

Effect of Exchange Rate Volatility on Uganda's Trade Balance

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ABSTRACT

This study examines the long-run and the short-run relationship between the real exchange rate, GDP, FDI, inflation (INF), gross capital formation (GCF), Net official's development assistance (NODA), GNI, and trade balance in Uganda for the period 1994-2018. We used an Augmented Dickey-Fuller (ADF) test for the stationarity test, and we use the Johannsen cointegration approach to prove the existence of cointegration. The ADF tests show that the series was non-stationary in level but became stationary after the first difference. The Johannsen cointegration test indicates the long and short-run relationship between all the explanatory and trade balance in Uganda. Under such circumstances, a Vector Error Correction Model (VECM) is employed since the results offer more information than other data generation processes. Our findings are as follows: Real exchange rates, FDI, GCF and GNI have a positive relationship with Trade balance. It means that Uganda can depreciate the Exchange rate to improve its Trade balance. The results proved the J-Curve effect's existence (i.e., the long-term impact of exchange rate on trade balance). The recommendations from this study are - Uganda's monetary policy management should emphasize more efforts on the stability and minimization of the volatility of exchange rates of the shillings since its movements affect international prices both negatively and positively, leading to either a decline or trade boost.

Keywords: Trade balance; Real exchange rate; Net official's development assistances; GNI; VECM model; Uganda

INTRODUCTION

The impact of exchange rate changes has been crucial to the growth of many economies as it determines their competitive nature in the world market and can either lead to a trade boost or decline within economies. Exchange rate devaluation will bring the economy back to equilibrium and act as a positive economic development factor. The real exchange rate is also an actual relative price that links domestic and international markets for goods and assets. It also points out the competitive nature of a country's exchange power against the rest of the world in a pure market [1]. It also determines lots of business, investment, and policy decisions [2]. As a result, it has attracted lots of attention from various policymakers. However, exchange rate volatility has been a central defining obstacle to economic growth in most African economies and Latin American hence have become a severe pressing issue for the government in the current periods.

Uganda have been suffering from trade deficits over the years, which has dramatically affected the country's growth and development adversely [3]. As a result, exchange rate policies need to highly look at as they act as a fundamental tool needed to determine and improve the nation's trade balance position. Hence, it is a prerequisite to investigate the exchange rate's impact on Uganda's trade balance. This could help us identify various effective policies that could help improve the Uganda economy's trade balance.

According to [4], trade balance refers to the value of exported goods minus the value of imported goods. A positive trade balance signifies a trade surplus, while a negative value indicates a trade deficit. In 2017, Uganda's trade deficit amounted to around 2.65 billion US dollars. In a simple term, trade balance refers to the difference between exports and imports for a given period, usually a year from one country to another.

The exchange rate refers to a foreign currency unit's price in terms of domestic currency [5]. The exchange rate serves as the fundamental link between the local and overseas markets for various goods, services, and financial assets. With the exchange rate, one can compare the prices of goods, services, and assets quoted in different currencies. Changes in exchange rates tend to affect domestic prices of imported goods and services directly. Exchange rate volatility can affect actual inflation and an expectation about future price volatility [6]. Exchange rate volatility can also affect the country's external sector through its impact on foreign trade. Lastly, the exchange rate affects the cost of servicing the country's foreign debt. Under the floating exchange rates, the foreign currency's value in terms of local currency is determined by demand and supply forces [7]. the fixed exchange rate refers to the par value rate set between the central bank's local and foreign currency [8].

[9] shows that the trade balance and exchange rate policy evolution started back in the 1975s in Uganda. That is when the financial institution held the official exchange rate with the US dollar close to the initial rate at which the East African Shilling fixed, which the Uganda shilling inherited in 1966 after the East African currency board's dissolution. The economic mismanagement of the 1975s and 1980s led to the emergence of a parallel foreign exchange market [10]. [9] contends that by 1981, the price of foreign currency in the parallel market was

over ten times higher than the official exchange rate, which limited export trade within the country, thus inhibiting a negative trade balance. Which later led to an adjustment program to correct the prevailing exchange rate distortion hence a massive devaluation of the shilling in July 1982. The policy objective was to eliminate the over-valuation of the Uganda shilling and establish a unified market-based rate that would provide a uniform price, promoting efficiency in allocating resources, growth, and development.

In October 1989, a crawling peg was introduced, and as a result, the nominal exchange rate got adjusted monthly. The foreign exchange bureau implemented the Legalization of the parallel market through the licensing foreign exchange bureau in 1990, where the bureau was permitted to conduct spot transactions at freely determined exchange rates and satisfy most private sector demand for foreign exchange to finance visible and invisible payment [10]. To address widespread concern about capital flight, creating a market-based foreign exchange system that aimed to increase the foreign exchange allocation processes' efficiency and encourage foreign capital flows through open and competitive exchange rate payment systems was implemented. Whereas exchange rates were market-determined, the foreign exchange market remained segmented. To eliminate the foreign exchange market's segmented nature and convergence, the exchange rates, an inter-bank foreign exchange market system, were introduced in November 1993 [11].

While the traditional theory states that, as the currency depreciates, the trade balance improves, leading to a rise in net export and a fall in net import, which leads to high aggregate demand. However, Uganda's trade balance has kept on worsening, whereby import bills have been growing by an even more significant margin irrespective of continuous currency devaluation.

Previously, Uganda recorded a trade deficit of 316 USD Million in September of 2020. Balance of Trade in Uganda averaged -163.81 USD Million from 1993 until 2020, reaching an all-time high of 14.60 USD Million in April of 1996 and a record low of -483 USD Million in April of 2019.

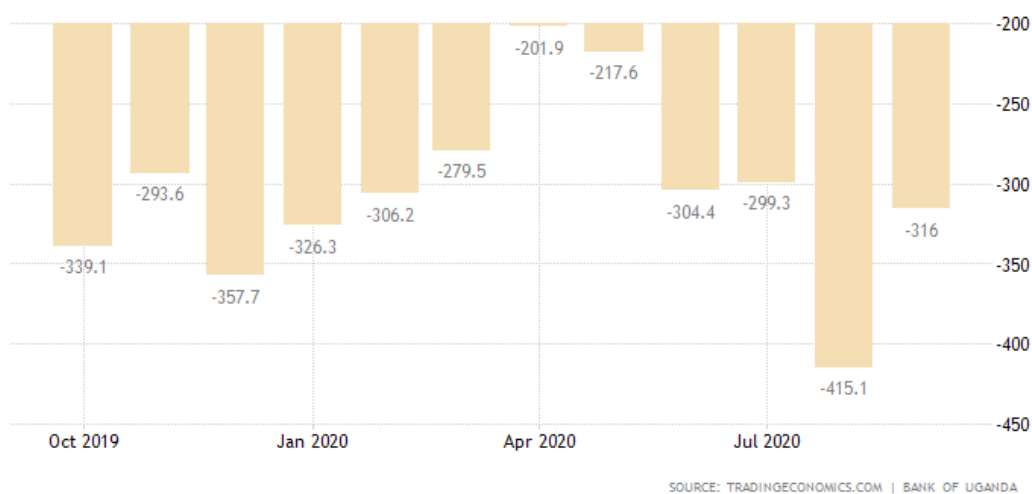


Figure 1: Uganda Balance of Trade.

Uganda has experienced a systemic trade deficit due to (1) its dependence on fuel imports. (2) Uganda's main agricultural net export products includes coffee and cotton. These goods, as a result, always faced lower global commodity prices. Uganda's leading trading partner is Kenya, with 15 percent of imports and 10 percent of exports. Other trading partners include the UAE and South Africa. (3) Problems in the regional markets, such as South Sudan conflicts, decreased tourism arrivals, and led to the country's increased trade deficit. (4) the country's continuous increase in imports of goods and services came partly from increased government expenditures on imports related to infrastructure projects and the more robust demand for the imported goods from the private sector. As a result of imports outweighing exports, our trade deficit rose exponentially for the past years.

As stated by [12], Uganda's trade deficit, with import outweighing exports, is unlikely to improve sooner until its economic infrastructure is fully developed. For more than a decade, the country's exports are on average half the value of its imports. The high imports result from the local firms' inability to produce quality inputs to outcompete the imported goods and services. There is also a lack of the local industrial capacity to produce quality goods of international standards and quality to attract global markets. Therefore, the government should strengthen the local industrial ability to stop the exportation of everything by both the government and the private sectors, especially materials for the construction of megaprojects like dams, roads, bridges [13].

According to Uganda's bank, Uganda recorded a Current Account deficit of 673.20 USD Million in the second quarter of 2020. The current account deficit for the second quarter of 2019/2020 improved slightly from a deficit of 938.8 to 673.20 USD million, as shown in Figure 2. The expansion of services largely drove this improvement. Service growth averaged 7.6% in 2019, and industrial development 6.2% was caused by construction and mining. Agriculture grew at just 3.8%.

Retail, construction, and telecommunications were vital economic drivers. However, Government spending continues to increase, underpinned by public infrastructure and capital investments for the nascent oil and gas industry. Expenditures have risen faster than domestic revenues, widening the fiscal deficit in 2019. The deficit is financed mainly through external borrowing, supplemented with domestic securities. Exports, dependent on primary products, have not kept up with imports, widening the trade deficit to an estimated 9.4% of GDP in 2019 from 8.3% in 2018. foreign direct investment largely financed the increasing current account deficit (2.6% of GDP) and externally funded projects.

Additionally, Poor global growth, affected by the US-China trade tensions and stagnant growth, and subdued demand in Europe, risks reducing Ugandan exports. Domestically, adverse weather has lowered agriculture production, harming the trade balance and current account balance, given Uganda's importance in exporting food to the East Africa region. Other domestic risks include weak revenue mobilization, weak private sector credit growth, and fiscal expansion in the run-up to the 2021 elections. As a result of all the above, our trade deficits continue to worsen.

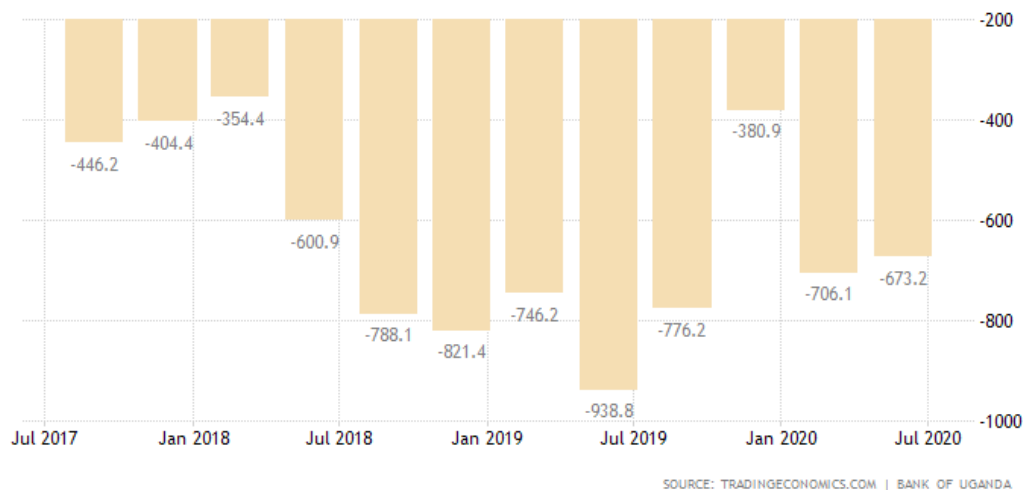


Figure 2: Uganda Current Account.

