

Determinants of Tanzanian Exports in the Light of Gravity Model Results

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Abstract

Tanzania's exports are mainly based on unprocessed agricultural products and mineral resources, which is not beneficial and does not improve the international competitiveness of the country's economy. Proper identification of factors that provide opportunities for improving the situation in Tanzanian exports requires the construction of appropriate econometric models. This paper proposes the use of a gravity model of trade, as it allows for the inclusion of foreign trade flows in bilateral relations. This paper argues that in gravity models, foreign direct investment (FDI) inflow limits Tanzanian exports. Factors that have a significant and positive impact on Tanzania's exports are GDP of partner countries, GDP of Tanzania, imports of Tanzania, the common language and the colonial ties with partner trading countries. The results presented in the article allowed for the indication of the strengths and weaknesses of Tanzanian exports and the formulation of recommendations that may be useful for decision-makers in taking actions to improve the competitiveness of the Tanzanian economy.

Keywords

Export, gravity trade model, competitiveness of the economy, Tanzania

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INTRODUCTION

The share of Tanzanian exports of goods and services in GDP is 15%, which indicates its great importance for the country's economy. The bulk of Tanzania's exports are agricultural goods, including tobacco, coffee, cotton, cashews, tea and cloves. Additionally, Tanzania is also one of the region's leading exporters of gold and other mineral resources (including diamonds). The structure of Tanzania's exports corresponds to the profile of the country's economy, which is clearly agricultural in nature: the agricultural sector employs over 2/3 of workers, and its contribution to GDP is over 20%.³

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For comparison, Tanzania's manufacturing sector employs less than 3% of employees and generates approximately 10% of GDP (Mgangeluma et al., 2023; Epaphra, 2016). Tanzania's more important export destinations are India, Japan, China, the United Arab Emirates, the Netherlands, Germany and Switzerland.

It should be emphasized that Tanzania is also an importer of agricultural products, including cereals necessary to feed the population. For many years, Tanzania's foreign trade balance has been negative, which is due to slowly growing exports and much faster growing imports. The trade deficit negatively affects economic growth and employment in the country (Luhwago, et al., 2023; Epaphra, 2016). The weakness of Tanzania's exports is that they are based mainly on unprocessed products, which often have an inelastic demand, which results in the prices of products falling compared to processed goods also due to the lack of differentiation between producers. The solution to limiting the foreign trade deficit would be to increase the share of processed goods and services in exports, the prices of which are more stable. Moreover, the significant share of gold in Tanzanian exports makes the entire economy highly susceptible to fluctuations in the exchange rate of this raw material (Mahona and Mjema, 2014; Epaphra, 2016). Export restrictions are also influenced by the very poor transport and energy infrastructure in this country. Strict international sanitary and phytosanitary regulations also pose a significant limitation to the export of Tanzanian food (Luhwago et al., 2023).

This situation could improve because Tanzania's potential export opportunities, also in the agricultural market, are much greater, but the country would have to modify its agricultural production technology to improve its quality and efficiency. Increasing exports and overcoming Tanzania's negative trade balance, however, requires identifying the factors that act as determinants of Tanzanian exports and will allow them to be appropriately controlled. There are few studies on Tanzania's exports, and even fewer that use the gravity model of foreign trade (Mahona and Mjema, 2014). Meanwhile, this model allows for taking into account foreign trade flows in bilateral relations, which improves the reliability of the modeled relationships between macroeconomic variables. More often than gravity models, you can find ARIMA or VAR models, which, although they focus on predicting temporal trends in exports, do not sufficiently isolate structural connections between countries that are important in international trade (Kingu, 2014; Luhwago et al. 2023; Epaphra, 2016). Thus, this article attempts to bridge this methodological gap. The aim of the article is to build a gravity model of foreign trade for Tanzania. The results of the model will indicate important determinants of the country's contemporary foreign trade and may be useful for decision-makers responsible for shaping trade policy.

1 LITERATURE REVIEW

The issue of examining the determinants of exports is not new and has been addressed many times in scientific research. Many researchers point to the relationship between exports and GDP and the dynamics of its changes. The positive impact of GDP on exports is confirmed, among others, by: Kumar (1998) and Fugazza (2004). Researchers also emphasize that economic growth measures the sustainability of production levels, so it is a more reliable determinant of exports compared to GDP (Epaphra, 2016). Many works analyze the two-way dynamic relationship between exports and GDP using the Granger causality test (Ahdi et al., 2015). The results in this regard are not clear. In linear models, these relationships are often insignificant (Ahdi et al., 2015), and in the case of non-linear models, a one-way relationship from GDP to exports is generally shown (Hiemstra and Jones, 1994), and less often a two-way relationship is indicated (Diks and Panchenko, 2005).

