyancy of gross tax revenue in Ethiopia was conducted .This is because according to the researcher's knowledge there is no single full fledge study in this area so far. Hence, the present study will fill the gap in the literature and address this issue in-depth by considering relevant control variables and time series econometric methodology. The study attempts to examine the determinants of buoyancy of gross tax revenue, paying particular attention on the effect of the percentage share of the service value added, industry value added, import, and official development assistance to GDP on buoyancy of gross tax revenue. Accordingly, this study will produce empirical evidence to address the following questions in line with the research objectives:

- Are buoyancy indexes of direct, domestic indirect, foreign trade and gross tax revenues of the Ethiopian economy buoyant both in short run and in the long run?
- What is the implication of buoyant tax revenue?
- Is there any deviation in tax revenues from its respective long run equilibrium? If yes, how fast these deviations are corrected/ adjusted per annum?
- What are the factors that determine the buoyancy of gross tax revenue in the country?

3. Objectives of the study

The main objective of this study is to estimate the short run and long run buoyancies of direct, domestic indirect, foreign trade and gross tax revenues and to figure out the factors that determine buoyancy of gross tax revenue in Ethiopia. While addressing this broad objective the researcher will explore the following Specific objectives:

- To estimate the short run and long run buoyancies of direct , domestic indirect , foreign trade and gross tax revenue in Ethiopia
- To analyze the speed of adjustment of short run tax revenue deviations from respective long run equilibrium values and their implication.
- To investigate the determinants of the responsiveness of gross tax revenue in the country.
- To examine the speed of adjustment of short run deviations of direct, domestic indirect, foreign trade and gross tax revenues with respect to their long run equilibrium.
- To examine the extent to which tax revenue indexes are explaining tax revenue performance in terms of adequacy and resource allocation in the country.

4. Hypotheses of the study

Keeping the objectives of the present study in view and based on empirical literature on tax buoyancy the empirical strength of the following hypothesis will also be examined.

- Buoyancies of both Direct, Domestic indirect and gross tax revenue in Ethiopia are non-buoyant both in the short run and in the long run.
- Tax revenue from foreign trade is more buoyant than domestic indirect and direct tax revenues both in the short run and in the long run.
- Domestic indirect tax revenue is expected to correct its deviation from its long run equilibrium faster than direct tax revenue and foreign trade tax revenues. Moreover, both (i.e., direct, domestic indirect, foreign trade and gross tax revenues) expected to have slow speed of adjustment (below 50%) towards their respective long run equilibrium.
- The percentage share of service and industry value added, import, and budget deficit as the share of GDP expected to have a positive effect on the buoyancy of gross tax revenue both in the short run and in the long run.
- Official development assistance as a percentage of GDP expected to have a negative impact on the buoyancy of gross tax revenue both in the short run and in the long run.

These hypotheses will be tested by determining the significance of the regression coefficients of relevant regression equation that will be estimated based on Engel Granger two step cointegration and the Johansson maximum likelihood method.

5. Data Source, Model Specification and Methodology

5.1 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.

5.2 Theoretical Model Specification

Chelliah (1971)[1] postulates that tax effort should be considered in the dynamic sense of comparing changes in the tax ratio over time, so that if a country has a low tax effort at a particular point in time, one may tell whether it has made efforts over a period of time to increase tax revenues. He viewed tax effort as a process, which takes several forms, including reform of existing taxes, improvement in administration, and introduction of new taxes, all of which require time to plan, legislate, and implement. For this reason a country, which started out with a low tax ratio, might have undertaken considerable effort to raise its tax ratio but may not yet have reached even the average level of taxes in developing countries. This therefore, according to him, calls for the necessity to compare income elasticity of total taxes. The income buoyancy of tax revenue provides information on the past efforts made to increase tax revenue.