[14] contend that the economy may be recovered if the weather conditions improved, increased the inflow of Foreign Direct Investment (FDI) into the country, stabilized the banking system, and immediately executed Capital spending without delays. However, the unfavorable investment climate triggered by an ongoing strike in South Sudan and its subduing export segments, low local business capacity, high credit costs all continue to discourage private domestic investment.

The government should help persuade more Foreign Private Investment into the country, for instance, in the oil sector, which might help in the country's growth recovery. More efforts should be put towards solving critical issues concerning regional instability, particularly in South Sudan, and together with any election-related disturbances that are currently going on in the regions. Reliance on traditional Agricultural produces without any additional value-added remains a downside risk to real GDP growth. Another pressing issue is the delays in completing public investment programs like the roads, Electricity dams, which would prevent the enhanced infrastructure from worsening the trade deficit. Therefore, this poses an empirical issue and calls for an empirical test in emerging economies like Uganda. The previous empirical findings regarding the nexus between exchange rate and trade balance are inconclusive and inconsistent for different countries. Additionally, most recent studies only focus on developed countries too. For instance, [15]–[18]. Therefore, it is fundamental to fill the knowledge gap left in developing countries such as Uganda. From this study's finding, Uganda's policymakers and commercial banks can devise suitable monetary policies to ensure stable economic development and improve the trade balance.

STATEMENT OF THE RESEARCH PROBLEM

The role of trade in the stated processes is to extent that trade is the motive engine in economic growth [19]. There is a continuously growing body of literature dealing with the effects of exchange rate uncertainty on international trade since the breakdown of the Bretton Woods (year) system of fixed exchange rates when both real and nominal exchange rates have fluctuated widely. The exchange rate in whatever conceptualization is not only an important relative price, which connects domestic and world markets for goods and assets, but it also signals the competitiveness of a country's exchange power vis-à-vis the rest of the world in a

pure market [1]. It is one of the important prices in an open economy, since it affects so many business, investment, and policy decisions [2]. While the traditional view states that a real appreciation lowers international competitiveness, which, in turn, causes net exports to fall and a fall in net exports, in turn, lowers the aggregate demand. These two conflicting theoretical views pose an empirical issue and call for an empirical test on growing economies like Uganda. Although markets have been diversified due to globalization, the country's imports bill has been on a tremendous growth by even a greater margin thus leading to an unfavorable trade balance and deteriorating terms of trade. Although the government has undertaken numerous measures to improve on the country's external trade performance, persistent exchange rate volatility coupled with price fluctuations have undermined these efforts hence leading to an inquest in the effect of exchange rate volatility on Uganda's trade balance.

RESEARCH OBJECTIVES

The main objective of this study is to assess the effect of exchange rate volatility on Uganda's trade balance.

Specific objectives

1. To establish the transmission mechanism through which exchange rate volatility affects Uganda's trade balance.
2. To draw conclusions and make policy recommendation

SIGNIFICANCE OF THE STUDY

The real exchange rate is one of the essential indicators of economy's international competitiveness, and therefore, has a strong influence on a country's foreign trade developments. It is commonly believed that the movements of the real exchange rate have a permanent effect on exports and imports. Most recent studies only focus on developed countries too. For instance, [15]–[17]. Therefore, it is fundamental to fill the knowledge gap left in developing countries such as Uganda. From this study's finding, Uganda's policymakers and commercial banks can devise suitable monetary policies to ensure stable economic development and improve the trade balance.

ORGANIZATION OF THE STUDY

The study is organized in five chapters. Chapter one presents introduction and background of the study. Chapter two presents the theoretical and empirical literature review. Chapter three presents information on research methodology. Chapter four presents data analysis, data presentation and interpretation. Chapter five presents summary of findings, discussions, conclusions and policy implication.

LITERATURE REVIEW

These chapters represent both the theoretical and empirical literature. Theoretical literature comprises different schools of thought: the monetary approach, elasticity approach, absorption approach, an imperfect substitute approach. Empirical literature includes that which has been tested using statistical and econometric analysis.

THEORETICAL LITERATURE REVIEW

Most research has presumed a negative relationship between exchange rate volatility and international trade and empirical studies have tried to estimate the size of this drag effect on

trade. However, neither theory nor empirical evidence has been able to establish a clear link in this regard. [20] and [21] provide surveys of the relationship between exchange rate volatility and trade that try to explain this apparent paradox. The standard model assumes a risk-averse exporting or importing firm. Increased volatility in the exchange rate is assumed to result in increased uncertainty by such firms about future profitability. The greater such uncertainty is, the less the supply of exports (or the demand for imports) and hence the negative relationship between volatility and the volume of international trade. The standard model assumes a risk-averse exporting or importing firm. Increased volatility in the exchange rate is assumed to result in increased uncertainty by such firms about future profitability. The greater such uncertainty is, the less the supply of exports (or the demand for imports) and hence the negative relationship between volatility and the volume of international trade [22].

Early models deriving this relationship include [23] and [24]. Even at this early stage an important distinction is made between uncertainty about the exchange rate and uncertainty about profitability. Ethier's model includes hedging in the forward exchange market and uncertainty about the exchange rate determines the demand for forward cover but does not necessarily affect the level of trade. The level of imports is affected negatively only if it is assumed that the firm is unable to determine its profitability at different exchange rates. [25] also develop a model in which a portion of trade is hedged in the forward exchange market such that volatility in the exchange rate only affects the portion of trade that is unhedged. Their model implies the standard negative relationship between exchange rate risk and the volume of trade.

The elasticity approach provides an analysis of what happens to trade balance when a country devalues its currency and conditions that must prevail in the foreign exchange market for a devaluation or depreciation of the currency to improve the trade balance starting from equilibrium [26]. According to Sugman (2005), the analysis was developed by Alfred Marshall, Abba-Lerner and later extended by Robinson (1937) and Machlup (1955). At the outset, the model makes some simplifying assumptions. It is partial equilibrium analysis holding constant everything else that may affect the supply of and demand for foreign or domestic currency, except the change in the relative price of foreign and domestic goods arising from the change in the exchange rate itself. The approach focuses on demand conditions and assumes the supply elasticities for the domestic export goods and foreign import goods are infinite, i.e. perfectly elastic so that changes in demand volumes have no effect on prices (the domestic price of exports, the foreign price of imports and prices of import and export substitutes are constant). In effect these assumptions mean that domestic and foreign prices are fixed so that changes in relative prices are caused by changes in the nominal exchange rate.

There is a general consensus by most economists that elasticity is lower in the short-run than in the long-run, in which case Marshall-Lerner condition may only hold in the medium to long-run. The possibility that in the short run, Marshall-Lerner may not be fulfilled although it generally holds over the long run leads to the phenomenon of what is popularly known as the "J" curve effect. The idea underlying the J-curve effect is that in the short run export volumes and import volumes do not change much, so that the price effect outweighs the volume effect leading to deterioration in trade balance. Three of the most important reasons advanced in explaining the J-curve effect are time lag both in producers and consumer's response and imperfect competition and under these assumptions, the condition for a devaluation to improve

the trade balance which directly contributes to the improvement of the balance of payments (starting from equilibrium) is known as the Marshall-Lerner condition. It states that devaluation will improve the balance of payments on trade balance if the sum of the foreign price elasticity of demand for exports (η_x) and domestic price elasticity of demand for imports (η_m) exceeds unity, in absolute value [27].

The two-country imperfect substitute model of [28] is another approach to trade balance. This approach shows the nature of the relationship of real exchange rate on trade balance in both short and long run. It stipulates that depreciation of the real exchange rate improves trade balance. Besides, the model assumes that there are no perfect substitutes in the imports and exports for the locally produced goods and services [28]. The model assumes also the following; first, price elasticities of demand and the domestic and foreign income elasticities are positive. Secondly, the income in the foreign or importing country may influence the level of exports by the domestic economy besides the price of domestic substitutes and the price of the imported goods. Moreover, there is need to prevent money illusion by considering that demand function is homogenous.

The model is expressed as the partial reduced form of the domestic trade balance which is a function of the real exchange rate, domestic and foreign income. The reduced form equation was derived from the incorporation of the relative price of imports which was a function of real foreign price, real income and the real exchange rate. By the adoption of this model by [28], it was concluded that foreign income and the real exchange rate have positive effects on trade balance while on the other hand the domestic income has negative effect on trade balance. The advantages of this model are that a single equation is adopted in the analysis process. Also, there is no need of the structural parameters and as a result it is likely to give the desired or undesired relationship /effect of the real exchange rate on the trade balance [29]. However, the model incorporates variables from other approaches and hence is not “stand-alone” model.

The monetary approach to devaluation analysis was pioneered by (Whitman et al, 1995). The fundamental basis of the monetary approach to the balance of payments is that the balance of payments is a monetary phenomenon and not a real phenomenon. It is argued that any disequilibrium in the balance of payments is a reflection of disequilibrium in money markets.

Three key assumptions that underlie the monetary model are the stable money demand function, vertical aggregate supply schedule and purchasing power parity. The monetary approach emphasizes that a devaluation will have only a transitory beneficial effect on the balance of payments only so long as the authorities do not simultaneously engage in an expansionary open market operation. The theme of the monetary approach is that exchange rate changes are viewed as incapable of bringing about a lasting change in the balance of payments.

As already mentioned, exchange rate change operates strictly by causing disequilibrium in the money market, causing a deficit or surplus in the balance of payments which continues only until equilibrium is restored in the money market via reserve changes [30].

Models that include the possibility of hedging transactions in the forward exchange market generally show little effect of exchange rate volatility on trade, although there are some

important exceptions, such as [31]. Moreover, hedging is not costless and the effective time-horizon of such facilities is normally less than a year. Manufacturing firms that have sales contracts extending over longer periods may find it more difficult to hedge their transactions. The insulating effect of changes in nominal exchange rates on profitability is important from a local perspective. The bulk of our commodity exports are denominated in US dollars and the nominal exchange rate tends to move in the opposite direction to commodity prices. Thus, when commodity prices decrease (increase) the profits of commodity producers are stabilized by a depreciation (appreciation) of the rand (Gidlow, 1987). Thus, a fixed rand exchange rate might lower nominal exchange rate risk but this would not necessarily lower the total risk (price risk and exchange rate risk) faced by exporters.

[32] shows that the assumption of risk aversion is not sufficient to establish the negative relationship between changes in the exchange rate and trade. He demonstrates that the results obtained by [25] depend on the assumption of constant absolute risk aversion. De Grauwe constructs a utility function which depends on the degree of risk aversion by exporters. Mildly risk-averse traders reduce their supply of exports as exchange rate risk increases, as in the standard models. However, very risk-averse firms want to avoid a collapse in revenues from the worst possible exchange rate outcome and thus their desired supply of exports increases as exchange rate risk increases. In other words, changes in exchange rate risk have both a substitution and an income effect on the volume of trade. The net result depends on the degree of risk aversion of the traders populating the utility function. Other papers showing how the effect of exchange rate variability on trade depends on the risk aversion properties of the traders in the model include [33] and [34].

This study will be guided by the balance of payment theory developed by [35]. The theory stresses that the exchange rate relates to the position of balance of payment of the country concerned. A favorable balance of payments leads to an appreciation of the country's external value, while an unfavorable balance of payments leads to a depreciation of external value. The balance of payment theory shows that the price of foreign money in terms of domestic money is determined by the free forces of demand and supply in the foreign exchange market. It, therefore, follows that the external values of a country's currency will depend upon the need for and supply of the money.

