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Tax Revenue and Economic Growth Nexus in Ghana: Co-integration and Granger causality Test

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Abstract

The paper sought to assess the taxes and economic growth nexus in Ghana. The study used annual time-series data collected from 1972 to 2019. The study used the Johansen Co-integration technique, vector error correction model, and Granger causality test to assess the causal relationship between tax revenue and economic growth in Ghana. The Co-integration test was used to establish the long-run relationship. In contrast, the Granger Causality test was used to establish the short-run relationship between the variables used in the model. The study revealed that the model has a speed of adjustment of 61.4% to restore the short-run relationship to the long-run equilibrium path.
Furthermore, the study found a unidirectional relationship between tax revenue variables and economic growth. Again, the study found support for a positive and significant nexus between direct tax revenue and economic growth and a significant and negative nexus between indirect tax revenue and economic growth. Based on the results, the study recommends that the government tax policy move gradually from indirect tax revenue concentration to direct tax revenue to finance development programs to sustain economic growth.

Keywords: Direct tax; Economic growth; Granger Causality; Indirect tax.

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1 Introduction

The endogenous growth model explains why countries require sufficient and quality capital to foster economic growth. Economic growth depends on capital accumulation (i.e., increasing the stock of capital to expand a country's productive capacity) and sufficient capital to finance critical sectors of the economy needed for economic growth. It is an undeniable fact; that the government fiscal policy is fashioned to shift funds from individuals and corporations to the state to contribute to economic growth and the well-being of the citizens. According Ali-Nakyea (2006) tax system is a government's primary fiscal policy tool used to achieve the desired financial objectives of the country. The government policy should provide quality and quantity of physical capital, quality human capital, and advanced technology as essential to creating the higher growth needed in the country. The government needs enough revenue to finance the physical capital, quality human capital, and advanced technology. The linkage between tax revenue and economic growth has become highly debated among policymakers, researchers, academics, and economists in developing and emerging economies. Whatever the direction of influence, most policymakers are interested in the causes of higher economic growth. A government's role in allocating tax revenue to finance public expenditure cannot be underestimated. It is an essential tool used in price stabilization, economic growth, and development (World Bank's World Development Report, 1997). A sound tax system is the surest way the government can generate enough tax revenue to finance essential capital expenditure and services needed for economic growth and development. Despite the importance of tax revenue to the governments, most African countries cannot mobilize sufficient income to finance development projects in the continents due to widespread tax avoidance and evasion (Cottarelli, 2011). Inadequate tax revenue generation affects the financing of critical infrastructures such as roads, schools, bridges, and essential services needed to propel economic needed in most African countries, including Ghana. The government often has to complement the insufficient revenue mobilized with public debt with its negative consequence. The governments are constrained usually amid inadequate tax revenue, ballooning debt, and declining foreign aid leading to low levels of economic growth in the developing countries. The poverty of developing countries begot poverty, perpetuating the vicious cycle of poverty in developing countries. Since tax revenues affect the nation's wealth creation, the government should concentrate on tax policy formulation, administration, and enforcement. A robust economic growth promotes human development that may lead to economic development. The need to reform Ghana's tax system to generate enough revenue is to finance developmental projects in the country. Ghana has consistently recorded lower tax revenue, far lower than the acceptable 15% tax revenue to GDP as recommended by OECD. This trend is worrisome, and if something is not done about it, the government will continue to depend on loans to finance the public expenditure needed to propel the country forward. Successive governments have been criticized for not raising enough revenue to fund infrastructure and social investment to drive the country into an advanced economy. In the past, a government has tried to reform the country's tax system to mobilize enough revenue based on the canons of taxation: equity, simplicity, and economic efficiency. A good tax structure plays multiple roles in the country’s economic development process. According to Nwaorgu, Wilson, and Onyilo (2016), reasonable tax taxation provides the following benefits to the nation: Major source of revenue for financing the government's socio-economic development plan, taxation enables the government to re-distribute wealth equitably among the citizenry, especially the progressive type and finally serves as an automatic fiscal stabilizer to cushion the effects of economic cycles. The government of Ghana recently embarked on tax reforms undertaken to change the tax structure and tax revenue trends in Ghana. McMahon and Berrios (1991) argued that the need for tax reform is due to a deficiency in the tax system to achieve the desired macroeconomic objectives. Tax reform is modifying an existing tax system to achieve the government's desired macroeconomic goals. It is a theoretical assumption that changes in the tax system will boost the economy's overall growth, especially in the long term, even though the effect and magnitude are subject to considerable uncertainty. Gale and Samwick (2014) defined tax reform as either broadening the base or changing the neutral tax rate concerning the pre-existing revenue levels and distributional burdens of taxation. It is a complex process, and it may involve tax rate cuts, broadening the base, or both.

Tax revenue in Ghana is broadly grouped into two main categories: Direct taxes and Indirect taxes. Tax revenue is an essential component of government revenue, and it accounts for about 78% of the total revenue mobilized in Ghana (Ministry of Finance and Economy Planning [MoFEP], 2019). Indirect tax has contributed more to tax revenue than direct tax (Osei & Quartey, 2005). Tax reform in Ghana aimed to change direct and indirect tax revenue contributions to the tax revenue collection. One of the most debated topics on taxation in political and academic circles is the choice between direct and indirect taxes regarding their virtues and defects. According to Martinez-Vasquez, Vulovic, and Lius (2009), the choice between direct and indirect taxes is fundamental to the optimal tax structure design of the tax revenue since those forms of taxation may affect the goals of efficiency and equity total tax revenue differently. However, indirect taxes are taxes levied on transactions irrespective of the circumstances of the buyer or seller. According to Osei and Quartey (2005), indirect taxes have contributed more to tax revenue than direct taxes in Ghana. Direct tax accounted for 26.1%, while indirect taxes accounted for 73.9% of Ghana's total tax revenue from 1980-to 2002. The recent tax reforms embarked on in the early 2000s have seen a substantial shift in contribution from indirect tax to direct tax to the economy of Ghana. According to the Bank of Ghana (2020), direct taxes contribute about 43%, and indirect taxes contribute about 57% to Ghana's overall tax revenue collection. This is a significant increase in direct tax at the expense of indirect tax, and coincidentally, it has seen a rise in economic growth.Similarly, studies conducted by Rahul (2015) and Stoilova and Patonov (2012) recommended that India's tax system and European Union tax system should focus on a direct tax system to enhance economic growth in India and European Union. Direct taxes are taxes that are levied or adjusted to reflect the individual taxpayer's characteristics. Wallstrom (2006) conducted studies on member countries of the European Union and revealed a gradual shift from indirect taxes to direct taxes in recent times to strengthened economic growth and increased employment in the member countries. There is a gradual shift from indirect tax to direct tax contribution of tax revenue in the advanced economies. Globally, studies conducted on tax revenue and economic growth are inconclusive. Some empirical reviews revealed mixed and uncertain outcomes (Barro & Redlick, 2011; Dackehag & Hansson, 2012; Mawejje & Munyambonera, 2016; Takumah, 2014; Worlu & Nkoro, 2012; Romer & Romer, 2010; Mertens, 2015; Tosun & Abizadeh (2005). Scholars have many different research results regarding the relationship between direct tax, indirect tax, and economic growth. This was based on the fact that earlier was tax revenue and separated into the components of direct and indirect tax revenue effect on economic growth. At the same time, some researchers opined that there is no effect on the economy of some specific countries (Gbato, 2017; Mehrara, Masoumib, & Barkhi, 2014). In Ghana, Takumah (2014) assessed the effect of tax revenue on economic growth in Ghana using a co-integration approach. The outcome concluded that tax revenue affects economic growth significantly in Ghana's long-run and short-run. But since direct and indirect taxes affect economic growth, it would have been appropriate to separate tax revenue into direct and indirect taxes revenue to make a specific recommendation to support government tax policy. My primary motivation for this study is to assess the fiscal policy of taxation (i.e., direct tax revenue and indirect tax revenue) on economic growth in Ghana by evaluating the role of each type of tax revenue contribution to economic growth in Ghana. We submit that the current study is important for the following reasons: Firstly, tax revenue plays a significant role in the development of a country, and therefore, the need for specificity of the contribution of direct tax revenue and indirect revenue to the economic growth of Ghana. Secondly, the fiscal policy on taxation influences other macroeconomic variables such as foreign direct investment and inflation. Finally, the result from this study will provide fresh insight into the contribution of direct tax revenue, and indirect tax revenue, to economic growth, especially from a developing country's perspective. This result from this study will provide the necessary empirical evidence needed to bolster support for or against the recent tax reforms in Ghana. It will assist tax policymakers in getting the right and deeper understanding of the contribution of direct tax revenue and indirect tax revenue contribution to the economy during the future budgetary setting to ensure the economy performs efficiently. The remainder of the paper is structured as follows: Section 2 provides a short related literature review on direct and indirect tax revenue and economic growth; Section 3 presents the methodology employed to collect and analyze data for the study; Section 4 presents the empirical findings