Hence estimation of short run and long runt tax revenue functions requires introduction of some dynamic concepts since policy changes especially in public finance needs time to adjust or take effect. The long run nonlinear tax revenue function can be specified as follows:

$$TR_t^{LR} = \beta_o GDP_t^{\beta_1} \qquad [1]$$

Where:

TR^{LR} - Represents long run actual tax revenue and $\beta_o \; and \; \beta_1$ are intercept and buoyancy coefficients respectively, the subscript t indicate time.

GDP– represents nominal gross domestic product (nominal GDP is taken as a base to get responsiveness of actual tax collection to the economy)

For the estimating purpose this function has to be transformed in to the following log linear form:

$$\mathrm{L}\,TR_t^{LR} = \mathrm{L}\,\beta_0 + \beta_1 \mathrm{L}\,GDP_t \qquad [2]$$

Where, $\mathrm{L}\,TR_t^{LR}$ represents the logarithm of long run or desired actual tax revenue and $\mathrm{L}\,GDP$ is the logarithm of gross domestic product and β0 and β1 are long run intercept and slope coefficients respectively.

Since the long run or the desired tax revenue (TR_t^{LR}) is not observable, this function should be estimated through the partial adjustment model[2]. The partial model is:

$$\left[\frac{TR_t}{TR_{t-1}}\right] = \left[\frac{TR_t^{LR}}{TR_{t-1}}\right]^{\delta} \qquad [3]$$

Where: TR_t is Actual tax revenue in the current period, TR_{t-1} is actual tax revenue in the previous period and δ is the partial speed of adjustment between desired and actual tax revenue, whose value will be less than or equal to unity and more than zero (($0 < \delta \leq 1$). If it is less than one then the actual change in tax revenue will be lower than the desired change in tax revenue. If it is equal to one, then actual change will be equal to desired change.

The logic behind the relationship in equation (3) is because of technological rigidities', habit, inertia, a dynamic business environment, and resource and institutional constraints it is not always possible for revenue and custom authorities to adjust the actual volume of tax collection to its desired level.

For the purpose of estimation, the above model will be transformed in to log linear as follows:

By substituting equation (2) in the partial adjustment mechanism we get,

$$\log TR_t = \delta[\beta_0 + \beta_1 \mathrm{L}\,GDP_t - \mathrm{L}\,TR_{t-1}] + \mathrm{L}\,TR_{t-1}$$

$$\mathrm{L}\,TR_t = \beta_o{}^{SR} + \beta_1{}^{SR}\,\mathrm{L}\,GDP_t + \beta_2{}^{SR}\,\mathrm{L}\,TR_{t-1} \qquad [4]$$

Where, $\delta\beta_0 = \beta_o{}^{SR}$, short run intercept

$\delta\beta_1 = \beta_1{}^{SR}$, short run buoyancy coefficient

$1 - \delta = \beta_2{}^{SR}$, $\delta = 1 - \beta_2{}^{SR}$ and the super script SR represents short run.

The derivative of $\mathrm{L}\,TR_t$ with respect to $\mathrm{L}\,GDP_t$ is the short run estimate of tax buoyancy and the long run tax buoyancy is to be estimated by deflating the short run tax buoyancy by the coefficient of partial adjustment δ. Accordingly, if the degree of tax buoyancy is more than unity, then the growth rate of tax revenue will be relatively greater than growth rate of the economy (GDP). If the tax buoyancy is less than unity, then the growth rate of tax revenue will be relatively smaller than the growth rate of GDP. If the degree of tax buoyancy is unity, then the growth rate of tax revenue and GDP will go smoothly.

As it is described from the above explanation the responsiveness of actual gross tax revenue to the change in nominal GDP is referred to as the buoyancy of gross tax revenue. Hence tax buoyancy can be estimated between two points of time or over the period of time. But for the purpose of next part (to formulate the determinants of

[1]Chelliah, R.J. (1971), "Trends in Taxation in Developing Countries", IMF Staff Papers, Vol. 18, No. 2, July, pp. 254-325.

