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# Manufacturing Exports and Economic Growth in Tanzania

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**Abstract**

*This study examines the relationship between manufacturing exports and economic growth in Tanzania. The study is based on the export-led growth model and the virtuous circle to analyse the relationship. Using secondary time series data, the study employed the Autoregressive Distributed Lags (ARDL) approach and the Granger causality test technique for analysis. It was found that manufacturing exports affects economic growth in the long-run; and that, for Tanzania, manufacturing exports are the ones causing economic growth, and not the other way round. Therefore, the study concludes that there is a significant relationship between Tanzania's manufacturing exports and economic growth. It recommends policies, strategies and further efforts to be made to increase manufacturing products; encourage firms to produce quality products; invest in professional skills, education, and training; and increase external markets for manufactured products.*

## 1. Introduction

Tanzania has been implementing the Long-Term Perspective Plan (LTPP 2011/12–2025/26), and the Tanzania Development Vision (TDV 2025), to attain manufacturing-led sustainable economic growth and development. Several policies and strategies were formulated for the implementation of the Second Five Year Development Plan (2015/16–2020/21), with a focus on local resource-based industries and light manufacturing, especially in agricultural-based industrialization, and the creation of direct and indirect employment (URT, 2016). These policies and strategies could be more effective through evidence-based understanding of the relationship between exports and economic growth in Tanzania, particularly manufacturing exports, since income from industrial exports is stable as manufactured goods face relatively small price fluctuations in international markets.

The data show that manufacturing exports in 2015/16 constituted the largest proportion of exports, and ranked third in 2017/18 and 2018/19. Additionally, manufactured goods contributed the largest share among non-traditional exports (27.3%), which was greater than the share of gold (24.9%). The large share of manufacturing exports is mainly accounted to the growth of the manufacturing sector in Tanzania, for example by 6.5% from 2014 to 2015, mainly due to stable electricity supply and increased demand in the East African Community (EAC), and

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the Southern African Development Community (SADC). About 59% of the value of manufactured goods was from beverages, tobacco and food activities; which raised the production index of manufacturing by 1.6% in 2015.

The performance of manufacturing in Tanzania compares favourably to that of agriculture, which remains one of the main sectors, particularly in terms of its contribution to real GDP. For example, in the period 1987–2000, the contribution of agriculture to the GDP ranged between 48.5% and 50%. In the same period, foreign earnings from the sector ranged between 54%–56% (URT 2000). However, in the period 2000–2010, the sector's contribution to GDP decreased to between 26% and 31%; and its contribution to foreign earnings in the same period followed the same trend, decreasing from 34% to about 19% (Alam & Myovella, 2016). On the other hand, the period 2000–2010 was marked by an increment of 12.3% in manufacturing value-added (MVA), as per the Industrial Competitive Report (URT, 2012). On average, the manufacturing physical volume increased from 7.1% in 2005 to 8.6% in 2011, which indicates that it survived the global economic shocks from 2008 to 2010 (Wangwe et al., 2014).

In comparison to the other East African Community (EAC) countries, MVA for Tanzania increased at a rate of 7.7% in the period 2000–2015, on average, which was the highest among all EAC member countries, as per the EAC Industrial Competitive Report (2017). Tanzania's share of MVA to GDP increased marginally from 6.2 in 2006 to 6.8 in 2015; and still it was the most stable among the EAC member countries. Furthermore, according to the EAC Industrial Competitive Report (2017), Tanzania has been diversifying its manufacturing exports since 2000, thereby increasing its competitiveness. As well, the composition of its manufacturing exports has been changing over time. Whereas in 2000 Tanzania exported mostly coke, refined petroleum and rubber; followed by textiles, apparel leather, food and beverages, in 2014 it exported mostly metals followed by food and beverages; then textiles, apparel and leather. In 2014, these products were mainly exported to China (17%), Congo Republic (12%), Congo DRC (11%), Kenya (9%) and Germany (8%).

The observed relationship between manufacturing exports and economic growth may be a reflection of various policy initiatives over the years to make the manufacturing sector a key driver of economic growth. These initiatives have their roots in the challenges faced, and lessons learned, since the 1970s. The main challenges have included the shortage of skilled labour, poor infrastructure, inefficient utilization of raw materials, limited demand for domestically produced manufactured goods, machine breakdowns, unfavourable economic conditions, the lack of diversification, and the inadequacy of policies to promote industrial base abroad (Msami & Wangwe, 2016).

The available data on the growth of the economy and the proportions contributed by various sectors point to the link between growth of exports and the overall growth of the economy. In addition, anecdotal evidence indicates that the manufacturing sector in Tanzania has played a key role in the sustenance of GDP growth for more than a decade due to a stable growth of manufacturing exports. However, a causal-effect relationship between these relationships has not been closely examined. Thus, this study was motivated by the need to examine the causal effect of manufacturing exports on the economy as the government continues to revive the industrial sector for industry-led development of the country. The export promotion strategies in place to foster comparative and/or competitive advantages to increase shares in external markets should be based on evidence, as provided by this study.

This study was guided by the following hypotheses:

(a) Growth in manufacturing exports positively determines economic growth in the country; and
(b) There is a two-way causation between manufacturing exports and GDP growth.

## 2. Literature Review

### *2.1 Theoretical Framework*

In the light of the export-led cumulative causation developed by post-Keynesian economists, exports have been considered as a stimulus to economic growth (Blecker, 2009). It is possible for aggregate demand to be boosted by an increase in exports, which in turn leads to a production increase. When aggregate demand shifts due to changes in exports, it significantly affects output through a multiplier effect. Expansions in exports can encourage a country to specialize in areas it has comparative advantages, leading to the allocation of resources to more efficient sectors from inefficient ones. Nevertheless, exports can ease foreign exchange problems, which can lead to the importation of production inputs like equipment and machinery for investment, hence boosting the growth of output. Moreover, trade openness promotes progress in technology, leading to efficient and effective production, increasing employment, and hence promoting output growth (Cong & Hiep, 2017). Furthermore, there could be a reverse effect from economic growth to exports through productivity increase and economies of scale. Increase in productivity reduces costs of labour, which in turn contributes to the reduction of the prices of domestic commodities, thereby raising the competitive advantage of a country, and hence leading to increase in exportation. Economic growth also can encourage the formation of skills and progress in technology, which together tend to cause competitive advantage by bringing production efficiency that leads to the expansion of exportation (Verdoorn, 1949; Cong & Hiep, 2017; Helpman & Krugman, 1985).

Similarly, in the course of explaining the differences of growth in industrialized countries' exports and economic growth relationship, Kaldor put forward stylized facts on what economic growth should be based. These later came to be known as the Kaldor's Growth Laws; of which four of them were summarized by Blecker (2009) as follows:

(a) Rapid growth rate in manufacturing sector will cause a rapid growth rate of GDP.
(b) Rapid growth rate of manufacturing output will cause rapid growth rate of labour productivity in manufacturing due to economies of scale and increased returns to scale (Verdoon's Law).
(c) Manufacturing output growth is not limited by supply of labour, rather it is determined by agriculture demand in the early development stages; and by exports in the later stages.
(d) Rapid growth rate of outputs and exports will set up a growth virtuous circle linking productivity growth and output growth.

