

Research Article

Maximizing Industrial Value Added in Sub-Saharan Africa: The Role of Trade Globalisation and Government Regulation

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Abstract—This paper investigates the combined impact of trade globalisation and regulatory quality on industrial value-added in sub-Saharan African countries. A panel dynamic model with data from 41 sub-Saharan African countries covering 2001 to 2023. The panel least squares estimation technique of fixed effects was employed. An initial stylized fact shows that SSA countries mainly experience low industrial value-added, unfavourable trade balances and terms of trade, an unstable real effective exchange rate, and poor regulatory quality. Evidence from the result shows that the balance of trade and terms of trade significantly enhance industrial value-added, while regulatory quality exerts a diminishing but statistically significant influence alongside the real effective exchange rate, which was found to be negative and statistically significant. This implies that the promising role of trade globalisation could be undermined by poor regulatory quality and unstable exchange rates. Accordingly, SSA countries must continually and productively enhance local industries, especially through the importation of intermediate goods like advanced technology to aid domestic industrial production and enhance the exportation of locally produced goods to foreign markets for foreign exchange earnings.

Keywords— Industrial value added, Trade globalization, Government regulation, Balance of trade, Trade openness, SSA

1. Introduction

Academics, researchers, and practitioners have debated about the growth effect of trade globalisation, especially in poor nations. There are shreds of evidence that Sub-Saharan African (SSA) countries have not been able to enhance industrial production; hence, these countries are highly dependent on foreign products, which has discouraged local production and oftentimes led to the import of substandard products [1]. As such, export earnings have been low while payments for imports are on the increase, militating against the expansion of domestic industries, creating a deficit in the trade balance, and causing exchange rate depreciation. Due to the relatively high prices of imports and low export prices in SSA countries, export commodities tend to be vulnerable to declining terms of trade, worsening balance of payment and currency crises in low-income SSA countries, and causing a negative trend in the balance of trade. Unfortunately, the regulatory quality in the SSA sub-region is weak in addressing the problems associated with trade deficits and low industrialization, despite the use of tariffs, nationalistic sentiments, and increasing agitation for higher protectionism to moderate trade dynamics [2], [3].

Studies within the African continent seem to have observed a positive and significant effect of trade globalisation on economic productivity [4], [5], [6]. Also, studies have shown that the regulatory quality of institutions determine the extent to which trade globalisation affects economic activities [7], [8]. It was also found that trade globalisation did not drive domestic production due to poor regulatory quality [9], [10], [11], [12]. Some studies found that openness to trade exerts a diminishing effect on the growth of industrial production due to excessive importation of non-productive goods and services [13], [14]. Some studies have established that the effect of foreign trade varies across countries depending on several interfering factors, such as macroeconomic dynamics [15], [16]. Again, some researchers hold the view that industrial productivity thrives only when the trade balance is favourable, that is, more exports than imports [17], [18]. These controversies in the empirical literature are the motivation behind this study.

SSA is deemed appropriate for this study because the region has embraced trade integration initiatives at the global level, like the World Trade Organisation (WTO), and even at regional levels, such as ECOWAS, the East African Community (EAC), the African Continental Free Area

(AfCFTA), and the Common Market for Eastern and Southern Africa (COMESA), as efforts to boost trade volumes and revive domestic industries make this study germane [19]. SSA countries' interminable vision of becoming industrialised is hinged on the inter-country trade orientation of accessing production aid from advanced countries through the import of intermediate goods and the receipt of foreign exchange earnings from the exports of high-quality finished goods.

This paper takes a leaf from the methodology as applied in prior empirical studies to predict the combined impacts of trade globalisation and regulatory quality on industrial sector value added in SSA using a panel of 41 countries from 2001 to 2023 [17]. The analysis indicates that trade globalisation in SSA countries is a prominent determinant of industrial value added. Generally, the empirical evidence is significantly aligned with trade-led industrialization. However, [7], [20], [21] are the only studies that included government regulation on SSA, but their study focused on economic growth rather than industrial value-added, as applied in this study.

The remaining portions of the paper are arranged as follows: Section 2 examines the mechanisms via which commerce between nations could impact industrial value as well as the analytical methodology. The theoretical framework was discussed in section 3. The analytical technique employed in the paper is explained in Section 4. Results and discussions were articulated in section 5 while section 6 brings the paper to a close, with a discussion of the outcomes.

Statement of the Problem

The trade performance of most SSA countries has fallen drastically over the years. This is due to the lack of development in export products and overdependence on foreign products, as well as the lack of diversification, which prevents the exploration of opportunities in foreign sectors. SSA's overreliance on foreign products has reduced its production of such goods in its home country as a result of discouragement among infant industries, which causes them to limit their production of such goods knowing fully well that the demand for their product would fall compared to that of foreign producers, leading to financial losses [22]. Hence, for the past decades, most SSA countries have been experiencing deficits in trade. For instance, resource-rich countries like Nigeria, which is seen as the "giant of Africa," have focused on crude oil exports, leading to the neglect of the agricultural sector, which has caused a reduction in overall productivity. Likewise, many of the resource-scarce economies within the region lack productive capacity, resulting in the lack of competitiveness of such countries within the global trade space [7].

On the empirical front, there appear to be myriads of studies on global trade and industrial development, but the findings arising from these studies vary, implying that there is no consensus in the empirical literature regarding the effect of

trade globalisation on industrial value added in SSA [23], [24]. There is also the perspective that the effect of trade globalisation on industrial value added requires effective government regulation to improve domestic institutions to facilitate trade relationships with foreign investors [2]. However, the prior studies did not consider the aspect of government regulation in their analysis. It is therefore essential to evaluate the effect of trade globalisation amidst government regulation on industrial value added in SSA.

Objectives of the Study

The specific objectives are to:

- ascertain the effect of balance of trade on industrial value added in SSA;
- assess the effect of terms of trade on industrial value added in SSA;
- evaluate the effect of government regulatory quality on industrial value added in SSA; and,
- analyze the effect of real effective exchange rate on industrial value added in SSA.

