

Testing the Hypothesis of the Triple Deficit in the Sudan Economy: An econometric study during the period (1990-2021)

Jaralnabi Babou Jaralnabi ^{1*}, Widad Mahmoud Mohammed Awad Alla ²

¹ Department of Econometrics, Alsalam University, Sudan

² Department of management University of Gezira, Sudan

اختبار فرضية العجز الثلاثي في اقتصاد السودان: دراسة قياسية خلال الفترة من (1990-2021م)

جار النبي بابو جار النبي ^{1*}، وداد محمود محمد عوض الله ²

¹ قسم الاقتصاد القياسي، جامعة السلام، السودان

² قسم الاقتصاد، كلية الدراسات التجارية، جامعة الجزيرة، السودان

*Corresponding author: majabi11@hotmail.com

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Abstract

The study aimed to test the hypothesis of nonlinear relationship between both the government, private saving deficit and the current account deficit (the triple deficit) in Sudan during the period 1990 – 2021, by using autoregressive distributed Lagged model, it revealed the existence of an equilibrium relationship in both short and long run, and asymmetric relationship in long run, the significance of government and private saving deficit coefficients, if they increased by 1%, the current account deficit will increase by 0.16, 0.49, a decrease of 1% leads to an increase in the current account deficit by 0.75, 0.49, this due to the small saving scales and not directing a part of them to investment, the value of Error correction coefficient was (-0.97), this means there is a long run equilibrium relationship, so any short run imbalance can be corrected within 12.27 month, it recommended the necessity to mobilizing savings and directing them towards investments to increase the competitiveness and reduce the current account deficit.

Keywords: Triple Deficit, Nonlinear Autoregressive Distributed Lagged Model, Error Correction Model.

الملخص

هدفت الدراسة إلى اختبار فرضية العلاقة غير الخطية بين عجز المدخرات الحكومية والإدخار الخاص وعجز الحساب الجاري (العجز الثلاثي) في السودان خلال الفترة من 1990 - 2021، باستخدام نموذج الانحدار الذاتي ذو الفجوات الموزعة غير الخطي (NARDL)، وكشفت عن وجود علاقة توازنية في الأجلين القصير والطويل، وعلاقة تماثلية في الأجل الطويل، وأن معاملات عجز المدخرات الحكومية والخاصة معنوية، إذا زادت بنسبة 1% تؤدي إلى زيادة عجز الحساب الجاري بنسبة 0.16 و 0.49، بينما إنخفاضهما بنسبة 1% يؤدي إلى زيادة عجز الحساب الجاري بنسبة 0.75 و 0.49، وقد يعزى هذا لصغر حجم المدخرات وعدم توجيه جزء منها إلى الاستثمار، وبلغت قيمة معامل تصحيح الخطأ (-0.97)، مما يعني وجود علاقة توازنية في الأجل الطويل، وأن أي اختلال في الأجل القصير سيتم تصحيحه خلال 12.27 شهراً تقريباً، وأوصت بضرورة الاهتمام بتعبئة المدخرات وتوجيهها نحو الاستثمارات التي تزيد من القدرة التنافسية للصادرات بما يمكن من خفض عجز الحساب الجاري.

الكلمات المفتاحية: العجز الثلاثي، عجز الحساب الجاري، عجز المدخرات الحكومية، عجز الإذخار الخاص، نموذج الأنحدار الذاتي ذو الفجوات الموزعة غير الخطي، نموذج تصحيح الخطأ.

Introduction

Economic studies were concerned with analyzing the reasons of the external and financial imbalance that affects the achievement of economic growth, and began to pay attention to analyzing the relationship between the current account and general budget deficit by testing the hypothesis of twin deficit by following the Ricardian equivalence hypothesis (Reh), Keynesian approach, and then testing triple deficits (Sen et al, 2014, 339), after editing capital in most world countries which causes the increasing of special saving deficit effect besides government savings deficit on the current account deficit.

Study problem:

Sudan's economy suffers from a chronic deficit in the balance of public budget and the current account balance, which causes an increasing in the burden of external debt, which led to a major imbalance in external balance levels. It was necessary to test the relationship between the internal financial deficit and external deficit, therefore the problem of the study is to try to answer the following question: Is there a relationship between governmental, private savings and the current account in Sudan's economy? Then the following questions are branched from:

- How we can test the relationship between the components of triple deficit?
- What is the appropriate method to examine the nature and direction of this relationship?

