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Tax revenue Determinants and Tax Efforts in Ethiopia from 2000 – 2019- ARDL Approach

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Abstract
Despite increasing gross tax collection trends and reports of economic growth trajectory since 2005, the percentage of tax to GDP ratio has not shown significant improvement in Ethiopia. Ethiopia's tax to- GDP ratio is far below the Sub-Saharan Africa average. Besides, the share of indirect tax has been consistently higher than direct tax over years. Several related studies on the determinants of tax revenue were conducted in Ethiopia. However, this particular study unlike the prior studies attempted to explain factors affecting tax revenue collection in terms of both structural variables and selected governance variables into account using the ARDL model. Accordingly, a stationarity test of the data and lag effect tests of the time series data from 2000 to 2019 were checked before the ARDL model selection using Stata. At the AR (4) level of the autoregressive process significant but negative ARDL values are observed for the agriculture, service, and industry sector as a share of GDP with an R-Squared value of 0.930. At this level, predictive variables such as inflation, government effectiveness, and control of corruption variables have shown no significant relationship. Thus, the fact that inflation and control of corruption have shown no significant relationship whereas industry and service as a share of GDP have shown a negative relationship requires further explanations. From selected governance variables both government effectiveness and control of corruption have shown no significant relationship whereas regulator quality has shown a significant but negative relationship. Accordingly, improving tax efforts focusing on the industrial, service sector and continually re-examining the tax administration effectiveness merit more regulatory organs attention.

Keywords: *Tax revenue, Tax Efforts, Ethiopia, ARDL Model*

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1. Background and Rationale

Ethiopia has sustained an economic growth trajectory since 2005. In the year 2000, the share of the agricultural sector to GDP was 54 % while the service sector contributed 35 %. The remaining 11 % came from the industrial sector. In 2019, the service sector contributed 40 % of GDP while the agricultural sector contributed 33 %. The fast-growing industrial sector contributed 27 % (Ketema and Diriba, 2021). The growth was largely driven by substantial public investment in infrastructure coupled with a solid performance by the service and construction sectors (Moller and Wacker, 2015; Shiferaw, 2017). According to UNDP (2016) working paper, tax collection in Ethiopia has been significant with an annual average collection rate of 30 percent over the last twelve years. Tax collection increased from ETB 12.4 billion in 2005 to ETB 165.3 billion in 2015.

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According to The World Bank microdata (2021), in 2001 the total amount of tax collected was 5. 541 billion ETB while in 2019 it reached 179.251 billion ETB. Similarly, the size of Ethiopia's real GDP was 8.08 billion USD in 2000 whereas it has reached 96.1 billion USD in 2018 (NBE, 2020). Accordingly, it can be argued that the possible factor for the increase in nominal tax collection was the growing size of the economy and the repeatedly implemented tax administration reforms since 1993 which somehow has contributed to the growth of tax collection among other factors (Geda and Shimeles, 2016; Harris and Seid, 2021; Delessa (2014); UNDP, 2016). However, it is difficult to clearly state that the extent to which tax policy and tax administration reform has contributed an increase in nominal tax collection increase.

On the other hand, despite a nominal increase in tax collection, Ethiopia's tax revenues to GDP ratio have been lower than those of its regional peer countries as indicated in figure 2.1. According to the ICTD/UNU-WIDER Government Revenue Dataset (GRD) accessed in September 2021; Ethiopia's share of tax to GDP ratio is much lower than the SSA average where its share of indirect tax as compared to direct tax is consistently higher since the 1960s (Mascagni, 2016; GRD, 2021). The GRD data show that Ethiopia lags notably behind most countries in terms of tax revenue mobilization as a share of GDP.

Fundamentally, two variables determine the tax revenue collected in a given country: the size of the tax base to which the tax applies, and the tax rate that is applied to the base. In this regard, the tax base is a function of several factors; including the way the base is defined in the tax legislation, the scale of any discretionary tax exemption and incentives; administrative factors such as compliance and enforcement, and the size and structure of different sectors of the economy. According to the findings of Feger (2014), the overall tax structure in Sub-Saharan Africa Countries is skewed towards indirect taxes. Similarly, the study conducted on BRICS by Neog and Gaur (2020), suggests that the size of the shadow economy undermines tax revenue collection. Thus, the proportion of indirect tax is higher than direct tax. Besides, the share of the informal sector and shadow economy in most SSA is believed to be significant. In Ethiopia, studies suggest that the structure of the economy has a large informal sector; a fairly weak tax administration system; and the government grants an array of tax incentives for foreign investors (UNDP, 2016; Harris and Seid, 2021). In this regard, Eshetu (2017) in his findings suggested that the tax system in Ethiopia has experienced a low level of productivity in revenue collection relative to the economic growth of the country as a result of the inelastic yield of individual tax elements to their bases. Cognizant of this reality, the Ethiopian Government envisages increasing its share of tax ratio to GDP from 9.2% in 2020 to 18.2% of GDP in 2030 (FDRE National Planning Commission, 2020/21).

Studies conducted on tax revenue in Ethiopia by (Neway, Kenenisa, and Woldemicael, 2017); and Workneh (2016) focused on the determinants of tax revenue from 1974 to 2013 considering multiple variables such as GDP per capita, foreign aid, the industrial value-added share of GDP, and inflation. Similarly, Kitessa and Jewaria (2018) focused on tax revenue determinants in East Africa countries. On the other hand, Mesele et al. (2020), focused on determinants of tax evasion in Ethiopia and identified factors considered as determinants of tax evasion in the country. Studies by Alemayaehu and Abebe (2005), Takele (2021) focused on tax reform issues. Furthermore, studies on business people's views of paying tax were covered by Yesegat and Fjeldsand, (2016) among others.