Research Questions

From the specific objectives, the following questions arose:

- in what way does balance of trade affect industrial value added in SSA?;
- to what extent does terms of trade affect industrial value added in SSA?;
- how does government regulation affect industrial value added in SSA?; and,
- to what extent does real effective exchange rate affect industrial value added in SSA?

1.4 Hypotheses

This study aims to test the following null hypotheses:

HO₁: balance of trade does not have a significant effect on industrial value added in SSA;

HO₂: terms of trade does not have a significant effect on industrial value added in SSA;

HO₃: government regulatory quality does not have a significant effect on industrial value added in SSA; and,

HO₄: real effective exchange rate does not have a significant effect on industrial value added in SSA.

2. Related Work

Industrial sector and trade in SSA: Stylized facts

Different stages of industrialization and global integration have been reached by the SSA nations. A snapshot of the simple average of industrial value added is provided in Figure 1. There are differences in terms of industrial value-added for the SSA countries.

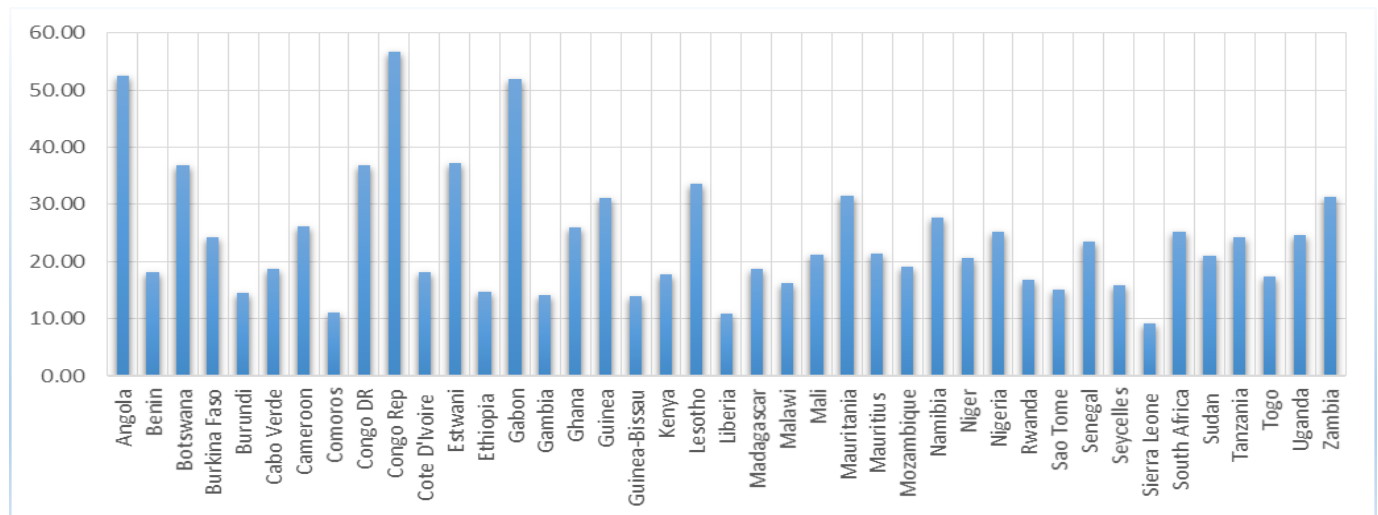


Figure 1. Mean of industrial sector value-added (simple average 2001 - 2023)

The SSA economies' trade structure is typified by a strong reliance on raw materials, with industrialised economies serving as the main export destination. This assertion is in line with the UNCTAD (United Nations Conference on Trade and Development) claim that a small number of primary commodities account for a large portion of SSA exports. The SSA countries have seen a sharp rise in their overall reliance on commodity exports in recent years. Primary products made up over 73% of all exports from SSA between 2010 and 2023, compared to 62% from 1995 to 1999 [25]. Crude oil alone accounted for nearly 45% of major exports during this time, while manufactured products accounted for the majority of SSA imports.

In recent years, SSA countries have undertaken measures towards reforms that result in improvements in domestic production for exports, trade openness, and integration into

the global economy. However, over the years, the SSA countries have been characterised by unfavourable trade balances with the global markets, despite devise efforts towards export promotion. Even with several years of international assistance and collaborations through the WTO, World Bank, and IMF on trade and investments with the SSA countries, the region still experiences deficit trade balances, implying several years of huge imports and low exports for most countries. Observing Figure 2, the balance of trade index, measured as the difference between aggregate receipts from exports and total payment for imports, shows a tendency of deficit and terms of trade below the optimal level of 100% for most of the SSA countries, except for Angola, Botswana, the Congo Republic, Cote d'Ivoire, Gabon, Nigeria, South Africa, and Zambia, whose average trade balances recorded surpluses within the period.