Study objectives:

The study aims to test the hypothesis of triple deficit in Sudan's economy to verify the relationship between the governmental, private savings and the current account deficit, and follow the path and direction of this deficit during the period 1990-2021.

The importance of the study:

Testing the hypothesis of the triple deficit by using non-linear autoregressive distributed lagged approach can help in determine economic policies relatively achieves the internal and external equilibrium and control the deficit of the economy's balances, the detection and analysis the paths of adaptation, and the duration of imbalance in the wake of a positive or negative shock that can provide useful information about the non-similar patterns in short-long run.

Study hypotheses:

- There is a balanced relationship in the short and long run between governmental, private savings deficit and the current account deficit.
- There is a symmetric relationship in the long run between governmental, private savings deficit and the current account deficit.

Study methodology:

The study uses the econometrics methodology through the use of non-linear autoregressive distributed lagged model (NARDL), to test the hypothesis of triple deficit between the governmental, private savings deficit and the current account deficit, during the period in which Sudan adopted the economic Policy.

Literature reviews:

Among the applied studies that provided supports to the hypothesis of the Keynesians approach and triple deficit hypothesis reached to a relationship between the budget and savings, private investment deficit and current account deficit, a study (Ashraf, 2022), used the non-linear autoregressive distributed lagged model NARDL during the period 1983-2017 in Egypt's economy, a study (Ali & Kakar, 2017), by applying on Pakistan economy during the period 1980-2014, by using autoregressive distributed lagged model ARDL, (Shastri et al, 2017), used the dynamic ordinary least squares DOLS during the period 1985-2015, for five countries in South Asia (India, Pakistan, Bangladesh, Sri Lanka and Nepal), a study (Coban & Balikcioglu, 2016), during the period 2002-2013, for some countries whose economics pass through a transitional stage, and used dynamic Panel Data Analysis, Study ((Bolat et al, 2014, for Poland countries, Oranges, Spain and Sweden, and used Granger's causality.

Among the studies that provide support to the hypothesis of Ricardian equivalence, the incorrectness of the hypothesis of the triple deficit, the study (Sen & Kaya, 2018), for a number of socialist countries by using a Granger causality analysis during the period 1994-2015, study (Yeniwati, 2018), in the economy of Indonesia during the period 2003-2016, It used the vector autoregressive VAR.

The contrast in the results of studies that tested the hypothesis of the triple deficit may be attributed to the use of different samples and methods of estimation, and applied studies have used number of econometrics methods such as the Bound Test, the Granger causality analysis, the vector

autoregressive model analysis, the analysis of the autoregressive distributed lagged model and the non-linear autoregressive distributed lagged model.

This study is consistent with the applied studies that supporting the Keynesians approach hypothesis and consistent with the validity of triple deficit hypothesis, while it differs from it in the method of testing the triple deficit hypothesis, the size of sample, except (Ashraf Muhammad, 2022) study used the non-linear autoregressive distributed lagged model.

Theoretical framework:

The financial deficit was accompanied by the trade deficit to create a synonym between the interior (financial) and external ghosts (commercial), and if studies differ on the direction of the relationship between them, is it external - internal? Or internal-external? Or a reciprocal dialectic? Theoretical hypotheses differ from those trends (Hassan Mahmoud (2022): p. 302), including:

- **The hypothesis of reckoning:**

which denies the relationship between the budget deficit and the current account deficit, with its assumption that the government financing method did not affect the budget deficit on the real entry and spending of individuals in the term Al -Taweel, who have adequate adult adults to adapt their spending and save them to balance the immediate and future effects of the financial policies of the government,

- **The hypothesis of dual divergence:**

which says that there is an inverse relationship between the deficits as a result of a partial response to the government's expansion policy, leads to an increase in savings, low consumption and investment in a way that reduces the current deficit.

- **Feldstine-Lahuka's hypothesis:**

Which is achieved by a strong link between local savings and local investment despite the freedom of capital movement internationally; What means not to apply to the hypothesis of the reward Al -Ricardi, the expulsion of the relationship between the internal and external deficit known as the dual impotence, to the five Kinzi hypotheses.

- **Kenzi hypotheses:**

The hypothesis of the twin deficit:

Which means the unit of deficit as a result of the dependence of the current deficit on the budget deficit (Iman Muhammad (2021), p. 181), through a decrease in savings or increased investment. - Kinzi absorption: which confirm the relevant and the previous direction directly, but through the multiplier of expansion financial policy on local income, total demand and competitiveness. Mondeel Model Flang: which supports the direction of the relationship from the budget deficit to the current deficit, through the expansion fiscal policy that leads to a positive interest rate and the exchange rate, and then negatively.

The reversal causation hypothesis: which sees the opposite, in the direction of the relationship from the current deficit to the budget deficit; As a result of commercial weakness in the early stages of development and in stagnation periods and crises. - The hypothesis of the reciprocal deficit: where each other deficit is paid through the interest rate channels and the exchange rate from the external to the internal, and through the total income channels and the cash supply J from internal to the outside. The theoretical framework of the triple deficit depends on the hypothesis of the twin deficit and then an identical national income analysis to obtain the relationship between the old and private savings and the current account deficit as follows:

Whereas, the available personal income (YD) is distributed between private consumer spending (C) and special savings (S), as the national income is after tax deduction (T), and it can be expressed through the following two matches: From (1) and (4): Government spending is distributed between CG) and investment spending (IG) and the equation becomes:

Government savings (SG) represents the difference between the proceeds of taxes (public revenues) and consumer spending: It is clear from the identical (10), that: the balance of commercial scale (X-M) is equal to each of: savings balance-Government investment and savings - private investment and the triple deficit occurs in the event of a deficit in each of the: commercial balance balances, the general budget balance and savings - private investment.

The hypothesis of the triple deficit in the Sudan's economy:

The development of the current account deficit: during the period from 1990-2021, it is clear that Sudan's economy suffers from a chronic deficit in the current account, as the lowest deficit of \$ 48.2 million in the year 1991, and its amounting was 6241.8 million dollars in the year 2012, in order to deteriorate the conditions of external exchange and a decrease in the competitiveness of black exports with Sudan adopting the policy of liberalizing the economy, and we notice this through Figure (1).

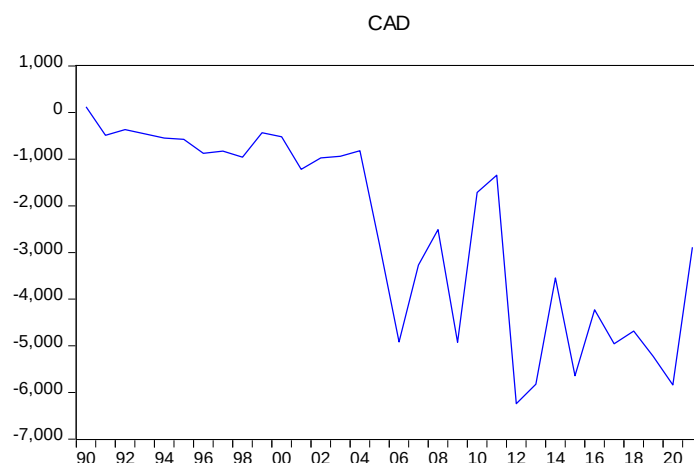


Figure 1: Development of deficit the current account in Sudan's economy.

The development of government savings deficit:

The period from 1990-2021 witnessed a variation in the values of government savings deficit, as the lowest deficit of 49451 million dollars in the year 2012, and its amounting was 90466 million dollars in the year 2020, to increase the volume of expenses The government is fluctuating the volume of public revenues as a result of not following the scientific method of economic planning, and we note this through Figure (2).