and the attendant's discussion of the results of this study. Finally, section 5 ends the study with some conclusions and limitations.

2 Literature Review

This section reviewed related literature on the relationship between tax revenue and economic growth nexus. The literature review is organized into two sub-sections: theoretical and empirical literature.

2.1 Theoretical Literature: Endogenous Growth Theory

Endogenous growth theory is referred to as the New Growth Theory. Endogenous growth theory was introduced by Robert Lucas of The University of Chicago. Lucas espoused the endogenous growth theory due to criticisms against the Neoclassical (Exogenous growth) theory of economic growth. Robert Solow promulgated the Neoclassical Theory on economic growth in 1956. Robert Solow was an Economist and a Nobel Prize recipient for his formulation of the neoclassical theory of growth, which stressed the importance of savings and capital formation for economic development, and for empirical measures of sources of growth and development. Proponents of Neoclassical theory argued that overcoming the endless vicious cycle of poverty requires a big push in demand and investment in infrastructure (i.e., physical capital) in the form of power, transport, and communication to create spillover for the entire society. The endogenous growth theory came to prominence due to Neoclassical economists' assumption that technology is constant. The Neoclassical economists could not better explain the role of technology in economic growth. The Neoclassical theory emphasizes capital formation. The Neoclassical Economists opined that aggregate growth refers to increases in total production.

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$$Y_t = f\left(A_t, K_t^{\beta}, L_t^{\alpha}\right) \tag{1}$$

Where Y denotes the economy's aggregate production function (i.e., GDP growth rate per annum) at the time t and represents technology advancement at the time t, it is assumed to be constant. K and L represent capital and unskilled labor, respectively. Despite the acceptance of neoclassical growth theory by many, it suffered some criticisms from Robert Lucas (1988) and Romer (1994). Lucas (1988) and Romer (1994) were the primary promulgators of the Endogenous growth theory. The Endogenous growth theory (i.e., The New growth economists) internalized technology into the neoclassical theory and provided a better explanation for the role of technological advancement in economic growth. The idea contrasted with the previous approach by incorporating two critical points into the neoclassical theory. First, it viewed technological advancement as a product of economic activity and not constant. Secondly, the theory holds that knowledge and technology are characterized by increasing returns, which drive growth, unlike physical objects.

The Endogenous growth theory challenges the neoclassical economists in many important ways that the Neoclassical scholars primarily did not try to explain what caused technology to improve over time. It assumed that technology plays greater importance in achieving economic growth, capital accumulation, and labor force improvement as a source of growth for countries. Endogenous growth theory explains why

countries are lesser developed countries (LDC). In contrast, other countries have more advanced economies than other countries because the LDC cannot attract capital inflow, and many LDCs even experience domestic capital flight. Schultz (1964), another Nobel economist, argues that a society can invest in its citizens through expenditures on education, training, research, and health that enhance their productive capacity. Mankiw, Romer, and Weil (1992) argued that technology is the essential component to be added to physical and human capital resources to generate substantial economic growth for a country. Therefore, the policymakers cannot downplay the government's role in providing quality and adequate physical capital, human capital, and technology. The supporters of the Endogenous growth theory opined that knowledge and ideas could be infinitely shared and reused; we can accumulate them without limit. They argued further that technology is not subjected to "diminishing returns" as claimed by the supporters of the Neoclassical Economists but rather to "increasing returns" to propel economic growth.

Endogenous economists stressed the ongoing shift from a resource-based economy to a knowledge-based economy. This explains why Sub-Saharan African countries with enormous natural resources still suffer poverty and under-development (Nafziger, 2005). Therefore, the variable technology in production technology is the speed of convergence between developed countries (DC) and the LDC. The proponents of the Endogenous growth theory, such as Barro (1990) and King and Rebelo (1990), took that a fiscal position catalyst to economic growth can stimulate economic growth. When a government reduces taxes on companies and individuals, the companies can attract sufficient revenue to invest in technology that will eventually increase the production level of goods and services.

In contrast, individuals can mobilize more money to acquire skills and education for the economy's growth. Barro (1990) conducted a study into the effect of tax revenue and economic development and concluded that there is a temporary (short-run) and permanent (long-run) effect on economic growth. This implies that a sound design tax system is a necessary ingredient for the attainment of economic growth. A good tax system acts as externalities that stabilize economic policymakers and can correct macroeconomic variables such as inflation, the balance of payment challenges, foreign exchange difficulty, and low economic growth with an efficient tax system.

2.2 Empirical Review

This section reviewed some works carried out by scholars on the relationship between direct tax and economic growth and indirect tax and economic growth to provide the empirical evidence needed for this study.

2.2.1 Effect of Direct Tax Revenue on Economic Growth

In this sub-section, the study explores the relationship between direct tax revenue and economic growth by reviewing pieces of empirical literature to support this study. Reports of empirical literature suggest that direct tax revenue influences economic growth positively. Macek (2017), Gashi, Asllani, & Boqolli (2018), Ibidunni, & Adetoyinbo (2017), Ogundana et al. (2017), and Rahul (2015) opined that there was a positive relationship between direct tax and economic growth. Rahul (2015) studied the effect of direct tax and indirect tax revenue on India's economic growth. He concluded that direct tax influenced economic growth positively. In the same disposition, Stoilova and Patonov (2012) conducted a study into the tax systems of the European Union. They concluded that the tax system should be based on direct tax to enhance economic growth. Therefore, the tax authorities should focus on increasing direct tax revenue of tax revenue mobilization.

