The Influence of Agricultural Sector in improving the overall-tax Revenue Performance of Ethiopia

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Abstract

Agriculture is one of the essential sectors in many developing economies contributing to labor force employment, GDP, and foreign exchange earnings. It contributes a significant share to the economic growth of these countries. Economic growth and rural development in developing countries require substantial financial resources for infrastructure, education, health and other social services. The sector is the primary locus of poverty; however, it needs a policy environment which facilitates growth and development. One of the financing resources to meet the developmental needs can be collected in the form of taxation. In this respect, the sub-Saharan African countries face a challenge to improve the tax collection. The study applied the Auto Regressive Distributed Lag (ARDL) econometric model approach for the cointegration analysis, to examine the responsiveness of tax revenue to the sectoral GDP performance and public expenditure. The study examined the responsiveness of the tax revenue to the broad sectors of the economy, which include the Agriculture sector, the Industry sector, and Services and components of the government public expenditure. The evidence also indicates that the dominance of the agricultural sector acts as the impediment to tax revenue performance. Conversely, service sector and industrial sector growth are positively associated with the tax revenue performance.

1. Introduction

Agriculture is one of the important sectors in many developing economies contributing to labor force employment, GDP, and foreign exchange earnings. It contributes a significant share to the economic growth of these countries. Economic growth and rural development in developing countries require substantial financial resources for infrastructure, education, health and other social services. The sector is the primary locus of poverty; however, it needs a policy environment which facilitates growth and development. One of the financing resources to meet the developmental needs can be collected in the form of taxation. In this respect, the sub-Saharan African countries face a challenge to improve the tax collection(S. Gupta & Tareq, 2008).

The structure of the economy is a major factor in a country's ability to collect taxes. For example, countries that are heavily dependent on agriculture tend to be under-developed usually with low productivity smallholder farms. Agricultural incomes may be one of the keys to factors in improving Ethiopia's tax revenue performance.

Domestic tax revenues are one of the sources of financing for public expenditure in developing countries (Allen, 1998; Evans, 2001; S. Gupta & Tareq, 2008). The tax revenue generated can be used to finance expenditures such as irrigation, agricultural research, and extension, reforestation, health, and education. A well-functioning public financing system is required to back up the sources of this expenditure. It needs a good tax system and proper administration of taxes. S. Gupta, Clements, and Inchauste (2004) report that challenges facing developing countries in implementing efficient tax regimes are large informal sectors, lack of reliable data that allow for effective monitoring and analysis, low tax morale, ineffective tax administrations, and powerful high-income groups that preclude the introduction of more equitable taxes.

We analyze the influence of agricultural sector in improving the overall- tax revenue performance of Ethiopia. Therefore the research seeks to investigate the following specific question:

Does the agricultural sector tax revenue matters in determining the overall- tax revenue performance of Ethiopia?

2. Literature Review

The literature on tax revenue performance has emphasized two major thoughts which are the structural factors and the institutional factors which may determine the tax efforts. The structural factors may include the composition of economic activity, and the Institutional factors include the government policies and political economy constraints. As noted by different scholars the structural factors that influence a tax effort include the share of agriculture GDP, per capita income, trade openness and the level of dependence on aid (Clist & Morrissey, 2011; Hisali & Ddumba-Ssentamu, 2013; Mahdavi, 2008; Thornton, 2014). Also the shares of direct and indirect taxes considered as another factor that influences the tax effort (A. Gupta, 2007). Bird, Martinez-Vazquez, and Torgler (2008) list three institutional factors that impact the effort and efficiency of tax collection. These are Government quality, policies, and corruptions.

Some studies find a negative correlation between the share of agriculture GDP and tax revenue performance (A. Gupta, 2007; Pessino & Fenochietto, 2010; Teera & Hudson, 2004). Countries that dependent on agriculture are potentially difficult to tax the sector due to smallholder and subsistence in nature. Furthermore, according to the research by Bird et al. (2008), due to political rather than economic reasons, some countries may exempt a significant share of agricultural activities from taxes, and this affects the tax revenue performance. As the level of the economy, development changed it is expected that there will be a positive influence in tax revenue performance.

Some literature has studied the evolution of tax revenue with the level of economic development (Tanzi, 1992). Moreover, according to Wagner's law, economic development is associated with an increased demand for public expenditure(Hettich & Winer, 1988)

Following Burgess and Stern (1993) found that the three other crucial economic determinants of the share of tax revenue over GDP: the share of agriculture in GDP, the openness of the economy as a rate of GDP and the debt obligation/GDP proportion. A country's economic structure is one of the primary components that may impact the level of tax assessment since a few segments of the economy are less demanding to charge than others. For developing nations, the share of agriculture is anticipated to be adversely identified with the level of tax revenue (Tanzi, 1992).