Ahdi et al. (2015) using linear and non-linear Granger causality tests analyze the dynamic cause-and-effect relationship between economic growth and exports for South Africa over the period 1911–2011. The one-way relationship between the impact of economic growth on exports was confirmed by, for example, Abdul-Khaliq et al. (2014), Shan and Sun (1998).

Numerous studies also point to trade liberalization as a factor creating exports, especially in developing countries. It is not surprising that the abolition of customs barriers and quantitative restrictions on exports should stimulate exports. This is confirmed by numerous empirical studies (Joshi and Little 1996; Ahmed, 2000). In fact, in some studies, trade liberalization is considered a key factor in the development of exports (Santos-Paulino, 2002). But there are also studies that do not confirm such a clear relationship (Jenkins, 1996).

An obvious factor that directly affects the prices of goods sold abroad is the exchange rate (Nyeadi et al., 2014). The increase in the real exchange rate causes domestic products to become less competitive in terms of prices compared to foreign products. As a consequence, this may lead to a reduction of exports in terms of quantity (Yi Lu and Zhou, 2013). In addition, an increase in the exchange rate reduces exporters' profits, making exports less profitable, which may also contribute to reducing the volume of exports. Balogun (2007) showed that the impact of exchange rate policy on exports is not clear and depends on the country under study. In the case of Gambia and Nigeria, a positive and significant impact on export performance was confirmed, while the exchange rate did not significantly affect the export performance of Ghana and Guinea. In turn, in the case of Sierra Leone, the results indicate a negative and significant impact of currency devaluation on export performance. Mohamad et al. (2009) showed the existence of a strong and negative impact of real exchange rate appreciation in Indonesia, Singapore, Malaysia and Thailand on export performance. Johnson et al. (2007) showed that appreciation reduced exports and led to a decline in economic growth. Haddad and Pancaro (2010), and Eichengreen and Gupta (2013) proved that exchange rate depreciation could be treated as a tool to stimulate exports only in the short term. In turn, Aryal (2024), using dynamic relationships between time series for the Nepalese economy, did not confirm the existence of a long-term relationship between exports and the exchange rate.

Another determinant of exports considered in the literature on the subject is foreign direct investment (FDI). There are extensive economic theories that explain the mechanism of the connection between FDI and exports. Mention should be made of Mundell's theory (1957), the theory of comparative advantages (Kojima, 1973), or the theory of dynamic comparative advantages (Ozawa, 1992). Although, as a rule, FDI supports foreign trade, in certain circumstances these categories are substitutes. Therefore, there are both empirical studies that confirm the positive impact of FDI on exports (Caetano and Galego, 2007) and studies showing that the impact of FDI on foreign trade, depending on various conditions, may have a substitutive nature (Shun-Chiao, 2009). The negative impact of FDI on the exports of the Philippines, Indonesia, Malaysia and Thailand was shown by Sieng et al. (2020).

Inflation is also mentioned among the factors affecting exports, and economists generally agree that high inflation has a negative impact on export activities (Abidin and Sahlan, 2013; Sieng et al., 2020). Gylfason (1998), based on studies of 160 countries, showed that one of the factors responsible for the decline in exports is high inflation. Dexter et al. (2005) using the Granger causality test confirmed the existence of a two-way causal relationship between inflation and exports. Many analyzes of exports also point to imports as one of the determinants. Exports and imports usually remain in a long-term relationship, and their time series often show cointegration (Mukhtar and Rasheed, 2010). Mostly, the correlation between exports and imports is positive, Arize (2002), although there are also studies that do not confirm a significant relationship between these categories (Fountas and Wu, 1999). The long-term relationship between exports and imports was also not confirmed by Aryal's research (2024).

When discussing possible factors shaping exports, we cannot ignore the geographical distance between trading partners. This is one of the factors influencing transport costs, delivery time and transport risk. It is natural that the increase in the distance between trading partner countries increases the costs of exports, so it may lead to their reduction. There is an abundant evidence for this in empirical research (Rauch, 2016). Research on Tanzania's exports generally uses dynamic econometric VAR or VECM models (Kingu, 2014; Luhwago et al., 2023), and less frequently, gravity models of foreign trade (Mahona

and Mjema, 2014). It is worth paying attention to the research of Darku (2009), who built a gravity model for Tanzania's foreign trade with the aim of identifying the effects of regional integration. However, this model does not take into account many important variables that may determine Tanzanian exports. The literature search indicates that there is a lack of gravity models that would comprehensively describe Tanzania's trade with its main partners, taking into account the key macroeconomic factors shaping exports. Thus, a research niche appears, which this article tries to fill by proposing this type of model of the Tanzanian economy.

2 METHODOLOGY AND DATA

We used the form of gravity model as it has been introduced by Tinbergen (1962), assuming that the volume of foreign trade between countries Y_{ij} is proportional to the size of their economies ($X_i^{a_1}, X_j^{a_2}$) measured by GDP and is inversely proportional to a distance between the said countries ($d_{ij}^{a_3}$). The basic form of the gravity model of foreign trade referring to Newton's law of gravity is as follows:

$$Y_{ij} = \frac{a_0 X_i^{a_1} X_j^{a_2}}{d_{ij}^{a_3}}. \quad (1)$$

Tinbergen (1962) based his theory on a static empirical analysis of the trade flows of 18 developed countries. The author had already noticed a significant impact of trade agreements between countries on the volume of their exchange, therefore he extended the study by introducing additional dummy variables into the model, indicating participation in the British Commonwealth organization, membership in the Benelux, as well as the existence of a common border with a country that is an exchange partner. Formula (1) is adapted in this paper in an extended form to model Tanzania's exports. Based on literature studies, a set of macroeconomic variables was selected that could potentially affect Tanzanian exports, and then, using a backward stepwise regression model (backward elimination), a gradual selection of explanatory variables was made, discarding subsequent statistically insignificant variables. Ultimately, the following form of the gravity model was adopted:

$$EXP_{i,t} = \beta_0 \cdot GDP_{i,t}^{\beta_1} \cdot GDP_Tanz_t^{\beta_2} \cdot DIST_i^{\beta_3} \cdot FDI_{i,t}^{\beta_4} \cdot IMP_{i,t}^{\beta_5} \cdot e^{\beta_6 ComLang_i} \cdot e^{\beta_7 ComBorder_i} \cdot \beta_8 ColonialTies_i \cdot e^{\varepsilon_{i,t}} \quad t = 1, \dots, n, \quad (2)$$

where:

$EXP_{i,t}$ – volume of export from Tanzania in the year t to country i ,

$GDP_{i,t}$ – gross domestic product in country i (trade partner of Tanzania) and the year t ,

GDP_Tanz_t – gross domestic product in Tanzania in the year t ,

$DIST_i$ – distance between the capital cities of Tanzania and country i (trade partner of Tanzania), which is time invariant,

$FDI_{i,t}$ – cumulative volume of foreign direct investment from country i (trade partner of Tanzania) to Tanzania in the year t ,

$IMP_{i,t}$ – volume of Tanzania imports from country i (partner in the year t),

$ComLang_i$ – binary variable which is equal to 1 if Tanzania and the trading partner country i share a common language,

$ComBorder_i$ – binary variable which is equal to 1 if Tanzania borders the trading partner country i ,

$ColonialTies_i$ – binary variable which is equal to 1, if the country i has colonial ties with Tanzania,

$\beta_0, \beta_1, \beta_3, \beta_5, \beta_6, \beta_7, \beta_8$ – model parameters,

$\varepsilon_{i,t}$ – error term.

The above Formula (2) can be transformed to the linear equation as:

$$\ln EXP_{i,t} = \ln \beta_0 + \beta_1 \ln GDP_{i,t} + \beta_2 GDP_Tanz_t + \beta_3 \ln DIST_i + \beta_4 \ln FDI_{i,t} + \beta_5 \ln IMP_{i,t} + \beta_6 ComLang_i + \beta_7 ComBorder_i + \beta_8 ColonialTies_i + \varepsilon_{i,t} \quad t = 1, \dots, n. \quad (3)$$

The parameters of model (3) were estimated using the fixed effects estimator (FE) and the random effects estimator (RE). It should be noted that dummy variables, such as a common language or a common border, which are constant over time for a given pair of countries may be perfectly correlated with fixed effects, which means that with fixed effects the parameters of such variables are impossible to estimate (they are “absorbed” by fixed effects). Model 3 was estimated for Tanzania’s main foreign trade partner countries. These countries come from different continents namely Africa, Asia, Australia, Europe and North America. There are: Kenya, Uganda, South Africa, Mauritius, