Examining the Export-Led Growth Hypothesis: Empirical Evidence from Sudan

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A B S T R A C T

The current study analyzes the relationship between Sudan's income growth and exports from 1970 to 2020. The system of equations using the Autoregressive Distributed Lag (ARDL) approach has been employed. The ARDL results showed that there exists a long-run relationship between the variables considered in the estimated model. The researchers observed a negative lagged error-correction term coefficient, which is highly significant in all cases supporting cointegration. The result reveals the existence of a long-run equilibrium relationship between GDP, export, import, labor force, and trade policy. This confirms that the export-led growth hypothesis is valid for Sudan. Thus, the most essential conclusion is that the economy's export expansion strategy is completely dependent on the imports of raw materials and capital inputs and the kind of goods being exported. The coefficient of import is of significance, which offers strong support for the import compression hypothesis. The most important policy implication of the findings is the implementation of an appropriate and optimal approach that can boost exports to increase economic growth substantially. Policy-makers should focus on export diversification strategies and invest more in Sudan's ability to provide value-added services to meet international export demand.

A B S T R A K

Penelitian saat ini menganalisis hubungan antara pertumbuhan pendapatan dan ekspor di Sudan selama 1970 sampai 2020. Sistem persamaan menggunakan pendekatan Autoregressive Distributed Lag (ARDL). Hasil ARDL menunjukkan bahwa terdapat hubungan jangka panjang antara variabel yang dikaji dalam model yang diestimasi. Peneliti menemukan bahwa koefisien 'lagged error-correction term' adalah negatif dan sangat signifikan dalam semua kasus yang mendukung kointegrasi. Hasilnya mengungkapkan adanya hubungan keseimbangan jangka panjang antara PDB, ekspor, impor, angkatan kerja dan kebijakan perdagangan. Hal ini menegaskan bahwa hipotesis pertumbuhan yang dipicu ekspor berlaku untuk Sudan. Dengan demikian, kesimpulan yang paling penting adalah bahwa strategi ekspansi ekspor perekonomian sepenuhnya bergantung pada impor bahan baku dan input modal serta jenis barang yang diekspor. Koefisien impor sangat penting, yang menawarkan dukungan kuat untuk hipotesis penekanan impor. Implikasi kebijakan terpenting dari temuan tersebut adalah penerapan pendekatan yang tepat dan optimal yang dapat mendorong ekspor untuk meningkatkan pertumbuhan ekonomi secara substansial. Pembuat kebijakan harus fokus pada strategi diversifikasi ekspor dan berinvestasi lebih banyak dalam kemampuan Sudan untuk menyediakan layanan bernilai tambah untuk memenuhi permintaan ekspor internasional.

1. INTRODUCTION

There is growing attention among researchers in recent years about studies conducted with different perspectives on export expansion and economic growth (Export-Led Growth Hypothesis – ELGH). As per the research findings, it has been strategically established that export expansion and economic growth are directly proportional to each other (Adebayo, 2020; Dokholyan & Sargsyan, 2019). In other terms, the export-led growth (ELG) strategy tends to outperform existing strategies in the development perspective compared to import

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substitution. The researchers place their argument that export expansion leverages the available resources and tends to adopt novel technologies to do so. This results in increased Total Factor Productivity (TFP) value, which in turn yields high output growth. In addition to this, the export expansion also leads to high utilization of the resources and capacities, competitive advantage over global players, and advantages from scale economies in association with global giants, which altogether contribute to increased growth (Kurniasih, 2019; Sharma, 2022).

Sudan is a small open economy, and its exports have been the backbone of the country's economic development. Sudan imports capital and intermediate goods too, which play an important role in the development of the nation's economy. As shown in Figure 1, the average rate of GDP growth for Sudan from 1970 to 2020 was 2.82 percent with the lowest at -17 percent in 2012 and the highest at 16.67 percent in 1976. The latest value from 2020 is -3.63 percent. The average value of exports as a percent of GDP for Sudan during that period was 10.19 percent with a lowest of 0.44 percent in 2020 and a highest of 21.77 percent in 2009. Sudan has benefited from the advent of oil in 1999. Oil revenue accounted for 60 percent of the total revenue, enabling the country to expand its physical and social infrastructure (International Monetary Fund, 2020). Sudan's economy has also become more integrated with the rest of the world. Its trade to GDP ratio has increased from 25 percent in 2000 to 44 percent in 2008, and the country has emerged as one of the highest recipients of foreign direct investment (FDI) in Africa (World Bank, 2009). The average value of imports during that period was 13.99 percent with the lowest at 0.35 percent in 2020 and the highest at 24.42 percent in 1982 (World Bank, 2022). It is observed that both export and imports are correlated with GDP growth over the period 1970–2020. The major economic shock in the country appeared in 2012 after the secession of South Sudan in 2011. This shock led to the loss of the oil revenue which accounted for more than half of Sudan's government revenue and 95 percent of its exports (Logan, 2021). Therefore, it has reduced economic growth and resulted in double-digit inflation that exceeded 60 percent in 2018 and reached 260 percent in November 2020 (World Bank, 2022). Sudan's economy has begun to shrink since 2018 and contracted negative GDP growth, which was -3.6 in 2020, partly due to the economic shock of the Covid-19 pandemic (Asare et al., 2020).