[2] In the literature this is known as Nerlovian partial adjustment model coined after Marc Nerlove (1956)

buoyancy of actual gross tax revenue equation) following the procedures employed by M. Upender, (2003) and Ankita Gupta (2009), Buoyancy of gross tax revenue between two points of time ($BGTR$) can be estimated as follows:

$$\mathrm{BGTR_t} = \left(\frac{\mathrm{GTR_t - GTR_{t-1}}}{GTR_{t-1}}\right) / \left(\frac{\mathrm{GDP_t - GDP_{t-1}}}{\mathrm{GDP_{t-1}}}\right) \quad [5]$$

Since the above estimate is at a point it might be biased towards one, so that a mid-point buoyancy estimation technique was employed in order to calculate the annual buoyancy of actual gross tax revenue (BGTR) as follow:

$$\text{Mid–point Buoyancy } (BGTR_t) = \frac{(\mathrm{GTR_t - GTR_{t-1}})}{(\mathrm{GDP_t + GDP_{t-1}})} \times \frac{(\mathrm{GDP_t + GDP_{t-1}})}{(\mathrm{GTR_t + GTR_{t-1}})} \quad [6]$$

$where,$

$BGTR_t$= 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 (8) below.

5.3 Empirical Model Specification

The theoretical model we have discussed so far shade light on how and why we should incorporate dynamism in public finance in general and tax policy in particular. However, direct estimation of equation [4] will automatically lead to a huge serial correlation problem. Hence in empirical works the time series nature of the data and the associated statistical problems should be taken in to consideration. Accordingly, to estimate the short run and long run buoyancies of direct, domestic indirect, foreign trade and gross tax revenues model [7] is formulated and the method of estimations are presented in the methodology part.

$$\log TR_{kt} = \beta_{ko} + \beta_{k1} \log GDP_t + \varepsilon_{kt} \quad [7]$$

Where $\log TR_{kt}$ − Is the logarithm of tax revenue (the subscript k denotes, direct tax revenue, domestic indirect tax revenue, foreign trade tax revenue and gross tax revenue hence the coefficients $[\beta_{ko}]$ is the intercepts of direct , domestic indirect , foreign trade and gross tax revenues and the slope coefficient $[\beta_{k1}]$ is the buoyancies of direct, domestic indirect , foreign trade and gross tax revenues and $\log GDP_t$ represents the common base i.e., the logarithm of nominal gross domestic product which is considered as a representative figure for the overall actual economic activities in the country. Finally $[\varepsilon_{kt}]$ is the stochastic error term for each of the four equations (equations of direct tax revenue, domestic indirect tax revenue, foreign trade tax and gross tax revenue)

In order to figure out the determinants of the buoyancy of gross tax revenue after calculating the buoyancies of tax revenue (i.e., buoyancy of gross tax revenue for each period) in equation [6] in the second step the researcher use these tax buoyancies $[BGTR_t]$ as a dependent variable and regressed it over the various explanatory variables discussed below.

In this study buoyancy of gross tax revenue is expressed as a linear function of the growth of the percentage share of service, import budget deficit, industry value added and official development assistance to GDP. In equation form it can be stated as follows:

$$\mathrm{BGTB_t} = \beta_0 + \beta_1 \mathrm{LSGDP_t} + \beta_2 \mathrm{LIMGDP_t} + \beta_3 \mathrm{LBDGDP_t} + \beta_4 \mathrm{LINDGDP_t} + \beta_5 \mathrm{LODAGDP_t} + \varepsilon_t \quad [8]$$

Where: BGTB - is buoyancy of gross tax revenue derived from equation $\mathrm{LSGDP_t}$ −represent the percentage share of service value added to nominal GDP, $\mathrm{LIMGDP_t}$ is the percentage share of import to nominal GDP, $\mathrm{LBDGDP_t}$ is the percentage share of overall government budget deficit to nominal GDP, and $\mathrm{LINDGDP_t}$ is the percentage share of industry value added to nominal GDP. $\mathrm{LODAGDP_t}$ is the percentage share of official development assistance to nominal 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.

Table 1 Description of explanatory variables

Independent variables	Description of Variables
LSGDP	The variable will capture the actual effect of the increase in the value added in the service sector to GDP on tax revenue collection. In case of many of the developing countries the service sector comprises huge informal sectors with a high degree of tax evasion and tax avoidance, which results a lower contribution to the gross tax revenue at least in the short run. However in the long run as institutional capacities expand and when government endeavor increase to bring new customers in to the tax net, the sector will yield promising tax revenue than other sectors such as agriculture and industry. Therefore, the researcher expects a positive and significant coefficient in the long run.
LBDGDP	The variable will capture the impact of budget deficit on tax collection. Budget deficit is the key issue for most developing countries and due to high budget deficit their borrowing increases. Different international agencies like international monetary fund (IMF), World Bank (WB) and other lending agencies have imposed different conditionality to reduce budget deficit. Due to these conditionality the developing countries compelled to increase their tax revenue collection (Ahmed, *et al*., 2010) so expected sign of this variable is positive.
LINDGDP	This variable will show the effects of growth in manufacturing sector on the tax revenue generating ability of Ethiopia. Increase in growth of manufacturing sector cause increase the revenue through sales tax, excise duty and corporate income tax etc. The expected sign of this variable is positive.
LODAGDP	This variable will capture the impact of reliance on foreign assistance for development on domestic revenue mobilization through tax. According to A. Rosser (2006)[1], States which are financed by natural resources, aid or other income not raised through the political effort of persuading their citizens to pay taxes, may be less likely to develop effective and democratic institutions. S. Gupta et al. (2003)[2] also asserts that if aid does undermine 'tax effort' it may also undermine public expenditure accountability, leading to the possibility of irresponsible spending by governments, further diminishing incentives to raise domestic revenues. Therefore since the increases in foreign resource inflow make government of developing countries to relax their effort towards mobilizing internal sources, the sign of this variable's coefficient is expected to be negative.
LIMGDP	The variables will capture the effects of growth in import sector on tax revenue. In most of under developing countries the contribution of import sector is very significant in collection of tax revenue through import duties, tariff etc. Hence, the expected sign of this variable is positive.

6. Result and discussion

6.1 Unit Root Tests

A crucial property of any economic variable influencing the behavior of statistics in econometric models is the extent to which that variable is stationary. Hence both augmented Dickey fuller (ADF) and Phillips Paron (PP) unit root tests were used to check the order of integration of variables. The number of lagged differences p is chosen to ensure that the estimated errors are not serially correlated in the ADF test.

The null hypothesis is H_0: β =0; rejection of this hypothesis implies that $\Delta Y_t \ is \ I(0)$

$$\Delta Y_t = \beta Y_{t-1} + \sum_{i=1}^{n} \gamma_i \Delta Y_{t-1} + u_t \quad (8)$$

$$\Delta Y_t = \alpha + \beta Y_{t-1} + \sum_{i=1}^{n} \gamma_i \Delta Y_{t-1} + u_t \quad (9)$$

$$\Delta Y_t = \alpha + \mu t + \beta Y_{t-1} + \sum_{i=1}^{n} \gamma_i \Delta Y_{t-1} + u_t \quad (10)$$

If the autoregressive has a root on the unit circle, then conventional distributional results are not applicable to coefficient estimates. Once the test has been computed the next step is deduce the level of integration of variables. If they are not I (0) then we should check for the first difference.

[1] A. Rosser (2006): The Political Economy of the Resource Curse: A Literature Survey: IDS Working Paper.
[2] S. Gupta et al. (2003): Foreign aid and revenue response: does the composition of aid matter? IMF Working Paper No. 03/176; L. Gambaro et al (2007): Does Aid Decrease Tax Revenue in Developing Countries?