The explanation is that direct tax is on income and is a progressive tax. When direct tax s sound-coordinated, it can encourage investment into priority sectors of the economy, leading to increased productivity and employment of labor. Rajaswari and Susai (2014) study the tax buoyancy factor and economic growth. The study recommended that the government concentrate on mobilizing more direct tax revenue because direct tax revenue positively affects economic growth. Ekpung and Wilfred (2014) studied the relationship between direct tax and economic growth. The direct tax revenue was represented by personal income tax and corporate income tax and concluded a positive and significant relationship between direct tax and economic development.

Similarly, the work conducted by Ahmad, Sial, and Ahmad into the relationship between direct tax revenue affected economic growth and concluded that was a positive and significant relationship between direct tax and economic growth. Ahmad (2018) studied the effect of indirect tax on the economic growth of Pakistan from 1974 to 2010. He concluded that indirect tax has a significant negative impact on economic growth in the long run. Currently, indirect tax accounts for 63%, and direct tax accounts for 37% of Pakistan's tax revenue. The study opined that a 1% increase in indirect tax would reduce Pakistan's economic growth by 1.68%. Finally, the study conducted by Ogundana et al. (2017) used regression analysis on data collected on direct tax revenue and economic growth from 1994 to 2013 in Nigeria. The results showed that direct tax had a positive but significant effect on the economic growth of Nigeria. However, despite most of the studies revealing a positive relationship between direct tax revenue and economic growth, the study conducted by Magu (2010) and Owina (2018) showed a contrary relationship between direct tax revenue and economic growth.

2.2.2 Effect of Indirect Tax Revenue on Economic Growth

This sub-section reviewed the existing empirical literature on the relationship between direct tax revenue and economic growth. Most of the literature studied revealed a negative relationship between indirect tax revenue and economic growth. Oshoke (2016), Ogundana et al. (2017), and Subrahmanya and Urmi (2015) conducted studies into the relationship between indirect tax revenue and economic growth using linear ARDL and concluded that in the long run, there was a significant and negative relationship between indirect tax revenue and economic growth long-run. The explanation is that indirect tax revenue is on consumption and expenditure. If care is not taken in indirect tax administration, it can lead to inflation. Inflation creates risk and uncertainty within an economy and may drive away investment and capital accumulation. However, some researchers have opined that indirect tax positively affects economic growth (Khumbuzile & Khobai, 2018; Ahmad, 2018; Widmalm (2001; Xing, 2012).

3 Data and methodology

The study adopted time-series data to assess the effect of tax revenue on economic growth. The dataset consisted of annual data from 1972 to 2019 taken from three official websites: World Bank Development Indicators [WBI] and OECD, to determine the causal linkage between tax revenue and economic growth in Ghana. This is far above the recommendation of Tabachnick and Fidel (2007). The study adopted the Augmented Dickey-Fuller test (ADF) to establish stationarity among the series. The Johansen Co-integration test was used to determine the optimal lag of the time series and prove co-integration among the variables. Again, the study used the Vector Error Correction Model (VECM) to assess the variables' long-run and short-run relationship. Finally, the Granger Causality test is performed to determine the direction of the relationship between the variables. STATA (version 15) is the software package used to analyze the dataset.

3.1 Research model

The model for this study is based on the functional model of Dladla and Khobai (2018), which was based on the theoretical framework of Endogenous growth theory on the aggregate production function. The model is modified to include debt (DEBT) and foreign direct investment (FDI), and it is expressed as equation (2), which also is consistent with Cobb Douglas form as an equation:

$$Y_{it} = \left(DT_{it}, IND_{it}^{\alpha 1}, DEBT_{it}^{\alpha 2}, FDI_{it}^{\alpha 3}\right) \tag{2}$$

Taking logs on equation (2) converts the functional equation (2) into linear multivariate regression equation (3): where i denote the country, t denotes time, Y represents output or GDP, DT represents direct tax revenue, IND represents indirect tax revenue, and DEBT represents a percentage of the country's debt to GDP. FDI represents the receipt of foreign direct investment to the country respectively.

$$InGDP_{it} = \alpha + \alpha_1 InDT_{it} + \alpha_2 InIDT_{it} + \alpha_3 InDEBT_{it} + \alpha_1 InFDI_{it} + \varepsilon_t \quad (3)$$

The limitation of equation (3) is that the study cannot use it to assess both short-run and long-run effects between the variables simultaneously. Equation (3) has to be converted to Vector Error Correction Model (VECM) to successfully evaluate the short-run and long-run relationship. The VECM is mainly used to determine whether a causal relationship between the variables exists. Once there is a co-integration among the variables, VECM cannot be used in such a situation. According to Lupiski (2013), when the variables are co-integrated at order one, that is, I (1), then the relationship between the variables should be presented in the form of VECM and expressed as equation (4). Two main advantages of employing VECM are: (1) The error correction term reduces the challenges of multicollinearity that is commonly associated with time series, (2) the long-term effects are summarised on the level matrix, and (3) and interpretation of VECM result is easier to interpret (Juselin, 2006).

$$\Delta InGDP_t = \alpha + \sum_{i=1}^{k-1} \beta_i \, \Delta InGDP_{t-1} + \sum_{j=1}^{k-1} \psi j \, \Delta InDT_{t-j} + \sum_{m=1}^{k-1} \delta m \, \Delta InIDT_{t-m} + \sum_{n=1}^{k-1} \pi n \, \Delta InDEBT_{t-n}$$
$$+ \sum_{q=1}^{k-1} \sigma q \, \Delta InFDI_{t-q} + \lambda ECT_{t-1} + \varepsilon_{it} \quad (4)$$

Where Δ is the operator differencing, k-1= the lag length and is reduced by 1, is the error term or the equation's constant, t represents the time from 2001 to 2019, λ represents the speed of adjustment, and ECT_{t-1} is the error correction term and is lagged value of the residuals from the VECM that is obtained from the co-integrating regression equation of the independent variables on the dependent variable. The sign, size, and statistical significance of the coefficient ECT_{t-1} must be negative and significant to ensure convergence of the dynamics to the long-run equilibrium (Adefeso, Egbetunde & Alley, 2013). A negative and significant, then it implies that the past equilibrium plays a role in determining the current outcomes of the model. The β, ψ, δ, π, and σ are the short-run dynamic coefficients parameters of the model's adjustment to long-run equilibrium. The ε_{it} y are residuals (stochastic error terms often called impulses or shocks).

3.2 Estimation Technique

The study adopted three stages of econometrics tools to ensure the VECM approach is suitable for the analysis. Equation (3) is a regression equation not capable of assessing both the short-run and long-run relationship between the variables. These are: Unit root test, Johansen-co-integration test, and estimation of the short-run and long-run impacts are applied to the data collected using the VECM approach. The first stage is to ensure the variables are stationary. There is a need to test whether the variables in the model are stationary and capable of assessing both the long-run and the short-run relationship. It is essential to test the stationarity of the variables because the characteristics of the variables may determine their influence on the model. Time series is stationary when the statistical features of mean and variance are both constant (i.e., has no unit root). Else the time series is non-stationary (i.e., has unit root). When the series is found stationary without differencing, it is referred to as integrated of order 0 or designated as I (0). Otherwise, when the series becomes stationary after the first difference, it is referred to as integrated of order (1) or designated as I(1). The Augmented Dickey-Fuller (ADF) and Philips-Peron tests are the recommended tests to establish the model's stationarity of time series variables. In the second stage, we will use Johansen co-integration test to verify the existence of co-integration among the variables for the analysis. When the variables are found to be co-integrated, it implies there exists a stable, linear, and long-run relationship among the variables, such that the disequilibrium errors would tend to fluctuate around zero mean (Engle and Granger, 1987; Johansen, 1988). The third and final stage uses the Granger causality test to determine the direction of causality between tax revenue and economic growth.