J-Curve effect describes that in the short-run, export volumes and import volumes do not change much so that the country receives fewer export revenues and spends more on imports leading to deterioration in the current account balance. There is a time duration before the trade balance improves following a real depreciation. A straightforward explanation for the J-Curve phenomenon is that the import price tends to rise as soon as there is real depreciation of the local currency. But the quantities of imports demanded take time to adjust downward because current imports and exports depend on orders placed sometimes back [36]. On the other hand, after depreciation, domestic exports become more attractive to the foreign markets, but quantities of goods supplied may not adjust immediately for the same reasons. An increase in the imports against exports results in a trade deficit in the short run. As time passes, importers will start adjusting to their import quantities concerning the rise in import prices due to depreciation, while the quantity demanded export will begin increasing, leading to an improved balance of trade [37].

The Marshall-Lerner (ML) condition is that an exchange rate devaluation or depreciation will only cause a balance of trade improvement if the absolute sum of the long-term export and import demand elasticity is more significant than unity. The best choice thereof leads to favorable economic repercussions. For trade to improve, currency depreciation is inevitable. With the ML condition's satisfaction, devaluation of any country's currency will increase import's price while decreasing the cost of exports. Thus, as the price of imports increased, there will be few demands for the number of goods imported, whereas the number of goods exported increased, leading to a favorable trade balance.

EMPIRICAL LITERATURE REVIEW

This section presents various empirical evidence on the effect of the exchange rate on the balance of trade. [38] was amongst the first researchers investigating the impact of exchange rate volatility on trade balance based on the J-Curve phenomenon. In his study, he observed that, although there was currency depreciation of the US Dollar, the balance of trade kept deteriorating in 1972. He concluded in his research that the trade balance deterioration was in the short-run due to some adjustment lags that were taking place between companies and the continued decline came as a result of the goods already previously ordered under contract, therefore, left unaffected. The effect of currency depreciation will affect the future trade due to adjustments, hence improving trade balance in the long-run. The improvement came as a result of the import's price becoming greater than the export price since the currency for an export country is cheaper than the importing country's currency. The duration of the time of adjustment for trade balance to improve, however, remained an unsolved question by many researchers.

[14] study the effect of exchange rate fluctuation on Uganda's bilateral trade flows with several Uganda trading partners. They used the panel data, and a GARCH model was employed to measure the volatility of the exchange rate and bilateral trade flows. The findings indicate that real exchange rate volatility negatively affects Uganda's bilateral trade, and it was statistically significant. The results also point out that real exchange rate volatility positively and significantly affects bilateral trade flows' volatility.

[39] Investigated the short-run and long-run impact of the exchange rate and price changes on Nigeria's trade flows using the exports and import's function. The study employed An Autoregressive Distributed Lag Model (ARDL) approach to cointegrating quarterly data from 1980Q1 to 2007Q4. The results show that relative prices influence Nigeria's trade flows, nominal effective exchange rate, foreign income, and external reserves stock both in the short and long-run. The results also show that devaluation is more effective than relative prices in altering imports demand both in the long-run at both baselines and augmented models. The results are, however, opposite in the case of export demand.

[40] study the impact of changes in exchange rates on the trade balance in the short run and long run-on Zambia. The applied the cointegration test and an Error Correction Model (ECM). the data used was for the period between 2000-2010. The results show that the exchange rate has no impact on Zambia's trade balance in the short run but, in the long run, impacted the trade balance. [41] investigated the impact of the exchange rate and trade balance in Ghana using data from 1980 to 2013 by testing the Marshall-Lerner Condition validity. The analysis used the cointegration test and ECM. Base on the findings, real exchange rate negatively relates to

the trade balance in the long-run. The results show a positive relationship between exchange rate and trade balance in the short-run. The study opposes the existence of the J-curve. The Marshall-Lerner condition was therefore not satisfied since the coefficient is less than the unity.

[42] study the impact of the real exchange rate and trade balance in Malaysia from 1955-2006. A unit root test is applied to check stationary. After stationary confirmation, cointegration techniques, the study employed the Engle-Granger test and VECM and impulse response analyses for estimation. The main finding shows the existence of a long-run relationship between exchange rate and trade balance. Domestic income also showed a long-run positive impact on the trade balance. However, foreign income showed a long-run negative relationship. exchange rate devaluation of the improves trade balance in the long-run, thus consistent with the ML condition. Lastly, the result shows no existence of the J-curve effect.

Conclusions of the theoretical models and empirical studies of the nexus between real exchange rate and trade balance are inconclusive. For instance, some literature has shown a positive relationship while others exhibit a negative relationship. In some cases, others are insignificant. For examples, [43]–[45] confirm the positive effect of exchange rate on trade balance (J-curve effect), while [46], [47] found no evidence for a J-curve effect.

Most previous literature has applied OLS and 2SLS methodology to estimate the exchange rate effect on the trade balance. Estimation bias may occur as a result of being subjected to spurious regression. To solve this, various researchers have employed cointegration techniques to account for the variables' integrating properties, thus allowing the investigation of the long-run relationship between the variables. Our study will utilize the cointegration technique to examine the long-run relationships amongst the variable of interest. The short-run association of the variables will be measured using the Error Correction technique.

METHODOLOGY

In This paper's primary purpose is to examine the short-run and long-run association between real exchange rate and trade balance. The data used originate from World Development Indicator for the period 1994-2018. The data was analyzed step by step using the processes and methods as described in the proceeding sections.

While the nominal exchange rate refers to the exchange of foreign currency for a domestic currency unit, the real exchange rate refers to the exchange of goods and services in the domestic country against goods and services in a foreign country. In this paper, the Trade balance (TB) present as a dependent variable, and real exchange rate (RER), Net official's development assistances (NODA), GNI, inflation (INF), gross capital formation (GCF) as a proxy of investment, GDP per capita, and foreign direct investment (FDI) indicates independent variables. Our purpose is to estimate the coefficients to justify the strength and the relationship between the variables. We want to investigate the short-run and long-run association among the variables using the Johannsen cointegration test and the VECM (Vector Error Correction Model). After that, we may conclude the J-curve's existence in trade balance and real exchange rate. Our objective is to evaluate the relationship between the variables if they are positively related or negatively related. Whether they are associated in the short run or the long run, that's the reason why our research is unit-free, and that's why we have less concentration on the

volume of the coefficient and more concentration on the sign of the coefficient term. In this paper, we want to investigate the determinant of trade balance and evaluate the existence of the J-curve pattern between trade balance and real exchange rate. We used the time-series data to investigate the relationship between the variables from 1994 to 2018.

THEORETICAL FRAMEWORK

To study the relationship between exchange rates and the trade balance, one must begin with a precise study of the elasticity view of the balance of payments. Consequently, this section, first, gives an exposition of the *BRM model* and its theoretical implications and presents the *BRM* and *Marshall-Lerner conditions*. Second, this section discusses the literature that has interpreted, reformulated, and incorporated the criticisms of the *elasticity approach*. This is focused on two views of the balance of payments: the *absorption* and the 'modern' *monetary approaches*.

The Bickerdike-Robinson-Metzler BRM Model and the BRM and Marshall-Lerner Conditions

The literature that has modeled the relationship between the trade balance and exchange rates, appeared first with the seminal paper of [48], and then continued with [49] and [50]. These are the sources of what has become known as the Bickerdike- Robinson-Metzler (BRM) model, or the *elasticity approach* (referred to here as EA) to the balance of payments. The core of this view is the substitution effects in consumption (explicitly) and production (implicitly) induced by the relative price (domestic *versus* foreign) changes caused by a devaluation.

The BRM model (or *imperfect substitutes model*) is a partial equilibrium version of a standard two-country (domestic and foreign), two-goods (export and imports) model. The effects of exchange rate changes are analyzed in terms of separate markets for 'imports' and 'exports.' The equations that define the model are given as follows. The domestic demand for imports (foreign exports) is a function of the nominal price of imports measured in domestic currency,

$$M^d = M^d(P_m) \quad (1)$$

Observe that P_m is nothing but $P_m = EP_m^*$, where E is the nominal exchange rate; that is, the domestic currency price of foreign exchange and P_m^* is the foreign currency price (level) of domestic imports (the symbol "*" refers to the analogous foreign variable). Now, the foreign demand for imports (domestic exports) can be similarly defined as,

$$M^{d*} = M^{d*}(P_x^*) \quad (2)$$

where M^{d*} is the quantity of foreign imports and P_x^* is the foreign currency price (level) of domestic exports. Analogous to the definition above, P_x^* is $P_x^* = P_x/E$, where P_x is the domestic currency price (level) of exports.

Similarly, to the demand functions, the export supply functions are defined depending only on nominal prices. The domestic and foreign export supply functions are defined as,

$$X^s = X^s(P_x) \quad (3)$$

$$X^{s*} = X^{s*}(P_m^*) \quad (4)$$

where X^s and X^{s*} are the quantity of domestic and foreign supplies of exports, respectively. The market equilibrium conditions for exports and imports are then,

