

Measuring the impact of tax revenues on economic growth and investment in Sudan during the period (2006-2021)

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Abstract

This study aimed to identify the nature of the relationship between tax revenues, economic growth and investment in Sudan during the period (2006-2021). Also building mathematical models through which tax revenues can be predicted. The descriptive analytical approach was used. The study relied on secondary data collected from the reports of the Central Bank of Sudan for different years. The study used the Autoregressive Distributed Lag Model methodology (ARDL) to analyze tax revenue data to find out the nature of the relationship between the study variables for the long and short period of time for the Sudanese economist. The standard approach was also relied upon to estimate the relationship and nature between tax revenues, economic growth and investment in Sudan. The research showed the validity of some of the hypotheses of the study. The existence of a positive relationship between tax revenues and economic growth and the invalidity of the hypothesis for the existence of a positive relationship between tax revenues and investment, the study reached a number of results, the most important of which is that there is a positive relationship between tax revenues and economic growth and the inverse relationship between tax revenues and investment, due to the weak ability of Sudan to compete in Attracting foreign investments, The main reason for this is due to the weak investment climate in the country, and the weakness of attractive regulations, laws and policies, The most important recommendation of the study is the need to work to improve the tax base and reduce tax evasion because taxes have a positive impact on GDP.

Keywords: Tax revenues, Economic growth, Investment, Sudan

1. Introduction:

Revenues and expenditures are considered among the main elements that reflect the strength or weakness of the economy and therefore reflect the actual picture of the economy through the difference between them. Where a deficit or surplus appears for the country budget, as well as the economic performance of the national accounts of various countries. As general revenues develop in volume and type, general expenditures increase and diversify. Revenues are considered an important performance among the financial policy tools, and through them governments can influence economic activity. The concept of general revenues includes achieving economic and social goals by collecting the incomes that the country obtains through its various economic or non-economic units. The governments depend on various sources of general revenues, and the importance of these sources varies according to the prevailing economic and political system in the country and the extent of its progress. Among its components are taxes, which are considered the most important sources in the modern era because of their impact on the economic, political and social aspects through which governments can influence the market, redistribute income and distribute resources. They are considered a source of government revenue to finance expenditures, which are known as tax revenues. Its importance has increased with the development of general career sector, and the country needs economic resources through which it can satisfy its tax needs. The tax is considered a contribution from members of society and bears general burdens as a contribution towards the country. The most important sources of tax revenues in Sudan are income tax, business profits, and capital gains, value added tax (VAT) and taxes on international trade and production.

1.1. The problem of the study: Despite the increase in tax revenues as a result of the expansion of the tax umbrella, Sudan still suffers from widespread evasion and the non exist of several commercial activities from the collection department.

The problem of the study emerges from the following questions:

What is the nature of the relationship between tax revenues and economic growth?

1.2. The importance of the study: The importance of the study lies in the fact that tax revenues have a vital role in addressing the financial imbalance, achieving growth and economic stability, and creating accurate predictions of tax revenues. The practical importance of this study comes to reach the best standard model for measuring the relationship between the study variables through the latest application Methodologies for measuring relationships in both the short term and the

long term, which is represented by the (ARDL) methodology, for the purpose of benefiting from this relationship in serving economic decision-makers in developing the appropriate economic policy for how to collect taxes and benefit from them.

1.3. Objectives of the study: The study aims to:

1. Determine the nature of the relationship between tax revenues, economic growth, and investment in Sudan during the period (2006-2021).
2. Identify the general trend in prediction tax revenues in Sudan during the period ((2006-2021) AD)
3. Identify the growth of tax revenues in Sudan during the period (2006-2021).

1.4. Study hypotheses: The study contains a number of hypotheses:

- 1- There is a long-term complementary relationship between tax revenues and total local product.
- 2- There is a long-term complementary relationship between tax revenues and investment.
- 3- There is a correlation statistically significant relationship between tax revenues and economic growth in the long and short term.
- 4- There is a correlation statistically significant relationship between tax revenues and investment in the long term and the short term.

1.5. Study Methodology: The study depends on the descriptive analytical approach, where the descriptive aspect is used in graphs and descriptive statistics of tax revenues in Sudan, while the standard aspect is used in building mathematical models to analyze the results to prove the study's hypothesis and the accuracy of its predictions. Through the use of an autoregressive with time gaps distributed known as the ARDL model.

1.5.1. Data sources: The study depended on secondary data obtained from reports for different years at the Central Bank of Sudan in Sudan during the period (2006-2021).

1.5.2. Study limitations:

Time limitations (2006 – 2021) AD

Place limitations (Sudan)

2. Previous studies:

Hazem Sakban Hassan - Manahil Mustafa Abdel Hamid 2023P: This study aimed to identify the tax system and its efficiency in the Iraqi economy during the period from (2004-2020). The study relied on the extrapolate analysis method by analyzing the data, tracking its developments

over time, extrapolating the economic reality, and then extrapolate the effects and results to reach to the specific results through the available economic tools. . The study concluded that the tax system in Iraq is characterized by its weak flexibility and its inability to respond to the requirements of economic growth or to the changes occurring in the structure of economic activity, and thus the reduced role of tax revenues in financing the general budget in Iraq as a result of the low contribution rate, as it constituted an average contribution rate of (11.1%) of total general revenues, and this confirms the rentier of the Iraqi economy and its heavy dependence on oil revenues to finance the general budget. Finally, indicators of the efficiency of the tax system in Iraq indicated a low level of efficiency of that system, as the tax system was unable to exploit tax capacity efficiently, and this led to the loss of tax revenues that would have provided tax revenues that would feed government expenditures. Tax rates also need the necessity adopting the replacement of some of the applied taxes with taxes that is more effective, contributes to increasing tax revenues and feeding better general budget. While the research recommended the need to increase the efficiency of the taxpayer inventory system because it is the first step to identify all sources of income subject to tax. The accuracy of the inventory expresses the extent of the management's success as well as activating the role of tax oversight in implementing the tax law and reducing opportunities for tax evasion through the formation of inspection committees from some independent bodies and academics are prepared to impart independence and efficiency upon inspection.