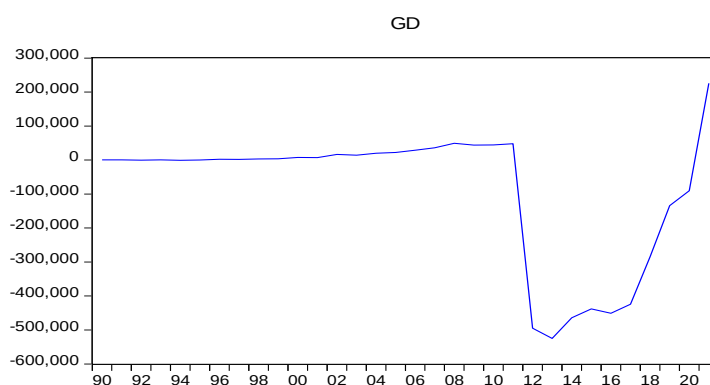


Figure 2: The development of government savings deficit in the economy of Sudan.

The development of private savings deficit:

The period from 1990-2021 witnessed a fluctuation in the values of private savings deficit, as the lowest deficit of 14420.8 million dollars in the year 2011, and its amounting was 50008.2 million dollars in the year 2021, to compete with government investments for the private sector and shape no. (3) Shows the course of this deficit.

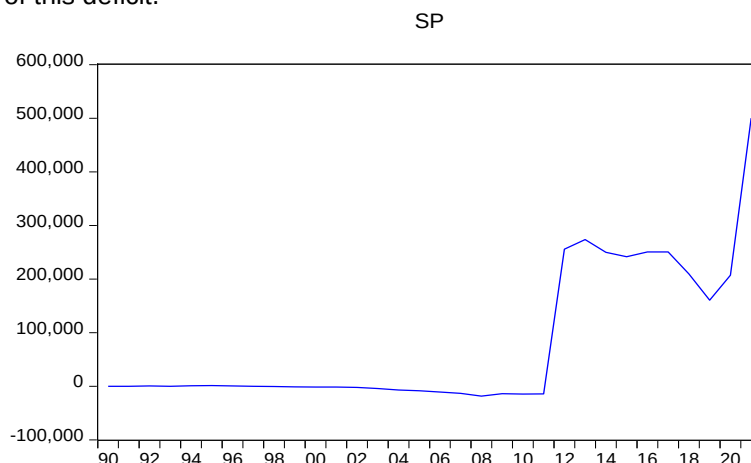


Figure 3: The develop of the deficit of private savings in Sudan's economy Sudan's economy.

Figure no (3) The develop of the deficit of private savings in Sudan's economy Sudan's economy has been suffering from a chronic deficit in its current account from 1990 to 2021, and its maximum in 2021 amounted to about 683.1 million dollars, including 12.7% of the gross domestic product volume, and the lowest deficit of \$ 108.99 million in 2003 by 1.65%, This is in addition to the deficit Chronic in the general budget, its maximum in 2021 is around 198204 million pounds, causing 4.99% of the gross domestic product, and the lowest deficit of 62.3 million pounds in 1990 by 5.6% of the gross domestic product.

Methodology application:

To formulate the triple deficit model, many economic theories and models are dependent on the current account deficit through the effect of government savings and special savings, according to the following form: Whereas: = the current account deficit = government savings deficit SP = private savings deficit= Model parameters = RAM.

To determine the degree of correlation between the variables of the model, the connection matrix was built as in table (1), and the degree of association between governmental and private savings and the current account deficit (0.65, 0.65), and (0.59) between the old and private savings.

Table 1: Correlation matrix.

	CAD	GD	SP
CAD	1.000000	0.649783	-0.651688
GD	0.649783	1.000000	-0.587629
SP	-0.651688	-0.587629	1.000000

Source: fro Study data and Eviews10

The preliminary results of the formation of spread no (4) and no (5) below indicate that the relationship between explanatory and the variable is a non -written relationship.