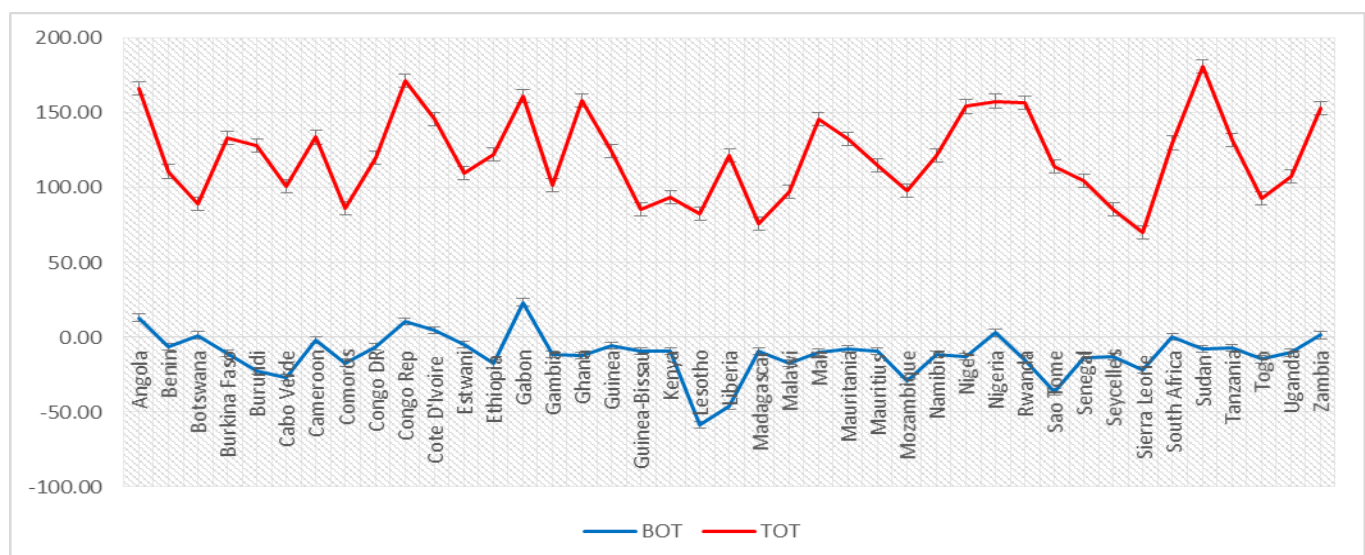


Figure 2: Mean of the balance of trade (BOT) and terms of trade (TOT) (simple average 2001 - 2023)

Government Regulation

The general measure of the government's capacity to create and carry out appropriate laws and policies that support actual sector growth is used to evaluate the regulatory quality of the

government. For the index of regulatory quality, the score ranges from 0 to 100, and 50 to 100 is seen as good regulatory quality [26]. Figure 3 shows that for the selected SSA countries, only a few countries' regulatory quality was

rated above 50, implying that the SSA region has poor and weak government regulatory quality. The largest SSA economy, Nigeria, has one of the poorest regulatory qualities.

Regulators typically argue that in order to address a market failure, the government must become involved. The industry may be a natural monopoly; businesses may be creating externalities like air pollution, contaminated water, or toxic waste; unchecked operations may be putting innocent parties in danger; and businesses may be withholding information or deceiving the public about their operations or goods. Government control proponents have used all of these externalities to support their case for regulation.

Government regulation has an impact on a large portion of the economy and its operations. Regulation aims to minimise unintended costs that the market economy fails to sufficiently account for or to offer social or economic benefits that would not naturally develop in a fully free market economy. In fact, government regulations are essential for promoting trade. Technical rules, for instance, inform exporters of the specifications that their product must meet and reassure local consumers that the goods will function as promised and that their health and safety are not jeopardised. Regulations may provide genuine benefits, such as lowering pollution harm or preventing accidents, illnesses, or injuries. Benefits are subject to arbitrary allocation, just as any policies that alter the way income and wealth are allocated through transfer payments, price supports, or subsidies.

There are costs associated with regulation. Trade regulations, for example, can stop dangerous products from being imported, but they can also impede the movement of economically significant goods. While safety features on cars and inspection of international trade may avoid sickness and harm, respectively, they also drive up the cost of imported goods. Regulation's advantages and disadvantages are typically difficult to quantify with precision. It is frequently challenging to ascertain whether a piece of legislation has a net benefit or a net cost. Nonetheless, it is critical to make an effort to support the public and policymakers in making informed decisions about whether and how much to regulate.

The efficacy and efficiency of a regulatory system can be used as benchmarks to evaluate its results. The social welfare objectives that the government has established for the regulatory authority are accomplished through effective regulation. The social and welfare objectives of regulation in Africa likely go beyond the pursuit of economic efficiency to include the promotion of sustainable development and the eradication of poverty. The objectives of social welfare are met with effective regulation at the lowest possible cost. There are two main ways that regulations might be economically costly:

- i. the costs of personally overseeing the regulatory system, which are covered by the government and represented in the financial allocations made to the regulatory bodies; and,
- ii. the external compliance costs of regulations, which are borne by producers and consumers in the form of

financial losses incurred by abiding by and circumventing the rules.

Regulation quality can also be assessed using good governance principles. A well-functioning regulatory system is one that strikes a balance between responsibility, transparency, and uniformity [27]. In order to be considered accountable, regulatory bodies must operate within the bounds of the law, take responsibility for the results of their judgements, and follow due process when making decisions. Transparency is the process of reaching regulatory decisions and disclosing them to the relevant stakeholders. Consistency is the third procedure that lends regulatory credibility. Public trust in a regulatory system is weakened by inconsistent regulatory decisions. Investors get uncertain when there is inconsistency, which drives up the cost of capital and can negatively impact their desire to invest. Since political intervention tends to weaken regulatory consistency and politicians may be prepared to change the rules of the game for short-term political advantage, consistency is a crucial justification for some sort of "independent" regulator. This discussion implies that a key factor influencing how well markets function will be the state's ability to establish robust regulatory institutions. A developed economy is more likely to have the institutional ability necessary to create and carry out efficient regulations, which should enhance cross-border trade and economic growth. It is possible to foresee that deficiencies in institutional capacity to provide "good" regulation would have an undesirable impact on economic progress [28].

While the body of studies on the effectiveness of state regulation in developing nations is still small, what is known about it generally indicates that the outcomes have been underwhelming. According to a recent study, regulatory agencies in 13 Asian countries were typically understaffed, and 80% of regulators lacked access to training. As per assessment, Asian countries rely excessively on independent regulators who lack the resources and assistance to perform activities that are beyond their purview. In Asia, political commitment to preserving regulatory independence is frequently lacking, as is support for independent regulation [29]. It was discovered that "instead of being implemented concurrently, implementation is being left to follow privatisation as part of individual sector initiatives" [30]. Analogous regulatory frameworks are linked to severe shortcomings in the establishment of institutions and to a bureaucratic mindset that stifles innovation [31]. Any idea of true regulatory independence is compromised and capture is encouraged in Malawi, where the power industry regulator is still tightly associated with the state electricity industry. The performance of the recently formed regulatory institutions varies widely, according to experiences in transitional economies [27]. Furthermore, acknowledging that not everything is as it seems, emphasis is placed on the importance of "improving regulatory regimes and building institutions and capacity effectively to supervise the private sector" [32]. The necessity for better regulation has also been underlined [33].