Shiad Faisal study 2022: This study aimed to identify the impact of taxes on economic growth in Arab countries during 2010 - 2018. The study conducted several preliminary tests, including descriptive statistics, stability tests from the first and second generation, and cointegration. The group mean and combined group test were used and models were better determined using the Hausman test. The results indicated that taxes are negatively related to economic growth in the study sample. Therefore, weak tax levels are more conducive to economic growth as supported by the economic impact of Ibn Khaldun's theory on taxes, which endorses the positive impact of a lower tax rate on work, output and economic performance. Using the generalized moments method estimation, it was found that there is an inverse effect of non-correlation taxes on gross capital formation.

Study by Houari Sufyan and Nagal Fatima 2021: This study aimed to determine the effectiveness of tax policy as one of the financial policy tools in achieving economic growth

during the period, 1990-2019, based on the least squares method OLS. It was found that there is a correlation and positive relationship through the impact of tax policy on economic growth through petroleum levy in the short and long term as Algeria's economy is rentier. It was also concluded that growth was not affected by regular collection despite the amendments made to it in 1992, but it remains insufficient and requires other reforms.

Study by Muhammad Amin Qabour - Misbah Harrak 2020: This study aimed to measure the impact of regular collection revenues on the general budget in Algeria during the period (1991-2018), through the position of regular collection revenues in the general budget revenues as well as its ability to finance general expenditures. The analytical approach was used following the joint integration approach within the framework of the ARDL model. , to use the Eviews program. The results of the study found that there is a co-integration between regular collection revenues (Impd, Ddn, Tva, Tmb) and the general budget, and there is a positive impact of regular collection revenues on the general budget in Algeria. This indicates that the higher the revenues (Impd, Ddn, Tva, Tmb) will lead to an increase in the general budget.

Study by Sanaa Nazmi - Khaled Mafah Muhammad 2015: This study aimed to identify the role of tax revenues in supplementing the Jordanian general budget with general revenues by conducting a comparative analytical study during the period between 2006-2013, which focused on comparing the role of income tax, sales tax, and other taxes in increasing the scale of general revenues in the general budget. In Jordan, the study used the analytical approach and to achieve the objectives of the study, the study was divided into two financial periods, the first period before the implementation of the amended income and sales tax law for the period between 2006-2009 and the one second after the implementation for the period between 2010-2013. The study concluded with the following most important results: Tax revenues contributed more than non-tax revenues, grants and foreign aid, in supplementing the general budget, in general revenues, as the percentage of tax revenues out of general revenues constituted approximately 64%. The sales tax played the largest role in supplementing the general budget with tax revenues, compared to the income tax and other taxes, as the sales tax, income tax, and other taxes each contributed, on average, approximately (64%, 25%, and 11%) of the tax revenues, respectively. One of the most prominent recommendations of the study was to make amendments to the income tax law and the sales tax law based on a thoughtful basis to increase tax revenues that contribute to supplementing the general budget with general revenues.

3. Theoretical framework:

General revenues:

General revenues are the important substrate upon which financing general expenditures is used, through which the country carries out all its financial activity and achieves its goals. (Flih Hassan Khalaf, 2008, p. 161)

One of the concepts that preoccupied many general finance thinkers is that general revenues have become increasingly important for two reasons:

- Collecting money is not the main purpose of revenues, but rather influencing general life to achieve economic and social goals.
- The scale of expenditures inflation as a result of the increase in the country's careers, so it was necessary to increase the scale of revenues in order to have a broader impact on general revenues. The increase and diversification of general revenues in a way that enables the structure of general revenues include:
 - Revenues that the government receives from taxes.
 - Revenues from general projects (General sector).
 - Revenues from internal and external loans.
 - Deficit financing through new monetary issuance.
 - Other revenues.

These types included in the general revenue structure differ according to their importance and the nature of the revenues in terms of the system and the degree of their development.. (Flih Hassan Khalaf, 2008, p. 164).

Tax revenues:

As a result of the country's intervention in economic activity and to increase national income, taxes were considered one of the main sources of financing that countries depend on to finance general expenditures. Therefore, taxes have a contemporary definition of the concept of tax, which is that it is a monetary payment imposed by the country on individuals and companies with the intention of covering general expenses. It is an obligation monetary borne by those assigned by the country to achieve its goals (Khaled Amin and others, 2015, p. 12) The tax is considered a monetary obligation and a compulsory duty, imposed by a country without charge. The tax aims to achieve general benefits (Mohammed Khasawneh, 2014, p. 90) The tax is not only used for a financial purpose, but it also achieves social goals, such as reducing disparities between classes.

Its economic goal is to limit consumption, investment guidance and encourage saving, and thus affect the national economy. (Abdul Karim Sadiq Barakat, 1983, p. 13). Therefore, the objectives of tax vary between economic, financial and social objectives. It becomes clear that the tax system in any country seeks to achieve these various tax objectives. The priorities of these objectives are political and social preference, and the means of tax policy tools that are applied differ with each economic system and the degree of development, whether it is economic or social (Khadija Al-Aasar, 2016, p. 141).