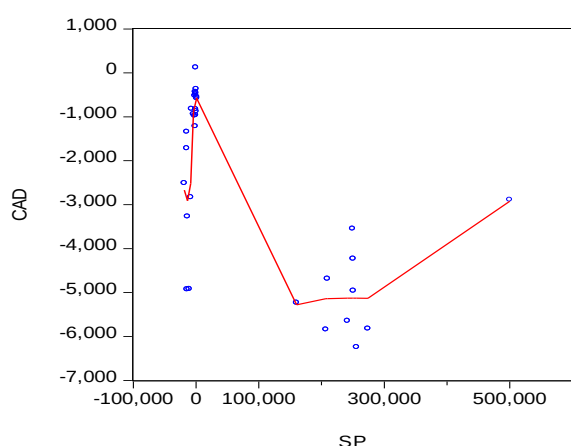


Figure 4: The shape of the spread

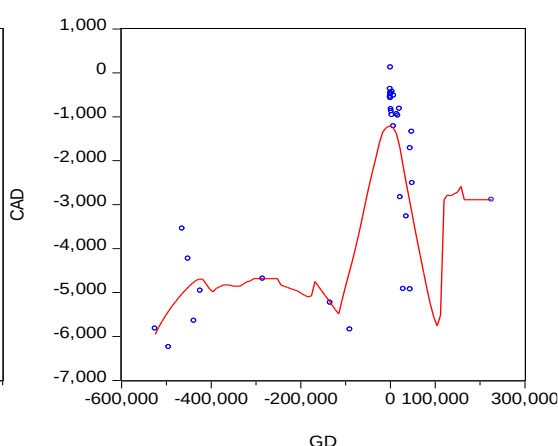


Figure 5: The shape of the spread

Unit root tests:

To examine the extent of the stable chains of the model variables have confirmed the stability of all the time chains of the study sample at the first difference, which means accepting the alternative hypothesis (H1) and its integration of the first degree (1) 1, and this is one of the conditions of the NARDL model, as table no (2).

Table 2: Results of unit root tests:

Variable s	ADF			PP		
	Level	First diff	decision	Level	First diff	decision
CAD	-1.010	-8.060	1(1)	-2.239	-8.039	1(1)
SP	0.218	-3.079	1(1)	1.002	-3.149	1(1)
GD	-1.366	-3.907	1(1)	-1.627	-3.911	1(1)
critical value at 5%: ADF=-2.976, pp = -2.976						

Source: from the Study data and Eviews10.

To estimate the self -slope model with non -linear distributed gaps, the values of the study variables were distributed to positive and negative values and then determining the rank of the test by choosing

the values that are slow to the model variables, and according to the AIC standard, the NARDL Model (1,2,2,2,2).

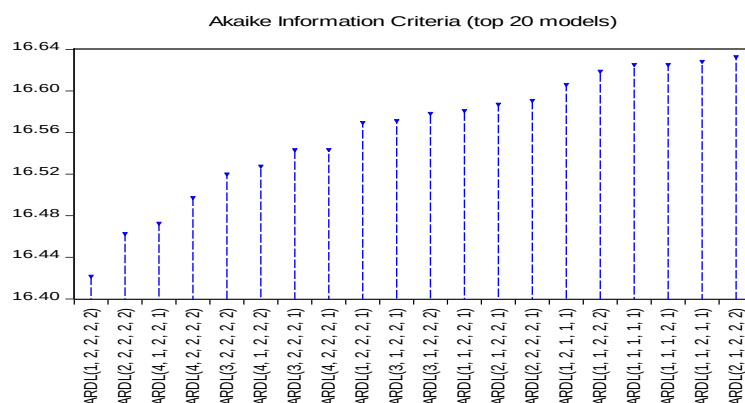


Figure 6: Rank test.

To ensure that the study data is free of structural transformations and the absence of sudden leaps or changes over time, a CUSUM and CUSUM IF Squares have been used, and it has been proven that the calculated values fall within the critical limits at a 5% morale as in Figure no (7) and (8), which means that there is stability and in harmony between the results of the short and long run.

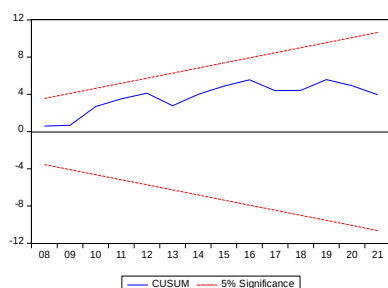


Figure 7: Cusum test.

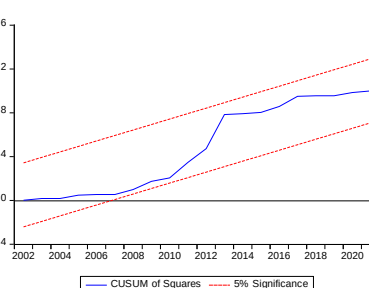


Figure 8: Cusum if squares test.