In summary, studies on developing countries assert that tax revenue as a proportion of GDP is typically much lower in developing countries than in developed countries The difference in tax revenues between the poorest and the richest nations of the world is entirely explained by the

weakness of direct taxation in developing countries. Informal sectors are larger in developing countries than in rich countries (Auriola, and Warlters, 2005). Genschel and Seelkopf (2016) claim that the taxation trends are closely associated with socio-economic changes (as summarized by GDP per capita) and structural factors (as summarized by country size). Yet the impact of political institutions on taxation is nonlinear and complex. Fundamentally, the variables determine the tax revenue collected: the size of the tax base to which the tax applies, and the tax rate that is applied to this base. Like most developing countries, Ethiopia has a large informal sector and has a fairly weak tax administration system with notable capacity constraints. Besides, The Ethiopian government also grants an array of tax incentives for foreign investors to attract foreign investment (Harris and Seid, 2021). However, it is difficult to say to what extent these factors contribute to Ethiopia's revenues being lower than its peers'. Thus, considering the nature of Ethiopia's economy and its structural composition as a driver of growth and the need for mobilizing more tax revenue in the land, it is imperative to study the relationship between tax revenue and predictive variables such as GDP per capita; agricultural as a percentage share of GDP; industry as a percentage share of GDP; service as a percentage share of GDP; inflation as indicated in consumer price index; selected governance parameters based on Global Governance indicators such as government effectiveness, regulatory quality, and control of corruption. Therefore, this study intended to examine factors that determine tax revenue mobilization and tax efforts in Ethiopia from 2000 to 2019 based on times series data considering both structural and governance variables selected.

2. Review of Related Literature

Tax revenue has remained the major source of government revenues in both developed and developing nations. The tax effort indices obtained show that generally the upper-middle-income and high-income OECD groups are making better use of their tax bases to increase revenue (Teera and Hudson, 2004). Studies conducted on the tax revenue performance of BRICS for the period 1996–2017 identified that economic development, trade openness, and control of corruption are revenue-enhancing factors for BRICS, whereas the agriculture sector discourages the tax revenue performance. However, the size of the shadow economy in BRICS undermines the productive implication of corruption control and economic development in revenue generation (Neog and Gaur, 2020).

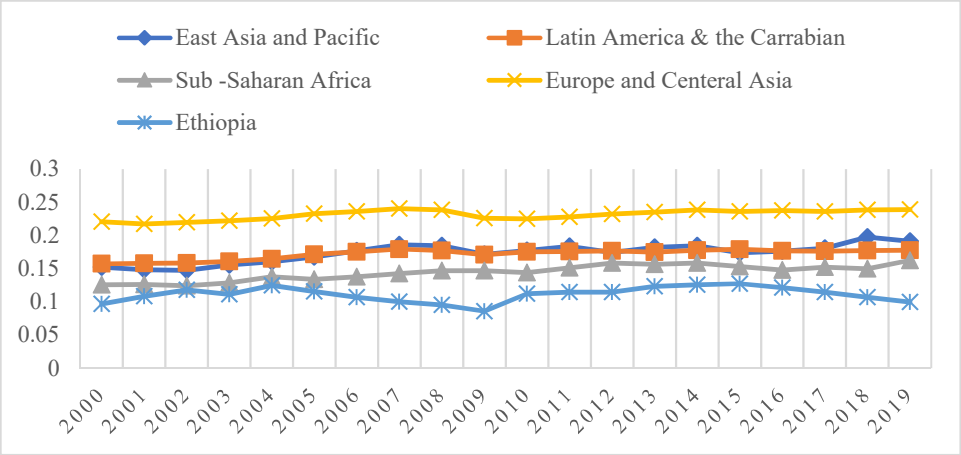
The study conducted on tax structures, economic growth, and development comparing in a panel of developing and developed nations claimed that the tax structure in low-income countries differs significantly from that in developed nations. While High-income and OECD countries rely on direct taxes, developing countries place a relatively heavy reliance on trade taxes such as import tariffs. trade taxes (McNabb and LeMay-Boucher, 2014).

The study which tried to evaluate the impact of tax structure change on economic growth in India for the period 1980-2016 found that, no threshold effect in the tax–growth relationship for India. Empirical results from the four-time series ARDL model imply the fact that corporation tax share, income tax share, and excise tax share are harmful to growth in the long run (Neog and Gaur, 2020).

According to Coulibaly and Gandhi (2018), Sub-Saharan Africa faces a sizeable shortfall in financing for investment, estimated at $230 billion a year, on average, over the next five years. This shortfall is due to low domestic savings rates, partly as tax revenue collection continues to underperform notwithstanding recent improvements. They found that the region's still-lower tax revenues are due to both lower taxation capacities—about 20 percent of GDP on average and to

inefficiencies in revenue collection. On the one hand, strengthening tax capacity should remain a medium- to long-term policy objective, given that capacity is largely determined by entrenched structural factors such as the stage of economic development, the size of the informal sector, the sectoral composition of economic activity among others. Improving governance, on the other hand, can yield near-term results. According to Auriola and Warlters (2005), informal sectors are larger in developing countries than in rich countries. Direct tax as a share of GDP is lower than indirect tax share of GDP in most African countries.

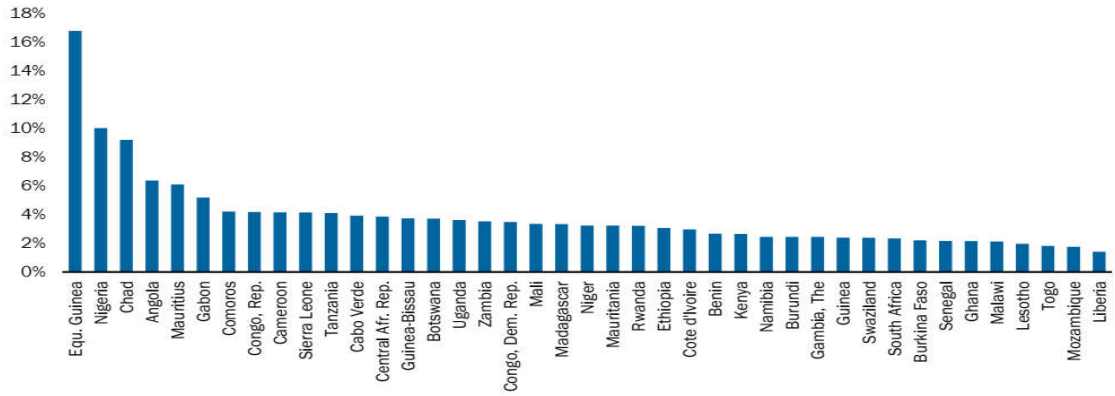
Figure 2.1 Tax revenue as a percentage of GDP