Tax revenues in Sudan: The budget structure in Sudan, which was issued by the International Monetary Fund in 2001, consists of general revenues, expenditures, surplus, total deficit, and sources of financing. General revenues include direct and indirect taxes, grants, and the most important sources of tax revenues are income, business profits, capital profits, value-added tax, taxes on international trade and production and some other taxes. Non-tax revenues consist of sales of goods and services, property rights income, and customs duties. (Bank of Sudan Report 2021, p. 123).

Taxes on income, profits and capital profits: It is deducting a portion of the income obtained from different incomes and dividing it according to the entity to which it is received. (Ministry of Finance, 2017, p. 21) The income is divided into several types (work - capital - industrial projects - income from professions), Thus, there is a difference in processing in the tax due to the multiple taxes, which leads to a difference in the estimation of the tax base and collection methods.

- **Property taxes** are a wealth tax, provided that they can be changeable. Wealth is considered as a balance, not a current. It is divided into real and inheritance taxes and they are considered as an important taxes.
- Taxes on goods and services have multiple forms, including customs and sales taxes, which are considered important for the country, especially in developing countries (Mohammed Khasawneh, 2014, pp. 98-110).
- Taxes on international trade and transactions are the taxes imposed on goods that cross borders, including customs, exports, imports, and exchange profits (Ministry of Finance 2017, p. 22). Revenue taxes and customs duties are imposed on imported goods when they enter the country and constitute a high percentage of government revenues due to the increase in imports goods (Mahmoud Hussein Al-Wadi, 2015, p. 77).

Table No. (1) Shows revenue growth during (2006-2021)

| Tax revenue growth | Taxes | Year |
|---------------------------|--------------|-------------|
| | 5.881 | 2006 |
| 9.938744 | 6,530 | 2007 |
| 9.49773 | 7,680,3 | 2008 |
| 11.2699 | 8,655.8 | 2009 |
| 13.51638 | 10,008.6 | 2010 |
| 14.50406 | 11,183,3 | 2011 |
| 28.16206 | 15,567.4 | 2012 |
| 30.49518 | 24,133.7 | 2013 |
| 35.39567 | 35,178.1 | 2014 |
| 36.16937 | 41,963.3 | 2015 |
| 41.20194 | 47257 | 2016 |
| 45.98631 | 63849 | 2017 |
| 50.10126 | 91,345 | 2018 |
| 69.91496 | 114,060 | 2019 |
| 70.68977 | 159,949 | 2020 |
| 74.98581 | 639,433 | 2021 |

Source prepared by the researcher from the main table of the study

Table No. (1) shows the tax revenues growth in Sudan during the study period. This is mainly due to the increase in correlation taxes (income taxes and property taxes) as a result of an expansion of the tax umbrella by reducing tax exemptions and adjusting some categories on goods and services, in addition To continue implementing and expanding the electronic collection project, despite widespread evasion and the departure of several commercial activities from the collection department, in addition to continue to organize campaigns to combat customs tax evasion (Bank of Sudan Report, 2020, p. 109).

Figure (1) shows the growth of tax revenues during the study period

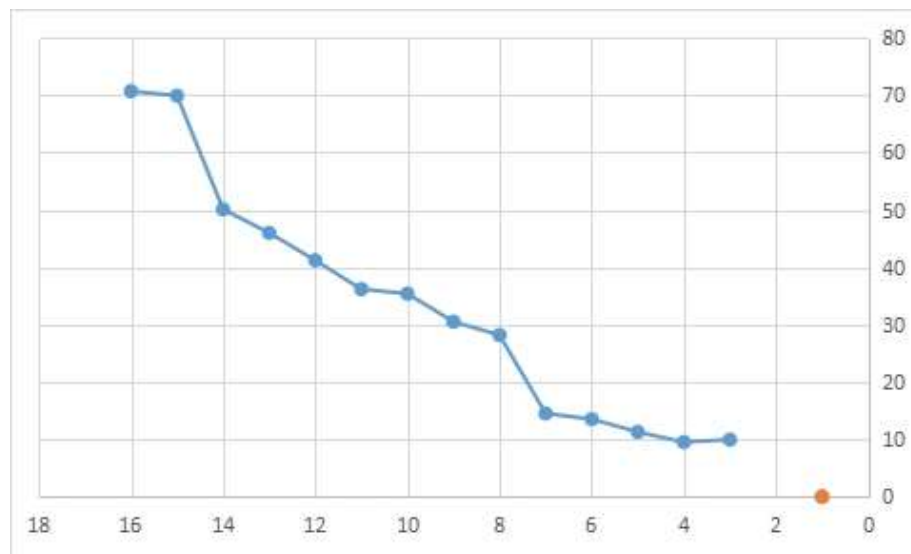


Figure (1) shows the growth of tax revenues during the study period

Tax challenges in Sudan (tax evasion):

Tax evasion means non-payment of the tax, in whole or in part, by the person responsible for paying it. As a result, the country does not receive revenues, as transferring its burden does not cause the country to lose the tax revenue. Tax evasion can be achieved by the following: -

- Not practicing the activity on which tax is imposed.
- Carrying out the activity in various illegal ways, such as financial fraud or deception, and in the case of customs tax, introducing goods illegally, and for income and wealth tax, concealing some elements of income, all these affects tax collection.
- The causes of tax evasion are many and varied, the most important of which are poor accuracy and clarity in the tax system, multiple taxes, weak tax awareness, and a weak degree of honesty, thus weakening tax efficiency.

There are many effects of tax evasion, including a decrease in revenue collection, which limits the general services that the country provides to society, and the country imposes additional taxes at higher tax rates. Tax evasion can also be reduced by using many methods, including reducing taxes and working to ensure accuracy and clarity in tax legislation, simplifying procedures for collecting taxes, setting deterrent penalties that are applied effectively, and increasing citizen awareness of the importance of paying taxes and the purpose for which the tax is paid to achieve his own benefit and the benefit that society obtains. (Flih Hassan Khalaf, 2008, p. 196).