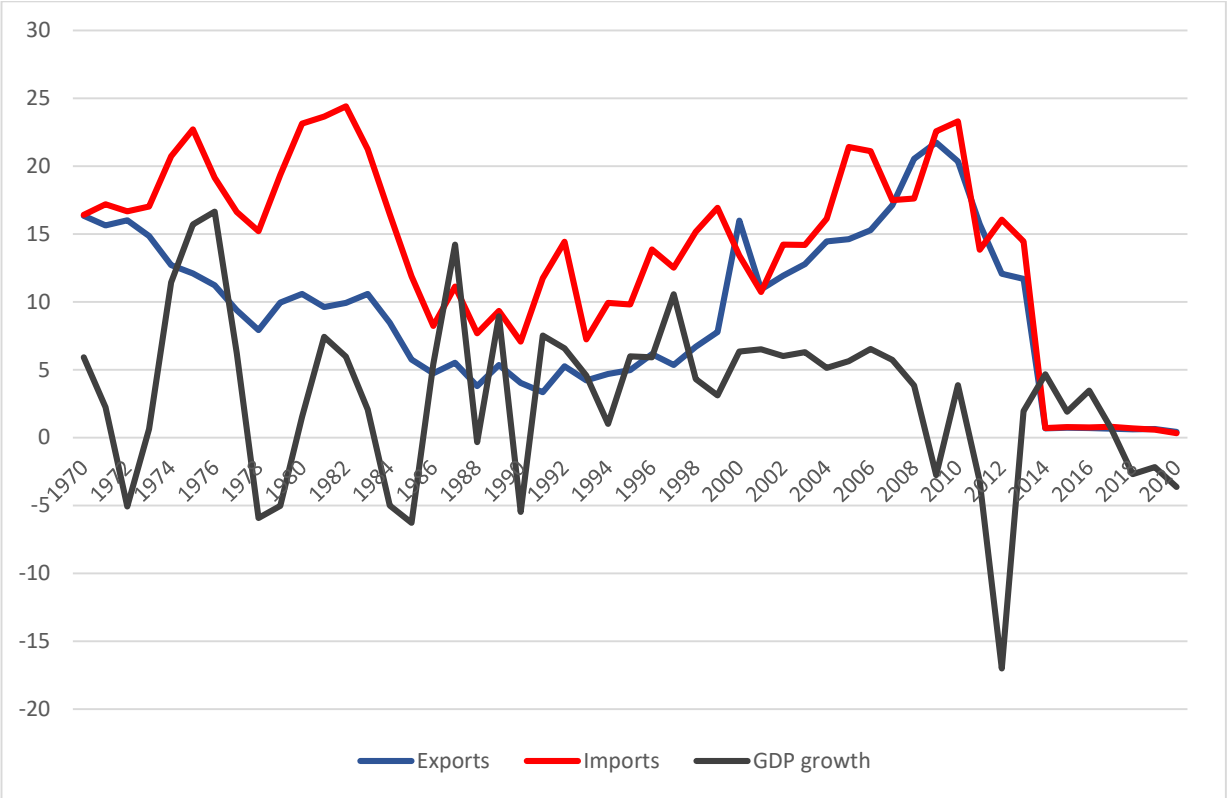

Figure 1. Sudan's Exports, Imports (%GDP) and GDP growth, 1970–2020

The current research work is aimed at analyzing the ELG and import compression hypothesis for Sudan. Thus, the main purpose of this paper is to examine the ELGH in Sudan for the period 1970-2020. The standard trade theory prescription is to encourage the production of those commodities in which the country has a comparative advantage. For many Least Developed Countries (LDCs) this comparative advantage is in the production of some agricultural commodities. Historically, Sudan has had a comparative advantage in the production of cotton and Arabic Gum. In Sudan, like in most developing countries, commodity composition is specialized in both production as well as export of primary commodities or concentrates on a small range of commodities, and geographical concentration concentrates on a small group of traditional export markets. Trade has been the backbone of the economic development of Sudan since colonial times. Sudan has diversified its exports; diversification takes place within the agricultural and raw natural resources exports to sustain the inflow of foreign exchange from the sector.

Few studies have investigated the relationship between exports, imports, and economic growth in Sudan, including Marwan et al. (2013), Bakri (2017), and Ibrahim & Abdalla (2020). Bakri (2017) found no relationship between economic growth, exports, and imports in the long run for Sudan from 1976 to 2015. In recent research, Ibrahim & Abdalla (2020) supported the ELGH both in the short and long term, revealing an inverse relationship between exports and GDP in Sudan's case. Therefore, our research is significant because it will contribute to the limited available literature on the Sudan economy by providing new evidence on ELGH.

2. THEORETICAL FRAMEWORK AND HYPOTHESES

Even as the early research followed the neoclassical production function framework, the latest ones relied upon testing for causal directions and searching for long relations using time series techniques. When analyzing the outcomes of different studies conducted earlier, it has been revealed that the evidence was contradictory to each other, as the studies followed different methodologies, sample periods, and analysis techniques.

The many existing studies on the subject have made useful contributions toward an understanding of the role of exports in economic performance. Many existing studies on this subject have made a useful contribution to understanding the role of exports in economic performance. The relationship between exports and economic growth is central to development policy. Recent empirical estimates tend to draw attention to the causal relationship between economic growth and exports with the help of the Granger causality test. However, in general, it is possible for the causation to run in both ways i.e., from economic growth to exports and vice versa. Sometimes, it also can run in both directions.

Ziramba (2011) analyzed the causal relationship between real GDP and export components of South Africa for the period 1960–2008. The researcher was able to identify the long-run relationship that exists between GDP and real export components. The causality test outcomes infer that ELG occurs only in the case of merchandise exports. There was reverse causality for income receipts and service exports. Further, no causality was found in both directions in the case of net gold exports.

In the study conducted by Debnath et al. (2014), the relationship that exists between non-export GDP and the exports of India during the period 1981-2012 was assessed. In this study, the researchers used the OLS-based Autoregressive Distributed Lag (ARDL) model in addition to Error Correction Model (ECM) within the former. The study outcomes infer that there was no significant impact created by exports upon the non-export sector output at the aggregate level. This inference made the popular ELGH, prevalently observed in India, void. Having said that, when exports were segregated into service exports and merchandise exports, the former had a positive spillover impact on the non-export sector of the Indian economy. The study found a statistically insignificant relationship between the non-export GDP and merchandise export. These outcomes validated the conventional hypothesis that Indian economic growth is fueled by non-export factors such as technical advancements, employment, and capital accumulation.

In literature, an investigation was conducted by Ali & Li (2018) to find the presence of ELG or Growth-Led Exports (GLE) in Pakistan and China from 1980 to 2015. Both the countries recorded the presence of ELG, as per the empirical outcomes, whereas the GLE hypothesis was rejected based on the results from the regression analysis of the Granger causality test. Further, the researchers also arrived at a conclusion that the economic growth of China is primarily fueled by import tariffs. In addition, Chinese exports largely depend on its exchange rate since there exists a unidirectional

relation between exports and the exchange rate. This relation denotes that a significant increase occurs in exports due to devaluation. This tends to occur in spite of the exchange rate being ineffective on the growth rate in China. On the contrary, the exports get significantly affected by imports, tariffs as well as exchange rates, as in the case of Pakistan.

In the study conducted with disaggregated annual data on exports, Sermcheep (2019) measured the contribution of services export to economic growth in the ASEAN countries for the period 1970-2004. The results infer the existence of a positive significant impact on economic growth by traditional and modern service exports in ASEAN. Further, the author mentioned that conventional services' exports can drive economic growth significantly.

Kollie (2020) analyzed some specific member states who are part of the Economic Community of West African States (ECOWAS) by disaggregated exports into merchandise exports, service exports, and total exports spanning between 2000 and 2017. From this panel ARDL analysis, the researcher found that merchandise exports exhibit no impact on economic growth on a long-term basis whereas service exports result in an impact on economic growth in the long run.

In the study conducted by Dixit & Parveen (2020), Lag-Augmented Vector Autoregressive non-causality test was used to find the export-growth relationship from both demand- and supply-side perspectives. The study results infer that economic growth is positively affected by service as well as manufacturing exports. However, between the two, only manufacturing exports' impact is significant.

The study conducted by Kappa (2020) assessed the impact of vegetable export on economic growth in some specific south Asian countries for the period from 1988 to 2018. In this study, the researchers used the Johansen-Fisher cointegration and Fully Modified Least Squares (FM-OLS) regression model. The analysis outcomes infer that only in the long-run can vegetable exports positively lead to high economic growth. However, the data clearly shows that vegetable exports had no impact on the economic growth of a few South Asian Association for Regional Cooperation countries (SAARC). This way, the hypothesis for ELG was straightforwardly rejected. In spite of this, the study proved the existence of a long-term relationship between capital and economic growth and other factors such as exports and imports of vegetables among a few SAARC economies.

Odhiambo (2021) conducted an investigation to analyze the causal relationship between economic growth and exports during 1980–2017 in Sub-Saharan African countries. The researcher further assessed whether the developmental stage of such countries influences the causal relationship between the macroeconomic variables chosen, in line with the per capita income. Though the study was able to identify the presence of a long-run relationship between economic growth and exports, the researcher could not establish the ELG response among middle- and low-income countries. Instead of this, the investigation outcomes infer the existence of directional causality in middle-income and neutral responses in low-income countries. The conclusion of the study was that ELGH is a much-hyped one and that such a strategy may not be appropriate for low-income generating developing countries, in the context of sub-Saharan Africa.