3.3 Research variables

The data collected are organized into dependent, independent, and control variables to assess the effect of the tax revenue on the economic growth nexus.

3.3.1 Dependent variable (i.e., GDP Growth Rate)

Gross Domestic Product (GDP) growth rate: GDP is the proxy used to measure the dependent variable for this study. The GDP growth rate is GDP's annual percentage growth rate at market prices based on constant local currency. Data is taken from the World Development Indicator (WDI) and the Bank of Ghana (BoG). The subsequent studies used GDP as the proxy for economic growth (Adusei, 2013; King & Levine, 1993; Nguena & Abimbola, 2013; Samuelson & Nordhaus, 2010).

3.3.2 Independent variables (i.e., Direct tax revenue and indirect tax revenues)

Direct tax (DT) revenue: This is one of the independent variables used to assess the effect on economic growth. The direct tax revenue is levied on personal income tax, corporate income tax, and capital gain tax. The data is taken World Development Indicator (WDI). The relationship between direct tax and economic growth is uncertain. Most studies revealed a positive relationship with economic growth (Rahul, 2015; Gashi, Asllani, & Boqolli, 2018), except the studies conducted by the study showed Magu (2010) and Owina (2018) revealed the contrary relationship between direct tax revenue and economic growth.

Indirect tax revenue (IDT): IDT is one of the independent variables. The indirect tax revenue represents tax revenue from customs duties, Value Added Tax, excise duties, etc. Data is taken World Development Indicator (WDI). Most studies revealed a negative relationship with economic growth (Oshoke, 2016; Ogundana et al., 2017; Subrahmanya & Urmi, 2015).

3.3.3 Control variables (i.e., debt and foreign direct investment)

Besides the well-established fact that capital flight can influence economic growth, other external factors can also affect economic growth. These external factors are known as control variables. The study used debt and foreign direct investment as control variables.

Debt (DEBT): One of the control variables is gross government debt. It is the debt as a percentage (%) of GDP. The relationship between debt and economic growth has attracted considerable interest among researchers, policymakers, and academics (Clements et al., 2003). Many studies concluded that debt has a significant and negative effect on economic growth (Amjad & Khan, 2004; Anning et al., 2016; Egert, 2015; Kowalski, 2000).

Foreign Direct Investment (FDI): This is another control variable used to assess the effect on economic growth. FDI is an essential estimator of economic growth (Kowalski, 2000). Mixed results have been documented in pieces of the literature. Akram et al. (2011) opined a negative relationship between FDI and economic growth (GDP), while Diego (2006) opined a positive relationship with GDP.

3.4 Research Hypotheses development

The following four hypotheses were espoused to assess the relationship between tax revenue and economic growth in both short-run and long-run so that inference can be made for this study:

H01: There is no significant relationship between direct tax (InDT) and economic growth (InGDP) in the long- run. Hence direct tax does not affect economic growth in the long- run for the period selected for this study.

H02: There is no significant relationship between indirect tax (InIDT) and economic growth (GDP) in the long-run. Hence indirect tax does not affect economic growth in the long-run for the period selected for this study.

H03: There is no significant relationship between direct tax (InDT) and economic growth (InGDP) in the short-run. Hence direct tax does not affect economic growth in the short-run for the period selected for this study.

H04: There is no significant relationship between indirect tax (InIDT) and economic growth (GDP) in the short-run. Hence indirect tax does not affect economic growth in the short- run for the period selected for this study.

Statistical analyses involving Pearson correlation analysis, the VECM approach, and the Granger causality test will be used to assess these hypotheses. Each of these hypotheses is accepted or rejected based on the outcome obtained from the p-value and t-statistic of less than 5% (i.e., $p<0.05$).

3.5 Description of variables

It is common knowledge that time-series data is subjected to a high rate of skewness due to the existence of many outliers along the trend line. This subsection uses descriptive statistics to measure the central tendency and dispersion of the variables used in this analysis. The outcome from the descriptive statistics is presented in Table 1.

Table 1: Descriptive statistics for variables

Variables	Mean	Std. Dev.	Min.	Max.	Skewness	Kurtosis	Jarque-Bera	Prob
GDP	3.75	4.51	(12.43)	14.05	0.098	3.09	19.61	0.165
DT	1,780.00	4,710.00	5.51	22,683	0.081	2.99	18.27	0.570
IDT	2,390.00	5,550.00	16.45	22,562	0.104	2.82	16.37	0.188
DEBT	60.42	22.56	26.20	119.10	0.095	2.41	11.94	0.116
FDI	1,833.35	1,444.29	58.93	3,485.33	0.109	2.73	15.35	0.137

Source: Researcher's STATA version 15 Computation

Table 1 presents the descriptive summary statistics of the variables used to analyze the model in this study. The table depicts the mean and standard deviation of the variables used. The mean annual GDP growth rate for the period was 3.75% and a standard deviation of 4.51%, representing a spread of 0.66% and the mean. The minimum annual growth rate was (12.43) recorded in 1975, and the maximum GDP growth rate was14.05% recorded in 2011. A careful look at the raw data revealed that the lowest GDP growth rate of (12.43) was recorded in 1975. Coincidentally, it was around the same period when the country recorded higher indirect tax revenue and lowered direct tax revenue contribution to the total revenue for the government. It confirms increasing direct tax contribution has accelerated GDP growth in Ghana. Secondly, direct tax recorded a minimum tax revenue of 5.51 but a maximum tax revenue of 22,683 higher than indirect tax in 2019. It confirms changes in tax structures in Ghana in recent times. Ghana's debt as a percentage of GDP is 60.42% and a standard deviation of 22.56%. The minimum debt to GDP was 26.2% recorded in 2006 compared to the maximum of 119.10 in 2000 for the period under study in Ghana.

Additionally, Table 1 shows the values of skewness and kurtosis. Measures of skewness and kurtosis determine whether the dataset met the assumption of normality (Kline, 2011). The acceptable values for skewness should be within -2 and +2, and kurtosis should be within -7 and +7 when assessing normality in regression analysis (Byrne, 2010). The result shows that GDP, DT, IDT, DEBT, and FDI exhibit a positive skewness and are closer to zero. A positive skewness implies the dataset has a right tail, and the distribution is longer in the right tail than in the left tail. The skewness for GDP, DT, IDT, DEBT, and FDI are approximately symmetrical. Despite the substantial increase in DT to tax revenue in recent times, Table 1 shows the mean of IDT is still higher than the DT, but the most important revelation is the skewness of DT and IDT. While the DT gradually moves to the center, the IDT is still heavy dataset distribution at the right, confirming that IDT has contributed more in the past. The kurtosis values for GDP, DT, IDT, DEBT, and FDI are 3.09, 2.99, 2.82, 2.41, and 2.73, respectively. The kurtosis values of the variables are closer to 3, which implies the distribution is normal. A kurtosis with a value lowers than 3 corresponds to a broadening

of the peak and "thickening" of the tails. Therefore, it is platykurtic, and it mirrors a normal distribution. Thus, the null hypothesis of the Jarque-Bera test shows that the distribution exhibits normality since the p-values are significant (i.e., the p-value is greater than 5%).