Sudan has established support for anti-evasion devices:

These devices aimed to achieve the following:

- The simplicity of the tax system in Sudan and the cancellation of multiple taxes, customs duties, and production fees on goods and services.
- These agencies sought to achieve justice and remove all negative effects on production, investment, saving and consumption.
- Preventing double taxation, especially on production inputs.
- Increasing non-correlation tax revenues.

The government of Sudan sought to mobilize idle capacities in order to increase supply from the overall economy and processing the tax base for many industrial goods. The processing included both the field of in-correlation taxes and export taxes (Khaled Abdel Hafeez, 2021, p. 144).

Financial policy regarding general revenues in developing countries:

Financial policy must work, through progressive taxes, to increase the collection of tax revenues imposed on income, wealth, and capital, so that they are not imposed in a way that negatively affects economic activity. This ensures high tax revenues, so the state obtains the largest amount of taxes, and this limits... Resources are directed to unproductive activities. Within the framework of fiscal policy, ensuring the reform of the tax system in developing countries to many problems and their solutions in a way that raises tax revenues and reduces evasion, especially by those most able to pay. Reaching out to hidden activities through the underground economy in which many illegal activities are practiced. Hence, countries must address the reasons that drive such activities in order to make them general in accordance with the laws. Following up on unorganized economic activities that are not subject to regulations in their work and whose practice is expanding in developing countries in order to reach incomes and returns from which tax revenues can be collected. The financial policy must develop such activities and oblige them to confirm their activity through records and documents through which they know the returns and are authorized to increase the revenue collection. tax Increasing the revenues of general projects owned by the state by increasing the productive efficiency of productive projects in order to achieve a surplus in revenues or lower state costs Warning developing countries against loans as a source of general revenues, especially those that are used for consumer purposes, which makes debts obligatory, and therefore it is necessary to reduce them so that they do not negatively affect economic activity. Or those that make a positive contribution are loans that expand productive activity.

Finally, fiscal policy should not depend on issuing cash because most developing countries depend on it in order to expand general expenditures, and one of the effects of this policy is the inflationary impact on the economy. (Flih Hassan Khalaf, 2008, pp. 349-354)

4. Analysis methodology and study model estimation results:

4.1. Description of the study model:

The standard model for measuring the impact of tax revenues on economic growth and investment in Sudan during the period 2006-2021 includes a number of economic variables expressed by a mathematical function that is determined through the literature represented in economic theory and applied studies.

The study variables are:

- * Dependent variable: economic growth (GDP).
- * Independent variable: tax revenues (RT). Investment(INV)

It is expected that landmark signs will be as follows:

- 1- The sign of the constant is expected to be positive (B_0), as it represents economic growth when all independent variables are equal to zero.
- 2- The sign for tax revenues (B_1) is expected to be positive because there is a correlation relationship between tax revenues and economic growth.
- 3- The investment sign (B_2) is expected to be positive because there is a correlation relationship between investment and economic growth.

4.2. Analysis results of the study model:

The practical application of the ARDL methodology includes three steps: determining the integration order of the variables under study using unit root tests, test of the existence of an integral relationship using the Bounds Testing Approach, and finally estimating the ARDL to obtain the short- and long-term processes. The following is a discussion for the results of the analysis of the study model:

A- Test of the stability of time series data (unit root tests):

The unit root test aims to examine the properties of the time series for all variables in the model during the study period, ascertain the extent of their stationary, and determine the degree of integration of each variable separately, as the condition of stationary is a basic condition for time series analysis to reach intact and logical results. Despite the multiple root tests Unit, the study

will depend on applying the Augmented Dicky Fuller test (ADF), in the event that there is a secant and a trend, and the estimation results are as shown in the following table.

Table No. (2) Results of the unit roots test for the study variables during the period (2006-2021)

| In the first difference | | In the level | | Variables |
|-------------------------|---------|---------------|---------|--------------------------|
| ADF Value | P Value | ADF Value | P Value | |
| -5.88 | 0.0000 | -1.023 | -1.711 | 1- Economic growth (GDP) |
| -6.060 | 0.0001 | -2.789 | 0.008 | 2- Tax revenue(TR) |
| -4.588 | 0.0026 | -1.571 | 0.471 | 3- Investment (INV) |

Source: Prepared by the researcher from the study data based on the outputs of the E.Views12 program

It is clear from Table (2), based on the Extended Dickey-Fuller (ADF) test, that all variables (economic growth, tax revenues, investment) are not stationary at their levels. Therefore, the unit root tests were re-conducted again for these variables, and the results indicated the presence of stationary for these variables. After the first differences at a 5% significance level, this means that the time series for these variables are integrated of the first degree, and this is considered a good indicator of the effectiveness of using the co-integration test between the time series.

B- Co-integration test:

After obtaining the results of the unit root test for the time series of the study variables and determining the degree of integration for each variable in the study model. Also ensuring that they are not integrated of the second degree, therefore, the appropriate test for this is the bounds test for co-integration (Bounds Test) to verify the existence of a long-term complementary relationship between the variables under study. Since the ARDL model is considered very sensitive to time gaps, which necessitates determining the optimal lag period for the variables through the using different criteria (Al-Shorbagy, p. 157, 2009), which are: the final prediction error (FPE) standard, Accurate Information Standard (AIC). Schwarz Information Standard (SC), Hanan Quinn Information Standard (Q-H), Maximum Likelihood Ratio (LR) standard.

According to these standards, the optimal lag period is chosen which has the lowest value and on which most standards are agreed upon.