ELGH was verified by Kalaitzi & Chamberlain (2021), in which the authors considered five Gulf Cooperation Council Countries (GCC): Saudi Arabia, Bahrain, Oman, Kuwait, and the United Arab Emirates. In this study, annual time series data spanning between 1975 and 2016 was used with an augmented production function. In order to determine the models and analyze the presence of a long-run relationship between exports and growth, the authors deployed the Johansen Cointegration test. The study outcomes supported that ELGH is valid in the short run for the United Arab Emirates, whereas in the case of Bahrain, the opposite is true. Further, in the case of Kuwait, a bi-directional causality was observed between growth and exports. In addition to that, ELGH validity was confirmed in the long run for Bahrain. At last, Kuwait and Saudi Arabia supported the argument that economic growth results in exports.

Barrie et al. (2021) examined both the import- as well as export-driven growth hypothesis in Sierra Leone from 1980 to 2020. It employed the ARDL bounds testing approach to cointegration. The empirical results show that both the hypotheses were valid in the case of Sierra Leone. However, exports appear to be relatively more important than imports in boosting economic growth in the short- as well as long-term horizons. It is therefore recommended amongst others that the government continue to focus on strategies that will broaden the export base and at the same time create a conducive environment for foreign investment that could result in the importation of capital goods into the country to support growth.

Malefane (2021) conducted a study with an aim to assess ELGH in the Southern African Customs Union countries (SACU) such as South Africa, Botswana, Lesotho, Namibia, and Eswatini. The annual data of these countries such as imports, exports, output, and a structural dummy variable were used in this study. The cointegration test was used in this analysis on the basis of Johansen and Johansen & Juselius's approach. After this, the vector error correction model, as well as Granger causality analysis was incorporated. For the period under study, a positive significant relationship was found, in the data from all SACU countries except Lesotho, between exports and economic growth. The study identified the existence of a negative relationship between economic growth and exports in the case of Lesotho. ELGH was found to be valid in the case of Namibia and South Africa, as per causality results. However, it was void in the case of Botswana, Eswatini, and Lesotho.

Onose & Aras (2021) conducted an investigation comprising data from five countries – Brazil, India, Nigeria, China, and South Africa (BRINS) – in order to assess the validity of ELGH on service exports. The study was conducted with data spanning from 1980 to 2019. In this study, the panel mean group ARDL procedure was deployed by the researchers to find the causal relationship between GDP per capita and service exports. The results infer the presence of a positive effect on economic growth by service exports in the short-run, whereas, in the long-run, other variables such as labor, gross capital formation and foreign direct investment (FDI) showed a significant effect on increasing economic growth. So, the study suggested that developing nations focus on internal investment so as to promote growth in both the long and short term.

In the study published by Sharma (2022), ELGH was checked through panel data analysis, cointegration, and panel regression tests for data from 107 countries. The study considered the data between 1990 and 2018. The analysis results strongly supported the long-run relationship between GDP and exports and validated the ELGH. In the results from the long-run dynamic least squares coefficient, when real exports increased to 1.0 percent, it reverberated in real GDP by 0.53 percent. Further, when compared between Global South and Global North in terms of the long-run coefficient of real exports, the former was higher compared to the latter. This reveals that in the globalization wave, there exists strong evidence to support the ELGH for the poor Global South compared to the wealthy Global North.

Panta et al. (2022) considered time series data from Nepal for the years spanning from 1965 to 2020 and analyzed equilibrium relationships, as well as the dynamic causality between exports and imports against economic growth. There is a lack of evidence from the study results to support short- and long-run ELGH. On the other hand, strong evidence was found in the study that supports both short-run and long-run import growth hypotheses (ILGH). The researchers arrived at no evidence for the hypothesis that foreign trade promotes the long-term economic growth of Nepal.

In the study conducted by Tivatyi et al. (2022), the researchers analyzed the relationship between exports, imports, and economic growth. In this study, the researchers considered four Southern African countries – Zimbabwe, South Africa, Botswana, and Namibia. They employed co-integration tests, Vector Autoregression (VAR) or Vector Error Correction model (VECM) models, and the Granger causality test. Their findings failed to validate the ELGH for South Africa in the long run but actively supported the ELGH in the short run. They found a noticeable indication of bidirectional causality between exports and growth for Botswana, Namibia, and Zimbabwe in the long run. A suggestive confirmation of unidirectional causality running from growth to imports was found in the case of Botswana, Namibia, and South Africa. Furthermore, bidirectional causality between exports and imports was confirmed by the Zimbabwe case study.

In general, the preceding literature demonstrates that no specific research has been conducted to determine the threshold to which economic growth and export are related in Sudan. This prompted us to conduct an empirical investigation that intends to find the relationship between economic growth and export growth in Sudan because the policymakers should understand the impact of exports upon economic growth quantifiably. Further, this research paper contributes to the literature in terms of relationship analysis between income growth and export growth in Sudan for a period of five decades using the ARDL approach to cointegration and causality methods.

3. RESEARCH METHOD

Data Sources

The study uses secondary data obtained from Bank of Sudan, Central Bureau of Statistics and World Bank. All variables including export (X), import (M) and GDP (Y) are in real values and measured in US$ dollars covering the period from 1970 to 2020.

Model Specification

The estimation of an augmented Cobb-Douglas production function has been employed. The real GDP, exports, imports and growth rate of labor force were considered important factors for promoting economic growth. A cointegrating equation that adopted from Asafu-Adjaye & Chakraborty (1999) can be expressed in logarithm form as follows:

$$Y_t = \alpha_0 + \alpha_1 X_t + \alpha_2 M_t + \alpha_3 L_t + \alpha_4 DI_i + \mu_t \quad (1)$$

where,
Y = real GDP
X = exports
M = imports a
L = growth rate of total labor force
D_i = trade policy dummy variable
μ_t = error term.

Method of Estimation

The current study adopted the VAR approach in time series analysis in order to assess the augmented Cobb-Douglas production function. In this section, the researcher further used variance decompositions (VDCs), error correction model (ECM), impulse response functions (IRF), and cointegration analysis too. The approach considered in this study i.e., VAR, helps predict interrelated time series-based systems and in analyzing the dynamic effect of random disturbances on the system of variables.

A brief description of the econometric procedures used for unit root tests, cointegration tests, and ECM, IRF, and VDCs estimates can be provided as follows:

Unit root tests

Prior to applying the cointegration and ECM methodology, the time series properties of all the variables were ascertained. Unit root tests are required to establish whether the variables present a stochastic trend. Augmented Dickey-Fuller (ADF) is one of the standard unit root tests, which is predominantly utilized in empirical investigations. ADF test statistic is calculated using the t-ratio of the null hypothesis α_1=0 in the regression of

$$\Delta X_t = \alpha_0 + \alpha_1 X_{t-1} + \alpha_2 t + \sum_{i=1}^{\rho} \beta_i \Delta X_{t-i} + \varepsilon_t \quad (2)$$

If the null hypothesis cannot be rejected, then it can be concluded that series X_t is a unit root process (i.e., non-stationary). The null hypothesis is that each variable is non-stationary. It is rejected when the variable is stationary (Bashir & Ibrahim, 2020).