3.6 Correlational among variables

This subsection used pairwise correlation to analyze the relationship between this study's dependent and independent variables. This analysis is carried out to determine the strength of the relationship between the dependent and independent variables. The outcome from this pairwise correlation matrix is shown in Table 2.

Table 2: Correlation matrix

Variables	InGDP	InDT	InIDT	InDEBT	InFDI
InGDP	1.000				
InDT	0.731	1.000			
InIDT	(0.623)	0.248	1.000		
InDEBT	(0.599)**	0.387	0.257*	1.000	
InFDI	0.665**	0.287*	0.342*	(0.346)*	1.000

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).
Source: Researcher's Stata version 15 Computation.

Table 2 shows that the correlation index (r) between DT, IDT, DEBT, FED and GDP are 0.731, (0.623), (0.599), and 0.665 respectively. It implied a significant relationship between GDP and tax revenue (i.e., IDT and InIDT). Again, Table 2 revealed that InDT, InFDI variables were positively and significantly correlated with InGDP while InIDT and InDEBT were negatively and significantly correlated with InGDP. The correlation between independent and dependent variables but correlation among independent variables was not so high to violate the multicollinearity assumption. This implies that there is a correlation between tax revenue and economic growth. The table revealed that the p-values for these variables are below 5% (i.e., $p<0.05$). According to Gujarati (2004), when the pairwise correlation coefficient between two independent variables is over 0.95, then multicollinearity is a serious problem for the study. The existence of multicollinearity would not affect how the regression is performed but rather affect the interpretation (Anderson, Sweeney & Williams, 2009).

4 Research results

The results obtained from regression analysis from the Augmented Dickey-Fuller Unit Root test, Johansen Co-integration test, Vector Error Correction result, and Granger Causality test are presented in this subsection. The result is organized into two subsections: (1) the first section presents the results from the preliminary tests before the analysis, such as the augmented Dickey-Fuller test and the Johansen Co-integration test, and (2) the VECM test and the Granger Causality test. According to Gujarati (2003), the co-integration test should precede the Granger Causality test.

4.1 Unit root test for stationarity

Most analyses involving macroeconomic time-series data are usually non-stationary (i.e., unit root) and, therefore, do not meet the standards for regression estimation. Adeleye et al. (2019) opined that using only visual examination to establish stationarity among variables is insufficient during time series analysis. To avoid spurious regression, it is essential to subject the stationarity test through scientific means to prevent spurious results from the study. A spurious regression result is an unstable model for estimating the relationship among the variables. Some econometrics tools used to test for stationarity in time series are the Augmented Dickey-Fuller (ADF) test and Philip-Perron (PP) test. This study used the ADF test to test for stationarity or unit roots in the data and not the PP test because the results of the ADF test are similar to the PP test under slightly different conditions. According to Arltova (2016), the result from ADF testing is

more reliable. It gives an excellent effect, especially in the case of small observations, while the PP test is a substitute for concise time series. Therefore, the study settled on ADF as the preferred stationary test in this study. The null hypothesis of the ADF unit root test assumes that the time series is non-stationary. The decision rule for the null hypothesis to be rejected is that the t-statistics value of the ADF unit root test should be greater than the critical value of 1% and 5% at the absolute value. Otherwise, the null hypothesis is not rejected. The result from the ADF test is presented in Table 3.

Table 3: Unit Root Test Results

		Critical values				Critical values			
Variables	Level	1%	5%	10%	1st Diff	1%	5%	10%	Order of int
InGDP	- 0.754	-2.567	-1.740	-1.333	-3.958	-2.583	-1.746	-1.337	I(1)
InDT	-1.295	-2.567	-1.740	-1.333	-3.439	-2.583	-1.746	-1.337	I(1)
InIDT	-2.474	-2.567	-1.740	-1.333	-2.692	-2.583	-1.746	-1.337	I(1)
InDEBT	-2.229	-2.567	-1.740	-1.333	-6.076	-2.583	-1.746	-1.337	I(1)
InFDI	-1.202	-2.567	-1.740	-1.333	-3.264	-2.583	-1.746	-1.337	I(1)

Source: Researcher's STATA version 15 Computation

Table 3 shows that the series were non-stationary (i.e., unit root) at the level of 1%, 5%, and 10% and therefore is, the need to convert the variables to become stationary at the first difference (i.e., unit root) at 1%, 5%, and 10% critical values. After the first differencing, the final result shows that all the variables are co-integrated at the first difference I(1) at 1%, 5%, and 10%. This result is consistent with Mathina and Jagongo (2016), who had the dependent and the independent variables at 1%, 5%, and 10% critical values at the first difference. Once the variables are integrated, we can perform the Johansen Co-integration test to establish a long-run relationship between the variables or among the variables. According to Granger (1988), VECM is the most appropriate approach to examining causality among the variables when integrated at I (1).

4.2 Determination of optimal lag length for the model

The optimal lag number is needed to assess the relationship between tax revenue and economic growth successfully. Liew (2004) opined that selecting an appropriate lag number is a sensitive matter in the lag order selection for a successful time-series analysis.

Table 4: Results of optimal lag length selector

Lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-68.10				0.002319	-6.62	-6.62	-6.62
1	18.28	172.76	25.00	0.000	2.90E-06	-13.44	-13.27	-12.21
2	86.99	137.42*	25.00	0.000	5.3e-08*	-18.2997*	-17.9587*	-15.83

Source: Researcher's STATA version 15 Computation

Before the conduct of Johansen Co-integration test, the study needs to test the optimal lag comprehensively using the Akaike Information Criterion (AIC), the Schwarz Bayesian Information n Criterion (SBIC), the Likelihood Ratio (LR), the Final Prediction Error (FPE), and Hannan Quinn Information Criterion (HQIC). The information criterion used to select the appropriate optimal lag follows most of the parameters; in this case, all the LR, FPE, AIC, HQIC, and SBIC showed the same lags of 2. To select the appropriate lag number depending on the Likelihood Ratio (LR) test, the Final Prediction Error (FPE) criterion includes Akaike Information Criterion (AIC), Hannan Quinn Information Criterion (HQIC), and Schwarz Bayesian Information n Criterion (SBIC). Table 4 shows that LR, AIC, FPE, HQIC, and SBIC have two lags, as indicated by the "*" in Table 4. It implies that the optimal lag selection should be at lag two because the AIC at lag 2 is (18.2997) and lower than the lag of (13.44). This selector suggests a long-run relationship among the variables at lags of two as defined by LR, AIC, FPE, HQIC, and SBIC.