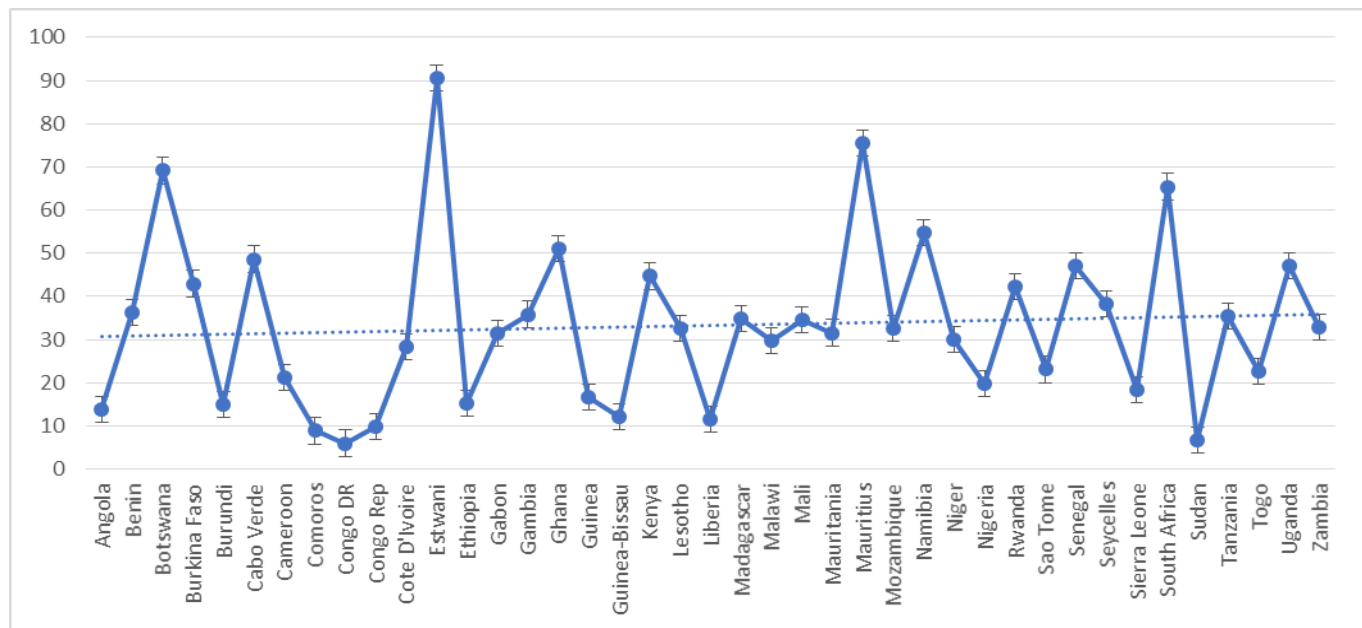


Figure 3: Mean of the regulatory quality index (simple average 2001 - 2023)

Exchange Rate and Foreign Trade in SSA

The requirement to conduct extensive trade in the currencies of their main trading partners is one of the main traits shared by the majority of rising nations, and the SSA in particular. Because exchange rates influence a nation's monetary, trade, and fiscal policies, it is vital to understand the exchange rate arrangements of the SSA countries. This study does this by making a distinction between the nations that use the fixed exchange rate system and the other group of countries that use the floating exchange rate regime. Thus, the study distinguishes between two groups of nations: those that are part of the Francophone zone and those that are not. Countries in the Franc zone, often recognised as the Communauté Financière Africaine (CFA) countries, are those that maintain a fixed exchange rate between the CFA franc and the Euro. Currently, the CFA franc is used by two distinct monetary unions, namely, the West African Economic and Monetary Union (WAEMU) and the Central African Economic and Monetary Community (CEMAC). While CEMAC comprises six (6) countries (Gabon, Cameroon, the Central African Republic, Chad, Congo, and Equatorial Guinea), WAEMU, on the other hand, is made up of eight (8) countries in total (Benin, Burkina Faso, Guinea-Bissau, Mali, Ivory Coast, Niger, Senegal, and Togo). Four fundamental ideas govern the conditions and guidelines of this arrangement: fixed parity, unrestricted currency convertibility, unrestricted transferability, and centralization of foreign exchange reserves. Each member of the CFA community is required to retain at least 50% of its foreign reserves in its current account, which is maintained at the Bank of France, in return for this guarantee. Because of their heavy reliance on one or two main agricultural commodities, the countries in the CFA zone have experienced similar shocks recently and share certain similarities in terms of their trade structure and institutional characteristics. Lesotho, Namibia, and Swaziland have their currencies pegged to the South African Rand, while the nations in the franc zone have

their currencies tied to the Euro. These nations, which share a common currency, gain from some commercial activities as a result of their membership in the Southern African Customs Union (SACU). A floating exchange rate regime has been implemented by the other group of countries, which has resulted in significant volatility in their respective currency rates. Most non-CFA nations were able to achieve significant exchange rate depreciation thanks to the transition to floating exchange rate regimes [34].

Empirical Review

Studies have been incoherent concerning their findings. For instance, using OLS for a dataset from 1971 to 2012, [14] showed that international trade failed to enhance growth when imports outweighed exports. In a panel of South-East European (SEE) countries, [35], [36] reported a positive effect of trade openness on economic success. In a study, [37] observed that the liberalisation of trade did not favour economic advancement in times of crisis. [38] established that trade aids poverty alleviation.