(Source: Own computation based on ICTD / UNU-WIDER Government Revenue Dataset, 2021)

As it is depicted in the illustrative figure, Europe and Central Asia have consistently raised more tax revenue to GDP ratio as compared to other regions. The tax to GDP ratio of the SSA has been lower than in other regions. Similarly, Ethiopia's share of tax to GDP ratio has been even lower than the SSA average.

Figure 2.2: Estimated tax revenue gaps for sub-Saharan African countries as a percent of GDP



Source: Coulibaly and Gandhi (2018:5)

As depicted in figure 2.2, most countries in Africa have demonstrated a tax revenue gap of various levels. In this regard, Ethiopia's tax revenue gap was around 6 percent. i.e., nearly more than 4 dollars remained uncollected, which is more than the country's annual export earnings.

The aggregate tax gap is therefore broadly defined as the difference between what a government could collect, given the characteristics of the national economy, and what it collects. This aggregate gap is the result of some individual tax gaps, or components of the aggregate tax gap, which stem from the economic and political environment as well as from the government's choices Currently, the governments of developing countries collect much lower proportions of their GDPs in tax revenue than do the governments of the OECD countries: 10-20% rather than 30-40%.

As Mascagni, Moore, and Mccluskey (2014) noted, Governments in developing countries face great challenges in mobilizing tax revenues, which result in a gap between what they could collect and what they collect. Experts on taxation in developing countries strongly agree that there is considerable potential to increase tax revenue in most low-income countries. That is significant contributors to tax gaps include tax evasion and avoidance, tax exemptions. Similarly, Bird and Martinez-Vazquez (2008) found out that, corruption, voice, and accountability also determine tax effort to a significant extent. Thus, empirical results suggest strongly that corruption and voice, and accountability play a significant role in the determination of the level of tax effort of developing and transition countries.

Mobilizing more financial resources involved several complex and perplexing scenarios in the context of lower-income countries such as Ethiopia. However, weak institutional setup, corruption, and absence of a transparent political system, on the one hand, and a high informality, coupled with poor awareness of paying tax among the business community, on the other, make tax collection ineffective (Epaphra and Massawe, 2017 and Gnangon, 2020).

Studies on factors affecting tax revenue considering the structure of tax and its administration are gaining attention. In this regard, Haldenwang (2015), asserts that a narrow tax base combined with an excessive reliance on a few commodity exports exposes countries to the risk of increased revenue volatility and, ultimately, lower tax collection. Shocks not only affect the level of tax collection but also (perhaps even more importantly) the stability and predictability of revenue. A study by Garcia and Von Galdenwang, (2016), identified that the relationship between political regimes and tax-to-gross domestic product ratio, using a panel dataset of 131 countries and covering the period 1990–2008. Findings suggest that the character of the polity affects taxation, but there is no linear trend in favor of democracy. Karran (1985), in assessing the determinants of taxation in Britain found out that three determinant factors such as tax base, the tax rate, and administration of tax collection issues. Besley and Persson (2014), identified that the limits to taxation are rarely tied to the administrative capacity of the state. But incentive constraints alone cannot explain the vast differences in the levels of taxation that we see across the world and across time. Low-income countries typically collect taxes of between 10 to 20 percent of GDP, while the average for high-income countries is more like 40 percent. The authors further identified the following as a factor that explained why developing countries tax so little. Accordingly, weak institutions, fragmented polities, and a lack of transparency due to weak news media. Moreover, sociological and cultural factors such as a weak sense of national identity and a poor norm for compliance may stifle the collection of tax revenue.

Studies focusing on tax administration and institutional factors remained relevant in explaining tax revenue mobilization efforts of developing countries. Langford (2016), claimed that, regardless of revenue mobilization plans, economic and institutional conditions limit the amount of taxes that a country can realistically raise. Similarly, Phuong (2015) suggested that governments in developing countries should appropriately adjust the institutional quality to improve the tax revenue and promote economic activities. Moreover, Epaphra and Massawe (2017), using panel data set for 30 African countries over the 1996-2016 period identified that the random effect regression results show that corruption and governance are two main determinants of tax revenues in Africa. While corruption has a significant negative effect on tax revenues, good governance measured in terms of government effectiveness, regulatory quality, rule of law, and voice and accountability tends to raise tax revenue generation and in particular, indirect taxes. However, these findings may not be conclusive for all countries and times.

As indicated in the background section, some studies have been conducted using different methods, combinations of variables, and different levels of analysis on the factors that determine tax revenue and efforts in Ethiopia (Workineh,2016; Kitessa and Jewaria, 2018; Neway, Kenenisa, Woldemicael, 2017; and others). Specifically, Kitessa and Jewaria (2018), focusing on the key determinants of tax revenue in East African countries using a novel dataset ranging from 1992 to 2015 by employing panel data cointegration approach. Workineh (2016), applied the Johansen-Co-Integration method for the period of 1974- 2013 in assessing tax revenue in Ethiopia. According to the finding of the study, the result revealed that in the long-run real GDP per capita income, foreign aid, and industrial value-added share of GDP positively and significantly affect tax revenue. However, inflation exerted a negative and significant influence. Whereas, in the short run Real GDP per capita income and inflation have a negative effect, whereas industrial Value-added share of GDP has a positive effect on tax revenue in Ethiopia. The sign of real gross domestic product per capita income is contrary to the prior expectation. Moreover, the coefficients of the lagged error correction term (ECM (-1) are significant and negative as expected, which implies the existence of economic or government forces that restore the long-run equilibrium from short-run shocks.