ADF test is used to test the stationarity on the basis of regression.

$$\Delta Y_t = d_0 + d_1 Y_{t-1} + \sum_j d_{j+1} \Delta Y_{t-j} + e_t \quad (3)$$

Here, Δ denotes the first-difference operator, whereas the stationary random error is denoted by e_t. The researcher rejects the non-stationarity null hypothesis of ΔY, at a time when d_1 is negative significant. This infers that every series is non-stationary, at a time when variables are defined in levels. However, in the case of using the first differences of the variables, the rejection of the null hypothesis of non-stationarity is executed (Bashir & Ibrahim, 2020).

Cointegration Process

Cointegration analysis is used to address spurious regression problems and violation assumptions of the classical regression model. Further, it is also used to analyze the long-run relationship between the variables (Y, X, M, L). An approach to testing for cointegration is to construct test statistics from the residuals of cointegrating regression. VECM can be used to capture both short-run dynamics as well as movement toward equilibrium. Here, long-run equilibrium relationship enters into a short-run model.

We estimate a cointegrating equation of the following form:

$$Y_t = \alpha_0 + \alpha_1 X_t + \alpha_2 M_t + \alpha_3 L_t + e_t \quad (4)$$

where X is exports, M is imports, Y is GDP, L is the labor force, *e* is an error term and *t* is annual time series data. For checking whether variables are cointegrated, we consider the autoregression of the residuals.

$$De_t^{\wedge} = \alpha_1 e_{t-1} + \varepsilon_t \quad (5)$$

where, $e_t^{\wedge}$ is the estimated residuals of the long-run relationship and D is a difference operator. When the null hypothesis is rejected i.e., $\alpha_1 = 0$, it can be understood that the residual series is stationary.

When unit root analyses recommend that all the variables are I(1) whereas residuals in Equation (1)

remain stationary, it can be concluded that the series can be cointegrated in the order of I(1). In order to determine the existence of long-run equilibria among the variables in the model, cointegration is tested with two steps: first, the stationary properties of the individual variables in the model should be investigated, and then their orders of integration should be determined by employing unit root.

ARDL Model Specification

In order to assess the dynamic interactions and long-run relationships among the considered variables, bounds testing is used to determine the model. Otherwise, Autoregressive distributed lag (ARDL) or cointegration procedure is also used, which was developed by Pesaran et al. (2001).

Error Correction Model (ECM)

Error-Correction Term (ECT), derived from long-run relationships using ARDL procedure, is considered an independent variable. As the entire set of variables remain stationary in the system, short-run adjustment mechanism can be modeled as ECM. ECT, lagged by one year (i.e., EC_{t-1}), is utilized in ECM, in addition to current and past differenced fundamentals and other variables that affect the economic growth and its determinants in the short run. The EC_{t-1} integrates short-run dynamics into long-run augmented Cobb-Douglas production functions (Pesaran et al., 2001). The specification of a general ECM can be provided as follows:

$$\Delta Y_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \Delta X_{t-1} + \sum_{i=1}^{n} \alpha_2 \Delta M_{t-1} + \sum_{i=1}^{n} \alpha_3 \Delta L_{t-1} + \alpha_4 EC_{t-1} + \mu_t \quad (6)$$

where EC_{t-1} is an error correction term lagged one period.

With annual observations considered in the study, two values are selected in order to achieve the highest order of lags in the ARDL model. Based on this value, the analysis is conducted for the period considered for the study i.e., 1970–2020. The error-corrected version of ARDL (2, 2, 2) model with regards to variables in (1), is given herewith.

$$\Delta \ln Y_t = \beta_0 + \sum_{i=1}^{n} \beta_1 \Delta ln Y_{t-i} + \sum_{i=1}^{n} \beta_2 \Delta \ln X_{t-i} + \sum_{i=1}^{n} \beta_3 \Delta ln\, M + \sum_{i=1}^{n} \delta_i \Delta \ln M_{t-i} + \delta_1 \ln Y_{t-1} + \delta_2 \ln L_{t-1} + \delta_3 \ln X_{t-1} + \delta_4 \ln M_{t-1} + \mu_t \quad (7)$$

If $(\delta_1 - \delta_4)$ are jointly significant, variables are said to be cointegrated. The short-run effects of the augmented Cobb-Douglas production function are inferred by the estimates of δ_i'.

Granger Causality Test

Granger causality test considers that the data with regards to forecasting of Y and X variables is present solely in time series data on these variables. Following are the equations that involve the determination of regression.

$$Y_t = \sum_{i=1}^{n} \alpha_i X_{t-i} + \sum_{j=1}^{n} \beta_j Y_{t-j} + \mu_{1t} \quad (8)$$

$$X_t = \sum_{i=1}^{m} \lambda_i Y_{t-i} + \sum_{j=1}^{m} \delta_j X_{t-j} + \mu_{2t} \quad (9)$$

here, both disturbances $\mu_{1t}\ and\ \mu_{2t}$ remain uncorrelated.

According to equation (9), current Y has a relationship with the past values of X itself and the current X, while as per Equation (10), a similar behavior is observed for X_t. Here, Y denotes the economic growth whereas X corresponds to export. Based on the assumption that the first difference of these variables (denoted by DLGDP, DLEX and DLIM respectively) remain stationary and are cointegrated, the following causality model is generated.

$$DLGDP_t = \alpha_0 + \sum_{i=1}^{l1} \alpha_{1i} DLGDP_{t-i} + \sum_{j=1}^{m1} \alpha_{2j} DLEX_{t-j} + \sum_{k=1}^{n1} \alpha_{3k} DLIM_{t-k} + \alpha_4 ECT_{t-1} + \mu_t \quad (10)$$

$$DLEX_t = \beta_0 + \sum_{i=1}^{l2} \beta_{1i} DLGDP_{t-i} + \sum_{j=1}^{m2} \beta_{2j} DLEX_{t-j} + \sum_{k=1}^{n2} \beta_{3k} DLIM_{t-k} + \beta_4 ECT_{t-1} + \nu_t \quad (11)$$

$$DLIM_t = \theta_0 + \sum_{i=1}^{l3} \theta_{1i} DLGDP_{t-i} + \sum_{j=1}^{m3} \theta_{2j} DLEX_{t-j} + \sum_{k=1}^{n3} \theta_{3k} DLIM_{t-k} + \theta_4 ECT_{t-1} + \varepsilon_t \quad (12)$$

where,

$\mu_t, \nu_t\ and\ \varepsilon_t$ denote the serially-independent random variables with a mean zero and finite covariance matrix.

ECT_{t-1} corresponds to the error correction term (lagged one period).

In causality testing, it is a usual procedure to regress the past and in some cases, the future values of white-noise process Y_t are also regressed against the current values of some other white-noise process, X_t. In the case where Y_t contains information that aids in the prediction of X_t, in Granger sense, Y_t causes X_t $(Y_t \rightarrow X_t)$. The reverse

procedure enables the testing process to be executed($X_t \rightarrow Y_t$). When both the regressions arrive at positive results for causality, then there exists a bidirectional (feedback) relationship between X_t and Y_t, ($X_t \leftrightarrow Y_t$).

Considering the Granger-cause, it is noted that a variable X is causal to variable Y if X is the cause of Y or Y is the cause of X based on the data set containing X and Y. In this case, it is possible to predict current Y with the help of X's past values. However, it occurs only when the existing information has been already used. The original Granger causality test is chosen here because of its straightforwardness and because it saves degrees of freedom. Since the number of observations is limited, the latter is an important consideration in this study (Raghutla & Chittedi, 2020). The Akaike Information Criteria (AIC) model selection criterion is utilized to find out the best lag length to be used in autoregression.