This is because small farmers are notoriously difficult to tax, and a significant share of agriculture is usually subsistence. Also, it may not produce high taxable surpluses, as many countries are unwilling to tax the main foods that are used for subsistence (Stotsky & WoldeMariam, 1997). On the other side, since many public-sector activities are largely city oriented, the most agricultural a country is, the less it will have to spend for governmental activities and services. Hence, as the share of agriculture over GDP rises, the need for total public spending and so for tax revenue may fall.

The structure of the economy is a major factor in a country's ability to collect taxes. For example, countries that are heavily dependent on agriculture tend to be under-developed usually with low productivity smallholder farms. Agricultural incomes may be one of the keys to factors in improving Ethiopia's tax revenue performance.

3. Methodology

3.1 Data Source and Variables

The paper utilizes yearly data from several sources, spanning a 34-year period, from 1981 to 2014. Data on tax revenue, GDP for agricultural, Industrial and Service sector sectoral composition, consumer price index, the development expenditure and the recurrent expenditure were obtained from the Ministry of Finance, monetary and trade data was obtained from the Central Bank of Ethiopia. But aid data were obtained from the WDI data base. The data that we utilize are the following:

LTAXGDP is the natural logarithm of total tax revenues divided by GDP (expressed as a percentage),

LAGRIC is the natural logarithm of agricultural output,

LIND is the natural logarithm of industrial output, and

LSERVE is the natural logarithm of output in the services sector.

LINFSEC is the proxy for the size of the informal or shadow economy expressed as the natural logarithm of the percentage of currency outside banks (COB) in broad money (M2).

LDEV is the natural logarithm of the ratio of development expenditure to GDP (expressed as a percentage). Development expenditures, as opposed to recurrent expenditures, are non-consumptive.

LCUR is the natural logarithm of the ratio of recurrent expenditures to GDP (expressed as a percentage).

LCPI is the natural logarithm of consumer price index.

LOPEN is the natural logarithm of the ratio of the sum of exports and imports to GDP (expressed as a percentage) and finally

AIDGDP is total aid grants that include direct budget support, project aid and HIPC assistance expressed as a ratio of GDP,

3.2 Analysis Procedure

Following Mawejje and Francis (2016) and Narayan and Narayan (2006), the model includes the reduced form model which arising from the analytical framework, and it takes the form:

$TAXGDP_t = f(F_t, N_t, G_t)$ but since $F_t = (A_t, I_t, S_t)$ As a result of the basic model that we will use to estimate takes the form:

$$TAXGDP_t = f(Ag_t, In_t, Se_t, N_t, Ge_t) \qquad (1)$$

We will adopt the Auto Regressive Distributed Lag (ARDL) econometric model approach to for the cointegration analysis, to examine the responsiveness of tax revenue to the three sectoral GDP performance and public expenditure. Therefore, we will examine the responsiveness of the tax revenue to the broad sectors of the economy which include the Agriculture sector, the Industry sector, and Services and components of the government public expenditure.

The ARDL model we utilize in this study considers lags to every variable. Furthermore, the regressors take the following

$$\Delta taxgdp_t = \alpha_0 + \sum_{i=1}^{k} \alpha_{1i} \Delta taxgdp_{t-i} + \sum_{j=1}^{n} \sum_{i=1}^{k} \alpha_{2ji} \Delta x_{jt-i} + \alpha_3 \, taxgdp_{t-1} + \sum_{i=1}^{n} \alpha_{4i} \, x_{it-1} + \varepsilon_t \qquad (2)$$

Where:

$Taxgdp_t$ = Represents tax-GDP ratio, a measure of tax revenue performance

x_t = Represents a vector of variables that explain changes in taxgdpt

ε_t = Represents a white noise error term

The ARDL bounds testing procedure will be used because it has more advantage than other cointegration methods. This method is mainly considered on the Wald or the joint F-statistic for the parameters whose joint significance implies a valid long-run relationship among variables. So, the importance of the joint F-statistic implies cointegration.

The sectoral composition of an economy may have a significant impact on tax capacity and, hence, on tax revenues. Quite a bit of these examination was qualitative in nature, and they underlined the potential implications of the between different economic sectoral linkages. In many developing countries, the agricultural sector was subject to heavy taxation. For example, before the agricultural reforms in 1979, Chinese agriculture sector was under substantial tax burden, and the revenues were used to subsidize urban and industrial development (Yao, 2000).

4. Results and Discussion

An agricultural development strategy can be evaluated by its ability to promote overall economic growth, the capacity to bring about structural transformation and its positive interaction with the other economic sectors.

Like in many other developing countries, Ethiopian agriculture continues to make the greatest contribution to the GDP although it has played a limited role as an engine of economic growth.