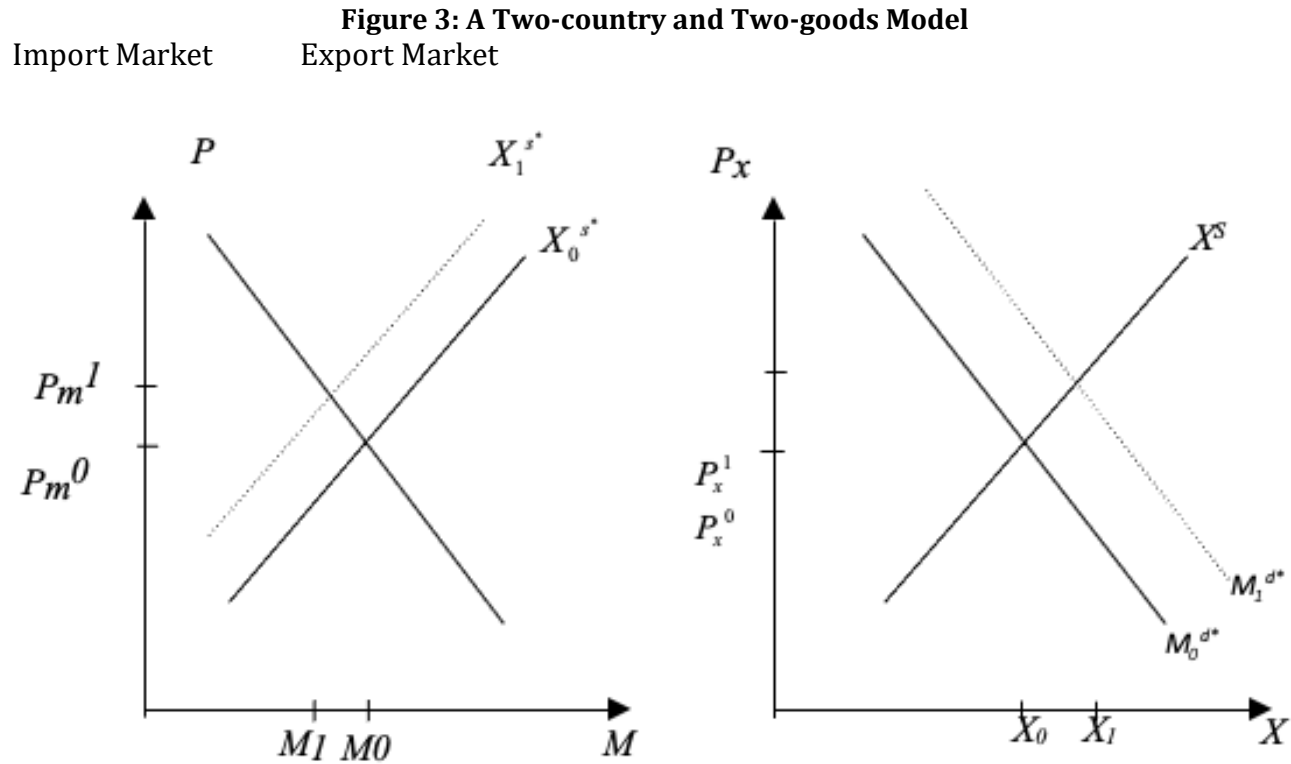
$$M^d = X^{s*} \quad (5)$$

$$M^{d*} = X^s \quad (6)$$

Given equations (1)-(4), the domestic trade balance, in domestic currency, is

$$B = P_x X^s - P_m M^d \quad (7)$$

To illustrate this equation one can, use the comparative-static framework of this model. There are two separate markets for domestic demand for imports and supply of exports. The functions are assumed to be normal downward and upward sloped, respectively, when drawn against their domestic currency prices. Also assume that there is equilibrium, that is, $B=0$. Now, the question is, does devaluation of the domestic currency improve the trade balance as defined by (7). The answer is not as obvious as one might think. The effects are depicted in Figure 1. At equilibrium, domestic exports equal X_0 and imports equal M_0 . The prices are P_x^0 and P_m^0 , respectively. Devaluation does not change the domestic supply of exports and demand for imports schedules since domestic prices not have changed. What occurs is a movement along both curves X^s and M^d where domestic supply of exports increases and the demand for imports decreases. However, the foreign demand for imports and supply of exports schedules shifts upward from M_0^{d*} and X_0^{s*} to M_1^{d*} and X_1^{s*} , respectively. In order to maintain the foreign currency prices of goods; as defined above, the domestic currency prices will have to increase in the same proportion as the devaluation to P_x^1 and P_m^1 for exports and imports, respectively. Consequently, both the foreign supply for exports and demand for imports schedule should shift in the same percentage as the rate of devaluation. The new equilibrium is reached where both markets clear. Thus, the devaluation raises the market-clearing domestic currency price in both markets, increases the volume of domestic exports, and reduces the volume of domestic import.



In all, what has happened is a substitution in consumption between domestic and foreign goods induced by a change in the exchange rate. Therefore, the value of domestic exports ($P_x X^s$) increases, while that of its imports ($P_m M^d$) may increase or decrease depending on the domestic price elasticity of demand.⁶ This implies, then, that the effect of a devaluation on the trade balance in this model is ambiguous [51].

A sufficient condition for trade balance improvement, and drawing from it, for stability of the foreign exchange market under the model, is provided by the *BRM condition*. Differentiating and putting the results in elasticity form, a general algebraic condition is derived. This condition relates the response of the trade balance to exchange rate changes and the domestic and foreign price elasticities of imports and exports:

$$\frac{dB}{dE} = P_x X^s \left[\frac{(1+\varepsilon)\eta^*}{(\varepsilon+\eta)} \right] - P_m M^d \left[\frac{(1-\varepsilon)\varepsilon^*}{(\varepsilon^*+\eta)} \right], \quad (8)$$

where η and ε denote the price elasticities (in absolute values) of domestic demand for imports and supply of exports. Analogously, η^* and ε^* denote the respective foreign price elasticities. As can be shown, if $B=0$ (initial equilibrium), then $dB/dE > 0$ if and only if and only if,

$$\frac{\eta\eta^*(1+\varepsilon+\varepsilon^*)-\varepsilon\varepsilon^*(1-\eta-\eta^*)}{(\varepsilon+\eta^*)(\varepsilon^*+\eta)} > 0. \quad (9)$$

Notice that a relevant case for this paper is that where $\varepsilon^* = \eta^* = \infty$ [2], that is, a “small country” case [52]. Here the foreign export supply and export demand are perfectly elastic. Under this case, condition (9) becomes $(\varepsilon + \eta)$. Another way to state this case is to say that a country is a price-taker in both its import and export markets. Accordingly, a country’s currency devaluation has no effect on the world prices (in foreign currency), of its exports and imports. This implies that only changes in volumes affect its trade balance. Thus, without considering the algebraic result, the effect of a country’s currency devaluation on the trade balance would be the following. One knows that if a country’s currency devalues, exporters would receive more units of domestic currency for their exports. Accordingly, one would expect they respond exporting more at the given foreign price. On the other hand, importers would face higher domestic currency prices for their imports. Consequently, they would reduce their imports. Thus, “with export volumes rising and import volumes falling at fixed ... [foreign prices], the devaluation would unambiguously improve the balance of trade” (Lindert and Kindleberger, 1982, p. 287). Therefore, under this case, and assuming export and import volumes respectively increase and decrease, a devaluation must improve the domestic trade balance in foreign currency.

If the trade balance is measured in domestic currency, the story might be quite different. The reason is that the increase in the value of domestic exports could be smaller than the decrease in the value of domestic imports, that is, the final effect on the trade balance would depend on the domestic price elasticity of supply and demand. A domestic country’s devaluation should improve the trade balance, in domestic currency, if $\varepsilon > |\eta|$ (remember that by assumption there are no qualitative or quantitative trade restrictions). But does $\varepsilon > |\eta|$ hold for a developing economy such as Uganda. Uganda export mainly raw products (e.g., agricultural products, oil, coal) and import durable goods, raw materials, and intermediate and final capital goods (e.g., equipment). With respect to exports, they may have ‘low’ short-run price elasticity of supply for some goods (e.g., oil, livestock, or goods with low domestic consumption) and ‘large’ elasticities for others, for example for those goods being produced with excess of capacity (some manufactures such as textiles), or goods with large stocks (e.g., some manufactures, some grains, coffee, or goods with high participation in domestic consumption so that exports can be increased by reducing it if needed). In the long run, one may expect ‘large’ elasticity for both types of goods. As for imports, durable goods should have a large import price-demand elasticity both in the short and long run and for most of the intermediate and many of the capital goods, one may expect low import-price elasticity, at least for the short run. It follows that the answer is not that straightforward. Of course, if it is true that Uganda exports primarily products with large price elasticity of supply and import, intermediate and final industrial products, then $\varepsilon > |\eta|$ should hold. Therefore, a devaluation should improve the Uganda trade balance. Otherwise, the answer is not direct.

Another result that can be derived from condition (9) is the so-called *Marshall-Lerner condition* (Marshall, 1923; Lerner, 1944). This condition (referred to here as the ML condition) comes from letting $\varepsilon \rightarrow \infty$ and $\varepsilon^* \rightarrow \infty$ [2]. This assumption implies that the left-hand side of condition (9) becomes $\eta^* + \eta^{-1}$. Thus, for a trade balance improvement when a country’s currency

devalues, $\eta^* + \eta > 1$ must hold. Or, in the standard presentation of the ML condition, $|\eta + \eta^*| > 1$. In words, this condition states that if domestic and foreign supply elasticities are strictly elastic and if income remains constant, then a devaluation causes an improvement of the trade balance when the domestic plus the foreign import demand elasticities for imports, in absolute value, exceeds one. This has been considered by the literature as a sufficient condition for stability of the foreign exchange market. Thus, if the ML condition holds, "then there is an excess of demand for foreign exchange when the exchange rate is below the equilibrium value and excess of supply when it is above the equilibrium rate. Under these conditions the exchange rate will move to its equilibrium value and the market will be cleared" [53]. The question that is relevant for the purposes of this paper is whether or not the ML condition empirically holds for a developing country such as Uganda. As was discussed above, at least as derived from theory, it seems that it does not. The Uganda economy might be better characterized by the "small country" case. Thus, a devaluation might or might not improve the trade balance (in domestic currency).

DEFINITIONS AND MEASUREMENTS OF VARIABLES

Trade balance (TB); refers to Net trade in imports of goods and services against exports of goods and services. Exports and imports of goods and services is made up of all transactions that involves a change of ownership of goods and services between residents of one country and the rest of the world. Data are in current U.S. dollars.

Real exchange rate (LER); Official exchange rate refers to the exchange rate determined by national authorities or the rate specified in the legally sanctioned exchange market. It is calculated as an annual average based on monthly averages (local currency units relative to the U.S. dollar).

GNI (LGNI) is the sum of value added by all resident producers plus any product taxes (less subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad. Data are in current U.S. dollars.

Net official development assistance (NODA) consists of disbursements of loans made on concessional terms (net of repayments of principal) and grants by authorized agencies of the members of the Development Assistance Committee (DAC), by multilateral institutions, and by non-DAC countries to promote economic development and welfare in countries and territories in the DAC list of ODA recipients. It includes loans with a grant element of at least 25 percent (calculated at a rate of discount of 10 percent). Data are in current U.S. dollars.

Foreign direct investment (FDI); adopted from a study by [54] Foreign Direct Investment, Trade and Real Exchange Rate Linkages in Developing Countries. FDIs are the net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. This series shows total net FDI. In BPM6, financial account balances are calculated as the change in assets minus the change in liabilities. Net FDI outflows are assets and net FDI inflows are liabilities. Data are in current U.S. dollars.

Gross Domestic Product (GDP); Adopted from a study by [55] on the effects of exchange rate change on the trade balance in Croatia and [56], GDP is the sum of gross value added by all resident producers in the economy plus any product taxes minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current U.S. dollars.

Gross capital formation (GCF); Gross capital formation (formerly gross domestic investment) consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. Fixed assets include land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. Inventories are stocks of goods held by firms to meet temporary or unexpected fluctuations in production or sales, and "work in progress." According to the 1993 SNA, net acquisitions of valuables are also considered capital formation. Data are in current local currency.

Inflation (INF); Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. The Laspeyres formula is generally used.

Model specification

Following studies by [57], [54], [58], [59], [56], [60], [61], the following variables were selected for the study as specified in the functional form.

$$TB = F(RER, FDI, GDP, NODA, GCF, GNI, INF) \quad (1)$$

Where TB is Trade balance, RER is Official exchange rate, FDI is Foreign Direct Investment, GDP is Gross Domestic Product, NODA is net official development assistance received, GCF = Gross capital formation, GNI is gross national income and INF is Inflation.

And the empirical form of the equation then takes the following form:

$$TB_t = \beta_1 + \beta_2 RER_t + \beta_3 FDI_t + \beta_4 GDP + \beta_5 NODA_t + \beta_6 GCF_t + \beta_7 GNI_t + \beta_8 INF_t + \mu_t \quad (2)$$

whereby:

μ_t is the error term, β_1 is the intercept $\beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8$ are parameter estimate,

Whereby GNI was used as a proxy of the national income. We know very much well that when a country's income increases, their import demand also increases, and hence trade deficit increases too. Hence, a negative relationship exists between the trade balance (TB) and national income (GNI). Also, we want to check if there is any relationship between the NODA (net official development assistance), proxy as foreign aid, and TB. From the theoretical background, we know that if foreign aid increases, then there may be an impact on the exchange rate, whereas domestic currency may be appreciated, and import demand may be stimulated, and therefore export volume may be decreased. Thus, we may find a negative impact between NODA and

trade balance. We also amalgamated FDI, from the theoretical view, FDI inflows leads to improvement on industrial infrastructure and production hence improving on the country's products which high quality, this will improve exports. Hence, we expect a positive relationship between FDI and trade balance. Increase in GDP per capita is expected to stimulate consumption of foreign good than domestic goods due to the mindset of foreign goods having more quality than the domestic good hence it's expected to worsen the Uganda trade balance. Rise in inflation is expected to reduce the currency purchasing power, investment, and production hence leading worsening the trade balance. We also integrate the most important independent variable, the real exchange rate, which mainly affects the trade. An increase in real exchange rate increases stimulate currency depreciation, hence making the foreign products become more expensive to people, and domestic goods become relatively cheaper. This may lead to the stimulation of an increase in export demand and a reduction in import demand. So, we may find a positive relationship between the trade balance and the real exchange rate.

Stationarity test

The stationary of a series is vital due to the influence it has on its behavior. Thus, if the time series data are non-stationary and regress the model disregarding this, we may find spurious regressions [62]. We must convert the data into stationary if we want to find an acceptable result. Time series data is stationary if its mean, variance, and covariance do not vary over time. Non-stationary data leads to spurious regression due to non-constant mean and variance [63]. Differencing a series using differencing operators produces other sets of observations. If a series is at first-difference without any differencing, it is said to be $I(0)$ or integrated of order 0. However, if a series is stationary after the first difference, $I(1)$ or integrated of order 1. In order to check for stationary in the series (whether in levels or first differences), An Augmented Dickey Fuller (ADF) (1979) test was used. First, we want to test the data of trade balance from 1994-2018. The probable equations of ADF are as follows:

$$\Delta TB_t = \alpha + \beta t + \gamma TB_{t-1} + \delta_i \sum_{i=1}^n \Delta TB_{t-i} + \mu_t \dots \dots \dots (3)$$

This equation involves trend and intercept. We may use the following equations for the respective variables, as shown below.

$$\Delta FDI_t = \kappa FDI_{t-1} + \mu_t \dots \dots \dots (4)$$

$$\Delta GCF_t = \ell GCF_{t-1} + \mu_t \dots \dots \dots (5)$$

$$\Delta GDP_t = \phi GDP_{t-1} + \mu_t \dots \dots \dots (6)$$

$$\Delta INF_t = \nu INF_{t-1} + \mu_t \dots \dots \dots (7)$$

$$\Delta GNI_t = \delta GNI_{t-1} + \mu_t \dots \dots \dots (8)$$

$$\Delta LER_t = \gamma LER_t = \gamma ER_{t-1} + \mu_t \dots \dots \dots (9)$$

$$\Delta NODA_t = \theta NODA_{t-1} + \mu_t \dots \dots \dots (10)$$

The null hypothesis represented in equation (1) indicate that the data is non-stationary, which can only be rejected when the computed γ is statistically significant and different from zero. We may come into a conclusion that the data is stationary, on the contrary, if γ coefficient is statistically insignificant, then the data exhibit non-stationarity. If a time series data set is non-stationary, then we take the first difference to make it stationary. Augmented Dickey-Fuller

follows this procedure. Here the first difference is taken. We will check all of my variables like the above mention equation.

Johansen cointegration test and the Vector Error Correction Model (VECM)

After stationarity test using ADF, the Johansen's cointegration method is then employed to determine whether their cointegrating vector among the variables [64], [65]. The technique involves the representation of VAR. A p -dimensional process is represented, and integrated of order d , $x_t \sim I(d)$, with VAR representation.

$$x_t = \alpha + A_k x_{t-1} + \varepsilon_t$$

Using the difference operator $\Delta = 1 - L$ or $L = 1 - \Delta$ the VAR in levels can be transformed into a vector error correction model (VECM).

$$\Delta x_t = \mu + \rho_1 \Delta x_{t-1} + \dots + \rho_{k-1} \Delta x_{t-k+1} + \pi x_t - 1 + t_t$$

After transforming the model using $L = 1 - \Delta$, we lose one lag, leading to $K-1$ lags in VECM. The more compact for the VECM becomes:

$$\Delta x_t = \alpha + \sum_{i=1}^{k-1} \rho_i \Delta x_{t-i} + \pi_{t-1} + \varepsilon_t$$

The number of co-integrating vectors is identical to the number of stationary relationships in the π matrix. If there is no cointegration π , all rows in must be filled with zeros. If there are stationary combinations or stationary variables, some parameters π will be nonzero. The rank of π the matrix determines the number of independent rows and the number of co-integrated vectors. The rank π is given by the number of significant Eigenvalues found π . Each significant Eigenvalue represents a stationary relation. Johansen derived two tests, the $\lambda - \max$ (or maximum Eigenvalue) and the $\lambda - trace$ (or trace test).

$$\mu_{trace}(r) = -T \sum_{i=r+1}^g \log(1 - \mu_i)$$

$$\mu_{max}(r, r+1) = -T \log(1 - \mu_{r+1})$$

μ Is the ordered Eigenvalue of matrices π , and T are the available observations. Both procedures test the null hypothesis of at most r co-integrating vectors against the unspecified or general alternative hypothesis of having more than one co-integrating vector [66].

The first difference operator, the vector of variables, μ is the drift parameter ρ_1 and ρ_{k-1} are coefficient matrices. Determining the rank of the matrices π is an essential task in the Johansen cointegration test. We amalgamated this test and VECM in my article to verify the co-integrated equations and find the cointegration among the variables. And before doing that, we tested a unit root test and finds that the variables are non-stationary at level, but after taking the first difference, they became stationary.

GRANGER CAUSALITY TEST

The Granger Causality test determines the causal relationship between the trade balance and the independent variables (Real exchange rate, GNI, and NODA). The Granger method sought to explain how much of a variable x (the independent variables) can be defined by its past values and whether adding lagged values of another variable y (trade balance) can explain better. It involves estimation of the following equations:

$$y_t = \alpha_0 + \sum_{i=1}^n \alpha_i y_{t-i} + \sum_{j=1}^n \beta_j x_{t-j} + \varepsilon_1 \dots \dots \dots (11)$$

$$x_t = \alpha_0 + \sum_{i=1}^m \lambda_i y_{t-i} + \sum_{j=1}^m \delta_j x_{t-j} + \varepsilon_2 \dots \dots \dots (12)$$

In the model, t denotes periods and ε is a white noise error term. The constant parameter α_0 indicates the constant of y in equation (5) and for x in equation (6). The trends are interpreted as general movements of cointegration between x and y that follow the unit root process. The null hypothesis for equation (5) is: $H_0: \beta_j = 0$, which implies that there is no causation from y to x or y does not Granger cause x . The null hypothesis for equation (6) is: $H_0: \delta_j = 0$, meaning that there is no causation from x to y or x does not Granger cause y . The granger causality test should analyze the presence of both unilateral and bilateral causality. Unilateral causality will occur between variables if either null hypothesis of Equations (5) and (6) is rejected, while bilateral causality will occur between variables if both null hypotheses are rejected. No causality exists if neither null hypothesis of Equations (5) and (6) are rejected [67].

DATA ANALYSIS AND DISCUSSION OF THE RESULTS

In this section, Descriptive statistics check for the data's normality, the preliminary analysis of the data to check whether the data is stationary. Time series plots, correlogram plots, represented in the Appendix, and the Augmented Dickey-Fuller (ADF) test are used to check for stationary variables in the dataset. Also, the Johansen test was performed, which determine the appropriate time series model to fit. Further, the results of VECM are specified and interpreted.

Descriptive Statistics

The descriptive statistics represented in this study is the summary statistic which is in Table 1 below. The summary statistics consist of mean, standard deviation, minimum, maximum, skewness, and kurtosis.

Table 1: Descriptive Statistics

Variables	Obs	Mean	Std. Dev.	Min	Max	Skew.	Kurt.
TB	25	-1.610e+09	8.860e+08	-3.160e+09	-6.234e+08	-.442	1.601
IFDI	25	19.779	.861	18.295	20.91	-.227	1.479
IGDP	25	6.079	.531	5.306	6.78	.168	1.293
INODA	25	20.914	.403	20.225	21.422	-.371	1.509
IGCF	25	29.245	1.275	27.194	31.033	.003	1.57
IRER	25	7.551	.395	6.876	8.223	-.052	2.267
IGNI	25	7.315	.323	6.697	7.705	-.4	1.684
IINF	24	1.628	1.059	-2.676	2.716	-2.878	12.565

Source : Author's computation

Descriptive statistics are brief descriptive coefficients that summarize a given data set, which can be either a representation of the entire population or a sample of it. Descriptive statistics are broken down into measures of central tendency and measures of variability, or spread. Measures of central tendency include the mean, median and mode, while measures of variability include the standard deviation or variance, the minimum and maximum variables, and the kurtosis and skewness.

To declare a variable to be normally distributed, it should have skewness of zero or close to zero that is, close to one or less than one in absolute terms. Skewness is a measure of asymmetry of the distribution of the series around its mean. Kurtosis is a measure of whether the data are heavy-tailed or light tailed relative to a normal distribution. It tells the height and sharpness of the central peak, relative to that of a standard bell curve.

Traditionally, kurtosis has been explained in terms of the central peak. Higher values indicate a higher, sharper peak; lower values indicate a lower, less distinct peak. The results in table 1 reveals that the variables are moderately peaked as high kurtosis values are problematic for accurate hypothesis tests and confidence intervals (and therefore problems with statistical inference). Higher kurtosis means more of the variance is the result of infrequent extreme deviations, as opposed to frequent modestly sized deviations.

From the results in table 4.1 the highest trade balance recorded for the period under consideration was -6.234×10^8 of GDP while the minimum was -3.160×10^9 with a mean and standard deviation of -1.610×10^9 and 8.860×10^8 respectively, Real exchange rate had a maximum of 8.223 and a minimum of 6.876 averaging at 7.551. The average GDP for the period under consideration was 6.079 with a maximum of 6.78 and a minimum of 5.306.

Correlation matrix of variables

The correlation matrix in Table 2 below show that Real Exchange rate is negatively related with Trade balance and positively correlated with Foreign Direct investment, GDP, FDI, NODA, GCF, GNI and inflation. Trade balance is negatively correlated with GDP, real exchange rate with foreign direct investment, NODA, GCF, GNI, and INF. Most of the coefficients were low below 0.5 which could rise suspicion for multicollinearity, however the test for multicollinearity will be done in subsequent sections.

Table 2: Correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) TB	1.000							
(2) IFDI	-0.864*	1.000						
(3) IGDP	-0.935*	0.899*	1.000					
(4) INODA	-0.781*	0.936*	0.857*	1.000				
(5) IGCF	-0.875*	0.921*	0.947*	0.893*	1.000			
(6) IRER	-0.728*	0.805*	0.800*	0.801*	0.939*	1.000		
(7) IGNI	-0.855*	0.958*	0.908*	0.933*	0.960*	0.886*	1.000	
(8) IINF	-0.114	0.183	0.167	0.313	0.166	0.086	0.225	1.000

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Testing for Stationarity

Unit root analysis is the uni-variate time series analysis which seeks to find out whether the series are stationary or not. A stochastic process is stationary if it has time-invariant first and second moments. In other words, a series of data is stationary if its mean and variance are not time dependent and the covariance does not depend on time, but on the distance in time between the two members of the process (Enders, 2004). The presence of a unit root in the time series representation of a variable has important implications for both the econometric method used and the economic interpretation of the model in which that variable appears. For graphs at levels and at first difference (see Appendix).

Time series plots usually give the most straightforward method for checking the stationarity of the variable dataset. The figure in the Appendix presents the results for time series plots. The output suggests possible non-stationary variables since their movement overtime exhibit a trend. The correlograms in Figure 6 in the Appendix further suggest non-stationary variables since they decay slowly, suggesting that there is a trend over time in the variables., an Augmented Dickey-Fuller (ADF) unit root test was performed to confirm that the variables are non-stationary empirically. The results in the tables shown below indicate that all the variables are non-stationary at levels. After completing the first differencing, all the variables became stationary. The tables shown below represent the ADF unit root test results for both the level and first difference of the variables (without trend). The results show that all variables are stationary after the first difference implying that all variables are integrated of order one $I(1)$. The time series plots and correlograms of the variables after the first difference of the data are shown in figures 5 and 7 in the Appendix, respectively, which also point the time series plot does not exhibit any trend, and the correlograms do not die away slowly, indicating that the first difference variables are stationary.

Augmented Dickey Fuller (ADF) test for Variable Trade balance

Here, we test whether the time series data set exhibits a trend or not. If the time-series data show a trend, then the regression result suffers from spurious regression problems. In order to eliminate the spurious regression problems, we have to test:

Null hypothesis: Data is non-stationary

Alternative hypothesis: Data is stationary

We used the value of t-test statistics and critical value comparison. If the test statistic is greater than the critical value, we may reject the null hypothesis and accept the alternative hypothesis.

Table 3: ADF-TB

		Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
For Level Form	Z(t)	-2.295	-4.380	-3.600	-3.24
For First Difference	Z(t)	-4.493	-3.750	-3.000	-2.63

Source: author, results from Stata, time series

From the t-test statistics and critical value results, we found that the level form is non-stationary, and if we take the first difference, they became stationary.

Table 3: ADF-FDI

		Test Statistic	1% Critical Value	5% Critical Value	10% Critical
For Level Form	Z(t)	-1.887	-4.380	-3.600	-3.240
For First Difference	Z(t)	-4.571	-3.750	-3.000	-2.630

Source: author, results from Stata, time series

From the t-test statistics and critical value results, we found that the level form is non-stationary, and if we take the first difference, they became stationary.

Table 3: ADF-GDP

		Test Statistic	1% Critical Value	5% Critical Value	10% Critical
For Level Form	Z(t)	-2.616	-4.380	-3.600	-3.240
For First Difference	Z(t)	-4.034	-3.750	-3.000	-2.630

Source: author, results from Stata, time series

From the t-test statistics and critical value results, we found that the level form is non-stationary, and if we take the first difference, they became stationary.

Table 3: ADF-GCF

		Test Statistic	1% Critical Value	5% Critical Value	10% Critical value
For Level Form	Z(t)	-1.741	-4.380	-3.600	-3.240
For First Difference	Z(t)	-3.634	-3.750	-3.000	-2.630

Source: author, results from Stata, time series

From the t-test statistics and critical value results, we found that the level form is non-stationary, and if we take the first difference, they became stationary.

Table 3: ADF-INF

		Test Statistic	1% Critical Value	5% Critical Value	10% Critical value
For Level Form	Z(t)	-2.915	-4.380	-3.600	-3.240
For First Difference	Z(t)	-5.616	-3.750	-3.000	-2.630

Source: author, results from Stata, time series

From the t-test statistics and critical value results, we found that the level form is non-stationary, and if we take the first difference, they became stationary.

Augmented Dickey Fuller (ADF) test for Variable GNI

Table 4: ADF-GNI

		Test Statistic	1%Critical Value	5%Critical Value	10% Critical value
For Level Form	Z(t)	-0.591	-4.380	-3.600	-3.240
For First Difference	Z(t)	-3.854	-3.750	-3.000	-2.630

Source: author, results from Stata, time series

From the t-test statistics and critical value results, it shows that the level form of GNI is non-stationary, and if we take the first difference, they became stationary.

Table 5: ADF-NODA

		Test Statistic	1% Critical Value	5% Critical Value	10% Critical value
For Level Form	Z(t)	-1.933	-4.380	-3.600	-3.240
For First Difference	Z(t)	-4.904	-3.750	-3.000	-2.630

Source: author, results from Stata, time series

From the t-test statistics and critical value results, we found that the level form of NODA is non-stationary, and if we take the first difference, they became stationary.

Table 6: ADF-LER

		Test Statistic	1% Critical Value	5% Critical Value	10% Critical value
For Level Form	Z(t)	-2.152	-4.380	-3.600	-3.240
For First Difference	Z(t)	-4.196	-3.750	-3.000	-2.630

Source: author, results from Stata, time series

From the t-test statistics and critical value results, we found that the level form of the Real Exchange rate is non-stationary, and if we take the first difference, they became stationary.

VECTOR AUTOREGRESSIVE AND VECTOR ERROR CORRECTION MODELS

The estimation can fit the Vector Autoregressive (VAR) model or Vector Error Correction Model (VECM) as the results in section 3.1 show that the variables are I(1). The paper needs to establish if the time series is co-integrated to choose the appropriate model. If cointegration exists in the series, then fitting the VAR model to the first difference of the variables may lead to misspecification of the model. Hence, the VECM will be appropriate, capturing both the short-run and long-run relationship between the variables.

At the beginning of this section, the paper determines whether cointegration exists among the variables using the Johansen cointegration test. If the series is co-integrated, then the VECM will determine the short-run and long-run causality between the variables. However, if there is no cointegration in the series, then the VECM is reduced to the VAR model. Before determining

whether there exists cointegration, the first step is to select the optimal lag length. Next is to identify the co-integrating rank before specifying the model and testing the adequacy of the model.

Cointegration test

The first process in the estimation of the time series analysis is to select an appropriate lag length, which ensures that the model is not mis specified [68]. In the literature, there are various methods used for optimal lag length selection, which include: Sequential Modified Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criteria (AIC), Schwarz Bayesian Information Criterion (SBIC), and Hannan-Quinn Information Criterion (HQIC). There is no clear thump of rule on which criterion to use for optimal lag length selection among the above methods. However, the decision rule is to choose the model with the lowest value of information criteria. Table 7 presents the results for lag length selection using the above-mention criteria.

The lowest information criterion for LR, FPE, AIC, HQIC, and SBIC is lag 4, as presented in Table 7 below. After determining the optimal lag length for analysis, the next step is to determine if the series are co-integrated, discussed in the proceeding section.

Table 7: Results of the lag length selection

lag	LL	LR	Df	p	FPE	AIC	HQIC	SBIC
0	-886.336				7.9e+31	84.7939	84.8371	84.9929
1	-804.804	163.07	16	0.000	1.6e+29	78.5527	78.7686	79.5475
2	-792.432	24.743	16	0.074	2.7e+29	78.8983	79.2869	80.6889
3	-755.553	73.758	16	0.000	6.8e+28	76.9098	77.4712	79.4963
4	-711.249	88.609*	16	0.000	2.5e+28*	74.2142*	74.9482*	77.5965*

JOHANSEN TEST FOR COINTEGRATION

Table 8: Trace statistic

maximum rank	parms	LL	eigenvalue	trace statistic	5% critical value
0	72	-2280.247	.	333.7667	156.00
1	87	-2221.7373	0.99383	216.7473	124.24
2	100	-2181.8505	0.96883	136.9736	94.15
3	111	-2154.0264	0.91103	81.3254	68.52
4	120	-2133.275	0.83544	39.8227*	47.21
5	127	-2122.6539	0.60290	18.5806	29.68
6	132	-2113.716	0.54031	0.7047	15.41
7	135	-2113.3637	0.03018	-0.0000	3.76
8	136	-2113.3637	-0.00000		

Table 9: Maximum statistic

maximum rank	parms	LL	eigenvalue	max statistic	5% critical value
0	72	-2280.247	.	117.0194	51.42
1	87	-2221.7373	0.99383	79.7736	45.28
2	100	-2181.8505	0.96883	55.6482	39.37
3	111	-2154.0264	0.91103	41.5028	33.46
4	120	-2133.275	0.83544	21.2421	27.07
5	127	-2122.6539	0.60290	17.8758	20.97
6	132	-2113.716	0.54031	0.7047	14.07
7	135	-2113.3637	0.03018	-0.0000	3.76
8	136	-2113.3637	-0.00000		

The study employed Johansen cointegration technique to find out if there is any long-run association among the variables. Two measures, one is the maximum statistics, and the other trace statistic produced. For trace statistic 0 means there is no cointegration. That indicates the null hypothesis of no cointegration among the variables, and the alternative hypothesis is when the trace statistics and the maximum statistics is greater than the critical values, it indicates that there is cointegration among the variables. The trace statistics and critical values are compared. A greater trace statistic than the critical value means we have to reject the null hypothesis and accept the alternative hypothesis. From the above in table 8, we can observe that the trace statistic is 334 greater than the critical value (156). that imply, we have to reject the null hypothesis and instead accept the alternative hypothesis that there is cointegration. Therefore, our variables, trade balance, real exchange rate, FDI, GCF, INF, GDP, GNI, and NODA are all co-integrated into one, and they have a long-run association and hence move together in

the long run. With all the variables being non-stationary at the level form and stationary at the first difference, they are co-integrated too in the long run. A VECM model (vector error correction model) is applied. Both the max statistics and trace statistics have given us the same results.

VECTOR ERROR CORRECTION MODEL

With time-series data being non-stationary at the level form and being stationary at the first difference, and after applying the cointegration test, they are co-integrated into the long run by the Johansen cointegration test. Hence, we apply the vector error correction model. We also use the model to differentiate the short-run and the long-run causality. As we have found that all our variables are stationary at the first difference and co-integrated in the long run, we can now apply the vector error correction model as follows:

$$\Delta TB_t = \alpha + \sum_{i=1}^{k-1} \beta_i \Delta TB_{t-i} + \sum_{j=1}^{k-1} \gamma_j \Delta ER_{t-j} + \sum_{h=1}^{k-1} \phi_h \Delta FDI_{t-j} + \sum_{b=1}^{k-1} \lambda_b \Delta GDP_{t-j} \\ + \sum_{m=1}^{k-1} \delta_m \Delta GNI_{t-m} + \sum_{s=1}^{k-1} \varepsilon_s \Delta NODA_{t-s} + \sum_{l=1}^{k-1} \phi_l \Delta INF_{t-j} + \sum_{x=1}^{k-1} \psi_x \Delta GCF_{t-j} + \pi_1 ECT_{t-1} + \mu_{it} \dots \dots (13)$$

Remarks:

- $K-1$ = The lag length is reduced by 1.
- $\beta_i, \gamma_i, \delta_m, \varepsilon_s, \phi_h, \psi_x, \lambda_b, \phi_i$ = Short-run dynamic coefficients of the model's adjustment long-run equilibrium.
- π_i = speed of adjustment parameters with a negative sign.
- ECT_{t-1} = The error correction term refers to the lagged value of the residuals obtained from the co-integrating regression of the regress variable on the regressors. It contains long-run information derived from the long-run co-integrating relationship.
- μ_{it} = residuals

Table 10: Vector error-correction model

D_TB _ce1 L1.	-1.217651	.4506319	-2.70	0.007	-2.100874	-.3344291
TB						
LD.	1.15851	.4428163	2.62	0.009	.290606	2.026414
RER						
LD.	625245.9	495302.4	1.26	0.207	-345529	1596021
FDI						
LD.	.6809108	.5236939	1.30	0.194	-.3455104	1.707332
GDP						
LD.	2315784	1365342	1.70	0.090	-360237.1	4991806
NODA						
LD.	-1.335287	.4562987	-2.93	0.003	-2.229616	-.4409577
GCF						
LD.	-.0002399	.0000571	-4.20	0.000	-.0003518	-.0001279
GNI						
LD.	1456284	1270491	1.15	0.252	-1033832	3946401
INF						
LD.	-5.91e+07	2.74e+07	-2.16	0.031	-1.13e+08	-5427357
_cons	-2.72e+08	1.54e+08	-1.76	0.078	-5.74e+08	3.04e+07

From table 10 above, the _ce1 coefficient is statistically significant, which is the long-run effect and the error correction term. On the other hand, LD for several variables are short-run coefficients. For the variables of trade balance (*TB*), GNI, INF and Net Official Development Assistance (NODA), all of their coefficients are statistically significant in the short run. Whereas for the real exchange rate and GDP, all the coefficients are statistically insignificant. In table 10, it can be concluded that both dependent and independent variables are stationary at first difference. This is because the coefficient of the error correction term is negative, less than one (-1.217651), and significant at 5%. The results of the entire model in the short run reveal that most of the exogenous variables did have the expected outcome.