The VAR Framework

To investigate the augmented Cobb-Douglas production or ELGH, two varied forms of econometric frameworks are used. Both frameworks function on the basis of VAR that includes IRF and VDCs models **(**Ibrahim & Bashir, 2021). Both IRF and VDC estimates are produced based on the estimate of unrestricted VAR model, in line with the equations given below.

$$\Delta X = \sum_{i=1}^{k} \beta 11 \Delta X_{t-i} + \sum_{i=1}^{k} \beta 12 \Delta Y_{t-i} + \sum_{i=1}^{k} \beta 13 \Delta M_{t-i} + \sum_{i=1}^{k} \beta 14 \Delta L_{t-i} + \mu_{1t} \quad (13)$$

$$\Delta Y = \sum_{i=1}^{k} \beta 21 \Delta X_{t-i} + \sum_{i=1}^{k} \beta 22 \Delta Y_{t-i} + \sum_{i=1}^{k} \beta 23 \Delta M_{t-i} + \sum_{i=1}^{k} \beta 24 \Delta L_{t-i} + \mu_{2t} \quad (14)$$

$$\Delta M = \sum_{i=1}^{k} \beta 41 \Delta X_{t-i} + \sum_{i=1}^{k} \beta 42 \Delta Y_{t-i} + \sum_{i=1}^{k} \beta 43 \Delta L_{t-i} + \sum_{i=1}^{k} \beta 44 \Delta M_{t-i} + \mu_{3t} \quad (15)$$

$$\Delta L = \sum_{i=1}^{k} \beta 31 \Delta X_{t-i} + \sum_{i=1}^{k} \beta 32 \Delta Y_{t-i} + \sum_{i=1}^{k} \beta 33 \Delta L_{t-i} + \sum_{i=1}^{k} \beta 34 \Delta M_{t-i} + \mu_{4t} \quad (16)$$

where,

β_{nm}^{i} denotes the parameter to be determined

k denotes the highest possible distributed lag length,

Δ corresponds to difference operator whereas μ_{nt} denote independently and identically-distributed error terms.

The time series data, utilized in the determination process, contains export X, economic growth, Y, import, M, and labor force, L. In VAR system, all the variables are treated as endogenous, thus each one is modeled as a function of lagged values of both self and other system variables.

4. DATA ANALYSIS AND DISCUSSION

Unit Root tests

Table 1 shows that the ADF stationarity test results in which the complete set of variables remain non-stationary at the level. However, they become stationary at first difference. So, it is worth to arrive at a conclusion that the complete set of variables remain integrated in the order of one.

Table 1. Augmented Dickey-Fuller (ADF) test

Variables	Level (test statistic)			First Difference (test statistic)		
	Intercept	Trend & Intercept	Lag	Intercept	Trend & Intercept	Integrated Order
lnY	-0.55 (-2.92)	-2.91 (-3.50)	2	-5.53 (-2.92)	-5.49 (-3.51)	I(1)
lnX	0.47 (-2.92)	-1.51 (-3.50)	2	-7.33 (-2.92)	-7.62 (-3.50)	I(1)
lnM	0.22 (-2.92)	-1.66 (-3.50)	2	-7.51 (-2.92)	-7.67 (-3.50)	I(1)
lnL	-1.73 (-2.92)	-7.61 (-3.50)	2	-7.10 (-2.92)	-7.07 (-3.51)	I(1)

Note: Figures between brackets are critical values at 5% level.
Source: Authors' calculations based on Eviews, 2021

Table 2. Phillips–Perron (PP) test

Variables	Level (test statistic)		First Difference (test statistic)		
	Intercept	Trend & Intercept	Intercept	Trend & Intercept	Integrated Order
lnY	-0.56 (-2.92)	-2.23 (-3.50)	-6.11 (-2.92)	-5.95 (-3.50)	I(1)
lnX	0.56 (-2.92)	-1.64 (-3.50)	-7.32 (-2.92)	-7.62 (-3.50)	I(1)
lnM	1.11 (-2.92)	-1.64 (-3.50)	-7.59 (-2.92)	-8.38 (-3.50)	I(1)
lnL	-3.40 (-2.92)	-8.72 (-3.50)	-32.74 (-2.92)	-33.80 (-3.50)	I(0)

Note: Figures between brackets are critical values at 5% level.
Source: Authors' calculations based on Eviews, 2021

The results of the PP unit root tests can be found in Table 2. It shows that in all cases, the unit root hypothesis cannot be rejected. Therefore, it can be concluded that the whole set of variables remain non-stationary in levels excluding stationary and labor force in first difference.

Lag Length Criteria

Lag length measurement is the most critical criterion in VAR model. Table 3 shows that optimal lag for the modeling is determined through the AIC, which indicates that with a minimum value of 0.39, a lag is sufficient.

Table 3. VAR lag order selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-151.6324	NA	0.006744	6.352343	6.506777	6.410935
1	10.42062	291.0340*	1.74e-05*	0.390995*	1.163167*	0.683956*
2	16.46217	9.863750	2.65e-05	0.797463	2.187371	1.324792

Note: * Indicates lag order selected by the criterion.
LR: Sequential modified LR test statistic, FPE: Final prediction error, AIC:Akaike Information Criterion, SC: Schwarz Information Criterion, HQ: Hannan-Quinn Information Criterion
Source: Authors' calculations based on Eviews., 2021

ARDL Bounds for Cointegration

In this study, ARDL cointegration technique is used to analyze the long-run relationships and short-run dynamic interactions empirically among the considered variables such as labor force, import, GDP, export, and dummy variable. Wald statistics was conducted as F-test. When F statistic value remains significant (i.e., more than upper bound), then H_0 is rejected and H_1 is supported. This reveals the existence of a long-run equilibrium relationship between GDP, export, import, labor force and trade policy.

Table 4. ARDL Bounds test

Null Hypothesis: No long run relationship exists				
Test Statistic	Value	Significance	I(0)	I(1)
F-statistic	6.002398	10%	2.2	3.09
K	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

Source: Authors' calculations based on Eviews, 2021

As shown in Table (4), the value of F-statistic is 6.002 which exceeds the upper bound of the critical value band at 5 percent level, and the lower and upper bond values are 2.56 and 3.49 respectively. In this case, the null hypothesis of no long-run relationship between Y, X, M, L and DI is rejected without considering their integration order, I(0) or I(1). This confirms the presence of a long run cointegrated relationship between dependent variable (Y) and independent variables (X, M, L, DI). In parallel terms, it can be said that the entire set of variables travel together in the long-run.

Error-Correction Model

After establishing a cointegration relationship, ECM is determined to establish the dynamic behavior of ELGH. Wald test is applied to quantify the extent of unrestricted estimates, coming together to meet the restrictions, under null hypothesis.

Table 5. ARDL Error-correction regression

Case 2: Restricted Constant and No Trend				
Variables	Coefficient	Std. Error	t-Statistic	Prob.
D(LONGDP(-1))	0.331585	0.132434	2.503779	0.0166
D(LNL)	0.001730	0.016644	0.103946	0.9177
D(DI)	-0.162408	0.055155	-2.944582	0.0054
CointEq(-1)*	-1.056515	0.165746	-6.374293	0.0000

Source**:** Authors' calculations based on Eviews, 2021

Table (5) shows that lagged error-correction term (EC_{t-1}) coefficient, which was found to be -1.056515, carries a correct negative sign. This remains highly significant in all the cases that support cointegration. Further, it recommends the validity of a long-run equilibrium relationship among the variables in

equation (7), and suggests a moderate speed of convergence to equilibrium. The larger the error correction coefficient (in absolute value), the faster the economy's return to its equilibrium after shock. These results are in line with the findings in the Indonesian case by Labibah et al. (2021), which confirmed that in the long run, the economic growth in China as well in Japan has a positive sign and significant effect on Indonesian exports, while in the short run, the US economic growth has a positive significant effect on Indonesian exports. Our findings are consistent with Wamalwa and Were (2019), who indicated a positive long-run relationship between exporting and output for Kenya. It is also in agreement with results by Faisal et al. (2017), which indicated that exports of Saudi Arabia have a positive impact on the economic growth in the long run. In addition, our findings also justify with the work for Sierra Leone done by Turay (2021) and Barrie et al. (2021) in terms of export having a positive effect on economic growth as well as the work by Kumar et al. (2020), which proved significant and positive impact of exports on GDP growth of South Asian countries.

Diagnostic Tests

To determine the reliability and certainty of robustness of the model for the possible policy targets, a series of residual diagnostic tests were performed. The Breusch-Pagan-Godfrey correlation test, Breusch-Pagan-Godfrey heteroskedasticity test, Jarque-Bera normality test and Ramsey RESET test were employed. The null hypotheses in this case are that there is no serial correlation, the model is homoscedastic, and the errors are normally distributed and that the model is correctly specified. The tests showed that the baseline model results are robust.

Granger Causality Test

According to pairwise Granger causality test, GDP has no Granger-cause export since the former has strong predictive power. On the other hand, export does not Granger-cause GDP. So, it is revealed that both GDP and export doesn't Granger-cause since P-value is greater than 0.05 (0.7844, 0.7491 respectively). Therefore, we can't reject null hypothesis, and we identify that there is an independent relationship between two variables. This result is consistent with Marwan et al. (2013) and Mehta (2015).

Impulse Response Functions (IRFs)

The IRFs used to determine whether ELGH exists in Sudan and assess the impact of export movements on GDP. The results are reported in Figure 2. The figure shows the estimated orthogonalized impulse response functions for export, import, labor force and trade policy to a one standard deviation innovation in the GDP.

Figure (2a) shows that a one unit of S. D. positive (because it's above the line) shock of GDP in its own and become steady until 10 years in the future. Figure (2b) shows that one unit of positive S. D. shock of GDP on export is negative because it's below the zero line. Figure (2c) shows one unit of S.D. shock of GDP on import. Figure (2d) shows one unit of S. D. shock of GDP on labor force. Figure (2e) shows one unit of S. D. shock of GDP on trade policy, which is negative, because it's below the line.

Figure (2f) shows one unit of S. D. shock of export on GDP. Figure (2g) shows one unit of S. D. shock of export on its own. Figure (2h) shows one unit of S.D. shock of export on import. Figure (2i) shows one unit of S. D. shock of export on labor force. Figure (2j) shows one unit of S. D. shock of export on trade policy.

Figure (2k) shows one unit of S. D. shock of import on GDP. Figure (2l) shows one unit of S. D. shock of import on export. Figure (m) shows one unit of S.D. shock of import on its own. Figure (n) shows one unit of S. D. shock of import on the labor force. Figure (2o) shows one unit of S. D. shock of GDP on trade policy.

Figure (2p) shows one unit of S. D. shock of labor force on GDP. Figure (2q) shows one unit of S. D. shock of labor force on export. Figure (2r) shows one unit of S. D. shock of labor force on import. Figure (2s) shows one unit of S. D. shock of labor force on its own. Figure (2t) shows one unit of S. D. shock of the labor force on trade policy.

Figure (2u) shows one unit of S. D. shock of trade policy on GDP. Figure (2v) shows one unit of S. D. shock of trade policy on export. Figure (2w) shows one unit of S. D. shock of trade policy on import. Figure (2x) shows one unit of S. D. shock of trade policy on labor. Figure (2y) shows one unit of S. D. shock of trade policy on its own. Hence, our findings are in line with those reported in the existing literature (Tivatyi et al., 2022; Barrie et al., 2021; Labibah et al., 2021; Dimoso et al., 2019; Chia, 2016; Marwan et al., 2013).

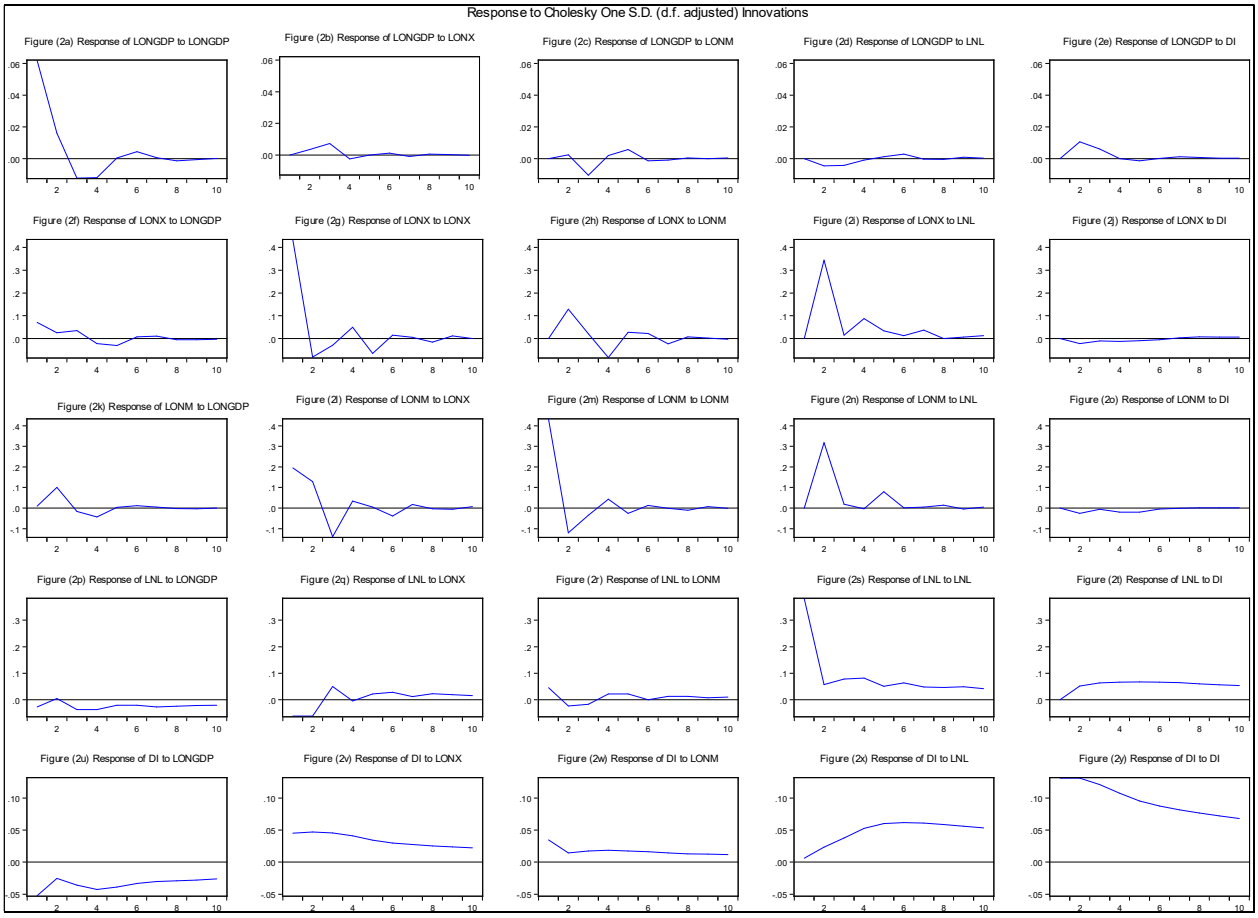

Figure 2. Impulse response functions

Variance Decompositions (VDCs)

A variance decomposition of an endogenous variable into component shocks provides information about the relative importance of each shock to the variable. Table 6 shows the ordering determined based on Cholesky.