Due to this, Blecker, Cong and Hiep proposed the export-led growth model showing a virtuous circle of the relationship between exports and economic growth as shown in Figure 1.

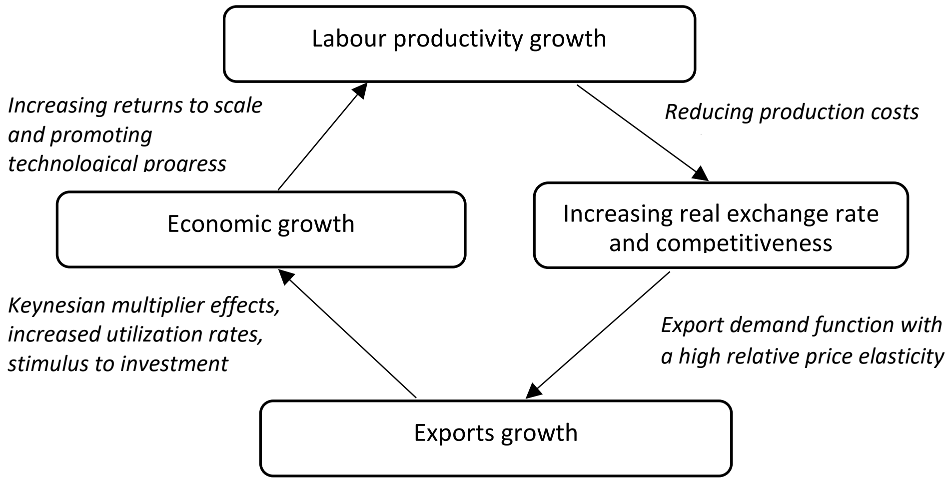


**Figure 1: The Basic Export-Led Growth Model showing Virtuous Circle of the Relationship Between Economic Growth and Exports**
**Source**: Blecker, 2009; and Cong and Hiep, 2017

Basing on the export-led growth model and the virtuous circle, this study proposes a transmission mechanism between manufacturing exports and economic growth in which the export of manufacturing products tends to motivate further production, which needs additional factors of production, hence increasing employment. Exports also boost foreign income, which makes it easy for a country to import required inputs for further production; including technology, intermediate and capital goods. As manufacturing exports promote comparative advantage, they facilitate optimum allocation of resources and encourage technological progress through the increase of economies of scale. From both increased employment and the availability of production inputs from importation, production expansion is realized that requires more physical factors for production. On the other hand, the combination of optimum resource allocation and technological progress leads to the reduction of costs and increase in total factor productivity. This combination leads to economic growth. Nevertheless, through productivity increase, there occurs a decrease in domestic commodity prices due to reduced production costs. This brings an increase in exchange rate, hence boosting competitiveness in the international market; a process that further increases manufacturing exports. Figure 2 presents a summary of the process.

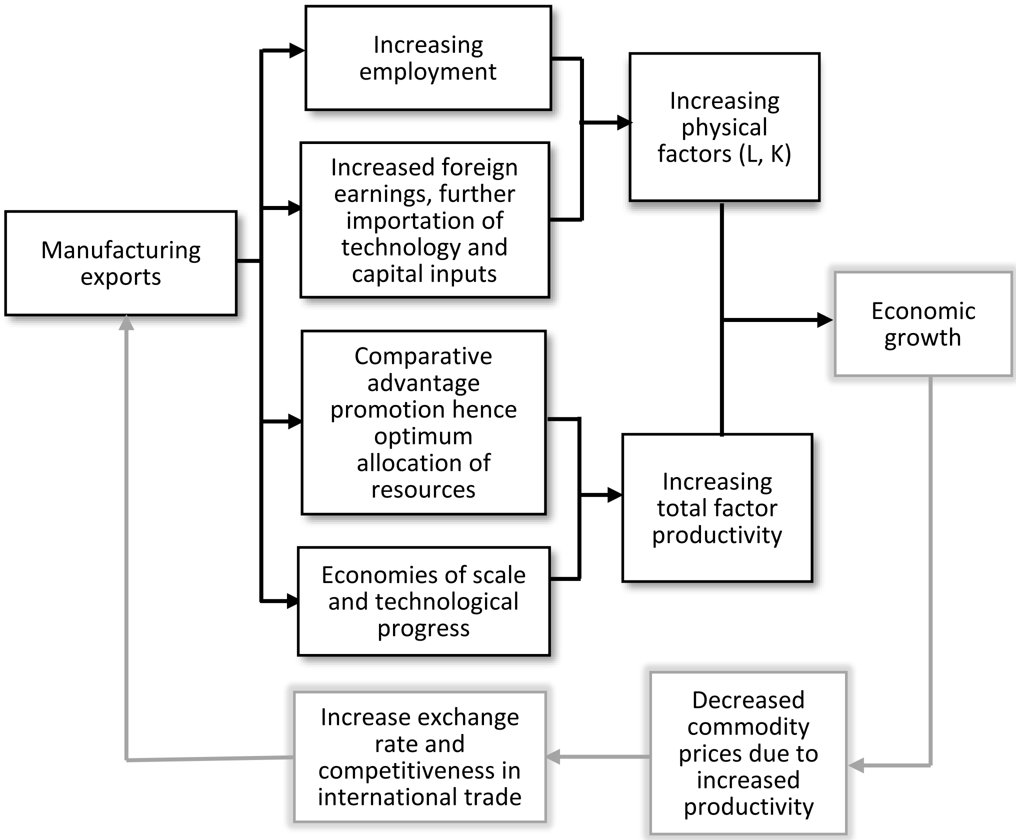


**Figure 2: Transmission Mechanism Between Manufacturing Exports and Economic Growth in Tanzania**

**Source**: Author's analysis based on the framework by Becker (2009) and Cong and Hiep (2017)

### *2.2 Empirical Literature Review*

Various empirical studies have been undertaken on the relationship between exports and economic growth. Chen (2009) contends that investigating the relationship between international trade and economic growth can be referred to as investigating the export-economic growth relationship, or export-led growth. With the focus on challenging the export-led growth hypothesis, DIW (2011) found that non-export GDP is stimulated by exports in developing countries, where it influences exports as well. A panel cointegration approach with 45 developing countries also revealed that countries differed in the case of a long-run relationship between the two variables. The influence of exports on the absorption of knowledge was insignificant for these countries, whereas variables like regulations for labour markets and business, as well as dependence on primary exports, revealed a negative relationship with the long-run influence of exports on non-export GDP, which differed from one country to another. A study by Mishra (2011) on India examined the link between exports and economic growth for the period 1970–2009 using the cointegration and vector error correction model (VECM), as well as the Granger causality test. The results refuted the hypothesis about export-led growth: they showed that only GDP caused increase in exports, with no feedback effect from exports to GDP. Merza (2007) used time-series Kuwaiti data for the period 1970–2004 to estimate an impulse response function, using econometric techniques. The study found oil exports, non-oil exports and economic growth to have a long-run relationship. Oil exports and the growth of the economy were found to Granger-cause each other. Non-oil exports, on the other hand, were found to be a cause for economic growth in a one-way relationship. Merza's study did not explicitly explain the state of causality sector-wise: it generalized oil and non-oil exports.