4.3 Johansen Co-integration analysis

Johansen Co-integration test is performed to ascertain whether there is a long-run relationship between the model's variables (i.e., dependent, independent, and control variables). A long-term relationship among the variables implies that the variables move together for a long time to remedy the short-term shocks. The Eigenvalue and the trace statistics determine whether the series were co-integrated. The null hypothesis for the co-integration test assumed there is no long-run relationship between the variables for the analysis.

Table 5: Johansen Tests for Co-integration

Rank (r)	Parms	LL	Eigenvalue	Trace statistics	5% critical value
0	30	-12.018927	.	174.2209	68.52
1	39	40.815637	0.99718	68.5517	47.21
2	46	60.7241	0.89052	28.7348*	29.68
3	51	70.149338	0.64910	9.8843	15.41
4	54	73.221014	0.28915	3.7410	3.76
5	55	75.091502	0.18766		

Source: Researcher's STATA version 15 Computation

The decision criterion to reject the null hypothesis is for the value of the trace statistics to be lower than the 5% critical value of the test result. Even if the variables deviate from each other in the short run, they tend to come back to the trend in the long run. The result from the Johansen co-integration test is presented in Table 5. Table 5 shows the information generated on the variables, the trend specification, and the number of lags included in the model. It shows the possible numbers of co-integration equations. The first null hypothesis at a rank (r) zero is rejected at a 5% significance level because the trace statistics value of 174.2209 is greater than the 5% critical value of 68.52 at a 5% significance value. The second null hypothesis at a rank (r) one is also rejected because the trace statistics value of 68.5517 is greater than the 5% critical value of 47.21 at a 5% significance value. However, the third null hypothesis at a rank (r) is not rejected because the trace statistics value of 28.7348 is lower than the 5% critical value of 29.68. Table 5 indicates more than one co-integration among the variables since the trace statistics are less than the 5% critical value for the rank (r) at three, and four are also co-integrated. The "*" at the trace statistic at a rank (r) suggests a co-integrating equation based on Johansen's multiple-trace statistics procedure. The null hypothesis of no co-integration among the series reject at a 5% significance level. Therefore, there is a co-integration relationship between direct tax revenue, indirect tax revenue, debt, foreign direct investment, and economic growth. Once co-integration was established, the Vector Error Correction Model (VECM) was the most suitable econometric tool to analyze causality between the variables.

4.4 Diagnostic checks

The study performed normality, autocorrelation, and heteroskedasticity tests to ensure the VECM was correctly specified for the analyses. The test provides the needed confidence that the model is suitable for examining the relationship between the variables so that the study can infer the outcome.

Table 6: Model diagnostic checks and stability test

Diagnostic tests	Specification	Results	Conclusion
Jarque-Bera	Normality	Chi(4)=13.864, and p-value= 0.973	Normality present
Brusech-Godfrey LM	Autocorrelation	Chi(4)= 2.35, and p-value= 0.326	No autocorrelation
Brusech-Pagan	Heteroscedasticity	Chi(4)= 2.71, and p-value= 0.321	No heteroskedasticity
Ramsey RESET	Omitted variables	Chi(4)=0.442, and p-value= 0.975	No omitted variables

Source: Source: Researchers' computation (2022)

Table 6 shows that all the assumptions: normality, autocorrelation, and heteroskedasticity tests, were well specified and not violated. Finally, the model stability revealed the model is stable, and the functional form is reliable and rightly established for the goodness of fit.

4.5 Vector error correction model result

Once co-integration is established among the variables InGDP, InDT, InIDT, InDEBT, and InFDI, these variables have a long-run relationship over the entire period, despite the potential deviation from equilibrium levels in the short-run, or the variables might converge towards an equilibrium. The section is divided into three sub-sections: The Long-run Causality Result, Short-run Causality Result, and Granger-causality test results.

4.5.1 The Long-run Causality Result

The long-run causality result is obtained from the Johansen Normalisation Restriction (Results of co-integration equation). It provides information on the error correction term (ECT). It allows the coefficients in the VECM to express the relationship between the dependent variable (InGDP) and the independent variables (InDT, InIDT, InDEBT, and InFDI) in the co-integrating equation. The _ce1 shown in the first column of Table 7 represents the error correction term (ECT), or the adjustment matrix of the model is statistically significant because all the p-values are less than 5% (i.e., $p<0.05$). Therefore, the overall model, the coefficients, the standard errors, Z- statistics, and 95% confidence intervals of the variables were well-fit for the analysis.

Table 7: Johansen Normalization Restriction (The Long Run Results)

Beta	Coef.	Std. Err.	Z-statistics	P>|z	[95% Conf. Interval]	
_ce1						
InGDP	1	.	.	.	. .	
InDT	(0.339)	0.4212	(0.798)	0.000	(0.5365)	(0.1768)
InIDT	0.368)	0.3808	0.967	0.000	1.426	0.4129
InDEBT	0.638	0.1710	(3.73)	0.001	0.3648	(0.9620
InFDI	(0.252)	0.0545	(4.62)	0.000	(0.3211)	(0.1913)
_cons	(2.334)	.	.	.	. .	. .

Source: Researcher's STATA version 15 Computation

Table 7 shows the signs, the directions, and the estimates of the coefficients of the independent variables on the dependent variable in the long run. Again, the coefficients of the independent variables were statistically significant in the long run since the p-values were less than 5% since p-values are less than 5% level. To generate the co-integration equation from Table 7, the Identified coefficients are the dependent variable, and the economic growth (InGDP) is constrained. However, since the results are normalized on the InGDP, the long-run coefficient signs are reversed to enable accurate and meaningful interpretation. To interpret the coefficients of the outcome, the signs of the coefficients are changed in the long-run to allow correct and meaningful interpretation, as shown through equations (5) to (6). It exhibits strong support from a co-integrating equation such that the error correction term into stationary series in equation (6):

$$ECT_{t-1} = \lfloor 1.00InGDP_{t-1} - 0.339InDT_{t-1} + 0.368InIDT_{t-1} + 0.638InDEBT_{t-1} - 0.252InFDI_{t-1} - 2.334 \rceil \quad (5)$$

To normalize equation (5) to the stationary series equation, the value 1 (one) in the second column and third row on Table 7 is moved to the LHS to change the estimate signs are shown in equation (6):

$$InGDP_{t-1} = 2.334 + 0.339InDT_{t-1} - 0.368InIDT_{t-1} - 0.638InDEBT_{t-1} + 0.252InFDI_{t-1} + ECT_{t-1} \quad (6)$$

The equation (6) can be explained as a one-percentage-point increase of direct tax revenue, and foreign direct investment will cause an increase of one-percentage-point in the economic growth of 0.339 and

0.252, respectively. At the same time, a one-percentage-point increase in indirect tax revenue and debt will cause a decrease of one percentage point in the economic growth of (0.368) and (0.638), respectively. This finding is consistent with Macek (2017), Rahul (2015), and Stoilova and Patonov (2012), who concluded that direct tax has a positive effect on economic growth and indirect tax has a negative impact on economic growth. However, this outcome contradicts Ogundana (2017) findings, which concluded a positive relationship between indirect tax and economic growth. Considering the negative consequence of income inequalities, the cause of imported inflation on the economy, etc., this study does not consider this approach based on the empirical evidence deduced from the result. Instead, the government should aim to remove the barriers to direct tax collection and broaden the tax net by roping in the non-formal considered underground economy to contribute more tax to the economy. This implies direct tax revenue and indirect tax revenue have asymmetric effects on economic growth in the long run, on the average ceteris paribus.