A review by [39] analysing the effects of the African Growth Opportunity Act (AGOA) revealed that while some SSA countries have benefited greatly from FDI inflows and export growth, others have not been able to fully utilise the benefits of AGOA because of issues with governance and absorptive capacity. Again, [40] examined the relationship between international trade and Nigeria's economic growth from 1981 to 2019, utilising the autoregressive distribution lag (ARDL) method to assess the relationship. The results showed that during the study period under review, international trade had no discernible effect on Nigeria's economic growth. Additionally, [41] examined how intra-African trade affected Nigeria's economic growth between 1981 and 2019 and discovered that, in the long run, Nigeria would benefit from increased trade among African nations, which is anticipated

to come from the full implementation of the African Continental Free Trade Agreement (AfCFTA).

Some other works either established a positive or negative interrelationship between trade globalisation, regulation, and industrial output. Using a panel least squares (PLS) analysis of African countries, [23] established that trade enhanced domestic output through its relationship with the digital economy using panel least squares for selected African countries between 2000 and 2018. With multivariate regression, [42] found that net exports increased productivity in Czechoslovakia only when imports were less than exports. In Indonesia, [13] used the ARDL method to conclude that trade openness inhibits production.

Few studies have taken into account the role that regulations play in interfering with growth. Most studies on Africa have focused on the effects of exports on overall growth or the influence of trade openness on growth rates. Also, [7] used panel data from African countries to show that both trade and institutional quality complemented each other to drive production. In a PLS of SSA using the Generalised Method of Moments (GMM), Calderon et al. (2020) established that trade integration was beneficial to economic prosperity. Again, [22], with a panel of ECOWAS countries, submitted that political stability was a major component of institutional quality that inhibited inter-country trade. Another study [20] showed that institutional quality helps in promoting favourable trade and output growth. Similarly, [21] showed that openness to global trade contributed positively to the growth in Africa's manufacturing and service value-added. Also, [43] observed that global trade promotes growth through more exports than imports in African countries.

A study by [5] used Seemingly Unrelated Regression (SUR) to conclude that financial development enhances the growth effect of global trade on the economic advancement of West African countries. In developing economies, [10] showed that openness to trade had a mixed effect, as it was not beneficial to non-oil exports but encouraged oil exports. Similarly, [6] used the pooled mean group (PMG) to indicate that global trade had a time-varying effect on output in ECOWAS countries. Again, [8] indicated that there was a threshold below which trade openness was beneficial in SSA. Also, [44] holds that inter-country trade fosters industrialization in Africa.

Other studies, such as [45], [46], [47], and [35], showed that trade openness is beneficial to economic productivity only when total exports exceed imports. A study [57] revealed that trade openness may not be beneficial if not complemented with domestic reforms to decrease the cost of doing business. In a comparative study, [15] established that openness to trade accelerated economic growth in Ghana but had a diminishing effect in Nigeria. Also, [9] established that an unstable exchange rate hindered the growth-enhancing effect of trade in Nigeria. Again, [14] concluded that international trade failed to enhance growth when imports outweighed exports.

3. Theory/Calculation

This study is developed from the Absolute Advantage Theory (AAT) proposed by Adam Smith in 1776 [48]. Though other scholars like David Ricardo (comparative advantage) and Eli Heckscher and Bertil Ohlin (O-H model) criticised the AAT because it failed to show whether countries that do not possess absolute advantage benefit from cross-border trade and what factors can influence trade [49], [50]. However, the AAT theory is still relevant as it demonstrates how countries can gain from trade by specialising in the exportation of goods they produce more efficiently and by importing the goods other countries produce more efficiently with their labour. The AAT takes its root from neoclassical aggregate production as follows:

$$Y = f(K, L, A) \quad (1)$$

Where Y represents GDP; K denotes capital; L is the amount of labour, and A represents the level of technology.

Due to the linkages between L and A, the neoclassical aggregate production is re-written as:

$$Y = f(K, AL) \quad (2)$$

Now, going by the tenets of the AAT that labour is the most important factor of production, equation (2) is then written as:

$$Y = f(AL) \quad (3)$$

Hence, building on equation (3), the AAT is represented thus;

$$Y = f\left(\frac{X}{AL}, \frac{M}{AL}\right) \quad (4)$$

Where X denotes exports while M represents imports. $\frac{X}{AL}$ and $\frac{M}{AL}$ explain the efficiency of expected export and import products given a level of labour and technology (AL).

Additionally, there is a need to ensure that a country exports more than it imports to make international trade favourable. Developing countries depend on developed countries for intermediate goods to boost domestic production for exports; hence, striking a balance in cross-border trade becomes pertinent. *Ceteris paribus*, a deficit, in this case, could inhibit further production for exports and over-reliance on imports if proper regulations are not put in place by the government, thus bringing the concept of trade balance and regulatory quality into the discussion [51]. Assuming a country is efficient in producing some products for exports and depends on imports for those they are inefficient in producing, it then implies that money gained from $\frac{X}{AL}$ exported should cover what is paid for $\frac{M}{AL}$ imported. Equation (4) is then re-written as:

$$Y = f(B, R) \quad (5)$$

Where B denotes trade balance and R is the notation for regulatory quality.

Incorporating the comparative advantage and O-H assertions into the AAT would help determine some factors that could influence the trade-growth benefit. For B to be favourable amidst R, the terms of trade (ratio of export and import prices) must be favourable as well to ensure that export receipts adequately cover import payments. Here, exchange rate policies must be put in place to strengthen the domestic currency of the country against those of other countries. In this case, Equation (5) is modified, thus:

$$Y = f(B, T, E, R) \quad (6)$$

Where T is the terms of trade and E is the exchange rate

Equation (6) implies that a country that desires to enhance productivity through global trade can do so successfully with a stable exchange rate and strong rules and regulations that would help moderate trade flows and their impact on domestic industries, all things being equal.