Corsetti et al. (2006) studied international productivity transmission shocks on manufacturing by specifically considering international transmission dynamics and relative prices together, while distinguishing terms of trade, non-tradables, relative prices, and real exchange rates in the G7 countries. It was found that gains in productivity in manufacturing tend to lower a producer price index relative to a consumer price index. Also, they found that both terms of trade and real exchange rates tend to appreciate in less open and largest economies, including Japan and USA; while for open economies, like Italy, relative prices tend to depreciate. Additionally, they found positive shocks to raise manufacturing output and total domestic consumption, leading to an unfavourable trade balance. Their results showed that growth in productivity for manufacturing in the US could cause external trade balance improvements. Furthermore, the results showed that changes in domestic demand due to productivity shocks do not reduce deficit in the current account in the US, instead, deficit is reduced by the growth in productivity of the rest of the world.

On the other hand, Cong and Hiep (2017) addressed the transmission mechanism between exports and economic growth in Vietnam. Applying the VECM, export growth was found to be the motivating factor for economic growth through the transmission of resource factors. These resource factors included the stimulation of investment, promotion of economies of scale, creation of more jobs, and increment of capital accumulation. Furthermore, increased productivity and improved competitiveness were found to be the mechanisms linked to economic growth that stimulated export growth. In line with the new trade theory, Montalbano (2020) contends that firms that specialize in export production would cover huge operation fixed costs if they were promoted and become highly productive. This coverage tends to lead to a country's productivity to rise on average, as it replaces low productive ones in the global market. This phenomenon tends to boost a country's real income as it raises people's real incomes.

The empirical analysis of the export-GDP relationship in Japan showed a two-way causal effect (Balcilar & Ozdemir, 2013). Using Japanese data from 1957–2009 and the bootstrap approach, it was found that Japanese economic performance was dependent on growth in exports (ibid.). Furthermore, the bootstrap rolling window technique showed that from the 1970s to the1980s, there was a direct proportionate predictive power for a two-way relationship between exports and GDP, whereas from the 1990s to 2009 the direct proportionate predictive power was for the growth of exports to the growth of GDP. Chen (2009) deviates from other studies by using a cross-sectional approach in analysing the countries of Japan, Taiwan and the USA. However, the study also treats exports in general and finds that, for Japan, exports and GDP do complement each other; for Taiwan, exports were found to cause economic growth; whereas the results for the USA were the opposite as economic growth was found to promote exports. Konya (2006) used Wald tests with specific bootstrap critical values for OECD countries and the systems of seemingly unrelated regressions (SUR). Furthermore, he applied a trivariate model, which related GDP, exports and openness; and a bivariate model that related GDP and exports. He found a unidirectional relationship from exports to economic growth for Sweden, Italy, Belgium, Spain, Denmark, New Zealand, Ireland and Iceland; and a causality from economic growth to exports for Norway, Austria, Greece, Portugal, France, Japan and Mexico. Additionally, he found a bi-directional relationship between exports and economic growth for the Netherlands, Finland and Canada. For the UK, Korea, Luxemburg, USA, Australia and Switzerland, the study did not find any significant causation between exports and GDP.

Hsiao and Hsiao (2006) applied both time series and panel-data approaches to examine exports-economic growth relationship, and found the panel approach to be superior to the time series approach. They considered eight Southeast and East Asian countries, including Thailand, China, Hong Kong, Philippines, Taiwan, Singapore, Korea and Malaysia; using both the random-effects and fixed-effect models for the period 1986–2004 to examine GDP, exports, and FDI relationships. From a panel vector autoregression (VAR), they found a direct causality from FDI to GDP, and an FDI effect on economic growth through exports. Hence, for these Southeast and East Asian countries, exports were found to stimulate economic growth indirectly as the economies used FDIs effectively. However, the use of time series and panel data techniques to compare several countries creates bias. The study did not incorporate single-country analyses when using these aggregate variables. In addition, the researchers analysed exports in general, rather than their components.

The diversification of exports to increase the rate of economic growth was considered by Hesse (2008), who found that diversification results in a higher rate of economic growth as it reduces the effects of unfavourable terms of trade, provides spill-overs—including knowledge spill-overs—and helps countries to gradually shift from producing only primary (agricultural) products, to producing more and more of industrial products. However, the study neither tested for causality between this diversified sector and economic growth, nor accounted for the relationship to any specific sector.

For Africa, Tekin (2012) used panel data techniques developed by Konya (2006), and found that exports were determinants of economic growth in Sierra Leone, Rwanda and Haiti; whereas in Zambia, Chad and Angola, economic growth was found to determine exports. In the case of the relationship between FDI and growth, the study found that in Togo and Benin, inward flows of FDI tended to cause economic growth; whereas in Malawi, Gambia, Burkina Faso and Madagascar, economic growth tended to cause inward FDI. Ajmin et al. (2015) caution about approaches and econometric techniques to be used in analysing the causality between exports and GDP due to the instability of the VAR. Using a linear Granger causality test, they showed that causality between exports and growth for South Africa was not significant for the period 1911–2011 (ibid.). However, when the Hiemstra and Jones's (1994) nonlinear test was used, the study found GDP to Granger-cause exports, thereby implying that economic growth was stimulating exports. The caution calls for testing for the stability of the VAR.

Ziramba (2011) categorized quarterly exports for the period 1960–2008 into net gold exports, services exports, and merchandise exports. Using the Bounds testing technique, the study showed that South Africa's economic growth was caused by the merchandise exports component. On the other hand, using Nigerian time series data for the period 1970–2005, Chimobi and Uche (2010) found economic growth to stimulate exports. This finding implies that production should increase for a country to satisfy the domestic market, and to have surplus to sell in the external market. This finding may not be generalizable to other African countries where economic conditions may be different. In addition, the two studies on South Africa and Nigeria did not consider explicitly the role of manufacturing exports in sustaining the economy. Hence, they could not offer detailed information for action to be taken.

On Tanzania, Shombe (2008) used time-series data for the period 1970–2005 to investigate the relationship between exports and economic growth by empirically analysing the causality relationship between manufacturing and agriculture, and exports. He found that, in Tanzania, agriculture causes manufacturing and exports; while manufacturing did not cause agriculture and exports in the period considered. He further found that manufacturing and exports are cointegrated, as was the case for agriculture and exports. The consideration of Shombe was causality between one sector and another. On his part, Wangwe et al. (2014) analysed the evolution of Tanzania's industrial sector. The study discusses how the economy's sustained growth for more than a decade was facilitated by the growth in the manufacturing sector. They noted the pitfall of that growth was that the manufacturing sector was not diversified, as such it could be easily affected by fluctuations in the performance of the agricultural sector, and by commodity prices. They listed the manufacturing products that promoted exports as including rubber and plastics, food products, non-metallic mineral products, basic metals and chemicals. Moreover, the study cautioned that heavy reliance on imported inputs limits inter-industry linkages, and value-addition of manufacturing exports. The study recommended that, to attain diversification and rapid growth in manufacturing, the government should address the remaining problems of administration, policies, finances, and technology. However, their study did not examine the causal relationships.

Kahyarara (2013) examined the relationship between growth in the manufacturing sector and exports in general. Using the error correction model (ECM) and cointegration analysis, the study found a long-run relationship between these two variables. The study concluded that manufacturing export growth in Tanzania was driven by manufacturing sector growth, and that increased production in manufacturing firms was accelerated by global market access, which lends support to the external-led growth policy adopted in Tanzania since 2003. However, the study does not examine the effect of these exports on economic growth, and how economic growth affects these exports. Kilindo (2019), on the other hand, used time series data for the period 1970–2017 to perform the Johannsen cointegration test and ECM, and found that the growth of Tanzania's economy supported an export-led approach; and a long-run relationship between economic growth and exports. Applying the Cobb Douglas function, the variables used by the study included exports, imports, labour, as well as capital.

In addition to the all the foregoing, studies by Dimoso and Utonga (2019), Mohamed et al. (2012), Mah (2015) and Mtaturu (2016) have also examined the relationship between total exports and economic growth. All used time series data techniques, including cointegration test, VAR and VECM. While Dimoso and Utonga (2019) found economic growth to cause exports, Mohamed et al. (2012) found the opposite; while Mtaturu (2016) found a bi-directional relationship. Like some of the reviewed literature, these studies considered the relationship between total exports and economic growth. Those that considered manufacturing sector specifically employed ECM and VECM. This study considers manufacturing the exports-GDP growth relationship, and uses the Autoregressive Distributed Lag (ARDL) approach in analysis.

## 3. Methodology

### *3.1 Relationship between Growth in Manufacturing Exports and GDP Growth*

This study employs the ARDL approach for both cointegration test procedure and estimation (Pesaran & Shin, 1999; Pesaran et al., 2001). Having the variables $y_t$, $x_{1t}$, and $x_{2t}$; and regarding $y_t$ as explained, and $x_{1t}$, and $x_{2t}$ as the explanatory variables, the following ARDL model was suggested by Pesaran et al. (2001):

$$\Delta y_t = \beta_0 + \sum_{i=1}^{n} \gamma_i \Delta y_{t-i} + \sum_{i=0}^{m} \varphi_{i1}\, \Delta x_{1,t-1} + \sum_{i=0}^{m} \varphi_{i2}\, \Delta x_{2,t-i} + \omega_1 y_{t-1}$$
$$+\omega_2 x_{1,t-1} + \omega_3 x_{2,t-1} + \mu_t \qquad (1)$$

In (1), $\omega_i$, following Wald with F-statistic, is used to formulate the null hypothesis, where $n$ is the number of lags. The null hypothesis for this test is given as:

$$H_0: \omega_1 = \omega_2 = \cdots \ldots \ldots \ldots .. = \omega_n = 0$$

Furthermore, Pesaran et al. (2001) suggested and tabulated critical value bounds for this test as its distribution is not standard. The calculated value of the $F$ statistic is compared with the upper and lower critical value bounds at a given level of significance, known as $F_U$ and $F_L$, respectively. If $F$ is greater than $F_U$, (i.e., [I_1]), the null hypothesis is rejected, which means there is cointegration. If $F$ is less than $F_L$ (i.e., [I_0]), then the null hypothsis cannot be rejected, meaning there is no cointegration; and if $F$ is greater than $F_L$ ([I_0]) but less than $F_U$ ([I_1])—that is, it is between lower and upper bounds—then the test is inconclusive. The conditional ARDL model for this study is presented as follows:

$$\begin{aligned}\Delta lnGDP_t = \alpha_0 &+ \sum_{i=1}^{n} \vartheta_i \Delta lnGDP_{t-i} + \sum_{i=0}^{m_1} \tau_{i1}\Delta\, lnKS_{t-1} + \sum_{i=0}^{m_2} \tau_{i2}\, \Delta lnLF_{t-1} \\ &+ \sum_{i=0}^{m_3} \tau_{i3}\, \Delta lnMEXP_{t-1} + \sum_{i=0}^{m_5} \tau_{i4}\, \Delta lnEXCH_{t-1} + \sigma_1 lnGDP_{t-1} \\ &+ \sigma_2 lnKS_{t-1} + \sigma_3 lnLF_{t-1} + \sigma_4 lnMEXP_{t-1} + \sigma_5 lnEXCH_{t-1} \\ &+ \theta_1 dummy + \mu_t \qquad (2)\end{aligned}$$

Where $GDP$ is a country's real GDP, $MEXP$ is manufacturing exports performance, $LF$ is labour force, $EXCH$ is the exchange rate, and $KS$ is capital stock.

Natural logarithms were introduced to take care of normality challenges. In (2), $\sigma_i$ are the long-run multipliers, $\Delta$ is the difference operator, $\alpha_0$ is the intercept, and $\mu_t$ are white noise error terms. Nevertheless, a dummy variable was included in the estimation to take care of trade liberalization adopted by Tanzania's economy in the 1980s. For estimation, the study uses ARDL model given as:

$$\begin{aligned}\Delta lnGDP_t = \alpha_0 &+ \sum_{i=1}^{n} \vartheta_i \Delta lnGDP_{t-i} + \sum_{i=0}^{m_1} \tau_{i1}\Delta\, lnKS_{t-1} + \sum_{i=0}^{m_2} \tau_{i2}\, \Delta lnLF_{t-1} \\ &+ \sum_{i=0}^{m_3} \tau_{i3}\, \Delta lnMEXP_{t-1} + \sum_{i=0}^{m_5} \tau_{i4}\, \Delta lnEXCH_{t-1} + \theta dummy \\ &+ \delta Ect_{t-1} + \mu_t \qquad (3)\end{aligned}$$

The coefficient $\delta$ from equation (3) is the adjustment speed in the long-run, while $\vartheta_i$ and $\tau_{ij}$ are the short-run dynamic coefficients of the model's convergence to equilibrium.

### *3.2 Causality Between Manufacturing Exports and GDP Growth*

Analysis of causality can be done by using a single equation model approach, as well as a simultaneous equations model approach, as it was suggested by Sprout and Weaver (1993). For the simultaneous equation approach, it is possible to endogenize export growth in a system, which allows a credible assessment of the theoretical causation between the examined variables. Furthermore, the use of 2SLS in a system of simultaneous equations captures the relationship among the two variables examined than it is so when using OLS with a single equation (Sprout & Weaver, 1993). Also, dynamics in variables can be modelled by using a different class of econometric models. When using more than one variable (a multivariate case), the dynamics can be modelled by using the special case of vector autoregressive moving average (VARMA), known as the vector autoregressive (VAR) model. OLS is appropriate to use in estimating the model since it is consistent because the current error terms are not correlated with the lagged ones. This study considers the dynamics of more than one variable (a multivariate case), hence uses the VAR model.

Granger (1969), used two-variable models to prove the definition of causality. Letting $X_t$ and $Y_t$ be two stationary time series with zero means, he gave a simple causal model:

$$X_t = \sum_{j=1}^{m} a_j X_{t-j} + \sum_{j=1}^{m} b_j Y_{t-j} + \varepsilon_t$$
$$Y_t = \sum_{j=1}^{m} c_j X_{t-j} + \sum_{j=1}^{m} d_j Y_{t-j} + \eta_t \qquad (4)$$

From the models above, $Y_t$ will be causing $X_t$ if $b_j$ is not equal to zero, while $c_j$ is zero; and $X_t$ will be causing $Y_t$ if $c_j$ is not equal to zero, but $b_j$ is zero. If $b_j$ and $c_j$ are not equal to zero, then the relationship is said to have feedback between $Y_t$ and $X_t$.

For the case of instantaneous causality, the general form is given as:

$$X_t + b_0 Y_t = \sum_{j=1}^{m} a_j X_{t-j} + \sum_{j=1}^{m} b_j Y_{t-j} + \varepsilon_t$$
$$Y_t + c_0 X_t = \sum_{j=1}^{m} c_j X_{t-j} + \sum_{j=1}^{m} d_j Y_{t-j} + \eta_t \qquad (5)$$

If the relationship of $Y_t$ and $X_t$ is such that the representation in (5) is needed, then there is an instantaneous causality. Therefore, knowledge of $Y_t$ is capable of improving the prediction, as well as the goodness of fit of the first equation for $X_t$ in (5). Thus, for this study, the set-up in equation (5) was used due to its general form, and that knowledge about $Y_t$ is of much help in terms of goodness of fit and prediction of improvements. In this case, $Y_t$ is real GDP growth ($GDPgr$); and $X_t$ is manufacturing exports ($lnMEXP$).

### *3.3 Estimation Methods*

The estimation of equation (2) was done using the Ordinary Least Squares (OLS). The joint F-test was used to test for the presence of a long-run relationship. The null hypothesis for this test is given as:

$$H_0: \omega_1 = \omega_2 = \omega_3 = \omega_4 = \omega_5 = \omega_6 = 0$$

After confirming the presence of cointegration, then the model was estimated by using conditional $ARDL(n, m_1, m_2, m_3, m_4, m_5)$. The process of model estimation involves a systematic selection of lags. After that, the short-run and long-run dynamics are estimated by using the error correction model associated with the used ARDL model.

For the case of testing for Granger causality, this study follows the recommendations given by Sims (1980) and Doan (1992) concerning stationarity while dealing with interrelationship issues, as was documented by Enders (1995). The non-stationary manufacturing export ($lnMEXP$) and real GDP growth ($GDPgr$) variables were used in the VAR estimation because the main intention of VAR is to determine the inter-correlation between variables and not the estimated parameters. The study intends to retain the co-movement information in the data, which is normally thrown away by differencing. Thus, in estimating VAR by using OLS, Lütkepohl (2005) considered the following form:

$$Y = BZ + U \qquad (6)$$

$$Y = (y_t, \dots \dots \dots, y_T), \qquad (K \times T) \text{ matrix}$$
$$B = (v, A_1, \dots \dots, A_P), \qquad \left(K \times (K_P + 1)\right) \text{ matrix}$$
$$Z_t = \begin{bmatrix} 1 \\ y_t \\ \vdots \\ y_{t-P+1} \end{bmatrix}, \qquad \left((K_P + 1) \times 1\right) \text{ matrix}$$
$$Z = (Z_0, \dots \dots, Z_{T-1}), \qquad \left((K_P + 1) \times T\right) \text{ matrix}$$
$$U = (u_1, \dots \dots, u_T), \qquad (K \times T) \text{ matrix}$$

Where $Y$ is the matrix with a $K \times T$ dimension containing observations of $y_t$ vector process with $t = 1,2, \dots . T$. In this matrix, time is placed on a column vector, and rows contain variables. $B$ is the coefficient matrix with the dimension $K \times (K_P + 1)$; the intercepts are placed in the first column. $Z$ is the matrix of regressor observations having dimension $(K_P + 1) \times T$; where the first row contains ones for intercepts. $U$ is the $K \times T$ matrix of errors (Kunst, 2007). Here $K$ stands for the number of variables, $T$ stands for time, and $p$ for pre-sample values for each variable.

OLS representation of the system in (6) is given as:

$$\hat{B} = YZ'(ZZ')^{-1} \qquad (7)$$

Nevertheless, because the estimated coefficients in the estimated VAR are less informative when interpreted in isolation, the Granger causality test—which is more informative on relationship and causality—followed. The post-estimation test followed, testing for the stability of VAR, which in other terms means stationarity in VAR (Kunst, 2007). The stability of VAR guarantees the results to be meaningful and to be used for inferences. Given the VAR(1) process as:

$$y_t = \nu + A_1 y_{t-1} + u_t \qquad (8)$$

Where $u_t$ is the white noise with mean $E(u_t) = 0$, and variance $var(u_t) = \sum_u$, which is not correlated over time. The process is assumed to be stable if all of the eigenvalues of $A_1$ have the modulus less than the unit. Using iterative substitution, the process continued, and generally the expression in (8) is given as:

$$y_t = \mu + \sum_{j=0}^{\infty} A_1^j u_{t-j}$$

Where $\mu = (I_K + A_1)^{-1}\nu$

In a matrix form, the eigenvalues of $A_1$ condition is given as:

$$\det(I_K - A_1 z) \neq 0 \text{ for } |z| \leq 1$$

For higher-order processes, VAR($p$), the condition for stability is given as:

$$\det(I_{KP} - \boldsymbol{A}z) \neq 0 \text{ for } |z| \leq 1 \qquad (9)$$

### *3.4 Data*

The study makes use of secondary time series data from the year 1970 to 2020. The main sources were the Bank of Tanzania (BoT), National Bureau of Statistics (NBS), and the Ministry of Finance and Planning (MoFP). The IMF, World Bank, Penn World Table, and International Financial Statistics were used to supplement missing information from the main sources.

## 4. Results and Discussion

### *4.1 Trends of Variables*

The analysis of trends in variables are shown in Figures 3–7.

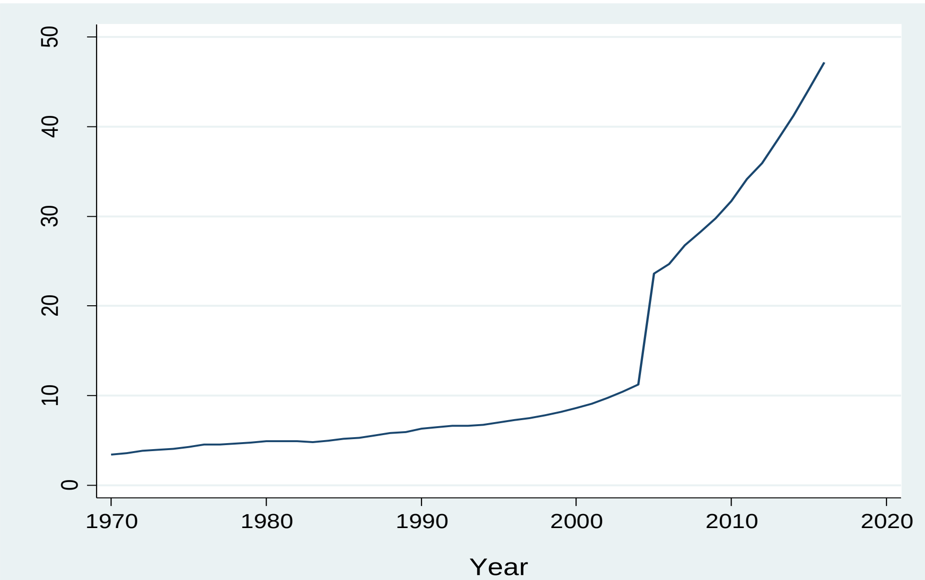


**Figure 3: Trends in Manufacturing Exports (TZStr)**

**Source**: Author's analysis based on World Bank Data, 2022

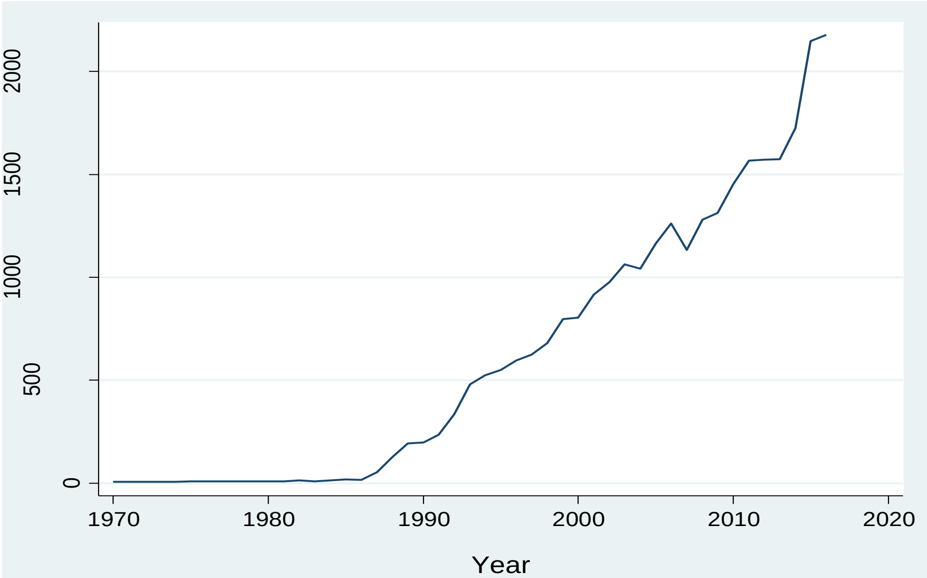


**Figure 4: Trends in Real GDP (TZStr)**
**Source**: Author's analysis based on World Bank Data, 2022

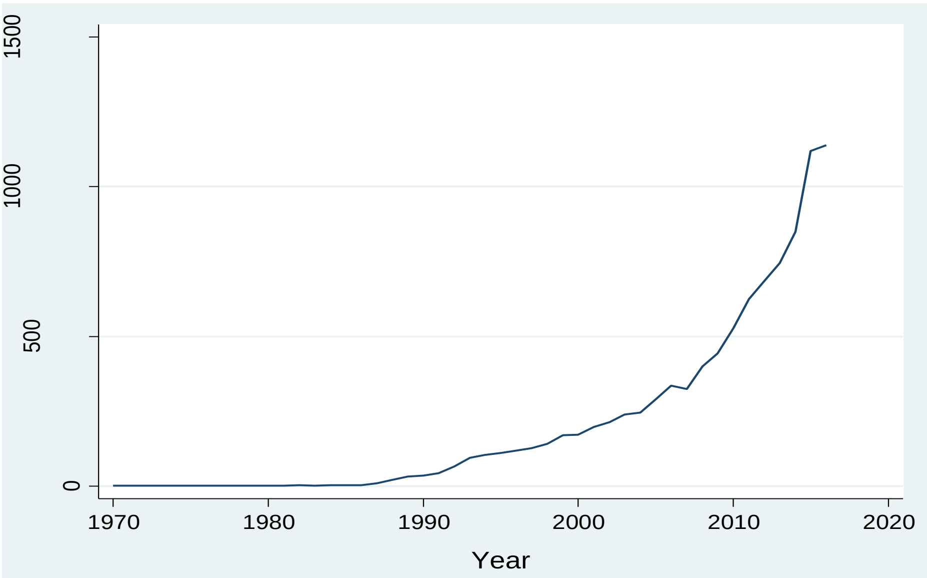


**Figure 5: Trends in Exchange Rate (TZS per One US Dollar)**
**Source**: Author's analysis based on World Bank Data, 2022

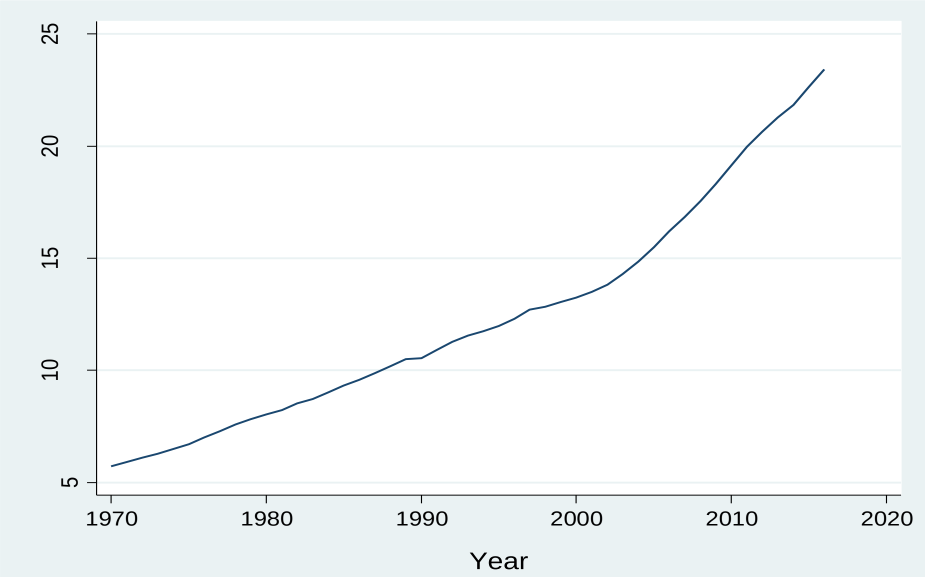


**Figure 6: Trends in Capital Stock (TZStr)**
**Source**: Author's analysis based on World Bank Data, 2022

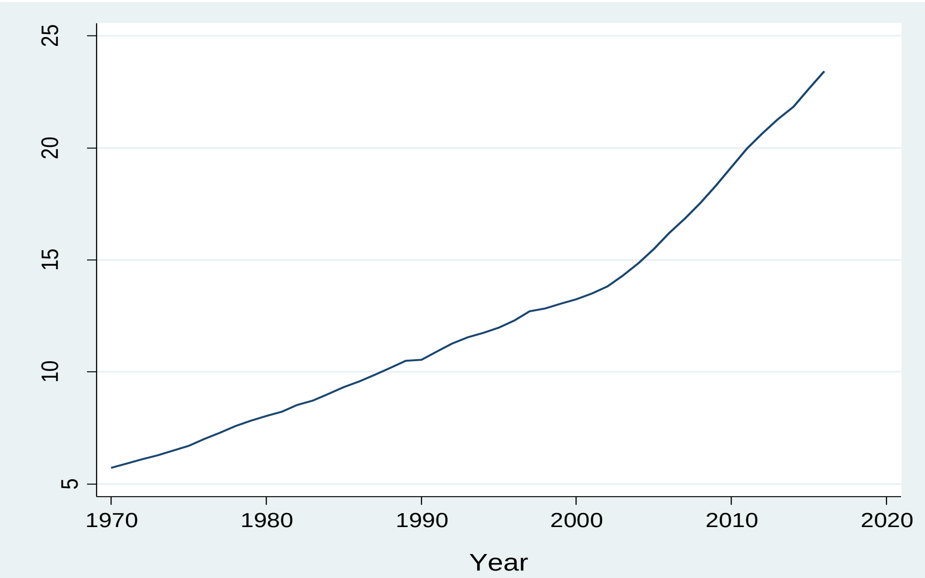


**Figure 7: Trends in Labour Force (Million persons)**
**Source**: Author's analysis based on World Bank Data, 2022

The trends for manufacturing exports, real GDP, capital stock, labour force and exchange rate have been increasing over time.

### *4.2 Relationship Between Growth in Manufacturing Exports and GDP Growth*

After taking care of the normality problem, the variables were transformed by using natural logarithms. A stationarity test was conducted for real GDP, capital stock, labour force, manufacturing exports and exchange rate variables. All were found not to be stationary at levels, but stationary at the first difference; which means they are integrated of order 1, as shown in Table 1.

**Table 1: Results for Unit Root Test**

| Augmented Dickey-Fuller | | | | | |
|---|---|---|---|---|---|
| At levels | | | After first difference | | |
| *Variable* | *Test Statistics* | *Critical Value 5%* | *Variable* | *Test Statistics* | *Critical Value 5%* |
| $lnGDP$ | -0.717 | -2.933 | $D.lnGDP$ | -4.841 *** | -2.936 |
| $lnMEXP$ | -0.194 | -2.933 | $D.lnMEXP$ | -5.931*** | -2.936 |
| $lnEXCH$ | -1.058 | -2.933 | $D.lnEXCH$ | -3.749*** | -2.936 |
| $lnLF$ | 0.995 | -2.933 | $D.lnLF$ | -3.245** | -2.936 |
| $lnKS$ | -1.114 | -2.933 | D.$lnKS$ | 4.559*** | -2.936 |

**Note:** *, ** and *** represent stationary at 10%, 5% and 1% significance levels, respectively.

**Source**: Author's analysis based on World Bank Data, 2022

The study also tested for cointegration of the variables. The decision on the maximum number of lags to included was made by using Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Hannan-Quinn Information Criterion (HQIC) and Schwarz Bayesian Information Criterion (SBIC). For this model, a maximum of one lag was suggested as shown in Table 2.

**Table 2: Lag Length Selection**

| Lag | LL | LR | Df | P | FPE | AIC | HQIC | SBIC |
|---|---|---|---|---|---|---|---|---|
| 0 | 10.9626 | 11.811 | 1 | 0.001 | 0.04747 | -0.21118 | -0.1223 | 0.025014 |
| 1 | 22.8116 | 23.698* | 1 | 0 | 0.029942 | -0.67284 | -.569142* | -.397281* |
| 2 | 24.0835 | 2.5438 | 1 | 0.111 | .029631* | -.684406* | -0.5659 | -0.36949 |
| 3 | 24.5319 | 0.8967 | 1 | 0.344 | 0.030378 | -0.66093 | -0.52761 | -0.30665 |
| 4 | 10.9626 | 11.811 | 1 | 0.001 | 0.04747 | -0.21118 | -0.1223 | 0.025014 |

**Note:** *Shows maximum lag suggested by Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Hannan-Quinn Information Criterion (HQIC) and Schwarz Bayesian Information Criterion (SBIC)

**Source**: Author's analysis based on World Bank Data, 2022

This was followed by an ARDL bound cointegration test, and the variables were found cointegrated. This is because the value of the F-statistic (6.041) was higher than the upper bound of F at both 5% and 10%, with values of 4.11 and 3.54, respectively. The same applied to the value of t-statistic (-4.507), which is greater than the upper bound of $t$ with values -4.442 and -4.033, respectively. Table 3 summarizes the results of the cointegration test.

**Table 3: ARDL Bound Test for Cointegration**

| **$H_0$: No level relationship** | | | | **F = 6.041**<br>**t = -4.507** | | |
|---|---|---|---|---|---|---|
| | **10%** | | **5%** | | **1%** | |
| | *I*(0) | *I*(1) | *I*(0) | *I*(1) | *I*(0) | *I*(1) |
| F | 2.315 | 3.54*** | 2.749 | 4.11*** | 3.76 | 5.423 |
| T | -2.539 | -4.033** | -2.881 | -4.442* | -3.57 | -5.256 |

**Note:** *, ** and *** represent level relationship at 10%, 5% and 1% significance levels, respectively.

**Source**: Author's analysis based on World Bank Data, 2022

Due to these results, the ARDL-ECM was used as the estimation method. The results for the estimated ARDL are shown in Table 4.

**Table 4: ARDL Error Correction Model Results**

| | $D.lnGDP_t$ | **Coefficient** | **Std. Error** | **t-value** | **P-value** | **95% Conf.** | **Interval** |
|---|---|---|---|---|---|---|---|
| **ADJ** | $lnGDP_{t-1}$ | -0.43093 | 0.174252 | -2.47 | 0.018** | -0.78311 | -0.07876 |
| **LR** | $lnMEXP_t$ | 0.11633 | 0.158562 | 1.83 | 0.067* | -0.10784 | 1.311291 |
| | $lnEXCH_t$ | 0.233881 | 0.146227 | 1.6 | 0.118 | -0.06166 | 0.529416 |
| | $lnLF_t$ | 0.198707 | 0.903107 | 0.22 | 0.827 | -1.62654 | 2.023955 |
| | $lnKS_t$ | 0.020974 | 0.042662 | 0.49 | 0.626 | -0.06525 | 0.107197 |
| | $Dummy$ | 0.511357 | 0.306655 | 1.87 | 0.079* | -0.10842 | 1.131129 |
| **SR** | $D.lnMEXP_t$ | -0.09169 | 0.063488 | -1.44 | 0.156 | -0.22 | 0.036625 |
| | $D.lnLF_t$ | 1.414751 | 3.467873 | 1.71 | 0.085* | -5.59408 | 8.423584 |
| | $Cons$ | 11.61035 | 4.24422 | 2.74 | 0.009*** | 3.032465 | 20.18824 |

**Notes:** No. of obs = 50; F (8, 41) = 39.10 [0.0000]; R-squared = 0.9790; *, ** and *** show the significance of the variables at 10%, 5% and 1%, respectively.
**Source**: Author's analysis based on World Bank Data, 2022

The results in Table 4 reveal that, in the short-run, there was no significant relationship between manufacturing exports and economic growth in Tanzania for a considered period. Nevertheless, labour force (D. $lnLF_t$) has a statistically significant influence on economic growth at 10% significance level as its $t$ probability value is 0.085. It has been found that a 1% increase in labour force in the country increases economic growth by 1.4%.

In the long-run, manufacturing exports significantly impact GDP growth. The variable is significant at 10% significance level, with a probability value of 0.067. A percentage increase in manufacturing exports increases economic growth by 0.12%. Indeed, the way the current performance in manufacturing exports is, may seem to have very little contribution to economic growth compared to other variables. However, what matters is that this contribution has a significant impact. The trade liberalization policy ($Dummy$) has significantly impacted Tanzania's economic growth since it was adopted in the 1980s. The variable is statistically significant at 10%, with a $t$ probability value of 0.079. The error-correcting term (ADJ $lnGDP_{t-1}$) is statically significant at 5%, with a $t$ probability value of 0.018.