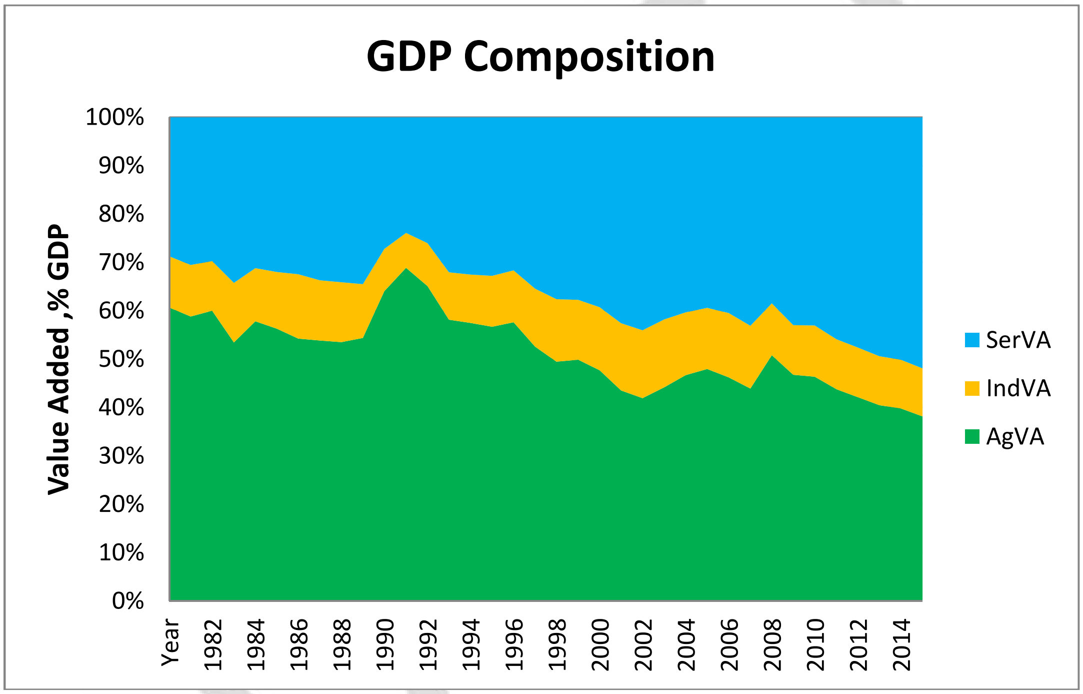

Figure 1: Sector GDP composition
Data Source: MOFED

Looking at Fig. 1 the patterns of the sectors in their contribution to GDP growth the agricultural sector decreases its dominance.

Inspection of the graphical presentation of the data is the first step in any time series econometric analysis in order to understand the features of the data such as forms of the trend, the direction of the trend, structural breaks, and stationarity. The graphical presentation of the data in natural log form for the variables of the aggregate import demand function is presented in Fig. 2.

Figure 2: Variables in levels:

Source: MOFED

Fig 2 shows that the variables have a different pattern on the stationarity. Indeed, the variables lnAgVA, lnIndVA, lnSerVA, lnRDevExp, lnshaM2 and lnTaidGDP have unit root or non-stationary in levels. On the other hand, Fig. 2 causes concerns about the presence of outliers and structural changes. Also, there is no strong visual evidence for the occurrence of an order of integration higher than one.

The figure shows that the main variables, namely the real development expenditure (lnRDevExp), the real recurrent expenditure (lnRRecExp), the real consumer price index (InCPI) and the real service sector value added (lnSerVA), exhibit a linear distinct upward and deterministic trend in pattern; while the real assistance and aid expressed as a ratio of GDP (lnTaidGDP) shows a linear and slightly upward trend with little explosive behavior. However, the InAgVA shows a minor downward break, and the lnIndVA shows a slight upward break. The visual inspections indicate that the variables are non-stationary. There are several tests for stationarity such as graphical analysis, the correlogram test, and the unit root test.

Table 1: Variable Definitions & Descriptive Statistics

Variable	Definition	Descriptive Statistics				
		Obs	Mean	Std. Dev.	Min	Max
lnTAXGDP	Natural logarithm of total tax revenues divided by GDP	36	-2.16375	0.183602	-2.633988	-1.840958
lnAgVA	The natural logarithm of agricultural output	36	3.954148	0.122412	3.735315	4.232366
lnInVA	The natural logarithm of industrial output	36	2.416558	0.150277	1.971271	2.643174
lnSVA	The natural logarithm of output in the services sector	36	3.583151	0.169237	3.17556	3.800371
lnSE	The proxy for the size of the informal or shadow economy expressed as the natural logarithm of the percentage of currency outside banks	36	3.349977	0.27441	2.734429	3.754689
lnDE	The natural logarithm of the ratio of development expenditure to GDP	36	8.723581	1.597147	6.838405	11.86452
lnRE	Natural logarithm of the ratio of recurrent expenditures to GDP	36	9.146583	1.174018	7.712444	11.55267
lnCPI	The natural logarithm of the consumer price index.	36	4.347606	0.686749	3.308351	5.694035
lnGE	General government total expenditure	36	2.965928	0.168272	2.62271	3.288887
lnTAID	Total aid grants that include direct budget support, project aid and HIPC assistance expressed as a ratio of GDP	30	1.096634	0.405031	0.1823216	1.824549

Source: Author’s calculation

Auto regressive-Distributed Lag is shown to provide a valuable vehicle for testing for the presence of long-run relationships between economic time-series. In its basic form, an ARDL regression model looks like this:

$$y_t = \beta_0 + \beta_1 y_{t-1} + \cdots + \beta_p y_{t-p} + \alpha_0 x_{t-1} + \alpha_2 x_{t-2} + \cdots \alpha_q x_{t-q} + \varepsilon_t$$

Where ε_t is a random "disturbance" term.