Bound Test was used to determine the relationship of joint integration Long-run between study variables, and the calculated value of F-Statistics (7.82) is greater than the critical limits value at a morale of 5%, which means accepting the alternative hypothesis that is conjugated with a common integration relationship between these variables as shown in Table (3).

Table 3: F-Bound test.

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	7.819428	10%	2.45	3.52
k	4	5%	2.86	4.01
		2.5%	3.25	4.49
		1%	3.74	5.06

Source: from the Study data and Eviews10

The values of model transactions were obtained in the long term that determine the impact of the old and private savings on the current account deficit in the Sudan economy, and the results, as in Table (4), confirmed the moral changes of independent variable shocks (GD, SP) on the dependent variable (CAD) The increase in government and private savings by 1% can lead to an increase in the current account deficit by 0.16 and 0.49, and this result is consistent with the study hypothesis, while their 1% decrease can lead to an increase in a deficit The current account is 0.75 and 0.49, and this does not agree with the assumption of the study, and this confirms the lack of interest in filling the savings and directing them towards investments that achieve the total goals of the Sudan economy, including reducing the current account deficit.

The equation of long term becomes as in the following form:

$$CAD = -1014.978 + 0.1572 * GD_POS + 0.7488 * GD_NEG + 0.4916 * SP_POS + 0.4918 * SP_NEG \quad (12)$$

Table 4: Long-run estimation results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GD_POS	0.157236	0.047310	3.323547	0.0050
GD_NEG	0.748770	0.205729	3.639591	0.0027
SP_POS	0.491620	0.407504	3.660379	0.0026
SP_NEG	0.491837	0.136341	3.607412	0.0029

Source: from the Study data and Eviews10

In order to test the extension of the symmetric relationship between the variables of the model, the WALD test was used, and the probability values of the F-STATISTICS category reached at a level of 5% (0.5731), and (0.7140) which is non-moral, which provides acceptance of the hypothesis (H₀) Saying that the relationship between the old and private savings and the current account deficit is analogous in the long term, as in table no (5).

Table 5: Wald Test.

Test Statistic	Value	Probability	decision
t-statistic	0.577039	0.5731	
F-statistic	0.332974	0.5731	Accept H ₀
Chi-square	0.332974	0.5639	
t-statistic	-0.374002	0.7140	
F-statistic	0.139877	0.7140	Accept H ₀
Chi-square	0.139877	0.7084	

Source: from the Study data and Eviews10

The error correction model (ECM) has been estimated from the results of the Nardl Self-Distribution Distribution Form (NARDL), and the value of the error correction coefficient (-0.97) reached a possibility (0.0000) as in table no(6), and since the value of the error correction coefficient is negative Statistically accredited at a 5% moral level, this means that there is a balanced relationship in the long run, and that any imbalance in the short term will be corrected within one year and twenty -seven days.

Table 6: Results of estimating the error correction model.

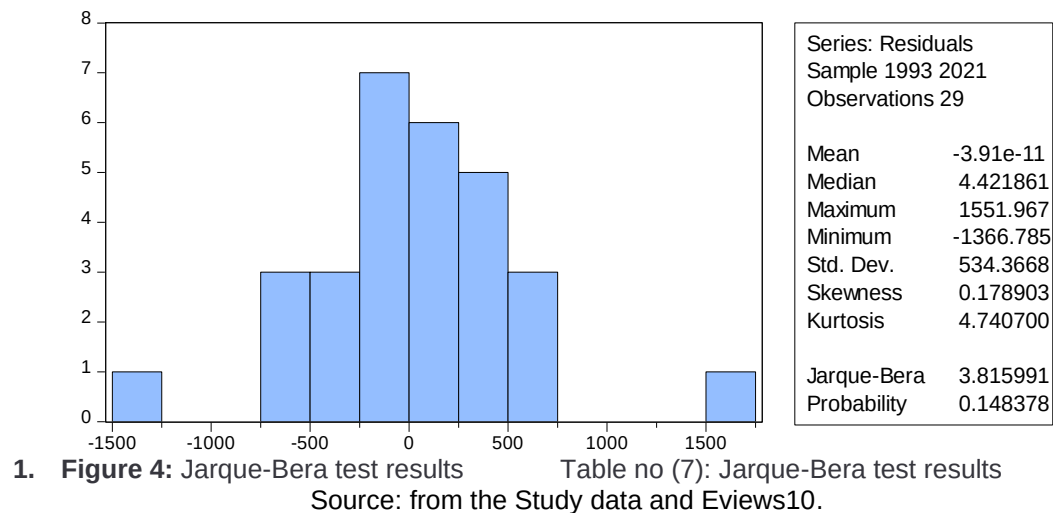
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1014.978	233.2326	-4.351783	0.0007
D(GD_POS)	-0.120987	0.024835	-4.871634	0.0002
D(GD_POS(-1))	-0.148105	0.052473	-2.822513	0.0136
D(GD_NEG)	0.003420	0.015324	0.223172	0.8266
D(GD_NEG(-1))	-0.389073	0.110868	-3.509346	0.0035
D(SP_POS)	-0.006423	0.030237	-0.212416	0.8348
D(SP_POS(-1))	-0.783324	0.223420	-3.506060	0.0035
D(SP_NEG)	-0.277210	0.067875	-4.084113	0.0011
D(SP_NEG(-1))	-0.327589	0.137410	-2.384036	0.0318
CointEq(-1)*	-0.969850	0.136792	-7.089976	0.0000