4.5.2 Short-run Causality and ECM Result

The short-run causality and the ECM test were performed to assess the short-run relationship between the independent and control variables and independent and dependent variables. When the variables are co-integration, then the variables in the relationship can specify the error correction term (ECT) to capture both the short-run and long-run relationships (Bannerjee et al., 1998; Engle & Granger, 1991). The ECT should be negative and statistically significant if the model can correct any of the shocks in the short run and can update any of the shocks in the short run in the long run. The result from the VECM is usually taken at the first difference of the variables, as represented by D_ (InGDP), D_ (InDT), D_ (InIDT), D_ (InDEDT), and D_ (InFDI) in Table 8.

Table 8: Short-run Causality Estimates and ECM Results

	D(InGDP)	D(InDT)	D(InIDT)	D(InDEBT)	D(InFDI)
CointEq(-1)	(0.614)***	(0.342)**	(0.033)	(0.494)**	(0.539)***
	[-1.914]	[0.026]	[-7.089]	[-4.953]	[-2.743]
D(InGPD (-1))	0.260**	0.024*	(0.017)	(0.021)*	(0.021)***
	[1.562]	[0.013]	[-1.246]	[-0.402]	[-0.402]
D(InDT (1))	0.302***	0.210*	(0.068)	(0.806)*	(0.806)**
	[0.811]	[0.301]	[-0.221]	[-0.697]	[-0.697]
D(InIDT(-1))	0.241***	(0.195)**	0.602	0.217*	0.217*
	[0.764]	[0.258]	[2.286]	[0.219]	[0.219]
D(InDEBT(-1))	(1.037)***	(0.015)*	(0.064)	(0.060)	(0.060)*
	[-1.047]	[0.080]	[-0.789]	[-0.196]	[-0.196]
D(InFDI(-1))	2.990***	0.024***	(0.122)**	(0.373)**	(0.373)***
	[2.030]	[0.119]	[-1.005]	[-0.816]	[-0.816]
Constant	(0.020)***	0.287	0.091	0.104***	0.104
	[-0.016]	[0.975]	[0.916]	[0.277]	[0.277]
R^2	0.8609	0.8939	0.866	0.2963	0.6102
Log-likelihood	360.995				
AIC	-34.629				
BIC	-31.037				

***, **, and * denote rejection of the null hypothesis at the 1%, 5%, and 10% significance levels, respectively.
t- Statistics are provided in square brackets.
Source: Researcher's Stata version 15 Computation.

There is a need to use the error correctio n model (ECM) to construct the dynamic relationship between the variables for the model once co-integration is established. The purpose of the ECM is to integrate the short-run behavior of tax revenue into its long-run behavior and to indicate the speed of adjustment from the short run to the long run (Gujarati & Porter, 2009). The coefficient of the ECM must be negative and statistically

significant to reveal the presence of a long-run causal relationship between the variables. Table 8 shows that the short-run error correction mechanism exists, and it is represented as CointEq(-1) in the first row of Short-run Causality Estimates and ECM Results. Since the coefficient of the ECT is negative and significant at a 1% level of significance. That is, [i.e., the coefficient is (0.614), p-value =0.000], implying the model can restore 61.4% from the short-run disequilibrium to the long run and explain the relationship between the dependent and the independent in Ghana that can be corrected within the current year. Therefore, the model possesses a suitable error correction term of about 61.4% certainty that the shocks in the current period (short-run) can adjust or converges to the long-run equilibrium. Therefore, the model possesses a suitable error correction term of about 61.4% certainty that the shocks in the current period (short-run) can adjust or converges to the long-run equilibrium.

A careful look at the relationship between tax revenue on economic growth in the short-run shows that there is a significant statistical relationship between D_ (InDT), D_ (InIDT), D_ (InDEBT), D_ (InFDI), and the D_ (InGDP) regression at lag one since the p-value is less than 5%. Furthermore, the short-run causal relationship is implied when the t-statistics of the coefficients of the independent variables are significant (i.e., when the p-values are less than 5%). Table to shows that, in the short-run coefficients between the direct tax revenue represented by D_(InDT (1)) is positively related to economic growth D_In(GDP(-1)), and it is statistically significant at 5% probability level. This implies that all things remaining equal, a percentage-point increase in direct tax is associated with 0.302% of economic growth. However, the short-run coefficients between the indirect tax revenue represented by D_(InIDT (1)) are negatively related to economic growth D_In(GDP(-1)), and it is statistically significant at 5% probability level. This implies that all things remaining equal, a percentage-point increase in indirect tax is associated with a decrease of 0.241% in economic growth. It meant that direct tax revenue and indirect tax revenue have an asymmetric relationship on economic growth and can affect economic growth at a 5% significant level. This outcome is consistent with previous literature ((Rahul, 2015), which concluded that government should reduce the proportion of indirect tax contribution to total tax revenue to increase economic growth and vice versa.

4.5.3 Wald Test Result

The Wald test aims to determine whether the variables contribute significantly to the short-run causality of the model. The Wald test computes the variables presented in Table 9. The Chi-square of the Wald test is used to identify short-run causality among the variables in the model. The null hypothesis of the Wald test assumes no short-run causality in the model.

Table 9: Results of the Wald Test Statistics for Short Run Causality

	Short Run Asymmetry	
Variables	Chi-square (2)	Prob.
InDT	17.2	0.002
InIDT	16.9	0.000
InDEBT	13.52	0.000
InFDI	12.97	0.001

Source: Researchers' computation (2022)

Table 9 shows the result of the Wald test. The Chi-square value and the p-values associated with the Chi-square at two degrees of freedom. The null hypothesis of no causality between independent and dependent variables is rejected since the p-values are less than 5%. The study concludes that there is short-run causality for InDT, InIDT, InDEBT, and InFDI. Therefore, the variables are significant and contribute to the short-run causality of the model fit.

4.5.4 Granger-causality test

In addition to assessing the long-run and short-run relationships between the variables, the study used the Granger Causality test to determine the direction of causality among the variables. Granger Causality test is preferred to other regression tests because used to detect the lagged relationships of the series. In the

usual sense, Granger's non-causality has more to do with prediction and causation. It is on the premise that the past can cause/predict the future, but the future cannot cause/predict the past. The result of the Granger-causality test is presented in Table 10 and confirms the short-run relationship among the variables and indicates the direction of causality among the series variables.