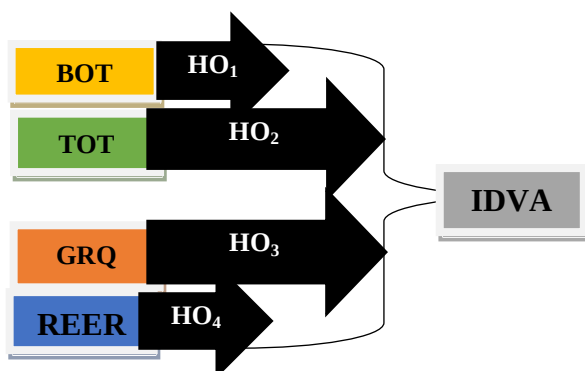


Figure 4: Conceptual Framework

The framework employed in this research postulates a connection between trade globalisation variables, government regulatory quality, and the industrial value added of SSA economies. The model delineates the dependent variable, assessed through industrial value added (IDVA), hinging on balance of trade (BOT), terms of trade (TOT), and the and the real effective exchange rate (REER), representing the independent variables.

4. Methodology

The econometric analysis of the effect of trade globalisation on industrial value-added in SSA is based on a panel least squares (PLS) approach. There has been a proliferation of PLS studies since the publication of [52] first edition panel data analysis, which brought to the fore an important theoretical development on PLS. A framework for panel data analysis involving rationality testing and the measurement of aggregate shocks was developed by [53]. Subsequently, further improvements to the prior theoretical literature have been noted, with recommendations for more extensions [54]. Some of these improvements include, but are not limited to, the introduction of a clear distinction between fixed effects

and random effects estimation using the Hausman test, the introduction of the pooled mean group (PMG) and mean group (MG) used for heterogeneous panel data, and the generalised method of moments (GMM) often used to address endogeneity problems [55]. In recent empirical studies, PLS has been used in different forms based on the diverse modifications earlier stated.

Empirical Model

The PLS model for this study follows a linear relationship between the variables under study. This relationship captures the actual level of industrial value-added resulting from trade globalization. In its simplest form, the linear equation is specified as follows:

$$IDVA_{i,j} = \beta_0 + \beta_1 BOT_{i,j} + \beta_2 TOT_{i,j} + \beta_3 GRQ_{i,j} + \beta_4 REER_{i,j} + \varepsilon_{i,j} \quad (7)$$

Where represents the industrial value-added, which is the dependent variable. The explanatory variables are, and, which denote the balance of trade, terms of trade, government regulation, and real effective exchange rate, respectively. The REER variable is used to ascertain the effect of exchange rate changes on promoting or inhibiting the impact of trade globalisation on IDVA. IDVA is dependent on the interaction effect of the explanatory variables, which are thus expected to be positive. *Ceteris Paribus* higher IDVA in SSA countries would indicate more export receipts than import payments. Again, it is expected that good regulatory quality would help to ensure that quality imports are made to boost domestic production for export revenue, thereby strengthening the trade globalisation-industrial value-added nexus. Other factors influencing trade in SSA countries that are not captured in the model are denoted by, which is known as the error term.

The description of model variables is as follow:

Industrial value added (IDVA): Value added represents a sector's net output following the subtraction of intermediate inputs and the addition of all outputs. Natural resource depletion and degradation, as well as the depreciation of fabricated assets, are not factored into the equation.

Balance of trade (BOT): The difference between the monetary value of a country's imports and exports over a specific time period is known as its net exports, or BOT. Positive values denote favourable trade, while negative values imply unfavourable trade.

Terms of trade (TOT): The ratio of export prices to import prices is known as the TOT, which is the relative price of exports in relation to imports. It can be understood as the quantity of imports that an economy can afford in relation to each unit of exports. Values less than 100% are considered unfavourable; hence, they would not favour domestic industrial value added.

Government regulatory quality (GRQ): The GRQ gauges public opinion on the government's ability to enact and enforce reasonable laws and regulations that foster the expansion of the private sector.

Real effective exchange rate (REER): The nominal effective exchange rate, or REER, is calculated by dividing the value of a currency against a weighted average of multiple foreign currencies by a cost index or price deflator. It is an index that calculates a currency's strength in relation to a group of other currencies.

Estimation Strategy

The efficiency of the panel data estimation technique is attributed to its ability to combine several cross-sections and time periods, resulting in more robust, valid, and trustworthy conclusions. In particular, heterogeneity specific to an individual can be taken into account by panel data analysis. Panel data provides greater degrees of freedom, less collinearity, and more data variances by combining data in various dimensions. The Fixed Effects (FE) and Random Effects (RE) models are used in this research to estimate panel data. The panel unit root test was performed in order to confirm the stationarity of the data before estimation.

FE and RE Model

According to the FE model, the dependent variable, industrial value-added, is linked to a non-stochastic group-specific factor for each group (the SSA countries). Put differently, the assumption behind the FE is that a particular individual effect is connected with the explanatory variable(s), whereas the assumption behind the RE is that there is no correlation between individual-specific effects and the explanatory variables. The FE equation is stated as follows:

$$Y_{it} = \alpha_i + \beta \cdot X_{it} + \mu_{it} \quad (8)$$

Where α_i is the country FE, that is, individual intercepts fixed for a given N, and the model captures no overall intercept. The random disturbance term is denoted by μ_{it} . Under the FE model, consistency does not demand that the individual intercepts whose coefficients are α_i 's and μ_{it} are not correlated. In this case, only $E(X_{it}\mu_{it})$ must hold. The variables are defined as follows:

Y_{it} = industrial value-added (IDVA)

X_{it} = value of the independent variables, BOT, TOT, GRQ and REER for the i^{th} country for t^{th} time.

t = 2001 – 2020

i.e. T = 20

i = 1 – 41

i.e. N = 41

The error term is aimed at controlling for unobserved influences on IDVA, which could be random (i.e., stochastic). To deal with this problem, the RE model becomes relevant. The RE model is expressed as:

$$Y_{it} = \alpha_i + \beta \cdot X_{it} + V_i + \mu_{it}$$

Where,

$$V_i \sim iid(0, \sigma_\alpha^2)$$

$$\mu_{it} \sim iid(0, \sigma_\mu^2)$$

Where V_i RE refers to unobserved country-specific effects. The diverse individual SSA countries are independent, with zero means, and they are assumed not to be too far from normality. The mean value for all countries is expressed as α , which is homoscedastic and time-invariant. The F-test is used to determine if the coefficients are concurrently or jointly significant, and the t-test is used to examine the significance of the variables' coefficients for both FE and RE.