The model is "autoregressive," in the sense that y_t is "explained (in part) by lagged values of itself. It also has a "distributed lag" component, in the form of successive lags of the "x" explanatory variable. Sometimes, the current value of x_t itself is excluded from the distributed lag part of the model's structure.

Let's describe the model above as being one that is ARDL (p,q), for obvious reasons.

Given the presence of lagged values of the dependent variable as regressors, OLS estimation of an ARDL model will yield *biased* coefficient estimates. If the disturbance term, ε_t, is autocorrelated, the OLS will also be an *inconsistent* estimator, and in this case, Instrumental Variables estimation was generally used in applications of this model.

The ARDL Cointegration Approach

An ARDL model is a general dynamic specification, which uses the lags of the dependent variable and the lagged and contemporaneous values of the independent variables, through which the short-run effects can be directly estimated, and the long-run equilibrium relationship can be indirectly estimated. Although ARDL modeling has been in use for a long time, (Pesaran, Shin, & Smith, 1999, 2001)introduced the bounds test for cointegration that can be employed within an ARDL specification. This method has definite advantages in contrast to other cointegration procedures. First, all other techniques require that the variables in the model be integrated of the same order, whereas the approach developed by Pesaran et al. could be employed regardless of whether the underlying variables are I(0), I(1) or fractionally integrated. Thus, the bounds test eliminates the uncertainty associated with pre-testing the order of integration. Secondly, it can be used in small sample sizes, whereas the Engle-Granger and the Johansen procedures are not reliable for relatively small samples.

Many past studies have used the Johansen cointegration technique to determine the long-term relationships between variables of interest. In fact, this remains the technique of choice for many researchers who argue that this is the most accurate method to apply for I(1) variables. Recently, however, a series of studies by Shin and Pesaran (1996); Pesaran et al. (2001) Pesaran et al. (2001) have introduced an alternative cointegration technique known as the ‘Autoregressive Distributed Lag (ARDL)’ bound test. This technique has some advantages over Johansen cointegration techniques.

First, the ARDL model is the more statistically considerable approach to determine the cointegration relation in small samples, while the Johansen co-integration techniques require large data samples for validity.

A second advantage of the ARDL approach is that while other cointegration techniques require all of the regressors to be integrated of the same order; the ARDL approach can be applied whether the regressors are I(1) and I(0). This means that the ARDL approach avoids the pre-testing problems associated with standard cointegration, which requires that the variables be already classified into I(1) or I(0) (Pessaran et al., 2001).

If we are not sure about the unit root properties of the data, then applying the ARDL procedure is the more appropriate model for empirical work. As Bahmani- Oskooee (2004:485) explains, the first step in any cointegration technique is to determine the degree of integration of each variable in the model, but this depends on which unit root test one uses and different unit root tests could lead to contradictory results. For example, applying conventional unit root tests such as the Augmented Dickey-Fuller and the Phillips-Perron tests, one may incorrectly conclude that a unit root is present in a series that is stationary around a one-time structural break (Perron, 1989; 1997) The ARDL approach is useful because it avoids these problems.

This method is found to be appealing because it applies to a set of time series even if series are I(1) and I(0). In other words, the ARDL method was shown to work regardless of the order of integration the time series under consideration.

Yet another difficulty of the Johansen cointegration technique which the ARDL approach avoids concerns the large number of choices which must be made: including decisions such as the number of endogenous and exogenous variables (if any) to be included, the treatment of deterministic elements, as well as the order of VAR and the optimal number of lags to be used. The estimation procedures are very sensitive to the method used to make these choices and decisions (Pesaran and Smith 1998). Finally, with the ARDL approach, it is possible that different variables have different optimal numbers of lags, while in Johansen-type models this is not permitted.

However, Loayza et al. (2000) pointed out the possibility that some explanatory variables, such as GDP per capita, may be endogenous to investment. In this situation, our estimated coefficients may be biased. However, the estimates obtained from the ARDL approach to cointegration are unbiased and efficient since they avoid the problems that may arise due to serial correlation and endogeneity (Pesaran et al. 2001).

The ARDL model testing procedure starts with conducting the bounds test for the null hypothesis of no cointegration. The calculated F-statistic is compared with the critical value tabulated by Pesaran et al. (2001). However, given the relatively small sample size in this study (31 observations), the present study adopts the critical values of Narayan (2005) for the bounds F test rather than Pesaran et al. (2001) since it is more appropriate for small sample size. If the F-test statistic exceeds the upper critical value, the null hypothesis of no long-run relationship can be rejected regardless of whether the underlying orders of integration of the variables are I(0) or I(1). Similarly, if the F-test statistic falls below the lower critical value, the null hypothesis is not rejected. However, if the sample F-test statistic falls between these two bounds, the result is inconclusive.

Unit Roots Tests

In this section, a preliminary analysis is made of the statistical properties of the series. Fig. 2 allows a visual inspection of the variables' behavior.

To add a robust testing of the statistical characteristics of the series to the guarantee of robustness, three different unit root tests were used to assess the integration order of the series: (i) the Augmented Dickey-Fuller (ADF) test; (ii) the Phillips-Perron (PP) test; and (iii) the Kwiatkowski Phillips Schmidt Shin (KPSS) test. In the ADF test, the Schwartz information criterion with a maximum of 12 lags was used, to test the null hypothesis of a unit root. The same null hypothesis of a unit root was tested in the PP test, where the Bartlett kernel spectral estimation method and Newey-West Bandwidth were used. Unlike the latter, the KPSS tests the null hypothesis of stationarity, and it was performed with the Bartlett kernel spectral estimation method and Newey-West Bandwidth. Table 2 shows the results of the tests, both for variables in levels and first differences.

Table 2: Unit Roots Tests

	Levels		
	ADF	PP	KPSS
NlnTAXGDP	-3.931(9)[a]	-2.637(2)[a]	.118[a]
lnAgVA	-1.310(9)	-5.185(9)	.265
lnIndVA	-2.006(2)	-7.093(9)	.291
lnSerVA	-0.692(5)	-3.385(8)	.218
lnRDevExp	2.003(5)	2.311(12)	.656
lnRRecExp	0.230(2)	1.583(2)	.410
lnshaM2	-1.787(8)	-3.703(11)	.727
lnCPI	-0.407(6)	-0.773(12)	.132
lnTaidGDP	-0.868(2)	-9.989(12)	.219
First Differences			

lnAgVA	-3.958(2)[a]	-27.506(9)[a]	.0604 [a]
lnIndVA	-4.281(1)[a]	-22.043(9)[a]	.0701 [a]
lnSerVA	-5.010(2)[a]	-23.621(8)[a]	.0433 [a]
lnRDevExp	-4.251(1)[a]	-26.257(12)[a]	.028 [a]
lnRRecExp	-3.181(1)a	-25.131(2)[a]	.0757 [a]
lnshaM2	-3.118(2)[b]	-42.579(11)[a]	.0407 [a]
lnCPI	-3.894(1)[a]	-24.059(12)[a]	.0682 [a]
lnTaidGDP	-6.025(1)[a]	-31.193(12)[a]	.0262 [a]

All variables in natural logs, lag lengths are determined via SIC and are in parentheses. Superscripts a, b, and c indicate significance at 1, 5, and 10% respectively. The null of all tests except KPSS are unit roots. KPSS null hypothesis is stationarity.

As per Table 2 much as expected, the variables lnAgVA, lnIndVA,lnSerVA,lnRDevExp, lnshaM2 , and lnTaidGDP have a unit root and, therefore they are I (1). In turn, the variable NlnTAXGDP appears stationary in levels, i.e., I (0). Overall, sometimes the unit root tests and the stationarity test are globally inconclusive, suggesting that some variables could be on the borderline of I (0)/I (1). Given that the variables are integrated of an order larger than one, then the ARDL bounds test approach could be pursued.

As per the result is given in Appendix A1 ARDL with restricted constant and maximum lag length (of both dependent and regressor variables) set to 2. According to AIC criterion, the best possible model is ARDL (1, 0, 0, 1, 2, 0, 0). One of the first statistics to look at is how well the data are to the regression line. High $R2$= 85.53% suggests that the most of variation in the dependent variable is explained by the variation in regressors.

The results of the test diagnostics of this model are given in Table 3. Moreover, the results of a few diagnostic tests in Tables 19 indicate that there is no error autocorrelation and conditional heteroskedasticity, the functional form is also acceptable, and errors are normally distributed. Second, the F-statistics suggests us that taken together, all variables are considered as a significantly different from zero. Thirdly, LM test for serial correlation of residuals claims as the null hypothesis that there is no serial correlation among residuals. P-value of a test result is 0.724, and it is bigger than F-statistics. That is why we cannot reject the null hypothesis of LM test, and we conclude that based on our evidence, residuals are not serially correlated.

Table 3:Serial Correlation & Heteroskedasticity Test (Breusch-Godfrey Serial Correlation LM Test)

F-statistic	0.327989	Prob. F(2,21)	0.724
Obs*R-squared	1.029889	Prob. Chi-Square(2)	0.5975
Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	0.603521	Prob. F(10,23)	0.7948
Obs*R-squared	7.067186	Prob. Chi-Square(10)	0.7191
Scaled explained SS	2.20679	Prob. Chi-Square(10)	0.9945

Source: Author's calculation

Lastly, in Fig 3, the Jarque-Berra test shows that residuals are normally distributed. This test claims under the null hypothesis that residuals have skewness and kurtosis matching a normal distribution. The p-value of the test indicates it is far larger even than 1% significance level. That is the reason why one cannot reject the null hypothesis. Finally, we conclude that our model has normally distributed residuals.

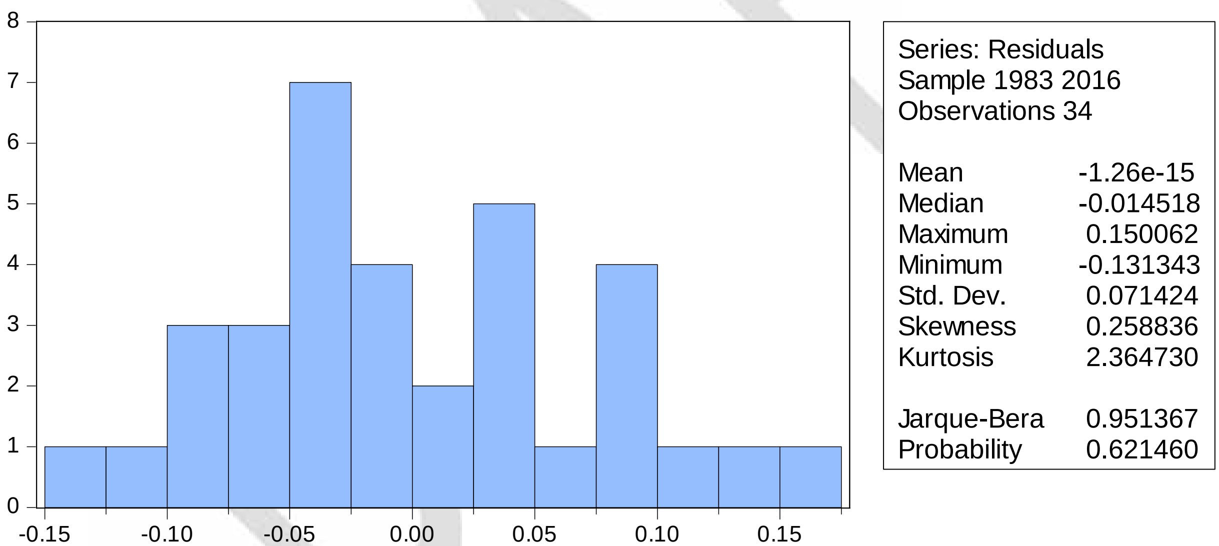

Figure 3: Normality Test

Source: Own calculations based on Ministry of Finance and Economic Development

Next step presents bounds test which should help us to determine if there is long run integration, that is, whether the variable moves together in the long run.

Δ is the operator for an increment. Between different possible criterions to choose for deciding which lag order to include; this paper employs the Schwartz Bayesian criterion since it turned out to give more accurate results for a small sample size.

Bound test null hypothesis states that Ho: δr=0 while alternative hypothesis $H1$: $\delta r \neq 0$ where r=1, 2,3,4,5. Following steps include calculating upper bound I(1) and lower bound I(0) critical values and comparing F-statistics value with them. Of course, bound levels will depend on the significance level, and therefore we will be able to make a more precise conclusion.

In case that out F-statistics is higher that I(1) critical values, we can conclude that there is co-integration among variables (at least one). In the event where F-statistics shows lower level with respect to I(0) lower bound, we cannot reject null hypothesis based on sample evidence. Lastly, when F-statistics lies between lower and upper bound, we cannot make a conclusive inference and the situation is not clear.

The bounds testing procedure in Table 4 indicates that there exists a valid long run (or co integrating relationship) between tax effort and its determinants. The computed F-statistics for the joint significance of the long run parameters is 3.76966 (k=6) while the asymptotic critical upper bound values for the F-statistic are 3.23, 3.61, and 3.99 percent for the 10,5, and 2.5 percent confidence levels respectively. Since the computed F-values exceed the critical values at 5% conventional levels of significance, we cannot reject the existence of a stable long-run (level) relationship among the variables. This implies that the null hypothesis of no co integration is rejected at 5% level of significance. In other words, the variables are co integrated. Therefore, there is a long-run relationship between these variables.

Table 4: ARDL Bounds Test

Null Hypothesis: No long-Run Relationships Exist		
Test Statistic	Value	k
F-statistic	3.769665	6
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.12	3.23
5%	2.45	3.61
2.50%	2.75	3.99
1%	3.15	4.43

Source: Author's calculation

Since ARDL bound test suggest there is long run relationship, author estimates the coefficients of long-run equation given in the form of equation.

Table 5: Error Correction Representation for the Selected ARDL (1, 0, 0, 1, 2, 0, 0) Model

Dependent Variable: NLNTAXGDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNAGVA)	4.074973	0.987119	4.128149	0.0004
D(LNINDVA)	0.620984	0.307623	2.018652	0.0553

D(LNSERVA)	3.09446	0.724379	4.271883	0.0003
D(LNCPI)	-0.264036	0.13989	-1.88745	0.0718
D(LNCPI(-1))	-0.195809	0.135792	-1.44197	0.1628
D(LNRDEVEXP)	0.25232	0.060436	4.175	0.0004
D(LNSHAM2)	-0.072764	0.129375	-0.56243	0.5793
CointEq(-1)	-0.548062	0.124722	-4.39429	0.0002

Source: Author’s calculation

As shown in Table 5 the error correction term (-0.548062) here is negative and significant meaning that there is a long-run causality running from independent variables to the dependent variable. It also confirms that all the variables are co integrated or have long run relationship. We can also say that about 54.81 percent gap between long run equilibrium value and the actual value of the dependent variable (TAXGDP) has been corrected. It can also be said that speed of adjustment towards long-run equilibrium is 54.81 percent annually (provided data is annual). Also, we can say that system corrects its previous period disequilibrium at a speed of 54.81% annually.

The coefficient of ECM (-1) shows how much of the disequilibrium in the short-run will be fixed (eliminated) in the long run. The Error Correction Model based upon ARDL approach establishes that changes in Agricultural Output, Industrial Output, Service output, and development expenditures variables have a significant short-run effect.

Once the existence of co integration is confirmed, the next step is estimating the long-run coefficients of the ARDL model.

Table 6: Long Run Coefficients (Dependent Variable: NLNTAXGDP)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNAGVA	-3.43524	2.50416	-1.371813	0.0069
LNINDVA	1.133055	0.659773	1.717339	0.0994
LNSERVA	7.32896	1.959059	3.741062	0.0011
LNCPI	-0.031132	0.17338	-0.179562	0.8591
LNRDEVEXP	0.460386	0.14652	3.142145	0.0446
LNSHAM2	-0.132766	0.247149	-0.537189	0.0563
C	-52.054969	17.079906	-3.047732	0.0057

Source: Author’s calculation

The long run equations along with coefficient estimates are given the in following:

$\mathrm{NLNTAXGDP} = -52.05 + \mathrm{LNAGVA}(-3.44) + \mathrm{LNINDVA}(1.133) + \mathrm{LNSERVA}(7.32896) + \mathrm{LNCPI}(-0.0311) + \mathrm{LNRDEVEXP}(0.460) + \mathrm{LNSHAM2}\ (-0.1327)$

It is important to mention that the coefficients that are statistically significant at 1% are LNAGVA and LNSERVA (as well as the constant). As usual, constantly does not have a meaningful theoretical explanation. What came as not surprise is negative and significant Agricultural Service output coefficient. In the long run, if the Agricultural value-added output increases by one percent, this will result in -3.434 percent decreases in the overall tax performance.

The short-run equation contains the error correction term. This equation element aims at 'stabilizing' the regressors' interaction toward the long run equilibrium. Mathematical representation is demonstrated in the equation.

Where ECM is error correction model term, ξ is error term of the long-run equation, while ψ is coefficient of error term. It is of crucial importance that ψ is negative and is significant. Only in that condition we, can interpret coefficient as a speed by which regressor tend to long-run stability, or steady state (Bennerjee and Mestre, 1998). Results of regression are given in the table 5.

A crucial conclusion from the estimates of the short-run effect coefficients is that coefficient of error correction term is significant at 1% level, and it has a negative sign. This result met the expectation of existence of long-run relationship between variables since the sign is negative. For that reason, we can infer that NLNTAXGDP tends to adjust by 52.05 % toward equilibrium from the previous to the next year.

The CUSUM test (Brown, Durbin, and Evans, 1975) is based on the cumulative sum of the recursive residuals. This option plots the cumulative sum together with the 5% critical lines. The test finds parameter instability if the cumulative sum goes outside the area between the two critical lines.