Table (3) shows the results of choosing the optimal lag period for the study variables.

| Log time | SC | AIC | FPE | LR | H.Q |
|----------|----------|-----------|-----------|-----------|-----------|
| 0 | 38.72498 | 38.66446 | 2.13E+14 | NA | 38.59808 |
| 1 | 31.56156 | 30.6678 | 9.34567 | 2.267823 | 36.78904 |
| 2 | 7.17252* | 36.99096* | 4.14e+13* | 17.31449* | 36.7918 |
| 3 | 37.84156 | 37.53898 | 8.39E+13 | 1.259923 | 37.20704 |
| 4 | 37.46645 | 37.04283 | 8.19E+13 | 3.888455 | 36.57812* |

Source: Prepared by the researcher from the study data based on the outputs of the E.Views12 program

* Indicates the optimal number of lag periods chosen for each standard at a significance level (5%).

It is clear from Table (2) that the optimal number of lag periods, which is agreed upon by all the used standards and which has the lowest values for all the standards, is two lag periods, which are the ones that are used in estimating the study model. After determining the optimal lag periods for the model variables, a bounds test for co-integration is conducted, in which the null hypothesis states that there is no co-integration relationship between the variables. The results of this test are shown in Table (4) as follows:

Table (4) Results of the bounds test for co-integration among the study variables

| Value | K | F – Statistic |
|--------------|------------|---------------|
| | 2 | 8.729 |
| Significance | I(0) Bound | I(1) Bound |
| 10% | 2.61 | 3.35 |
| 5% | 3.01 | 3.87 |
| 2.50% | 3.55 | 4.38 |
| 1% | 4.01 | 5 |

Source: Prepared by the researcher from the study data based on the outputs of the E.Views12 program

Through Table (3), we find that the value of F reached (8.927), which is greater than the critical value of (3.87) at the 5% significance level, which confirms the existence of a co-integration relationship between the variables of the model, and this means the existence of a long-term

balanced relationship between each of the tax revenues, investment and economic growth during the study period.

4.3. Results of estimating the study model:

In light of the previously presented results of the stability test and ensuring the existence of a long-term equilibrium relationship between the dependent variable (economic growth) and the explanatory variables (tax revenues and investment), the ARDL model is estimated for the long and short terms and the error correction vector parameter (ECM) according to the equation shown in the previous paragraphs. Based on the number of lag periods specified according to the standard for choosing the lag period for all variables. All calculations for estimating the model were performed using the E-views12 program, as follows:

A- Estimating the relationship in the long term:

The results of estimating the ARDL model for estimating the relationship between tax revenues and investment as independent variables and economic growth as a dependent variable in the long term, shown in Table (4), showed the existence of a correlation, statistically significant relationship between tax revenues and economic growth in the long term, where the value of the regression coefficient reached (0.6487). With a level of significance (0.0146), which is a value lower than the level of significance (0.05), which indicates that a change in the volume of tax revenues by 1% increases economic growth at a rate of (0.65%). While the estimation results indicate that there is a correlation relationship between investment and economic growth in the long term, as the value of the regression coefficient reached (0.167), but it is not significant as the probability value reached (0.461), which is a value greater than the level of significance (0.05). As the coefficient of determination indicates (Adjusted R-squared) which had a value of 0.89, provided that the explanatory variable (tax revenues) explains 0.89% in the long term of the variance in the dependent variable (economic growth), while the remaining percentage of these changes (00.11%) can be traced back to other variables not included in the model. This result indicates the ARDL model is good quality in explaining tax revenues on Sudan's long-term economic growth.

Table (5) Estimation results of the long-term study model during the period (2006-2021)

| Variable | Coefficient | Std. Error | t-Statistic | Prob.* |
|-----------|-------------|------------|-------------|--------|
| LOG (TR) | 0.648734 | 0.201258 | 3.223391 | 0.0146 |
| Log (INV) | 0.167767 | 0.215122 | 0.779871 | 0.4610 |
| C | 3.694540 | 1.201564 | 3.074776 | 0.0179 |

Source: Prepared by the researcher from the study data based on the outputs of the E.Views12 program

$$\text{Log}(GDP) = 3.694 + 0.648\text{LogTR} + 0.167\text{Log}(INV)$$

R-squared= 0.997 Adjusted R-squared=0.995 F-statistic=30.06

Prob (F-statistic)=(0.0000).

B- Estimating the relationship in the short term:

The results of estimating the ARDL model showed that the study model was estimated in the short term using the error correction model, and the results were as shown in Table (6).

| Variable | Coefficient | Std. Error | t-Statistic | Prob.* |
|---------------|-------------|------------|-------------|--------|
| DLOG (TR) | 1.484475 | 0.251626 | 5.899529 | 0.0006 |
| CointEq (-1)* | 0.812341 | 0.113737 | 7.142276 | 0.0002 |

Source: Prepared by the researcher from the study data based on the outputs of the E.Views12 program

$$D(GDP) = 1.484\log(XP) - 0.8123\text{CointEq}(-1)$$

R-squared= 0.93 Adjusted R-squared=0.91

It is clear from Table (5), which shows the results of estimating the ARDL model for the short term, that there is a correlation, statistically significant relationship between tax revenues and economic growth in the short term, where the value of the regression coefficient of the relationship reached (1.484) and a level of significance level (0.0006), which is a value less than the level of significance (0.05), which indicates that a change in the volume of tax revenues by 1% increases economic growth at a rate of (1.48%) in the short term. The Adjusted R-squared, whose value was (0.91), indicates that the explanatory variable (tax revenues) explains (91)% in the short term of the variance in the dependent variable (economic growth), while the remaining percentage of these changes (9%) can be returned to other variables not included in the model. This result indicates ARDL is good quality model in explaining the impact of tax revenues on economic growth in Sudan in the short term. The estimation results also indicate that the error correction coefficient has a negative sign and is significant, as the value of the error correction factor (CointEq(-1)) reached (-0.812) with a significance level of (0.0002). This value means that the deviation from the equilibrium relationship in the long term is corrected annually by (81)% to reach equilibrium, meaning that the dependent variable takes about a year and two months (1/0.812 = 1.2). Also, the significance of the error correction coefficient indicates the existence of a long-term equilibrium

relationship between the explanatory variable (tax revenues) and the dependent variable (economic growth).

4- Checking Model validity: The validity of the model is diagnosed by ensuring that the model meets a number of necessary standard criteria for the process of intact statistical inference. The most important of these standards is to verify the assumptions regarding the error limits, which are the observations of the random error limit are independent of each other and similar.

The distribution is normally distributed with zero mean and variance 2 and since it is unknown, the residuals are used instead. The results of verifying the validity of the model are as follows:

A- Results of the autocorrelation test for the residuals:

The following table shows the results of testing the null hypothesis that the residuals are not independent of each other using the Lagrange multiplier test (Breusch-Godfrey Serial Correlation LM Test) where the results indicate that there is no statistical evidence to accept the null hypothesis; Meaning that there is no autocorrelation for the residuals, as the value of the level of significance reached (0.254), which is a value greater than 5%.

Table (7) Lagrange multiplier test for the independence assumption of residuals for a model Breusch-Godfrey Serial Correlation LM Test:

| | | | |
|--------------------|--------------|----------------------|--------------|
| F-statistic | 2.490 | Prob. F(2,5) | 0.239 |
| Obs*R-squared | 9.118 | Prob. Chi-Square (2) | 0.254 |

Source: Prepared by the researcher from the study data based on the outputs of the E.Views12 program

B- Results of testing the variance invariance hypothesis:

To ensure homogeneity of error (Breusch-Pagan-Godfrey test) was used. The following table shows the test results, which indicates that there is no statistical evidence to reject the null hypothesis, which means that there is no problem of variance, as the test value reached (0.642), which is a value greater than the level of significance level (5)%.

Table 8: Breusch-Pagan-Godfrey test for the non-constancy of variance hypothesis:

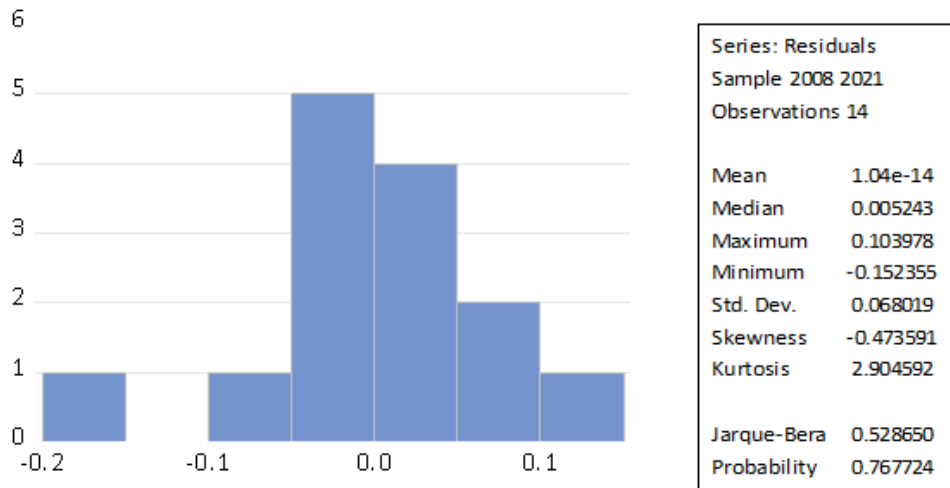
| | | | |
|---------------------|-----------------|-----------------------|---------------|
| F-statistic | 0.509487 | Prob. F(6. 7) | 0.7853 |
| Obs*R-squared | 4.255466 | Prob. Chi-Square (6) | 0.6421 |
| Scaled explained SS | 1.013116 | (Prob. Chi-Square)(6) | 0.9851 |

Source: Prepared by the researcher from the study data based on the outputs of the E.Views12 program

C- Results of the normal distribution test for the error term:

The condition of normal distribution was verified using the Jarque-Bera test, and the results indicated that the test value was (0.528) with a probability value of 0.776, which is greater than the 5% significance level. This value indicates that the residuals follow the normal distribution at the 5% significance level.

Table (9) Normal distribution test for the error term:



Source: Prepared by the researcher from the study data based on the outputs of the E.Views12 program

D- Suitability test of the estimated model:

To verify the suitability, specification and design of the estimated model in terms of the functional form, the Ramsey test was used, and the results shown in Table (10) the probability value corresponding to the F-statistic reached (0.837), which is greater than the level of significance (0.05), which indicates acceptance. The null hypothesis states that the functional form of the estimated model is correct.

Table No. (10) Ramsey test results for the suitability of the functional form to the estimated model

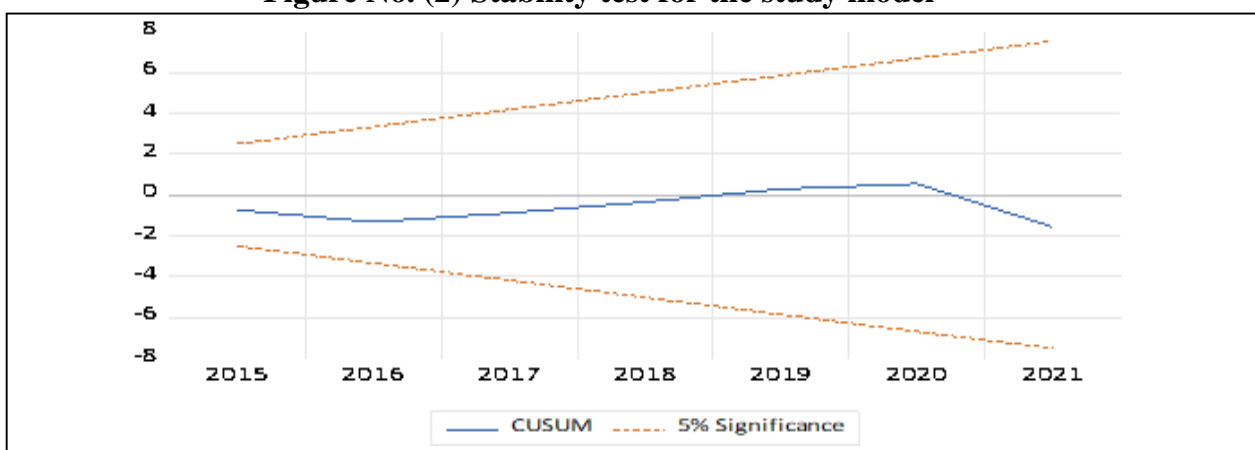
| Probability | df | Value | |
|-------------|--------|----------|------------------|
| 0.8372 | 6 | 0.214557 | t-statistic |
| 0.8372 | (1, 6) | 0.046035 | F-statistic |
| 0.7436 | 1 | 0.107005 | Likelihood ratio |

Source: Prepared by the researcher from the study data based on the outputs of the E.Views12 program

E- Structural stability test of the model parameters:

To know the consistency of the coefficients of the model variables in the long and short run, the Cumulative Sum of Residuals (CUSUM) test was used. According to this test, the structural stability of the coefficients estimated using the error correction formula for the (UESM) model is achieved when the graph line for the CUSUM statistic is confined within the critical graph lines at a significant level. (5%), while these coefficients are not characterized by stability if the statistical graph line falls outside the critical graph lines. In the estimated model, it is noted that the Cumulative Sum of Residuals (CUSUM) test falls within the critical limits at a significance level (5%), which indicates that There is stability and consistency in the model estimates between the long-term results and the short-term results, meaning that the estimated coefficients of the unconstrained error correction model used are structurally stable during the study period

Figure No. (2) Stability test for the study model

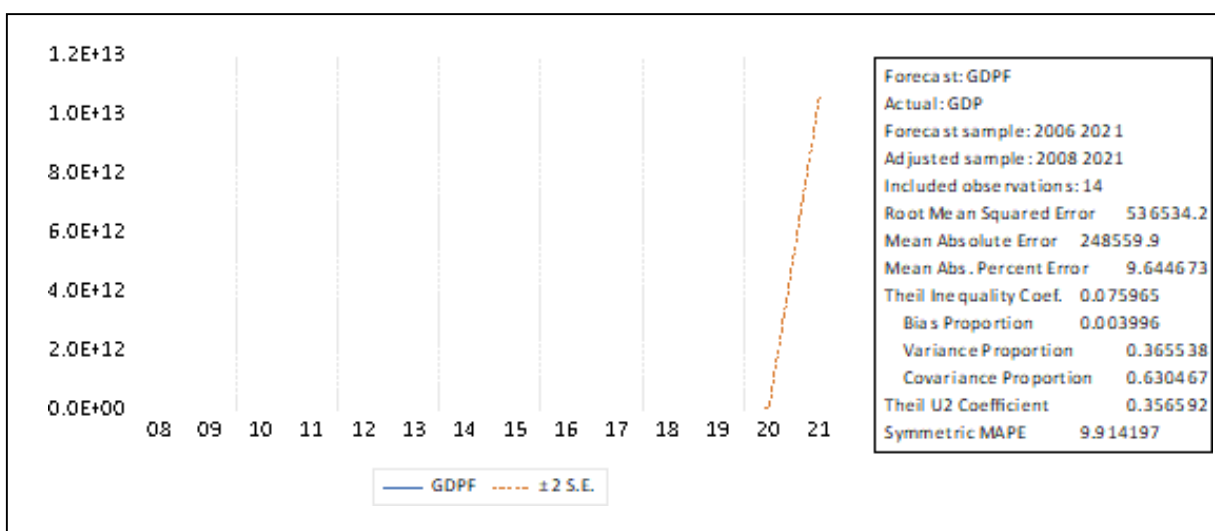


F- Model's predictive ability test:

Prediction is considered one of the important goals in econometrics, as it determines the path of the phenomenon in the future to help in the process of planning, control, and decision-making. Prediction studies the development of the phenomenon over time as a factor that shows the resultant effect of all factors affecting this phenomenon. Phenomena change with time from one month to another and from an year to another. Time itself is not an influential factor in the development of economic phenomena as it is an independent indicator objective of human action. However, time is inherent in the development of economic phenomena, and therefore it is possible to link the state of the phenomenon and the moment that corresponds to this condition, or between the developments of the phenomenon and the period of time during which those developments took place or will take place resulting from other factors than time that affect the

phenomenon and lead to its change in quantity and quality. It is possible to test the extent to which the estimated model can predict by using the Theil equality coefficient standard . It is clear from the estimation results shown in Table (10) that the value of the Thiel coefficient reached (0.75), which is a value close to zero. This result indicates that the estimated study model has an excellent ability to predict during the period under study, and this ability to predict can be observed through the figure (2) Which explains the behavior of the actual and expected values of economic growth in Sudan according to the estimated model. Accordingly, the results of this model can be relied upon for the purposes of analysis, policy evaluation, prediction, and economic decision-making.