Hausman Test

FE may be preferred if there is a high possibility of little change in the values of estimated parameters and a modest number of cross-section units (N) and time-series data (T). Additionally, the estimations from the FE and RE can differ greatly when T is small and N is large; in this case, RE is considered appropriate. Under the null hypothesis (H_0) that the RE estimates are consistent and efficient while the FE estimates are inefficient, Hausman tests are used to determine the statistical significance of the difference between the coefficients of FE and RE.

Data

The study covers 41 SSA countries with data ranging from 2001 to 2023, due to data availability; thus, a total of 943 observations were analyzed. The data used were collected from the World Development Indicators (WDI) database.

5. Results and Discussion

Levin, Lin & Chu t* test for panel unit root

The variables were verified for stationarity by subjecting them to a panel unit root test using the Levin, Lin, and Chu tests for stationary tests. Table 1 demonstrates that the variables are stationary at level 1, supporting the application of FE or RE. The time-series features of the data were investigated using the [56] approach to unit root testing. The variables, namely industrial value added (IDVA), balance of trade (BOT), terms of trade (TOT), and real exchange rate (REER), were stationary at levels. Therefore, the bias arising from the non-stationarity of the data is negligible.

Table 1. Panel unit root test (Levin, Lin & Chu t*)

Variable	t-Statistic	Prob.	Decision
IDVA	-1.81474	0.0348	Stationary
BOT	-5.05569	0.0000	Stationary
TOT	-1.83117	0.0322	Stationary
REER	-5.34913	0.0000	Stationary
GRQ	-3.71972	0.0001	Stationary

Source: Author's calculations using EViews 10.0

Hausman test

The study contrasted the fixed effects versus random effects models using the Hausman's test. The fact that (9) random effects are estimated via partial pooling while fixed effects are not is the primary practical distinction between the two types of effects. When a group has few data points, its effect estimate

is partially based on the more plentiful data from other groups, a phenomenon known as partial pooling.

Table 2. Hausman test

Test Summary	Chi-Sq. Stat.	Chi-Sq. d.f.	Prob.
Cross-section random	11.1485	4	0.0249

Source: Author's calculations using EViews 10.0

The alternative hypothesis is that the model is FE, while the null hypothesis is that the preferred model is RE. The null hypothesis of RE was rejected by the Hausman test in favour of FE (prob. chi-sq. = 0.0249). For this reason, the fixed effects model is better suited for this research.

Fixed-effects (FE) Estimates

With an adjusted R-squared of 0.898593, the regression result in Table 3 showed that the estimated model is good overall. It suggests that BOT, TOT, REER, and GRQ (the independent variables) can account for roughly 90% of the overall variation in IDVA (the dependent variable), with the remaining 10% being explained by factors that were left out of the model (the error term). The overall model was also statistically significant at the 5% level of significance, as indicated by the F-statistic value of 165.9403 and the probability (F-statistic) of 0.000000, suggesting a substantial overall influence of the independent variables on the dependent variable.

Hypothesis One:

HO: balance of trade does not have a significant effect on industrial value added in SSA

HA: balance of trade has a significant effect on industrial value added in SSA

From table 3, the coefficient under balance of trade (BOT) is 0.110750, representing the unique contribution of BOT to the dependent variable [industrial value added (IDVA)]. In this case, the significance level for BOT is $0.0000 < 0.05$. It demonstrates that a unit increase in BOT caused IDVA to increase by 0.11075 units. Consequently, it can be said that BOT has a considerable impact on IDVA. Consequently, the alternative hypothesis (HA), which asserts a substantial effect of BOT on IDVA, is accepted, and the null hypothesis is rejected.

Hypothesis Two:

HO: terms of trade does not have a significant effect on industrial value added in SSA

HA: terms of trade has a significant effect on industrial value added in SSA

The coefficient for terms of trade (TOT) is 0.022292, indicating its positive contribution to the dependent variable, industrial value added (IDVA), with a probability value of 0.0000, which falls below 0.05, showing its significance. Thus, it is possible to adopt the alternative hypothesis. Consequently, it is appropriate to adopt the null hypothesis, which claims that terms of trade have no discernible impact on industrial value added.

Hypothesis Three:

HO₃: government regulatory quality does not have a significant effect on industrial value added in SSA

HA: government regulatory quality has a significant effect on industrial value added in SSA

Looking at the coefficient of government regulatory quality (GRQ) in Table 3, it is seen that GRQ turned out with a coefficient of -0.039853 with a probability value of $0.0247 < 0.05$, indicating GRQ has a significant contribution to industrial value added (IDVA). As a result, it is appropriate to accept the alternative hypothesis and reject the null hypothesis (HO). As a result, the alternative hypothesis—which holds that government regulatory quality significantly influences the value added to the industrial sector in South Africa (SSA)—is adopted.

Hypothesis Four:

HO: real effective exchange rate does not have a significant effect on industrial value added in SSA

HA: real effective exchange rate has a significant effect on industrial value added in SSA

As displayed in Table 3, the estimated coefficient of the real effective exchange rate (REER) is -0.028076, denoting that a unit increase in REER causes a downward trend in industrial sector value added. The null hypothesis (HO) is rejected, and the alternative hypothesis (HA) is accepted when the probability value is $0.0009 < 0.05$. Thus, it can be said that industrial value added in SSA is positively and significantly impacted by the real effective exchange rate.