Table 6. Variance decompositions

(a) Variance Decomposition of LONGDP						
Period	S. E.	LONGDP	LONX	LONM	LNL	DI
1	0.061936	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.065155	96.41587	0.290486	0.131751	0.490723	2.671175
3	0.067928	91.96289	1.412418	2.531570	0.849406	3.243718
4	0.069060	92.00690	1.486083	2.530521	0.838238	3.138260
5	0.069324	91.30927	1.474780	3.199476	0.860530	3.155942
6	0.069551	91.11759	1.495849	3.222723	1.028311	3.135529
7	0.069578	91.05573	1.514991	3.241501	1.029672	3.158101
8	0.069602	91.03539	1.522298	3.241690	1.035182	3.165443
9	0.069612	91.01928	1.524297	3.240770	1.049687	3.165962
10	0.069614	91.01216	1.525464	3.243015	1.051838	3.167524
(b) Variance Decomposition of LONNX						
Period	S. E.	LONGDP	LONX	LONM	LNL	DI
1	0.439203	2.600066	97.39993	0.000000	0.000000	0.000000
2	0.579183	1.692688	57.94762	4.940426	35.26868	0.150590
3	0.581648	2.048306	57.70323	5.034850	35.03487	0.178747
4	0.596591	2.078153	55.53664	6.704933	35.46629	0.213988
5	0.602582	2.292692	55.60417	6.787510	35.08392	0.231715
6	0.603365	2.301378	55.52125	6.903692	35.03527	0.238405
7	0.605094	2.321023	55.21301	7.014363	35.21212	0.239478
8	0.605415	2.325605	55.22175	7.021367	35.17482	0.256460

9	0.605627	2.331810	55.22234	7.018418	35.16050	0.266933
10	0.605810	2.332366	55.18900	7.017108	35.18447	0.277059

(c) Variance Decomposition of LONM

Period	S. E.	LONGDP	LONX	LONM	LNL	DI
1	0.474004	0.038093	16.94991	83.01200	0.000000	0.000000
2	0.606079	2.786088	14.88133	54.72733	27.42564	0.179609
3	0.623473	2.700374	19.08312	52.03362	26.00402	0.178864
4	0.627717	3.143366	19.11555	51.81032	25.65696	0.273806
5	0.633568	3.089146	18.76861	51.02817	26.75169	0.362386
6	0.634991	3.109774	19.04710	50.84350	26.63201	0.367615
7	0.635266	3.113795	19.10504	50.80018	26.61350	0.367483
8	0.635524	3.112891	19.09351	50.78481	26.64142	0.367362
9	0.635624	3.115449	19.09701	50.78259	26.63737	0.367585
10	0.635677	3.114968	19.10442	50.77438	26.63858	0.367647

(d) Variance Decomposition of LNL

Period	S. E.	LONGDP	LONX	LONM	LNL	DI
1	0.389610	0.489845	2.460066	1.372383	95.67771	0.000000
2	0.402766	0.472556	4.647180	1.617403	91.58001	1.682849
3	0.420194	1.209743	5.715105	1.652657	87.57235	3.850146
4	0.435386	1.856026	5.330599	1.787696	85.12168	5.903998
5	0.445014	1.982183	5.344590	1.949976	82.81183	7.911421
6	0.455692	2.093618	5.479236	1.859664	80.91088	9.656603
7	0.463861	2.348253	5.356523	1.870700	79.18630	11.23822
8	0.471364	2.541293	5.426578	1.884311	77.64287	12.50495
9	0.478191	2.670274	5.430497	1.854538	76.48440	13.56029
10	0.483859	2.790049	5.404747	1.860164	75.44646	14.49858

(e) Variance Decomposition of DI

Period	S. E.	LONGDP	LONX	LONM	LNL	DI
1	0.152351	11.70055	8.741898	5.222120	0.161297	74.17414
2	0.209710	7.651012	9.626119	3.226316	1.337676	78.15888
3	0.252404	7.308083	9.892113	2.706908	3.134835	76.95806
4	0.286113	7.912249	9.773157	2.528378	5.838425	73.94779
5	0.312391	8.176422	9.400555	2.427087	8.608983	71.38695
6	0.333659	8.161197	9.048004	2.371012	10.96508	69.45471
7	0.351585	8.090004	8.769047	2.301877	12.88884	67.95023
8	0.366888	8.057754	8.528633	2.239803	14.39882	66.77499
9	0.380069	8.047793	8.334644	2.195743	15.59249	65.82933
10	0.391502	8.033598	8.178693	2.160596	16.56984	65.05727

We divide the period into short and long-run as follows:

(a) Variance Decomposition of LONGDP.
In the short-run, that is quarter 3, shock to GDP accounts for 92 percent variation of the fluctuation in the GDP, or in its own shock. The second shock is the shock to export, which can cause 1.4 percent fluctuation in GDP. But a shock to import can contribute up to 2.5 percent fluctuations on GDP. A shock to labor force can contribute 0.9 percent fluctuation to GDP. A shock to dummy variable can contribute 3.2 percent fluctuation to GDP. As a result, total fluctuation becomes 100 percent.

In the long-run, that is quarter 10, shock to GDP can contribute to 91 percent variation of the fluctuation in the GDP, or in its own shock. The second shock is the shock to export, which can cause 1.5 percent fluctuation in variance of GDP. But a shock to import can contribute 3.2 percent fluctuations on GDP. A shock to labor force can contribute 1 percent fluctuation to GDP. But a shock to dummy variable can contribute 3.2 percent fluctuation to GDP. As a result, total fluctuation becomes 100 percent.

(b) Variance Decomposition of LONNX.
In the short-run, that is quarter 3, shock to GDP accounts for 2 percent variation of the fluctuation in export. The second shock is the shock to export, which can cause 58 percent fluctuation in export or in its own shock. But a shock to import can contribute 5 percent fluctuations on export. A shock to labor force can contribute to 35 percent fluctuation to export. A

shock to trade policy variable can contribute 0.18 percent fluctuation to export. As a result, total fluctuation becomes 100 percent.

In the long-run, that is quarter 10, shock to GDP can contribute 2.3 percent variation of the fluctuation in the export. The second shock is the shock to export, which can cause 55 percent fluctuation in variance of the export or in its own shock. But a shock to import can contribute 7 percent fluctuations on export. A shock to labor force can contribute 35 percent fluctuation to export. A shock to trade policy variable can contribute 0.3 percent fluctuation to export. As a result, total fluctuation becomes 100 percent.