Neway, Kenenisa, Woldemicael (2017) in the study of the determents of tax revenue in Ethiopia based on time series data from 1999- 2015 identified that industry sector share to GDP, per capita income, and trade openness as measured by the share of export and import to GDP has a significant positive effect on tax revenue whereas; agriculture sector share to GDP and the annual rate of inflation has a significant and negative effect on tax revenue as measured by the share of tax revenue to GDP. The correlation output indicated that there is a positive correlation between tax revenue and industry share, trade openness, per capita income, and foreign direct investment while there is a negative correlation between TR and agriculture share to GDP and inflation rate. The output revealed that the annual rate of inflation and agriculture share to GDP was found to have a statistically significant and negative effect on tax revenue.

In summary, tax revenue as a proportion of GDP is typically much lower in developing countries than in rich countries. The indirect tax takes the larger share in most developing countries. In Ethiopia, Indirect tax is higher than direct tax since the 1960s. A study by Feger (2014), suggested that the tax structure in SSA is skewed towards indirect taxes because of the existing structural, institutional, and policy characteristics.

According to Hassen (2016), the growth in the agricultural GDP does not have a significant impact on the growth of agricultural income tax collection in Ethiopia. The trend of the agricultural income

tax and land use fee collection is highly inconsistent. According to Skinner (1991), progressive tax rates based on landholdings are nearly impossible to administer. A significant percentage service sector in Ethiopia operates in the informal sector and shadow economy which is usually difficult to tax. The literature suggests the existence of untaxed income due to reasons related to the structure of the economy and administrative inefficiencies (Khan (2001). The impact of the change in per capita income is not statistically significant as opposed to the theory and empirical evidence from other countries. This indicates that there is a reasonable share of the economy which is not taxed

In general, economic, structural, and administrative factors determine the size of the tax base and the level of tax efforts. The major factors that are usually considered in the studies of tax revenue and efforts are multiple and varied. The results are also largely remained inconclusive. Gupta (2007), identified several factors as determents of tax revenue such as structural factors such as per capita GDP, agriculture share in GDP, trade openness and foreign aid significantly affect revenue performance of an economy (Tanzi (1989). Other factors include corruption, political stability, the share of direct and indirect taxes. Accordingly, for this particular study, GDP per capita, manufacturing as a percentage of GDP; Service as a percentage share of GDP; Agriculture as a percentage share of GDP; inflation as measured in consumer price index; governance parameters such as government effectiveness; institutional quality and control of corruption are considered as variables to be considered in influencing factors of tax revenue in Ethiopia. Unlike the earlier studies, this study tried to include both structural and selected governance as explanatory variables of determents of tax revenue in Ethiopia over the last two decades.

3. Methodology of the Study

This study intended to examine factors that determine tax revenue mobilization and tax efforts in Ethiopia from 2000 to 2019 based on time series data. The selections of the variables and methodological approaches used in this study have drawn insights from earlier done similar studies. Accordingly, the variables considered in this study are GDP per capita; agricultural as a percentage share of GDP; industry as a percentage share of GDP; service as a percentage share of GDP; inflation as indicated in consumer price index; selected governance parameters based on Global Governance indicators such as government effectiveness, regulatory quality, and control of corruption.

Data used in the study were obtained from World Development Indicators, World Bank Global Governance Indicator database, IMF database; Ethiopian Central Statistics Agency, ICTD / UNU-WIDER Government Revenue Dataset; annual reports of National Bank of Ethiopia; FDRE Ministry of Finance and Economic Development; National Plan Commission Ten Year Strategic Plan documents and African Statistical yearbooks until 2018. Accordingly, the variables considered in this study were GDP per capita; agricultural as a percentage share of GDP; industry as a percentage share of GDP; service as a percentage share of GDP; inflation as indicated in consumer price index; selected governance parameters based on Global Governance indicators such as government effectiveness, regulatory quality, and control of corruption.

Specific regression model application selection was guided by checking the stationarity test of the data and lag effect tests of the time series data. Test for stationary is a prerequisite for consistent and valid inference of time series models and co-integration analysis. The first step in time series analysis is to check whether the variables are stationary or not. Dickey fuller test for unit root test has been used. Following the stationary test, the dependent variable (tax revenue as a percentage of GDP) is integrated of order one I (1), and independent variables (structural and selected governance variables)

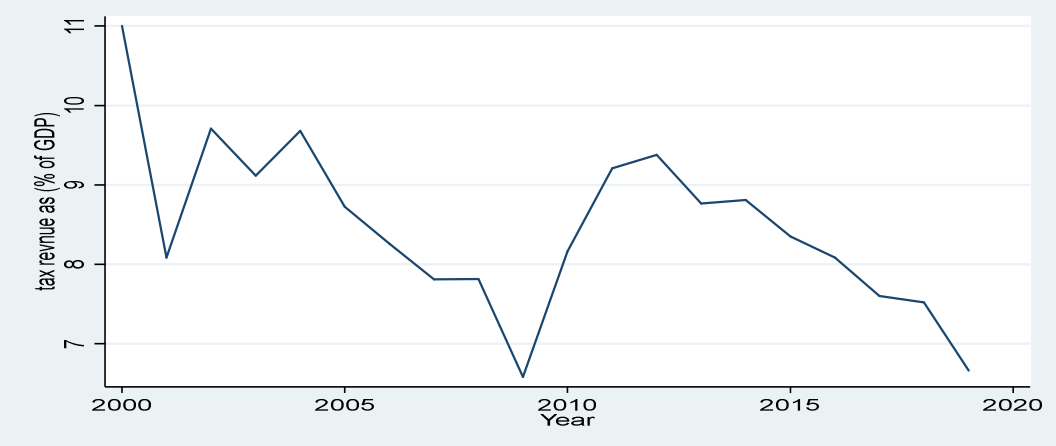
are integrated of order one and zero I (1) and I (0). Accordingly, the autoregressive distributed lag (ARDL) model was found to be the right model based on the taste and the nature of the data. However, it is required to determine the optimal lag length of each variable before we use the ARDL model. In economic and other analyses, the dependence of a variable Y (outcome variable) on another variable(s) X (the predictor variable) is rarely instantaneous. Therefore, it is very important to determine the optimal lag length before the estimation of the model. There are different criteria to determine the optimal lag length: Akaike's information criterion (AIC), Schwarz's Bayesian information criterion (SBIC), Hannan and Quinn Information criterion (HQIC), and Final Prediction Error (FPE). Accordingly, the Stata software is used as briefly discussed under the results and discussion section.