Table 3. Fixed-effects Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BOT	0.110750	0.015064	7.351896	0.0000
TOT	0.022292	0.004381	5.088681	0.0000
GRQ	-0.039853	0.014550	-2.739038	0.0247
REER	-0.028076	0.008427	-3.331469	0.0009
C	25.80249	1.165020	22.14768	0.0000
R ²	0.904041			
Adjusted R ²	0.898593			
F-stat.	165.9403			
Prob(F-stat.)	0.000000			

Source: Author's calculations using EViews 10.0

Discussion of Results

The estimates indicate a positive and significant linkage between BOT, TOT, and industrial value-added (IDVA). They also reveal the diminishing effect of regulatory quality and real exchange rate (REER) dynamics. Considering the explanatory variables, BOT, TOT, and REER are the most significant determinants of IDVA in SSA. The results are in tandem with those obtained by [6], [22], [24], and [36], who found a growth-enhancing effect of global trade. Also, GRQ, which appeared negative and statistically significant, signals a strong disruption to the global trade effect on industrial value added because poorly regulated countries are more vulnerable to foreign exploitation, thus offering a competitive disadvantage. Again, the negative and statistically significant estimate of REER is indicative of a major disruptive impact of the real exchange rate on the contribution of trade to IDVA. These findings are in contrast with those of [22], who

observed a non-significant role of GRQ in enhancing trade in West Africa, and [9], who concluded that trade-growth linkages were inhibited by exchange rate dynamics.

The findings differ from those of [7], who observed that the interaction between trade and institutional quality enhanced domestic production, implying that the more regulatory quality ameliorates, the better the growth effect of trade. The findings of [57] found that a positive trade-growth relationship is enhanced if complemented with domestic regulatory reforms to decrease the cost of transactions. A study by [10] observed varying effects of trade globalisation on production in some SSA countries, a result that was seen to be undermined by omitted variables as long as the interference of key variables like regulation and exchange rate was not considered. However, the estimate of SSA countries from 2001 to 2023 lends credence to the Absolute Advantage Theory, which presents trade globalisation as growth-inducing, but the finding that regulatory quality and real exchange rate interfered negatively in the trade-growth nexus justifies the criticisms of David Ricardo (comparative advantage) and Eli Heckscher and Bertil Ohlin (O-H model) regarding the Absolute Advantage Theory (AAT).

6. Conclusion and Future Scope

Conclusions

A panel regression model was used to test the combined effect of trade globalisation and regulatory quality on industrial value-added in SSA. The results show that the balance of trade and terms of trade positively and significantly enhanced industrial value-added, while the effects of REER and regulatory quality were negative and significant. This implies that weak regulatory quality and the dynamics of the REER in SSA are inhibiting the potential growth-enhancing effect of trade globalisation on domestic industries. According to the empirical findings, trade globalisation needs to be complemented by strong regulations that support local content in the SSA region. This would then give room for the reallocation of resources towards the more promising industrial sector, which holds the key to sustainable growth and development. Subsequently, SSA countries should promulgate relevant and quality reforms to encourage favourable trade and drive the value-added of local industries in SSA.

In conclusion, trade globalisation has a positive effect on IDVA, but this was seen to be inhibited by weak regulatory quality and trends in the REER. In addition to the diverse supply-side limitations and the inadequately diversified structure of SSA economies, low IDVA and a significant trade imbalance may be associated with unstable exchange rates and poor regulatory quality. It is important to remember that Figure 2 shows that the majority of SSA nations experienced adverse trade balances, while Figure 3 shows that the average GRQ for the majority of SSA countries is negative. Indeed, poor regulatory quality and REER dynamics have hindered harmonious industrialization through trade globalization. As a result, it is determined that the positive effects of trade globalisation depend on the

effectiveness of the regulatory tools and policies in place as well as the calibre of the regulatory actions carried out by the SSA authorities.

Recommendations

- i. this study advocates that SSA countries' should endeavour to put in place regulations that seek to enhance favourable trade balances, such as an embargo on the importation of goods and services that can be produced locally;
- ii. there is a need to promote the exportation of quality products that could compete in the global market by prioritising the funding of key economic sectors that have the potential and efficiency to produce such goods.
- iii. The government should ensure that appropriate policies are put in place to set a minimum requirement for its global trade engagements, making exporters and importers aware of the requirements their products must satisfy, thereby giving foreign and domestic consumers' confidence that their health and safety are not being compromised.
- iv. Again, for foreign trade to effectively enhance industrial value added, governments of SSA countries must strengthen its currencies by increasing production through the industrial sector to ensure full economic benefits of global trade are achieved.

Suggested Areas for Further Research

The following research areas are hereby recommended.

- i. The study exclusively focused on a panel of SSAs from 2001 to 2023. As a result, there is a need for further investigations involving comparative analysis of selected SSA studies.
- ii. Scholars in this field have the opportunity to conduct similar research using a non-quantitative approach by assessing the effect of trade policies on foreign trade performance in the SSA. This effort can assist in providing precise recommendations to the SSA regarding the provision of suitable policies that maximise the value of foreign trade. This is especially relevant since many prior studies have relied on evidence from a single country.
- iii. Upcoming research should aim to broaden the scope of this study to include additional geographical regions across the world. This expansion will contribute to the enrichment of knowledge, considering that the current study is exclusively conducted in SSA.

Contribution to Knowledge

The findings of the study hold implications for theoretical, practical, policy, and regulatory domains. The significant and meaningful effects observed in the study provide an opportunity for well-informed decision-making among governments in SSA, enabling them to develop enhanced strategic policies towards enhancing the benefits of trade globalisation to the domestic industry. The insights gained from this research will also be employed by practitioners and stakeholders to communicate the benefits associated with trade globalisation, particularly in improving industrial sector value added and the overall development of the economy.

Conflict of Interest

No conflict of interest exist.

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Author Contributions

The authors made equal contributions to this research endeavor. Hence, the manuscript was collectively reviewed, and the final approval was done with the consent of all the authors.

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