From table 11 below, the co-integration equation between trade balance (TB), real exchange rate, RER, GDP, FDI, GNI, and NODA in the period 1994-2018 are:

Table 11: Cointegration equation-Johansen normalization restriction imposed

beta	Coef.	Std. Err.	z	P>z	[95% Conf. Interval]	
_ce1						
TB	1	.	.	.	.	.
RER	-350391	3919.346	-89.40	0.000	-358072.8	-342709.3
FDI	1.279988	.0033331	384.02	0.000	1.273456	1.286521
GDP	2789603	14754.73	189.06	0.000	2760685	2818522
NODA	-.4738176	.0034641	-136.78	0.000	-.4806072	-.4670281
GCF	3.01e-07	4.54e-07	0.66	0.507	-5.88e-07	1.19e-06
GNI	.2880799	9023.98	0.00	1.000	-17686.39	17686.96
INF	-4.89e+07	217199	-225.10	0.000	-4.93e+07	-4.85e+07
_cons	8.62e+08	.	.	.	.	.

The co-integration equation suggests that with an increase in the real exchange rate, FDI, GDP improves trade balance in the short run and its statistically significant. GNI is also seen to improve on trade balance. However, its statistically insignificant. In contrast, an increase in net official development assistance (NODA), inflation, worsens the trade balance in the short run. A rise in real exchange rate leads to devaluation of Uganda's currency's, hence lowering their demand for imports and instead increasing the demand for Uganda's export by foreign countries. This will, in turn, reduce the trade deficit in Uganda hence improving the trade balance as well as increasing the economic growth of the country. This implies that depreciation of the real exchange rate causes an improvement in the trade balance. The results are consistent with the economic theory, which suggest that depreciation of the exchange rate increases country exports and country competitiveness in the international market, which eventually leads to trade balance improvement. As seen in the table above, an increase in foreign aid (NODA) increases the trade deficit. This may be true since foreign aid though given to the government with terms and conditions specifically for the operation of assigned specific development projects such as public infrastructural development in the country and not for external consumption or used, is still diverted for personal consumption by the government officials through corruption and embezzlement of public aid funds. Which in the long-run worsen trade balance. Inflation is also seen to worsen the trade balance since it lowers production and economics activities and raises the money value hence preventing other country from importing from Uganda hence leading to more imports than exports. An increase in gross national income (GNI) decreases trade deficit in the short run, but its coefficient is statistically insignificant. It may not be accurate since an increase in income can drive consumption towards import goods from foreign countries due to their high international

quality than domestic goods, leading to an increasing trade deficit, and the balance of trade continues to deteriorate. An increase in foreign direct investment (FDI) decreases trade deficit in the short run, and its coefficient is statistically significant. It may be accurate since an increase in FDI can drive production and exports than import of goods from foreign countries hence leading to an improving trade balance. An increase in GDP per capita decreases trade deficit in the short run, and its coefficient is statistically significant. This is contrary to the expectation since an increase in income can drive consumption towards import goods from foreign countries due to their high international quality than domestic goods, leading to an increasing trade deficit, and the balance of trade continues to deteriorate. An increase in gross capital formation (GCF) decreases trade deficit in the short run, but its coefficient is statistically insignificant. It may be accurate since an increase in GCF (proxied as investment) can drive production and exports than import of goods from foreign countries hence leading to an improving trade balance.

Table 12 shows the results for individual adjustment of the variables in the short run towards the long-run equilibrium. Trade balance responds faster (at speed 1.22%) than other regresses towards long-run equilibrium if exist disequilibrium in the economy in the short run. It is as expected since the trade balance depends on various factors for its changes; hence, it should respond faster than variables independent of other factors. For regresses, the foreign direct investment (FDI) responds faster (0.060%) than the rest of the regressors, with the inflation responding at the lowest speed.

Table 12: Adjustment parameters

Alpha	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
trade balance _ce1 L1.	-1.217651	.4506319	-2.70	0.007	-2.100874 - .3344291
GNI _ce1 L1.	3.77e-11	8.29e-11	0.45	0.650	-1.25e-10 2.00e-10
NODA _ce1 L1.	.0525057	.2145767	0.24	0.807	-.3680568 .4730683
Real exchange rate _ce1 L1.	3.39e-08	2.24e-07	0.15	0.880	-4.06e-07 4.74e-07
FDI _ce1 L1.	.0598934	.1873319	0.32	0.749	-.3072704 .4270572
GDP _ce1 L1.	-1.11e-07	8.33e-08	-1.34	0.181	-2.75e-07 5.19e-08
GCF _ce1 L1.	-7728.34	1741.036	-4.44	0.000	-11140.71 -4315.971
INF _ce1 L1.	-6.40e-09	4.98e-09	-1.29	0.198	-1.62e-08 3.35e-09

DIAGNOSTIC TEST**1.Test for heteroscedasticity**

The Breusch-Pagan-Godfrey tests whether the variance of the errors from a regression is dependent on the values of the independent variables. In that case, heteroskedasticity is present. If the p-value is (preferably) 0.05 or smaller, then the null hypothesis is rejected and there is significant evidence that there is heteroscedasticity and vice versa. From the results the fail to reject the null hypothesis and conclude that the model is free from heteroscedasticity.

2.Normality of the model

The Jarque-Bera Test, a type of Lagrange multiplier test, is a test for normality. Normality is one of the assumptions for many statistical tests, like the t test or F test; the Jarque-Bera test is usually run before one of these tests to confirm normality. Jarque-Bera statistics follows chi-square distribution with two degrees of freedom for large sample. The null hypothesis in this test is data follow normal distribution, the results below reveal a P value greater than 0.05 and

hence we fail to reject the null hypothesis and conclude that the data in the model is distributed normally.

We performed the post estimation analysis of the model to check for the model's robustness in modeling the relationship between the trade balance and regressors in Uganda. The heteroskedasticity in the residuals in the VECM is check using the Breusch-Pagan-Godfrey tests. The results are shown in Table 12.

HO: no autocorrelation at lag order.

The results indicate no heteroskedasticity in the residuals, and therefore the model was well specified in terms of lags numbers, and there is no finite-sample bias in the parameter estimates [69]. Next, the study checks the model's stability conditions using the jarque-bera test, and it shows the stability in the model in table 14. The graph of the eigenvalues in figure 3.1 shows that none of the remaining eigenvalues appears close to the unit circle. The stability check does not indicate the model is mis specified.

Table: 12Breusch-Pagan-Godfrey tests

Heteroscedasticity	Chi2(1) = 1.64	0.2005
--------------------	----------------	--------

To determine the reliability of the statistical criteria, and establish whether or not the estimates have desirable properties of no bias, consistency, and no auto correlation, the Breusch-Pagan-Godfrey tests statistic was used. From the results, Breusch-Pagan-Godfrey tests was 0.2005 implying some degree of negative heteroscedasticity. Thus, there was present of heteroscedasticity and autocorrelation in the model.

Stability diagnostic test:

Table 13: Eigenvalue stability condition

Eigenvalue	Modulus
1	1
1	1
1	1
1	1
1	1
1	1
1	1
.6109647 + .5319524i	.810093
.6109647 - .5319524i	.810093
.1477106 + .7826098i	.796427
.1477106 - .7826098i	.796427
.7296173	.729617
.6077238 + .1363819i	.622839
.6077238 - .1363819i	.622839
.2021268 + .4273049i	.472699
.2021268 - .4273049i	.472699

We also evaluated the stability of the estimated VECM. For a K-variable model with r cointegrating relationships, the companion matrix will have $K - r$ unit eigenvalues. For stability, the moduli of the remaining r eigenvalues should be strictly less than unity. As shown in table 13, the moduli of the remaining r eigenvalues is less than unity hence there is stability in the model.

Table 14: Jarque-Bera test

Equation	chi2	df	Prob > chi2
TB	0.093	2	0.95441
RER	8.587	2	0.71366
FDI	4.480	2	0.10643
GDP	0.144	2	0.93065
NODA	0.743	2	0.68953
GCF	1.007	2	0.60427
GNI	0.361	2	0.83472
INF	0.427	2	0.80758
ALL	15.844	16	0.46391

Table 14 represent the residual diagnostic tests for the residual of the regression for the VECM model, and the model specification performed well. The residuals are normally distributed, and there is no higher-order serial correlation and heteroscedasticity in the model. Therefore, the value of the Jarque-Bera test shows that the residuals are normally distributed.

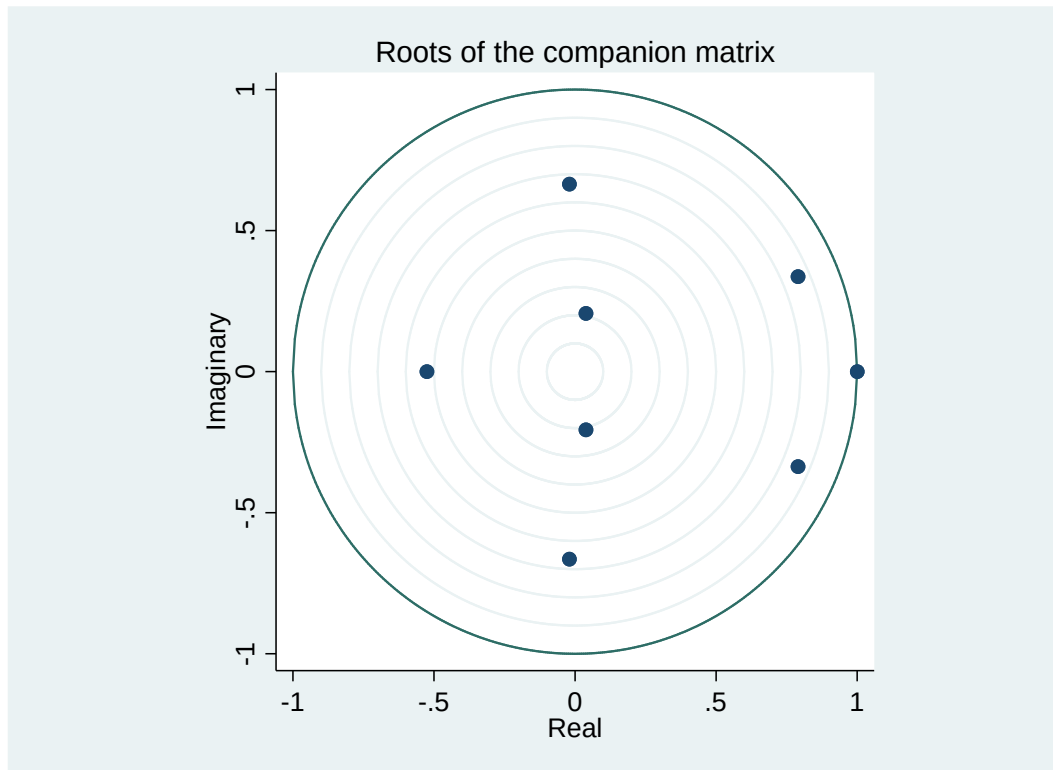


Figure 3.1

The graph of the eigenvalues in the figure shows that none of the remaining eigenvalues appears close to the unit circle. The stability check does not indicate the model is mis specified. The eigenvalues meet the stability condition.