The negative coefficient of this term means the system is adjusting from disequilibrium to equilibrium at the rate of 43%. The post-estimation tests revealed a further usefulness of the model as there was no problem of multicollinearity (mean VIF value is 2.095); no autocorrelation problem (Chi-square probability value of Breusch-Godfrey test is 0.0982); no omitted variables (F probability value of Ramsey test is 0.1287); and no heteroscedasticity problem (Chi-square probability value of Breusch-Pagan test is 0.132). $R^2$ for this model was also found to be 0.9790, which is considerable; and the probability of F-statistic, a test for overall significance, is 0.0000: meaning the overall model is significant. Nevertheless, the results support the hypothesis that growth in manufacturing exports positively determines economic growth in Tanzania. This is due to the positive significant coefficient for manufacturing exports found by the study.

### *4.3 Causality between Manufacturing Exports and GDP Growth*

The study performed a Granger causality test. Since a Granger causality test is a post-estimation analysis, the study first estimated the VAR model to determine the inter-correlation between the examined variables. The lag length included in this VAR model is 1, as was revealed by AIC, BIC and HQ in Table 5.

**Table 5: Lag Selection for Real GDP Growth and Manufacturing Exports VAR**

| Lag | LL | LR | Df | P | FPE | AIC | HQIC | SBIC |
|---|---|---|---|---|---|---|---|---|
| 0 | -128.542 | | | | 1.71694 | 6.21628 | 6.24661 | 6.29903 |
| 1 | -116.023 | 25.037* | 4 | 0 | 1.14496* | 5.81064* | 5.90163* | 6.05888* |
| 2 | -114.934 | 2.1787 | 4 | 0.703 | 1.31753 | 5.94924 | 6.10089 | 6.36297 |
| 3 | -112.416 | 5.0356 | 4 | 0.284 | 1.41956 | 6.01982 | 6.23213 | 6.59904 |
| 4 | -110.939 | 2.9547 | 4 | 0.565 | 1.61234 | 6.13995 | 6.41291 | 6.88466 |

**Note**: *Shows maximum lag suggested by the Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Hannan-Quinn Information Criterion (HQIC) and the Schwarz Bayesian Information Criterion (SBIC)

**Source**: Author's analysis based on World Bank Data, 2022

The growth rates used were calculated using original values of the variables, and not in the form of a logarithm, to avoid digging into the data; and for them to have meaningful interpretations. The results of the estimated VAR model are summarized in Table 6.

**Table 6: Estimated VAR model for Real GDP Growth and Manufacturing Exports**

| Explained Variable | Explanatory Variable | Coefficient | Std. Error | z-value | P(z)-value |
|---|---|---|---|---|---|
| $\boldsymbol{GDPgr}$ | $GDPgr_{t-1}$ | 0.38254 | 0.130087 | 2.94 | 0.003 |
| | $lnMEXP_{t-1}$ | 0.29642 | 0.100137 | 2.96 | 0.003*** |
| | *Constant* | -4.1718 | 2.106776 | -1.98 | 0.048 |
| $\boldsymbol{lnMEXP}$ | $GDPgr_{t-1}$ | 0.04707 | 0.032404 | 1.45 | 0.146 |
| | $lnMEXP_{t-1}$ | 0.97512 | 0.024943 | 39.09 | 0.000 |
| | *Constant* | 0.58675 | 0.524777 | 1.12 | 0.264 |

**Source**: Author's analysis based on World Bank Data, 2022

After estimation of VAR, there was a need to proceed with the Granger causality test to acquire information needed on causality in the relationships. Results of the Granger causality test are presented in Table 7.

**Table 7: Granger Causality Test Between Real GDP Growth and Manufacturing Exports**

| Equation | Excluded | Chi square | Degrees of Freedom | P-value |
|---|---|---|---|---|
| $\boldsymbol{GDPgr}$ | $lnMEXP$ | 8.7624 | 1 | 0.003*** |
| $\boldsymbol{GDPgr}$ | $ALL$ | 8.7624 | 1 | 0.003 |
| $\boldsymbol{lnMEXP}$ | $GDPgr$ | 2.1099 | 1 | 0.146 |
| $\boldsymbol{lnMEXP}$ | $ALL$ | 2.1099 | 1 | 0.146 |

**Source**: Author's analysis based on World Bank Data, 2022

As Table 7 shows, manufacturing exports ($lnMEXP$) were found to Granger-cause economic growth ($GDPgr$) in Tanzania. This information can be relied on since the VAR used to reach this causality test is stable, as shown in Figure 6. Economic growth, on the other hand, is seen not to Granger-cause manufacturing exports. It gives the notion that for Tanzania to have a vibrant and further sustainable economic success, improvements in manufacturing exports are inevitable. The results give the information that manufacturing exports is one of the priorities a country should consider to attain higher levels of economic growth. The observation of stability for the VAR model used to examine causality between manufacturing exports and economic growth is presented in Figure 8. In this figure, all the eigenvalues lie inside the unit circle. This means the VAR model is stable since it satisfies the stability condition. It also means that the results from this model are useful for inference.

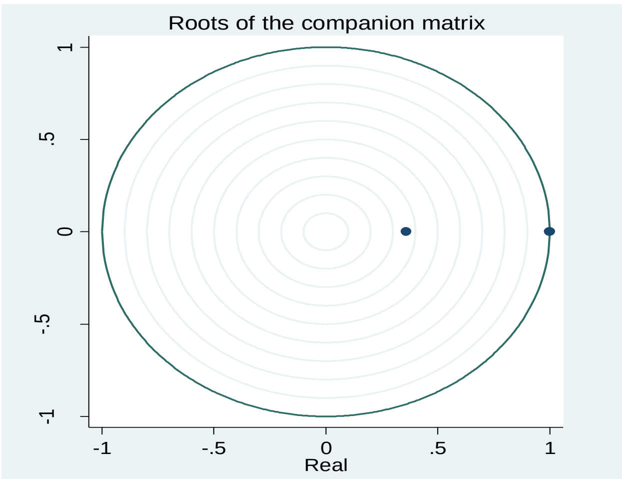


**Figure 8: Real GDP Growth and Manufacturing Exports VAR Stability**
**Source**: Author's analysis based on World Bank Data, 2022

These results do not support the hypothesis that there is a bi-directional relationship between manufacturing exports and the growth of Tanzania's economy that was put forward by this study. They show a single-direction relationship between manufacturing exports and economic growth, hence refuting what was hypothesized earlier.

## 5. Conclusion and Policy Recommendation

This study has found that the relationship between manufacturing exports and economic growth exists in the long-run. Also, manufacturing exports were found to cause economic growth in Tanzania. Thus, the study recommends that as Tanzania embarks on reviving the industrial sector, it should promote exports from the manufacturing sector. Furthermore, the government should put in place policies and strategies to strengthen markets for products from the manufacturing sector, and to enable firms to produce more quality products, enough to satisfy domestic, as well as external markets.

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