(c) Variance Decomposition of LONM:

In the short-run, that is quarter 3, shock to GDP accounts for 2.7 percent variation of the fluctuation in the import. The second shock is the shock to export, which can cause 19.1 percent fluctuation in import. But a shock to import can contribute 52 percent fluctuations on import or in its own shock. A shock to labor force can contribute 26 percent fluctuation to import. A shock to dummy variable can contribute 0.2 percent fluctuation to import. As a result, total fluctuation becomes 100 percent.

In the long-run, that is quarter 10, shock to GDP can contribute 3.1 percent variation of the fluctuation in import. The second shock is the shock to export, which can cause 19 percent fluctuation in variance of the import. But a shock to import can contribute to 51 percent fluctuations on import or in its own shock. A shock to labor force can contribute 27 percent fluctuation to import. A shock to dummy variable can contribute 0.4 percent fluctuation to import. As a result, total fluctuation becomes 100 percent.

(d) Variance Decomposition of LNL

In the short-run, that is quarter 3, shock to GDP accounts for 1.2 percent variation of the fluctuation in the labor force. The second shock is the shock to export, which can cause up to 5.7 percent fluctuation in export to labor force. But a shock to import can contribute 1.7 percent fluctuations on labor force. A shock to labor force can contribute 88 percent fluctuation to labor force or in its own shock. A shock to dummy variable can contribute 3.9 percent to labor force. As a result, total fluctuation becomes 100 percent.

In the long-run, that is quarter 10, shock to GDP can contribute 2.8 percent variation of the fluctuation in the labor force. The second shock is the shock to export, which can cause 5.4 percent fluctuation in variance of the labor force. But a shock to import can contribute 1.9 percent fluctuations on labor force. A shock to labor force can contribute 75 percent fluctuation to labor force or in its own shock. A shock to dummy variable can contribute 15 percent fluctuation to labor force. As a result, total fluctuation becomes 100 percent.

(e) Variance Decomposition of DI

In the short-run, that is quarter 3, shock to GDP accounts for 7.3 percent variation of the fluctuation in dummy variable. The second shock is the shock to export, which can cause 10 percent fluctuation in dummy variable. But a shock to import can contribute 2.7 percent fluctuations on dummy variable. A shock to labor force can contribute 3.1 percent fluctuation to dummy variable. A shock to dummy variable can contribute 77 percent to dummy variable or in its own shock. As a result, total fluctuation becomes 100 percent.

In the long-run, that is quarter 10, shock to GDP can contribute 8 percent variation of the fluctuation in the dummy variable. The second shock is the shock to export, which can cause 8 percent fluctuation in variance of the dummy variable. But a shock to import can contribute 2.2 percent fluctuations on dummy variable. A shock to labor force can contribute 17 percent fluctuation to dummy variable. A shock to dummy variable can contribute 65 percent fluctuation to dummy variable or in its own shock. As a result, total fluctuation becomes 100 percent.

In both short and long-ran, export and import have very weak influences on GDP, while GDP implies strong influence on its own. Import and labor imply strong influences on export. From the variance decompositions analysis, this paper concludes that the GDP, X, M, L, export and DI are mainly sensitive to their own shocks.

Stability tests

In order to assess whether estimation regression equations remain stable across the sample period, CUSUM (cumulative sum) and CUSUMQ (cumulative sum of squares) tests were plotted as shown in Figures 3 and 4. If these plot statistics are within 5 percent significance level, then stable coefficients are possible. If the blue lines lay inside the red lines, it means that the model is stable.

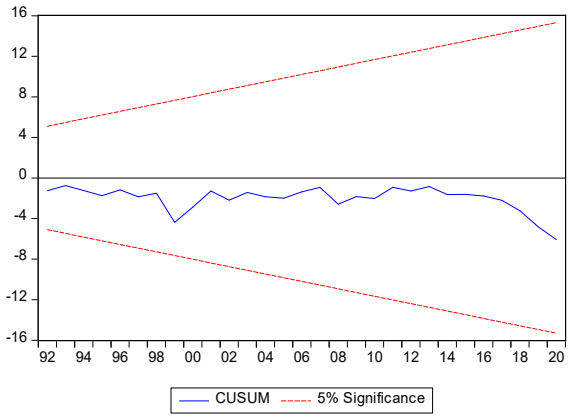

Figure 3. CUSUM test

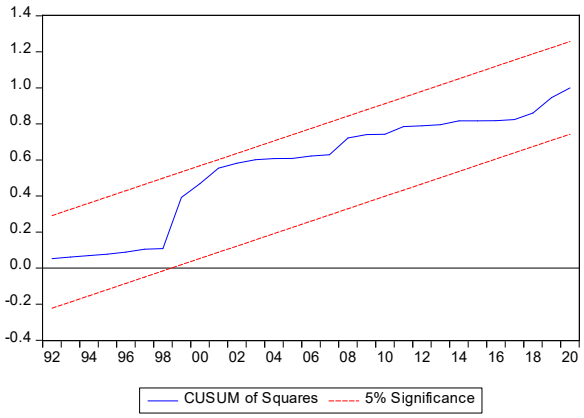

Figure 4. CUSUMQ test

5. CONCLUSION, IMPLICATION, SUGGESTION, AND LIMITATIONS

The current research article has a main objective i.e., to assess the ELGH for Sudan during 1970–2020. On the basis of annual data, ARDL approach identifies the presence of a long-run relationship among import, export, GDP, labor force and trade policy. The outcomes infer that the considered variables are co-integrated with each other. Hence, it shares a common linear trend, or it can be inferred that the variables travel in a long-term path together. The results indicate that all the variables have unit roots, which is consistent with macroeconomic literature. The ELGH can be proven in this circumstance, according to the empirical data.

Sudanese export characterized by non-export diversification in commodity production and diversified in commodity demand of import, either in intermediate or final goods, even in consumption of imported goods. Suggest one reason why the success of an ELG strategy might depend upon what kind of good is being exported. The coefficient of imports is of significance; this provides strong support for the import compression hypothesis. In other terms, intermediate imports, as well as capital goods remain mandatory inputs to produce exports. As a result, import compression can seriously take a hit on export performance.

The current study has a critical policy implication i.e., any export promotion strategy tends to boost the economic growth and vice versa. The success of such a policy would probably depend on the country's efforts to increase its share of international market through regional integration. The export strategies of Sudan can gain success in the future only based on its ability to increase labor productivity, expansion into new markets and manufacturing of quality produce through product innovation and R&D. Diversifying export markets and products will be important for Sudan to increase its trade volumes, reduce its trade deficit, increase foreign currency earnings and support firm growth and productivity.

Policy-makers should also concentrate on putting efforts on an export diversification strategy by investing more in its capacity to supply more to meet world demand for exports and accordingly and thus avoiding export instability. Specialization in production and export of primary commodities generally implies a higher degree of export instability than specialization in manufactures, because the primary commodities tend to be characterized by low price elasticity's of demand and supply and by uncontrolled variability in demand, in supply or both. The typical recommendation to any LDCs like Sudan is to diversify exports in order to reduce its export instability, in which they have a comparative advantage.

Some limitations of the data should be highlighted. For example, Sudan's macroeconomic data suffers from many inconsistencies. The GDP for the same year is recorded differently in different yearbooks issued from the same source. Therefore, developing a consistent database was a difficult task. It is recommended that future research on this topic be based on high frequency data and larger sample sizes to make the results more reliable. Additional studies are recommended to investigate Sudan's export diversification, export volatility, import contraction hypothesis, and Sudan's export performance.

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