Granger Causality Test

Cointegration between two variables does not specify the direction of causation between variables. Economic theory suggests that there is at least one direction of causation between variables [70]. Estimation results for Granger causality between the variables are presented in Table 14 below.

Table 14: Granger Causality Tests

Equation	Excluded	chi2	df	Prob > chi2
TB	RER	33.185	2	0.000
TB	FDI	29.118	2	0.000
TB	GDP	47.091	2	0.000
TB	NODA	47.13	2	0.000
TB	GCF	146.56	2	0.000
TB	GNI	66.081	2	0.000
TB	INF	70.986	2	0.000
TB	ALL	612.79	14	0.000
RER	TB	12.814	2	0.002
RER	FDI	59.58	2	0.000
RER	GDP	70.614	2	0.000
RER	NODA	12.06	2	0.002
RER	GCF	.	0	.
RER	GNI	77.925	2	0.000
RER	INF	41.688	2	0.000
RER	ALL	213.17	12	0.000
FDI	TB	80.617	2	0.000
FDI	RER	1.8323	2	0.400
FDI	GDP	173.98	2	0.000
FDI	NODA	15.098	2	0.001
FDI	GCF	27.613	2	0.000
FDI	GNI	9.5535	2	0.008
FDI	INF	58.812	2	0.000
FDI	ALL	604.47	14	0.000
GDP	TB	31.894	2	0.000
GDP	RER	40.404	2	0.000
GDP	FDI	147.92	2	0.000
GDP	NODA	6.3747	2	0.041
GDP	GCF	.	0	.
GDP	GNI	27.171	2	0.000
GDP	INF	23.588	2	0.000
GDP	ALL	631.21	12	0.000
NODA	TB	71.096	2	0.000
NODA	RER	16.205	2	0.000
NODA	FDI	2.2308	2	0.328
NODA	GDP	25.35	2	0.000
NODA	GCF	26.87	2	0.000
NODA	GNI	42.907	2	0.000
NODA	INF	39.706	2	0.000
NODA	ALL	223.01	14	0.000
GCF	TB	22.178	2	0.000

GCF	RER	35.392	2	0.000
GCF	FDI	93.511	2	0.000
GCF	GDP	69.74	2	0.000
GCF	NODA	12.258	2	0.002
GCF	GNI	52.411	2	0.000
GCF	INF	26.09	2	0.000
GCF	ALL	502.54	14	0.000
GNI	TB	73.036	2	0.000
GNI	RER	.21292	2	0.899
GNI	FDI	55.253	2	0.000
GNI	GDP	5.9987	2	0.050
GNI	NODA	4.8855	2	0.087
GNI	GCF	.	0	.
GNI	INF	.31497	2	0.854
GNI	ALL	490.05	12	0.000
INF	TB	1.9438	2	0.378
INF	RER	3.0125	2	0.222
INF	FDI	5.2148	2	0.074
INF	GDP	1.3477	2	0.510
INF	NODA	5.9715	2	0.051
INF	GCF	.	0	.
INF	GNI	7.3882	2	0.025
INF	ALL	99.004	12	0.000

There is a unidirectional causality running from all the independents variables toward trade balance. This implies that all the variables of interest have a relationship with the trade balance and all are statistically significant. There is a bidirectional relationship between trade balance and real exchange rate, trade balance and GNI, trade balance and GCF, trade balance and GDP, trade balance and FDI, and also trade balance and NODA. Thus, any change in the real exchange rate, NODA, GNI, FDI, GNI, GCF, and GDP will cause a change in the trade balance. GNI and NODA is seen to granger cause inflation.

Again, the real exchange rate, NODA, GNI, INF, FDI, GCF and trade balance are all seen to granger cause GDP. Thus, for economy to grow, all factors such as real exchange rate, foreign aid, gross national income, inflation, foreign direct investment and investment must be critically taken into account. It is also found that the real exchange rate, GDP, NODA, GNI, INF, FDI, and trade deficit granger cause investment (GCF). Lastly, NODA, GNI, INF, GDP, FDI and trade balance granger cause real exchange rates and are all statistically significant.

Overall, the results show that there is causation between trade balance, real exchange rate, NODA, and GNI, FDI, GDP, GCF, INF and the results are all statistically significant. These findings are consistent with those of [71], who finds a causal nexus between the trade balance and the real exchange rate in Bangladesh.

DISCUSSION

The nexus between the trade balance and the exchange rate has a very long history. In the past, researchers sought conditions through which devaluation or depreciation could improve the trade balance. However, countries still did continue to experience a decrease in their trade balance irrespective of the repeated devaluation. Improvement did come but only after some periods and after completion of pass-through of exchange rates to price, hence the J-curve effect. Since import and export prices adjust to exchange rate changes in an asymmetric way [72], there is a significant evidence to believe that trade flows will follow the same way. [73] study for instant found that the trader's expectations change when a currency appreciates versus when it depreciates. Therefore, the trade balance is likely to react asymmetrically changes in exchange rate. Another fundamental factor that could contribute to asymmetric effects is that imports and exports originate from two different countries subjected to differentiated sets of foreign and domestic trade rules, policies, and regulations. In other words, for countries with more bureaucratic red tape, the adjustment lags will be longer, which can contribute to asymmetric effects [74]. Currency depreciation is said to worsen trade balance first before improving it, resulting in a movement pattern that proves the existence of the J-curve effect. Numerous empirical studies have used aggregate trade data which has led them to face barriers of aggregation bias problem. One of the possible obstacle faces is that, a favorable effect of currency devaluation against one country could be offset by its unfavorable effect against another, hence resulting in a conclusion that depreciation is ineffective. In this study, we employed the stationary time series data and using the Johansen Cointegration test and VECM model to find the long run association among the variables. Our study showed that real exchange rate, FDI, GCF and *GNI* have a positive relationship with the trade balance. The study shows that the depreciation of exchange rate leads to an improvement in the Uganda Trade balance. However, the study has shown that an increase in official aid (*NODA*), GDP, INF, decreases trade balance but its statistically significant. Our finding also has shown that all the independent variables and trade balance co-move towards a long run equilibrium. Therefore, the government of Uganda should constitute strong monitoring and evaluation mechanisms to effectively manage and control real exchange rate, Net Official Development Assistance expenditures, inflation, investment, and also to effectively allocate and evaluate government financed projects in all sectors in order to improve productivity, trade flows and exports hence improving trade balance in Uganda.

CONCLUSION AND POLICY IMPLICATION

The main aimed of this study is to explain the short-run and long-run association/relationship between trade balances, real exchange rate, foreign direct investment (FDI), GDP, inflation, gross capital formation (GCF), Gross National Income (GNI), and Net Official Development Assistance (NODA) in Uganda using a time series data collected between 1994-2018. The study employs the Augmented Dickey-Fuller (ADF) test to prove the stationary of the variables. The ADF test shows that the variables used were not stationary in level but their first differences. The next step involved the cointegration test using the Johannsen cointegration technique, which proved cointegration. Under such circumstances, the Vector Error Correction Model (VECM) was applied to the dataset since it offers more and better information than other data generation processes. The results show the long-run impact of the exchange rate, NODA, GNI, FDI, INF, GCF, GDP on trade balance. The nexus between the trade balance and the real exchange rate is positive and significant in the short run. an increase in net official development

assistance (NODA), inflation, is seen worsens the trade balance in the short run. A rise in real exchange rate leads to devaluation of Uganda's currency's, hence lowering their demand for imports and instead increasing the demand for Uganda's export by foreign countries. This will, in turn, reduce the trade deficit in Uganda hence improving the trade balance as well as increasing the economic growth of the country. This implies that depreciation of the real exchange rate causes an improvement in the trade balance. The results are consistent with the economic theory, which suggest that depreciation of the exchange rate increases country exports and country competitiveness in the international market, which eventually leads to trade balance improvement. As seen in the table above, an increase in foreign aid (NODA) increases the trade deficit. This may be true since foreign aid though given to the government with terms and conditions specifically for the operation of assigned specific development projects such as public infrastructural development in the country and not for external consumption or used, is still diverted for personal consumption by the government officials through corruption and embezzlement of public aid funds. Which in the long-run worsen trade balance. Inflation is also seen to worsen the trade balance since it lowers production and economics activities and raises the money value hence preventing other country from importing from Uganda hence leading to more imports than exports. An increase in gross national income (GNI) decreases trade deficit in the short run, but its coefficient is statistically insignificant. It may not be accurate since an increase in income can drive consumption towards import goods from foreign countries due to their high international quality than domestic goods, leading to an increasing trade deficit, and the balance of trade continues to deteriorate. An increase in foreign direct investment (FDI) decreases trade deficit in the short run, and its coefficient is statistically significant. It may be accurate since an increase in FDI can drive production and exports than import of goods from foreign countries hence leading to an improving trade balance. An increase in GDP per capita decreases trade deficit in the short run, and its coefficient is statistically significant. This is contrary to the expectation since an increase in income can drive consumption towards import goods from foreign countries due to their high international quality than domestic goods, leading to an increasing trade deficit, and the balance of trade continues to deteriorate. An increase in gross capital formation (GCF) decreases trade deficit in the short run, but its coefficient is statistically insignificant. It may be accurate since an increase in GCF (proxied as investment) can drive production and exports than import of goods from foreign countries hence leading to an improving trade balance.

Furthermore, the results show that short-run fluctuations are adjusted towards a long-run equilibrium at a speed of approximately 1.22%. The speed is fast, implying strong co-movement between trade balance, real exchange rate, GNI, and NODA, FDI, GCF, GDP, and INF towards the long-run equilibrium hence the existence of the J-curve effect.

Looking at the causal relationships between trade balance, real exchange rate, GNI, and NODA, FDI, GCF, GDP, and INF, the study finds causation running through all the variables. Real exchange rate, NODA, GNI, FDI, GCF, GDP, and INF are all seen to granger cause trade balance.

Based on the findings, the exchange rate is positively related to trade balance for the period 1994-2018, which implies that currency depreciation can improve Uganda's trade balance. For these reasons, currency depreciation should be amended by the Uganda monetary policymakers. But as the currency depreciation becomes a policy priority by the policymakers, consideration should also be put on depreciation within the country as it may accelerate

domestic price levels, thus leading to inflation. Therefore, the Uganda monetary policymakers should devise tools that can emphasize price stability and minimization of the volatility of interest rate and the exchange rate of the Uganda Shillings. The study also recommends that the increased income should be directed towards domestic goods consumption as it would lead to a trade boost hence increased export quality and economic growth in the long run.

The study's limitation is that the model used in explaining how the exchange rate affects trade balance in our research is in Aggregate form. Therefore, future studies should consider using the model to explain the impact of exchange rate on the trade balance in a disaggregated form in a sectoral form such as the Agricultural sector, service sector, or industrial sector. By doing this, it's able to identify the channels through which the exchange rate may affect the trade balance.

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