Table (11): Results of model’s predictive ability test



Source: Prepared by the researcher from the study data based on the outputs of the E.Views12 program

5. Results and recommendations:

1.5. Results: The study reached the following results:

- The results of the stability tests for the series of study variables, using the unit root test, showed that all the variables under study (tax revenues, investment, and economic growth) are unstable at their levels, as they stabilized at the first difference.
- Through testing the limits, the study found that there is a co-integration relationship between tax revenues, investment, and economic growth.
- The study demonstrated the existence of a correlation, statistically significant relationship between tax revenues and economic growth in Sudan in both the long term and the short term during the study period.

- The study found that there is no correlation, statistically significant relationship between investment and economic growth in Sudan in both the long term and the short term during the study period.
- The study demonstrated the importance of the explanatory ability of tax revenues in economic growth, as the value of the coefficient of determination was (93%) in the short term and (99%) in the long term.
- The study found, through testing the error correction factor, that the deviation from the equilibrium relationship in the long term is corrected annually by 81% to reach equilibrium.

5.2. Recommendations: Based on the previous results, the study recommends the following:

- Working to improve the tax base and reduce tax evasion, as taxes have a positive impact on the gross domestic product.
- Expanding tax exemptions for investment projects that effectively contribute to increase production
- It is necessary to process many issues related to achieving long-term economic growth through reform of the tax system.
- Activating the digitization of tax administrations by facilitating electronic tax payment procedures.
- Encouraging investment because of its positive effects by expanding the production base and promoting growth.

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Supplements

Limit test for integration

Null Hypothesis: No levels relationship

F-Bounds Test

| I(1) | I(0) | Signif. | Value | Test Statistic |
|----------------|-------|---------|----------|--------------------|
| Asymptotic: | | | | |
| n=1000 | | | | |
| 3.35 | 2.63 | 10% | 8.927119 | F-statistic |
| 3.87 | 3.1 | 5% | 2 | K |
| 4.38 | 3.55 | 2.5% | | |
| 5 | 4.13 | 1% | | |
| Finite Sample: | | | | |
| n=35 | | | | |
| | | | 14 | Actual Sample Size |
| 3.623 | 2.845 | 10% | | |
| 4.335 | 3.478 | 5% | | |
| 6.028 | 4.948 | 1% | | |
| Finite Sample: | | | | |
| n=30 | | | | |

| | | |
|-------|-------|-----|
| 3.695 | 2.915 | 10% |
| 4.428 | 3.538 | 5% |
| 6.265 | 5.155 | 1% |

Results of estimating the long-term model

Levels Equation

Case 2: Restricted Constant and No Trend

| Prob. | t-Statistic | Std. Error | Coefficient | Variable |
|--------|-------------|------------|-------------|----------|
| 0.0146 | 3.223391 | 0.201258 | 0.648734 | LOG(TAX) |
| 0.4610 | 0.779871 | 0.215122 | 0.167767 | LOG(INV) |
| 0.0179 | 3.074776 | 1.201564 | 3.694540 | C |

$$EC = LOG(GDP) - (0.6487*LOG(TAX) + 0.1678*LOG(INV) + 3.6945)$$

Short-term model estimation results and error correction parameter

ECM Regression

Case 2: Restricted Constant and No Trend

| Prob. | t-Statistic | Std. Error | Coefficient | Variable |
|-----------|-----------------------|------------|--------------------|---------------|
| 0.0044 | -4.132933 | 0.379505 | -1.568467 | DLOG(GDP(-1)) |
| 0.2171 | 1.356445 | 0.122399 | 0.166028 | DLOG(TAX) |
| 0.0006 | 5.899529 | 0.251626 | 1.484475 | DLOG(TAX(-1)) |
| 0.0002 | 7.142276 | 0.113737 | 0.812341 | CointEq(-1)* |
| 0.333892 | Mean dependent var | 0.931825 | R-squared | |
| 0.260506 | S.D. dependent var | 0.911373 | Adjusted R-squared | |
| -2.040742 | Akaike info criterion | 0.077553 | S.E. of regression | |
| -1.858155 | Schwarz criterion | 0.060145 | Sum squared resid | |
| -2.057644 | Hannan-Quinn criter. | 18.28520 | Log likelihood | |
| | | 2.514840 | Durbin-Watson stat | |

A table showing the data that the researcher relied on to reach the results of the study

| GDP growth | GDP | Investment | taxes | Years |
|------------|--------------|------------|----------|-------|
| 9.9 | 96,611.5 | 208,687 | 588.1 | 2006 |
| 10.9 | 106,527.0 | 136,645 | 6,530 | 2007 |
| 6.4 | 124,609.1 | 235,812 | 7,680,3 | 2008 |
| 5.9 | 135,659.0 | 253,796 | 8,655.8 | 2009 |
| 5.2 | 162,203.9 | 215,380 | 10,008.6 | 2010 |
| 2.8 | 186.689.9 | 340,929 | 11,183,3 | 2011 |
| 1.4 | 222,548.0 | 574,810 | 15,567.4 | 2012 |
| 3.6 | 304,116.0 | 768,286 | 24,133.7 | 2013 |
| 4.0 | 447,999.6 | 957,021 | 35,178.1 | 2014 |
| 7.0 | 505,760.7 | 832,167 | 41,963.3 | 2015 |
| 6.8 | 605,408.6 | 618,911 | 47257 | 2016 |
| 2.4 | 815,855.4 | 846,581 | 63849 | 2017 |
| 2.1 | 1,317,968.8 | 532,768 | 91,345 | 2018 |
| 6.5 | 1,950,330.2 | 776,836 | 114,060 | 2019 |
| 6.2 | 4,727,134.7 | 118,573 | 159,949 | 2020 |
| 143.6 | 11,417,292.2 | 116,196 | 639,433 | 2021 |

Source: Bank of Sudan Annual Report 2006 to 2021

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