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

Variables	Test statistics			
	Augmented Dickey Fuller Test		Philips Paron Test	
	Constant	Constant +Trend	Constant	Constant +trend
LSGDP	-0.743 (0.821)	-2.965 (0.156)	-0.527 (0.873)	-3.044 (0.135)
LIMPGDP	-1.237 (0.646)	-1.907 (0.629)	-1.237 (0.646)	-1.845 (0.660)
LBDGDP	-2.723 (0.080)	-2.802 (0.206)	-2.604 (0.101)	-2.709 (0.239)
LINGDP	-2.487 (0.127)	-2.581 (0.290)	-1.6439 (0.450)	-1.796 (0.684)
LODAGDP	-1.404 (0.568)	-1.845 (0.660)	-1.405 (0.568)	-1.879 (0.643)
Critical values:1% 5% 10%	3.632 -2.948 -2.612	-4.243 -3.544 -3.204	-3.632 -2.948 -2.612	-4.243 -3.544 -3.204
LGTR	2.173 (0.999)	0.594 (0.999)	2.173 (0.999)	0.594 (0.999)
LDTR	0.276 (0.973)	-1.782 (0.691)	0.931 (0.994)	-0.792 (0.957)
LDITR	2.543 (1.000)	0.846 (0.999)	2.297 (0.999)	0.846 (0.999)
LFTTR	1.099 (0.996)	-0.639 (0.970)	0.978 (0.995)	-0.794 (0.9568)
LGDP	3.783630 (1.00)	1.151 (0.9999)	8.024 (1.00)	0.985 (0.999)
Critical values:1% 5% 10%	-3.626 -2.945 -2.611	-4.234 -3.540 -3.202	-3.626 -2.945 -2.611	-4.234 -3.540 -3.202

Values in the bracket are MacKinnon (1996) one-sided p-values

Table 2[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 term) given both at 1% and 5% level of significances. This necessitates differencing the variables until it becomes stationary.

[1] The null hypothesis β=0, when β = δ-1. A number of things should be noted here; firstly, both critical values are negative. When we conduct normal t-testing, the critical values are both positive and negative, and this is because the normal t-test is a two-tailed test: We allow as the alternative hypothesis that our coefficient can be both positively and negatively significant different from zero. Here, however, because we do not consider the explosive option (and because the explosive option is also non-stationary), then we only consider as our alternative hypothesis that β < 0, since this corresponds to β < 1, the stationary case. Hence our test is one-tailed, and so our critical values are negative. If our t-test statistic is less than t- critical we will reject our test at the given percent (1%, 5% and 10) level of significance: We will say that there is less than that much % support for the null hypothesis of a unit root.

Table 3 ADF and PP unit root test results at first difference

Variables	Test statistics			
	Augmented Dickey Fuller Test		Philips Paron Test	
	Constant	Constant +Trend	Constant	Constant +trend
DLSGDP	-6.475 (0.000)	-6.365 (0.000)	-7.700 (0.000)	-7.501 (0.000)
DLIMPGDP	-6.489 (0.000)	-6.387 (0.000)	-6.489 (0.000)	-6.387 (0.000)
DLBDGDP	-7.939 (0.000)	-8.151 (0.000)	-8.166 (0.000)	-9.598 (0.000)
DLINDGDP	-4.485 (0.0011)	-4.447 (0.0062)	-4.441 (0.0012)	-4.395 (0.007)
DLODAGDP	-6.078 (0.000)	-6.104 (0.0001)	-6.080 (0.000)	-6.111 (0.0001)
Critical values:1% 5% 10%	-3.639 -2.951 -2.614	-4.252 -3.548 -3.207	-3.639 -2.951 -2.614	-4.252 -3.548 -3.207
DLGTR	-3.816 (0.0063)	-4.111 (0.013)	-3.823 (0.0062)	-4.111 (0.013)
DLDTR	-3.027 (0.042)	-3.091 (0.123)	-3.027 (0.042)	-3.135 (0.114)
DLDITR	-4.145 (0.0026)	-4.480 (0.0055)	-4.145 (0.0026)	-4.501 (0.0053)
DLFTTR	-4.744 (0.0005)	-4.990 (0.0015)	-4.727 (0.0005)	-4.968 (0.0016)
DLGDP	-4.671332 (0.0006)	-6.4663 (0.0000)	-4.581653 (0.0008)	-5.96493 (0.0001)

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

Table 3 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 the five variables stated above are integrated of order one or I (1) series. As the two step cointegration test proposed by Engel and Granger (1987) required we need to estimate the LDTR, LDITR, LFTTR and LGTR regression equations using OLS technique and test the stationarity of associated residuals. Using the adjusted critical values from Neil R. Ericsson and James G. MacKinnon (2002) at 1%, 5% and 10% the test statistics are bigger in absolute value terms than the critical values. This implies that the residuals generated from the four different equations (direct, domestic indirect, foreign trade and gross tax revenue) are stationary and do not have a unit root. Hence we conclude that these variables have a cointegration with respect to explanatory variable. So once the presence of cointegration is checked the next task is to estimate the long run coefficients and then to estimate the short run models (Error correction models) in sequence.

6.2 Estimated long run buoyancy coefficients

Table 4 Estimated long run buoyancy results
Method: Ordinary Least Square (OLS)
Sample period: 1974-2010

Dependent variables	Explanatory variables	coefficient	Stand. error	t-value
LDTR	Constant	-0.84	1.389	-0.607
	LGDP	0.67**	0.156	4.33
	Trend	0.04*	0.015	2.71
	R^2=0.95 ,F(2,34) = 356.9 [0.000]**			
LDITR	Constant	-3.35**	1.102	-3.04
	LGDP	0.94**	0.123	7.61
	Trends	0.01	0.0119	0.840
	R^2=0.96 ,F(2,34) = 519.3 [0.000]**			
LFTTR	Constant	-5.096	1.790	-2.85
	LGDP	1.15**	0.201	5.72
	Trend	0.0046	0.0194	0.238
	R^2= 0.93 ,F(2,34) = 259.1 [0.000]**			
LGTR	constant	-1.690	0.998	-1.69
	LGDP	0.890 **	0.112	7.94
	Trend	0.022 *	0.010	2.07
	R^2= 0.97 ,F(2,34)=726.9[0.000]**			

Where LDTR, LDITR, LFTTR and LGTR represent the natural logarithm of direct tax revenue, domestic indirect tax revenue foreign trade tax revenue and gross tax revenue **, * denotes significance at 1% and 5% level of significance respectively and values in the parentheses are F-statistics p-values

Table 4 presents the results obtained from the regression output using OLS method in the Engel-Granger two step cointegration procedures. The results of the long run coefficients from the log linear tax revenue functions shows that only foreign trade tax revenues was found buoyant in the long run. Whereas direct tax revenue, domestic indirect tax revenue and gross tax revenues were not buoyant in the long run. This implies that in the study period only foreign trade tax revenue was well responding to the change in the overall economic activities of the nation (measured by GDP).

6.3 Estimated short run buoyancy coefficients

Table 5 Estimated Short Run Buoyancy Coefficients
Method: Ordinary Least square (OLS)
Sample Period: 1974-2010

Dependent Variables	Independent variable	Coefficients	Stand. Error	t-value
DLGTR	Constant	0.06	0.04240	1.52 [0.139]
	DLGDP	0.646*	0.2957	2.18 [0.036]
	ECMt-1	-0.503*	0.2080	-2.42 [0.021]
DLDTR	DLGDP	0.872***	0.5049	1.73 [0.094]
	ECMt-1	-0.468***	0.2442	-1.92 [0.064]
DLDITR	DLGDP	0.784**	0.1577	4.98 [0.000]
	ECMt-1	-0.382*	0.1775	-2.15 [0.03]
D LFTTR	DLGDP	0.936**	0.2961	3.16 [0.00]
	ECMt-1	-0.310***	0.1681	-1.85 [0.074]

***, *, *** denotes significance at 1%, 5% and 10% level of significance respectively and values in the parentheses are t-probabilities. D denotes first deference's.*

Table 5 shows that a unit increase or decrease in GDP result foreign trade tax revenue to increase or decrease by 1.15%, all else equal. Similarly the buoyancy coefficients of direct ,domestic indirect and gross tax revenues shows that a unit increase or decrease in GDP result direct , domestic indirect and gross tax revenues to increase or decrease by 0.67, 0.94 and 0.89 percent respectively, all else equal in the study period.

6.4 Determinants of the Buoyancy of Gross Tax Revenue Equation

The next section presents the determinant of the buoyancy of gross tax revenue using Johanson maximum likelihood approach. The null of no cointegration vector ($r \leq 0$) is rejected by λ_{trace} and λ_{max} at 1% level of significance. The cointegration test reports the eigen values, trace statistics, beta and alpha coefficients.

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. This is what we call a test for weak exogeniety[1]. This test requires imposing zero restriction on the reduced form alpha coefficients.

Table 6 Weak Exogeniety Test (Test for Zero Restriction on α Coefficients)

α coefficients	LR test of restriction Chi^2(1)	Probability Value
BGTR	7.0421	[0.0080]**
LSGDP	0.46459	[0.4955]
LIMGDP	0.066569	[0.7964]
LBDGDP	3.5064	[0.0611]
LINDGDP	0.19012	[0.6628]
LODAGDP	10.081	[0.097]

*** denotes rejection of the null at 1% level of significance (rejection of the null Implies that the variable is endogenous)*

The results, using the likelihood ratio test, presented in the Table 6 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.

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 is called exclusion test. So the test generate is a likelihood ratio (LR) based test on the validity of the restriction.

Table 7 Exclusion Test (Significance of long run Coefficients)

β coefficients	LR test of restrictions Chi^2(1)	Probability Value
BGTR	4.6125	[0.0317]*
LSGDP	14.996	[0.0001]**
LIMPGDP	8.0845	[0.0045]**
LBDGDP	9.4549	[0.0021]**
LINDGDP	0.047488	[0.8275]
LODAGDP	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 long run results presented in table7 shows that all explanatory variables, except LINDGDP, are significantly different from zero. Moreover, the result rejects the null hypothesis that the coefficients are jointly insignificant at 5% level of significance.

Other diagnostic tests for the long run results indicate that serial correlation, normality and heteroskedasticity are not a problem to the model at any conventional level of significance. 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 to gross domestic product of the country has statistically positive significant effect on the buoyancy of gross tax revenue. Statistically speaking the VAR result predicts that a 1 percent increase or decrease in the percentage share of service value added to gross domestic product of the country increase or decrease gross tax buoyancy 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 become a VAT registered, which expands the number of tax payers through indirect tax, even though it doesn't attain its optimal customer as buoyancy

[1] To test for weak exogeniety in the system as a whole requires a test of the hypothesis that $H: a_{ij} = 0 \; for \; j = 1 \ldots r$ (i.e., row i contains zeros). These tests conducted in PcGive 10.1 and OxMetrics 6.1 by placing row restrictions on a to give a new restricted model and then using a likelihood ratio test involving the restricted and unrestricted models to ascertain whether the restrictions are valid.

index estimated earlier in our model for indirect tax revenue indicated a less than unity value. Secondly, tax exemption in the sector is relatively too limited, unlike in the case of agriculture and industry. The cost of verification of actual income relatively (relative to agriculture) is low in the sector as it is mostly located in the urban area at least in the long run.

The percentage share of import value added 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)[1]. This is the actual fact that we observed earlier when we estimate the buoyancy coefficient of foreign trade tax revenue. It was more buoyant both in the short run and in the long run than direct and domestic indirect tax revenues.

The share of budget deficits to GDP has a positive effect on the buoyancy of gross tax revenue primarily due to during the period of high budget deficit frequent change in the tax rate and fierce enforcement policies are always high. This will have a tendency to increase the responsiveness of gross tax revenue to the economic activities of the country as panic forced officials to look for new way to raise 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)[2]. In developing countries, a higher level of ODA is generally associated with a lower tax effort. 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.

6.5 Short run dynamic modeling - Vector Error Correction Model (VECM)

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

Table 8 Estimated vector Error Correction Model DBGRT
Method: Ordinary Least Square
Sample Period: 1977-2010 (adjusted for lags)

Variables	Coefficients
Constant	0.124 (0.345)
DLIMGDP	0.744* (0.330)
DLBDGDP	0.413* (0.165)
DLODAGDP	-2.098* (0.693)
ECM_{t-1}	-0.487** (0.1941)
F (4, 27) = 2.861 [0.043]* 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*

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. 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 has a positive and significant effect on the responsiveness of gross tax revenue to GDP (Buoyancy). 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 due to the fact that availability of alternative sources of fund will make governments to relax their endeavor of mobilizing domestic revenue in the form of tax. The percentage share of service value added to GDP which had a substantial positive and significant impact on the buoyancy of gross tax in the long run from our previous discussion is unable to span in our VECM. The enormous informal activities with in the service sector, productive types of indirect taxes such

[1]Tony Addison and Jörgen Levin: The Determinants of Tax Revenue in Sub-Saharan Africa
[2] 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.

as VAT being a recent phenomenon and the capacity of revenue authorities being limited in developing countries like Ethiopia to bring informal activities in to tax net might be the reason behind this 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 also. 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 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 in one year.

6. Conclusion and policy recommendation

The focus of the study was to examine Ethiopia's tax system performance in terms of its responsiveness to the overall economic activity. Accordingly, four tax revenue equations (direct, domestic indirect, foreign trade and gross tax revenues) were identified in the first section of the study to estimate the respective buoyancy indexes. In the second part determinant factors of the buoyancy of gross tax revenue were identified.

The findings of the present study show that gross tax receipt grows at a slightly lower rate than GDP both in the short run and in the long run. Moreover gross tax revenue adjusts its deviation from the long run equilibrium with a moderate speed of adjustment, about half of the disequilibrium adjusted per annum. Moreover, both direct, domestic indirect, foreign trade taxes were found non buoyant in the short run. While long run results indicate only foreign trade tax revenue was buoyant. Regarding the speed of adjustment parameter of short run deviations, the speed is well pronounced for direct taxes than in the case of domestic indirect taxes and foreign trade taxes. In both cases the speed of adjustments were a bit sluggish only about 46, 38 and 31 percent of the deviations from the long run equilibrium values of direct, domestic indirect and foreign trade tax revenues were adjusted within one year. 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, industry, 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. 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 10.9 percent on average during the study period exhibits the need of pragmatic approach of policy makers to raise the tax revenue level. Hence, based on the findings of the present study the next section presents policy recommendations. The low coefficients obtained through the sensitivity (buoyancy) analysis are an indicator of the role of pragmatic measures to maintain a sustainable source of tax revenue. Broadening the tax base and bringing new tax payers in to tax net, eliminating tax exemptions'[1], creating economic environment that increases revenue and decreases overall budget deficit and foreign reliance are the timely fiscal policy issues that the study would like to remind concerned bodies based on the implications of the analyses. The targeted GTP and MDGs could be achieved only with rigorous efforts of fiscal authorities to improve the overall tax system as well as revenue administration.

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