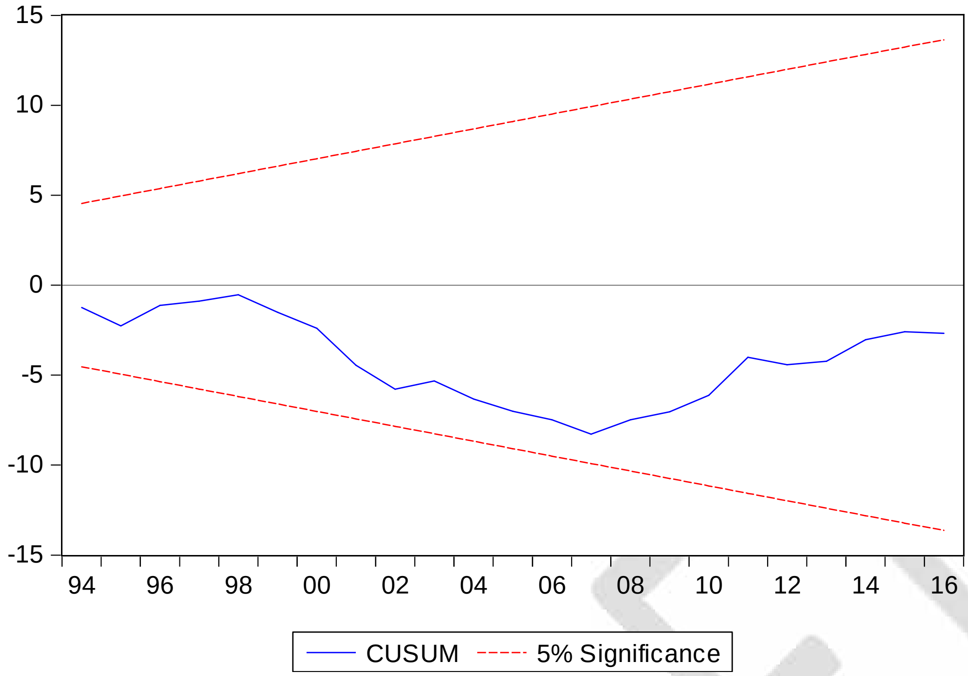

Figure 4: Cumulative Sum Control Chart
Source: Author's calculation

The test indicates stability in the equation during the given period.

1. CUSUM of Squares Test

The CUSUM of squares test provides a plot of the test statistic against time and the pair of 5 percent critical lines. As with the CUSUM test, movement outside the critical lines is suggestive of parameter or variance instability. The cumulative sum of squares is generally within the 5% significance lines, suggesting that the residual variance is somewhat stable.

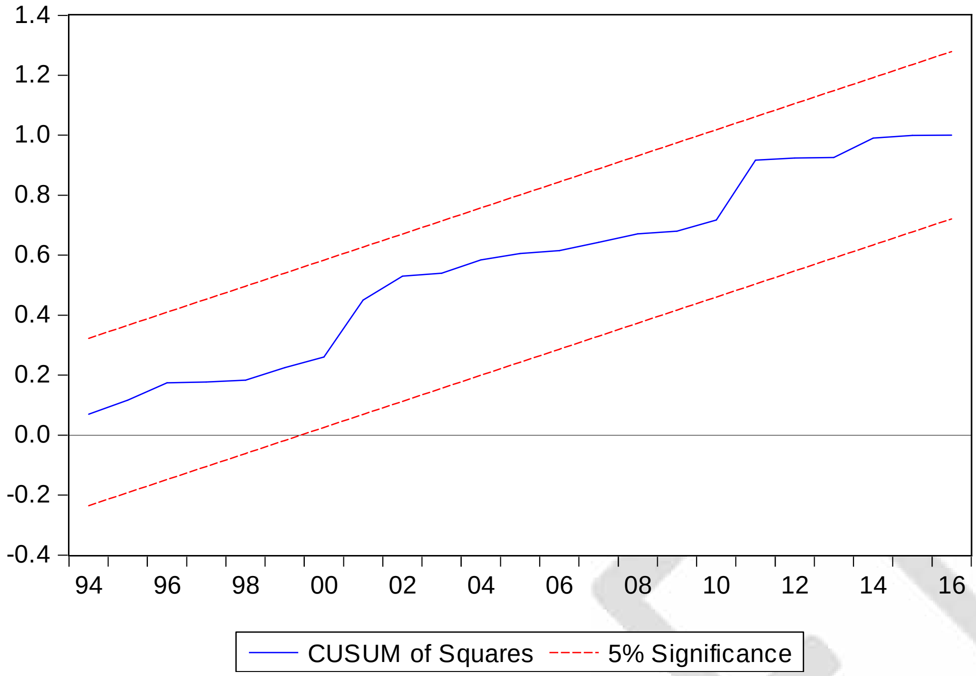

Figure 5: Cumulative Sum Squared (CUSUMSQ) Chart
Source: Author's calculation

Therefore, the model(parameter)stability test using cumulative sum (CUSUM) and (CUSUMSQ) control chart also confirmed that the null hypothesis of parameter stability could not be rejected at the 5% critical bound. Thus, the parameters of the estimated saving model do not suffer from any structural instability over the period of study.

In summary, our ARDL results indicate that in the long run tax revenues are positively influenced by Agricultural Output, Industrial Output and Service output, development expenditure and negatively influences by the informal sectors and consumer price index.

5. Conclusion

In analyzing the influence of agricultural sector in improving the overall- tax revenue performance of Ethiopia, the bounds testing procedure indicates that there exists a valid long run (or co integrating relationship) between tax effort and its determinants. What came as not surprise is negative and significant Agricultural Service output coefficient. In the long run, if the Agricultural value-added output increases by one percent, this will result in -3.434 percent decreases in the overall tax performance.

Using Auto Regressive Distributed Lag (ARDL) methods, the paper has demonstrated some mismatches in the sectoral contributions to GDP and overall tax revenue collections. The informal sector and the agricultural sector hold the largest impediment to improving tax revenues in the long run. The industrial sector and the development expenditure have exhibited a positive long-run relationship with tax-GDP growth.

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