4. Results and Discussion

This part presented data on the trends of economic performance trends for agriculture, industry, and service sector as a share of GDP. The presentation of results and discussion is based on empirical evidence based on past performance of the economic structure on the performance of tax revenue; the effects of inflation on tax performance; and the effects of selected governance parameters on tax revenue for the duration of study in Ethiopia.

4.1 Trends of data on tax revenue, economic structure, and governance

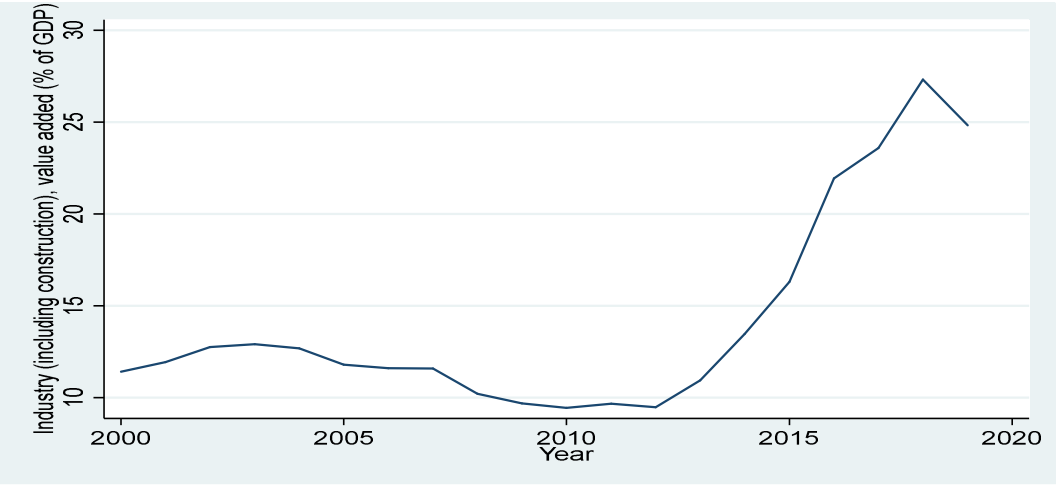
Figure 4.1 Trends of tax revenue as a percentage of GDP from 2000 to 2019



Source: (Stata output based on World Development indicator Dataset, 2021)

As it is depicted in the figure above, the overall trend of percentage of tax to GDP ratio has shown a relative decreasing trend despite the increasing trend of GDP growth report in Ethiopia. This may have multiple implications such as the existence of a tax effort gap or maybe there is an untaxable segment of economic activities probably due to tax evasion or prevalence of shadow / informal economy. As a result, growth in the GDP may not adequately translate into the growth of the amount of tax to be generated in the economy.

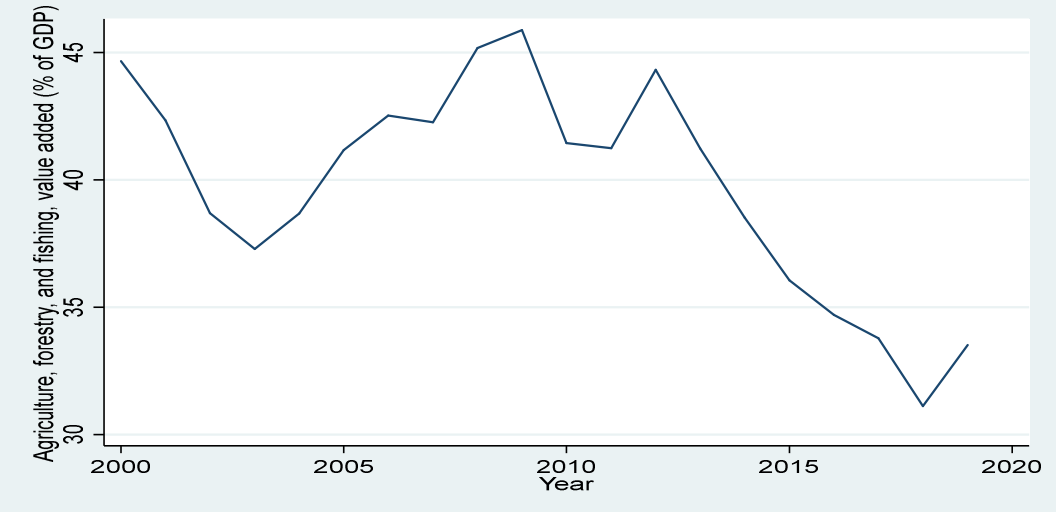
Figure 4.2 trends of share of industry as a percentage of GDP



Source: (Stata output based on World Development indicator Dataset, 2021)

As it is depicted in the figure above, the percentage share of industry in GDP has shown increasing trends from 2012 to 2018. However, whether this increasing trend has translated proportionally into the amount of tax revenue to be discussed in the subsequent discussion.