Table 10: Granger Causality Wald tests

Null hypothesis (Ho)	F-Stat.	Prob	Conclusion
InGDP des not Granger-cause InDT	1.719	0.423	H0 is not Rejected
InDT does not Granger-cause InGDP	64.829	0.000	H0 is Rejected
InGDP does not Granger-cause InIDT	5.876	0.183	H0 is not Rejected
InIDT does not Granger-causes InGDP	61.898	0.000	H0 is Rejected
InGDP does not Granger-cause InDEBT	0.267	0.875	H0 is not Rejected
InDEBT does not Granger-cause InGDP	143.220	0.000	H0 is Rejected
InGDP does not Granger-cause InFDI	0.891	0.641	H0 is not Rejected
InFDI does not Granger-cause InGDP	65.293	0.000	H0 is Rejected

Source: Researchers' computation (2022)

Table 10 provides the empirical evidence needed to accept or reject the null hypothesis of Granger Causality between the independent variables (InDT, InIDT, InDEBT, and InFDI) and the dependent variable (InGDP). The null hypotheses that InDT, InIDT, InDEBT and InFDI do not Granger-cause InGDP is rejected because the p-values were below 5% confidence level but the study failed to reject the reverse that economic growth (InGDP) on direct tax revenue (InDT), indirect tax revenue (InIDT), debt (InDEBT) and foreign direct investment (InFDI) because the p-values were above 5%, that is (p-value=0.423), (p-value=0.183), (p-value=0.875), and (p-value=0.641) for indirect tax revenue (InIDT), debt (InDEBT) and foreign direct investment (InFDI) respectively. In other words, direct tax revenue, indirect tax revenue, debt, and foreign direct investment influenced economic growth and not the other way around. Therefore, there is a unidirectional causality among the variables. This outcome of unidirectional causal flow from tax revenue to economic growth is consistent with the conclusion drawn by Owusu-Gyimah (2015), Takumah and Iyke (2017), and Egbunike et al. (2018). It implies that tax revenue is affected by economic growth and not vice versa.

4.6 Discussion of the results

In the long run, the study observed a statistically significant relationship between the independent and control variables (InDT, InIDT, InDEBT, and InFDI) and InGDP, as shown in Table 7, since the p-values were lesser than 5%. The coefficient between InDT and InGDP, in the long run, was 0.339, and it implies that a 1% increase in direct tax revenue (InDT) increases economic growth (InGDP) by 0.339%. This finding is consistent with Macek (2017), Rahul (2015), and Stoilova and Patonov (2012), who concluded that direct tax revenue has a positive effect on economic growth. The outcome suggests that direct tax is systematically associated with economic growth in the long run. Therefore, based on Table 7, the study failed to reject the null hypothesis (H01) and concludes that direct tax (InDT) has a significant relationship or can positively influence economic growth. Secondly, in the long run, the coefficient between InIDT and InGDP was 0.368, and it implies that a 1% increase in indirect tax revenue (InIDT) decreases economic growth (InGDP) by 0.368%. A 1% increase in indirect tax revenue (InIDT) decreases economic growth (InGDP). The main reason indirect tax causes negative growth is the shrinking effect on production (Stoilova & Patonov, 2012). An aggressive indirect tax policy can cause inflation for a country that imports a substantial amount of fuel and machinery from outside to support the substitution agenda of the government of Ghana. Inflation may cause investors uncertainties leading to lost foreign direct investment. This finding is consistent with Macek (2017), Ahmad, Sial, Ahmad (2018), and Rahul (2015), who

concluded that indirect tax has an adverse or negative effect on economic growth in the long run. Therefore, based on this result and the explanation, the study failed to reject the null hypothesis (H02) and concludes that indirect tax (InIDT) has a significant relationship or can negatively influence economic growth in the long run. Furthermore, the coefficient between InDEBT and InGDP, in the long run, was (0.638), and it implies that a 1% increase in direct tax revenue (InDEBT) will decrease economic growth (InGDP) by 0.638%. The finding is consistent with Fosu (1996), Egert (2015), and Anning et al. (2016), who opined that debt is a problem for the economic growth in Ghana. Therefore, the government should take steps to reduce the levels to support economic growth in Ghana. Finally, the coefficient between InFDI and InGDP, in the long run, was 0.252. It implies that a 1% increase in foreign direct investment (InFDI) will positively increase economic growth (InGDP) by 0.252 in the long run. The finding is consistent with Diego (2006), who opined that foreign direct investment could boost economic growth positively in the long run. It implies that foreign direct investment can cause economic growth in the long run. The positive effect of FDI re-established that Ghana has benefited positively from the spill-over effect of foreign investors in the country. Again, Table 8 shows that in the short-run, D_ (InDT) and D_ (InIDT) as the first difference indirect tax revenue and indirect tax revenue, respectively. The coefficient between D_ (InDT) and D_ (InIDT) in the short-run was 0.302, and it implies that a 1% increase in direct tax revenue (InDT) increases economic growth (InGDP) by 0.302% in the the the short run. This outcome is consistent with previous studies by Ogbonna and Ebimobowei (2012), Ogundana et al. (2017), Rahul (2015), and Takumah (2014). Therefore, the study failed to reject the null hypothesis (H03) and concludes that direct tax (InDT) has a significant relationship or can influence economic growth positively in the short run. Furthermore, **t**he coefficient between InIDT and InGDP in the short-run was (0.241), and it implies that a 1% increase in indirect tax revenue (InIDT) decreases economic growth (InGDP) by 0.241% in the short run. Therefore, the study failed to reject the null hypothesis (H04) and concludes that indirect tax (InIDT) has a significant relationship or can influence economic growth negatively in the short run.

5 Conclusions and recommendations

The paper aims to assess the short-run and long-run relationship between tax revenue and economic growth. The result of the Johansen co-integration test revealed the series are integrated at I (1), suggesting the VECM approach and Granger causality as the most appropriate econometrics tools to investigate the effects of the long-run and short-run relationship between direct tax revenue, indirect tax revenue,,, and economic growth. The study infers long-run and short-run causality between the variables using the Johansen Co-integration and Wald tests. Again, the outcome from the Granger Causality test revealed that there is unidirectional causality between direct tax and indirect tax revenues, debt, and foreign direct investment in economic growth. This outcome is consistent with economic growth theory and other empirical predictions. Apart from tax revenues, the study found that other macroeconomic variables such as debt and foreign direct investment affect economic growth in both the short and long.

The study makes three recommendations to government tax policymakers based on the findings from this study: (1) The government should restructure the current direct tax system to increase the contribution of the direct tax revenue to the total tax revenue mix and reduce the ratio of indirect tax revenue contributions to the total tax revenue. (2) The government's effort to mobilising more tax revenue should be directed at direct tax revenue rather than indirect tax revenue. (3) The tax authorities should reduce all administrative bottlenecks impeding direct revenue collection and introduce e-filing to maximize direct tax revenue to the state. (4) There should be a concerted effort to expand the tax base rather than increasing the marginal rate of tax of direct tax to avoid tax evasion and profit shifting of individuals and companies. Finally, the tax authority should reduce the corporate tax rate for Small and Medium-sized Enterprises as an incentive to promote new enterprises and improve production and business capacity. Finally, government tax policy on direct tax should aim at roping in more taxpayers, especially in the non-formal sector of the economy, rather than increasing the tax rate to increase indirect tax revenue in Ghana. There are two main limitations to this study. The first limitation identified for this study is the scarcity and reliability of data availability in developing countries like Ghana. For that matter, the study focused on data from 1985 to 2019. The second limitation is based on the fact that only direct tax (DT), indirect tax (IDT), Debt (DEBT), and foreign direct

investment (FDI) is the macroeconomic variables used as independent variables for the analysis. It is a known fact that capital flight and grants can also influence economic growth. Therefore, future research should assess the effect of capital flight and its contributions to economic growth.

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