Source: from the Study data and Eviews10.

The estimate results were examined by using the diagnostic tests of the estimated form diagnostics Tests as follows:

- Normal distribution:

The probability value of the (Jarque-Bera test) reached (0.1484) as in Table (7) below, which is greater than 5%, i.e., non-moral, which means accepting the hypothesis of nothingness (H₀) that the random error is distributed naturally.



- Serial Correlation LM Test

The LM test (LM) was used, and the probability value of the test (0.9851) as in Table (8), which is greater than 5%, i.e., non-moral, which means accepting the hypothesis of nothingness (H_0) saying that there is no connection Self between errors.

Table 8: Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.015029	Prob. F(2,12)	0.9851
Obs*R-squared	0.072461	Prob. Chi-Square(2)	0.9644

Source: from the Study data and Eviews10

- Heteroskedasticity Test:

The Breusch-pagan-Agodfrey and Arch test, the probability value of the two tests, respectively (0.1322) and (0.5595) as in the two tables (9-10), which is greater than 5%, is non-moral, which means Acceptance of the hypothesis (H_0) that there is no difference in contrast.

Table 9: Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.843886	Prob. F(14,14)	0.1322
Obs*R-squared	18.80268	Prob. Chi-Square(14)	0.1726

Source: from the Study data and Eviews10

Table 10: Heteroskedasticity Test: AECH

F-statistic	0.349508	Prob. F(1,26)	0.5595
Obs*R-squared	0.371400	Prob. Chi-Square(1)	0.5422

Source: from the Study data and Eviews10

Results:

From the results of examination of the NARDI Self -Distributed Settings, the study concluded the following results:

- There is a common integration relationship between study variables.
- The hypothesis of the triple deficit is achieved with the existence of a balanced relationship in the short and long periods between the old and private savings and the current account deficit in the economy of Sudan.
- The presence of analogous relationship between the components of the triple deficit in the long term.
- It reached values the error correction coefficient (-0.97), which is a negative and statistically moral value at a 5% moral level, which means that any imbalance in the short term will be corrected within one year and twenty-seven days. The study model does not suffer from measurement problems after conducting diagnostic tests.
- The increase in government and private savings by 1% may lead to an increase in the current account deficit by 0.16 and 0.49, and this result is consistent with the study hypothesis, while their 1% decrease may lead to an increase in the current account deficit by 0.75 and 0.49, This does not agree with the study hypothesis, which confirms the lack of interest in mobilizing

savings and directing them towards investments that achieve the total goals of the Sudan economy, including reducing the current account deficit.

Recommendations:

Based on the above results, the study recommends the following:

- The necessity of paying attention to mobilizing savings and directing them towards investments that increase the competitiveness of exports in a way that enables to reduce the chronic deficit in the current account, which reflects positively on placing the balance of payments and total balance.
- Paying attention to analyzing and examining the course of the triple deficit in the Du for developing to avoid its effects on the national economy.

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