Figure 4.3 trends of share of agriculture as a percentage of GDP

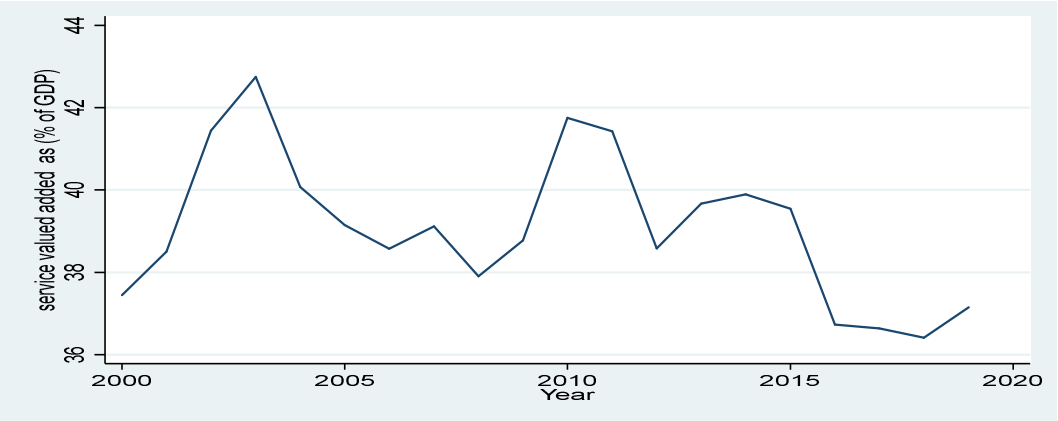


Source: (Stata output based on World Development indicator Dataset, 2021)

The percentage share of agriculture to GDP has relatively shown decreasing trend since 2013. According to Hassen (2016), the growth in the agricultural GDP does not have a significant impact on the growth of agricultural income tax collection in Ethiopia. The trend of the agricultural income tax and land use fee collection is highly inconsistent. According to Skinner (1991). Other

studies indicated that the tax contribution, agriculture is usually negatively related to its contribution of tax share (Khan, 2001).

Figure 4.4 trends of share of service as a percentage of GDP



Source: (Stata output based on World Development indicator Dataset, 2021)

As it is depicted in the figure above the percentage share of service to GDP has been swinging on average between 36 to 40 percentage. Despite a slightly increasing trend of the service sector as a share of GDP from 35% in 2000 to 40% in 2019 (Ketema and Diriba, 2021); the service share of GDP has shown a decreasing trend. This may suggest the existence of a shadow economy or informal service sector.

4.2 Stationarity and lag test

The first step in time series analysis is to check whether the variables are stationary or not. Dickey fuller test for unit root test has been used. Most variables are stationary at the first difference I (1) but only one variable- inflation is stationary at level I (0) (Table x)

Table 4.1: Summary of the stationary test using Duckey fuller test

Variables	Order of integration	Description
Tax revenue as a percentage of GDP	I (1)	Stationary at first difference
Log GDP per capita	I (1)	Stationary at first difference
Agriculture as (% of GDP)	I (1)	Stationary at first difference
The industry as (% of GDP)	I (1)	Stationary at first difference
Service as (% of GDP)	I (1)	Stationary at first difference
Government effectiveness	I (1)	Stationary at first difference
Inflation consumer prices annual	I (0)	Stationary at level
Regulatory quality	I (1)	Stationary at first difference
Control of corruption	I (1)	Stationary at first difference

Source (Based on Stata computation)

From the above stationary test, the dependent variable (tax revenue as a percentage of GDP) is integrated of order one I (1), and independent variables are integrated of order one and zero I (1) and I (0). In this case, the autoregressive distributed lag (ARDL) model is the right regression model. However, that depends on the optimal lag length test of each variable before using the ARDL model. In economic and other analyses, the dependence of a variable Y (tax revenue as a percentage of GDP) on other variables (s) such as the predictor variables are rarely instantaneous. Very often, predictive variables (X) respond to Y with a lapse of time. Such a lapse of time is called a lag. Therefore, it is very important to determine the optimal lag length before the estimation of the model. There are different criteria to determine the optimal lag length: Akaike's information criterion (AIC), Schwarz's Bayesian information criterion (SBIC), Hannan and Quinn Information criterion (HQIC), and Final Prediction Error (FPE). Using Stata software optimal lag length is determined using the above-mentioned selection criteria (table 4. 2)

Table 4.2: the estimated optimal lag length of each variable used in the analysis

Variables	Criteria used	Lag length
Tax revenue as percentage of GDP (TR pGDP)	HQIC	1
Log GDP per capita (Log GDP pc)	FPE	1
Agriculture as (% of GDP) (ApGDP)	AIC	1
The industry as (% of GDP) (IpGDP)	FPE	3
Service as (% of GDP) (SpGDP)	FPE	1
Government effectiveness (GE)	AIC	0
Inflation consumer prices annual (Icpi)	AIC	1
Regulatory quality (RQ)	AIC	3
Control of corruption (CoC)	AIC	1

Source (Based on Stata computation)

4.3 Presentation of results and discussion

Auto-regressive distributed lag results examination of the order of integration and results allow to use of the ARDL model in data series. The optimal lag structure for all models is based on AIC, HQIC, FPE criteria. As it is indicated in the table below the lag value of tax revenue as a percentage of GDP at AR (1) level has shown negative but significant at five percent. On the other, hand GDP Per capita has not shown any significant relationship with tax revenue. Similarly, inflation and selected governance values have not shown any significant relationship with tax revenue. Similar to earlier studies Agriculture as a share of GDP has shown a negative but significant relationship with tax revenue at 10 percent of the level of significance. Finally at AR (1) level, in contrast with earlier studies both service and industry have shown a negative but significant relationship with tax revenue at a 10 percent of the level of significance. Accordingly, the detailed presentation of ARDL from level 1 to level 4 is presented in the table below as accompanied by a brief discussion.

Table 4.3 ARDL tests results

VARIABLES	(1) ARDL	(2) ARDL2	(3) ARDL3	(4) ARDL4
LD. Tax revenue as (%GDP)	-0.552**	-0.647	-0.612*	-0.587**
	(0.166)	(0.185)	(0.264)	(0.160)
D. Log GDP per capita	-6.287	-7.646	1.171	-0.0796
	(5.034)	(7.776)	(5.280)	(3.850)
LD. Log GDP per capita	0.755	-1.682	-8.249	1.107
	(4.539)	(3.791)	(5.204)	(3.999)
D. Agriculture as (% of GDP)	-0.609*	-0.551		-0.552*
	(0.224)	(0.329)		(0.229)
LD. Agriculture as (% of GDP)	-0.424	-0.543		0.217
	(0.313)	(0.611)		(0.305)
D. Industry as (% of GDP)	-0.497*	-0.407		-0.615**
	(0.227)	(0.264)		(0.207)
LD. Industry as (% of GDP)	-0.216	-0.0910		0.325
	(0.289)	(0.531)		(0.302)
D. Service as (% of GDP)	-0.660*	-0.613		-0.579*
	(0.285)	(0.410)		(0.261)
LD. Service as (% of GDP)	-0.282	-0.403		0.447
	(0.412)	(0.789)		(0.387)
Inflation (measured in consumer price index annual)	0.00560	0.00158	0.0241	0.00993
	(0.0237)	(0.0174)	(0.0283)	(0.0176)
Government effectiveness	0.0413	0.0331	-0.0305	
	(0.0432)	(0.0474)	(0.0649)	
Regulatory Quality	-0.00509	0.0661	0.163	
	(0.153)	(0.200)	(0.203)	
Control of Corruption	-0.0605	-0.123	0.0411	
	(0.0568)	(0.102)	(0.0817)	
D. Government effectiveness		0.0118	0.0197	0.0306
		(0.0587)	(0.0587)	(0.0326)
D. Regulatory Quality		-0.0777	-0.313	-0.286*
		(0.161)	(0.172)	(0.128)
D. Control of Corruption		0.105	-0.0213	-0.0232
		(0.0772)	(0.0734)	(0.0354)
Constant	0.832	2.132	-2.793	-0.334
	(2.841)	(4.534)	(4.085)	(0.354)
Observations	18	18	18	18
R-squared	0.901	0.988	0.607	0.930

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In first-order AR (1) of autoregressive process significant but negative ARDL values are observed for the independent variable (tax revenue as a percentage of GDP) and predictive variables (industry as a percentage of GDP, Service as a percentage of GDP, and Agriculture as a percentage of GDP) with R-Squared value of 0.901. At the AR (1) level, predictive variables such as inflation, government effectiveness, regulatory quality, and control of corruption variables have shown no significant ARDL values are observed.

At AR (1) level, the ARDL value for tax revenue is -0. 552 at a five percent level of significance ($p<0.05$) with a standard error value of 0.166. Holding other factors constant, the tax revenue has shown a negative relationship with GDP. i.e., an increase in the GDP during the study period has not resulted in a proportional increase in the positive tax revenue share of GDP. Under ideal conditions increase in the GDP has to translate into proportional tax revenue of a country. Yet that presumption depends on several factors, the nature and structure of the economy, the tax basis, applicable tax rate, and efficiency of tax administration in a country which is difficult to determine from this ARDL test. Specifically, during the study period, a percentage increase in GDP has shown a decrease of 0.552 percent of tax revenue as a percentage of GDP. Thus, holding other factors constant, an increase in GDP has not translated into a proportional increase in tax revenue as a share of GDP in the country during the study period.

Similarly, at AR (1) level, the ARDL value for agriculture is -0.609 at a 10 percent level of significance ($p<0.1$) with the standard error value of 0.224. Accordingly, agriculture as a percentage of GDP has shown a negative relationship with tax revenue as a percentage of GDP which is consistent with prior done research results. Thus, during the study period, a percentage change in agriculture has resulted in a decrease of 0.609 percent of tax revenue as a percent of GDP. The usual explanation could be due to the nature of agriculture in low-income countries and its difficulty to tax subsistence agriculture which is prevalent in most low-income countries.

On the other hand, still at AR (1) level, the ARDL value for the industry is -0.497 at a 10 percent level of significance ($p<0.1$) with the standard error value of 0.227. In this case unlike the outcome of the earlier done research results, negative and significant relationship between the industry as a percentage share of GDP with tax revenue as a percentage share of GDP is observed. Accordingly, a one percent increase in the value-added industry resulted in a decrease of 0.497 percent of tax revenue as a percentage share of GDP during the study time. Thus, holding other factors constant, the nature and structure of the industry, compositions of value-added manufacturing export, the degree of tax holidays for export-oriented for foreign direct investors or export-oriented firms, and maybe the competitiveness of the manufacturing sector in generating profitable revenue may be among the possible factors for the explanation for the negative relationships. However, generalization may require further in-depth analysis or study.

Concerning service, at AR (1) level, the ARDL value for value-added service is -0.660 at a 10 percent level of significance ($p<0.1$) with the standard error value of 0.412. Thus, a negative and significant relationship with service as a percentage share of GDP with tax revenue as a percentage share of GDP is observed. Accordingly, a one percent increase in value-added service resulted in a decrease of 0.660 percent of tax revenue as a percentage share of GDP. Hence, holding other factors constant the negative relationship between service and tax revenue may be explained may be the nature of service whether it is dominated by valued adding services or not; share of the informal sector of the service sector in the low-income countries such as Ethiopia may be higher than limits the sector's contribution to share of GDP among other factors.

Finally, inflation, governance parameters such as government effectiveness, regulatory quality, and control of corruption have shown a significant relationship in predicting their effect on a percentage share of tax revenue of GDP. Especially, the absence of a significant relationship between inflation and control of corruption with a percentage share of tax revenue with GDP contradicts with prior done research results. Although, it requires additional explanation, considering the stationarity and lag effect of the predictive valuables (inflation and control of corruption) no significant correlation is observed.

At AR (2) level, no significant relationship between the independent variable (tax revenue as a percentage of GDP) and predictive variables are overserved. However, at AR (3) level, only, the tax revenue as a percentage of GDP has shown a negative ARDL value of 0.612 at a 10 percent level of significance ($p<0.1$) with the standard error value of 0.264. Thus, the nature of the relationship between tax revenue as a percentage share of GDP with GDP has remained negative except with a slight variation in the value of ARDL and Standard error as compared to at AR (1) level.

At the AR (4) level of the autoregressive process significant but negative ARDL values are observed for the independent variable (tax revenue as a percentage of GDP) and predictive variables (industry as a percentage of GDP, Service as a percentage of GDP, and Agriculture as a percentage of GDP and regulatory quality) with R-Squared value of 0.930. At this level, predictive variables such as inflation, government effectiveness, and control of corruption variables have shown no significant ARDL values are observed.

At AR (4) level, the ARDL value for tax revenue as a percentage of GDP is -0. 587 at a five percent level of significance ($p<0.05$) with a standard error value of 0.160. Holding other factors constant, the tax revenue has shown a negative relationship with GDP. i.e., an increase in the GDP during the study period has not resulted in a proportional increase in the positive tax revenue share of GDP. Under ideal conditions increase in the GDP has to translate into proportional tax revenue of a country. Yet that presumption depends on several factors, the nature and structure of the economy, the tax basis, applicable tax rate, and efficiency of tax administration in a country which is difficult to determine from this ARDL test. Specifically, during the study period, a percentage increase in GDP has shown a decrease of 0.587 percent of tax revenue as a percentage of GDP. Thus, holding other factors constant, an increase in GDP has not translated into a proportional increase in tax revenue as a share of GDP in the country during the study period.

At AR (4) level, the ARDL value for agriculture is -0.552 at a 10 percent level of significance ($p<0.1$) with the standard error value of 0.229. Accordingly, agriculture as a percentage of GDP has shown a negative relationship with tax revenue as a percentage of GDP which is consistent with prior done research results. Thus, during the study period, a percentage change in agriculture has resulted in a decrease of 0.552 percent of tax revenue as a percent of GDP. The usual explanation could be due to the nature of agriculture in low-income countries and its difficulty to tax subsistence agriculture which is prevalent in most low-income countries.

Concerning the industry sector, still, at AR (4) level, the ARDL value for the industry is -0.615 at a five percent level of significance ($p<0.05$) with the standard error value of 0.207. In this case unlike the outcome of the earlier done research results, negative and significant relationship between the industry as a percentage share of GDP with tax revenue as a percentage share of GDP is observed. Accordingly, a one percent increase in the value-added industry resulted in a decrease of 0.615 percent of tax revenue as a percentage share of GDP during the study time. Thus, holding other

factors constant, the nature and structure of the industry, compositions of value-added manufacturing export, the degree of tax holidays for export-oriented for foreign direct investors or export-oriented firms, and maybe the competitiveness of the manufacturing sector in generating profitable revenue may be among the possible factors for the explanation for the negative relationships. However, generalization may require further in-depth analysis or study.

About service, at AR (4) level, the ARDL value for value-added service is -0.579 at a 10 percent level of significance ($p<0.1$) with the standard error value of 0.261. Thus, a negative and significant relationship with service as a percentage share of GDP with tax revenue as a percentage share of GDP is observed. Accordingly, a one percent increase in value-added service resulted in a decrease of 0.579 percent of tax revenue as a percentage share of GDP. Hence, holding other factors constant the negative relationship between service and tax revenue may be explained may be the nature of service whether it is dominated by valued adding services or not; share of the informal sector of the service sector in the low-income countries such as Ethiopia may be higher than limits the sector's contribution to share of GDP among other factors.

Finally considering one of the governance parameters, at AR (4) level, the ARDL value for regulatory quality is found to be -0.286 at a 10 percent level of significance ($p<0.1$) with the standard error value of negative 0.0232. Thus, despite negative standard error value negative, significant but weak relationship between regulatory quality and a percentage share of tax revenue with GDP was observed. Thus, considering the value of R-Squared (0.930), the predictive valuables considered in this study using the ADRL model at AR (4) level, suggest that, the predictive variables considered in this study have 93% of the predictive value of the nature of the relationship with predictive variables and tax revenue as a percentage of GDP for the period considered in the study.

5. Conclusion

Despite increasing trends of tax collection reports and economic growth trends, the percentage of tax to GDP has not shown significant improvement. Ethiopia's tax to GDP ratio is far below the Sub-Saharan Africa average. Besides, the share of indirect tax has been higher than direct tax over years. According to the National Ten Years Development Strategy of Ethiopia (2021-2030) document, the Government intended to raise the percentage of tax revenue to GDP from 9.2 % in 2020 to 18.2 % of GDP in 2030. The findings at the AR (4) level of the autoregressive process indicated it is significant but negative ARDL values are observed for the independent variable (tax revenue as a percentage of GDP) and predictive variables (industry as a percentage of GDP, Service as a percentage of GDP and Agriculture as a percentage of GDP and regulatory quality) with R-Squared value of 0.930. At this level, predictive variables such as inflation, government effectiveness, and control of corruption variables have shown no significant ARDL values are observed.

Concerning the industry sector, still, at AR (4) level, the ARDL value for the industry is -0.615 at a five percent level of significance ($p<0.05$) with the standard error value of 0.207. In this case unlike the outcome of the earlier done research results, negative and significant relationship between the industry as a percentage share of GDP with tax revenue as a percentage share of GDP is observed. Similarly, at AR (4) level, the ARDL value for value-added service is -0.579 at a 10 percent level of significance ($p<0.1$) with the standard error value of 0.261. Thus, a negative and significant relationship with service as a percentage share of GDP with tax revenue as a percentage share of GDP is observed. Thus, the fact that inflation and control of corruption have shown no significant relationship whereas industry and service as a share of GDP have shown no significant relationship

requires additional study and remains an issue that demands explanations in the other in-depth research.

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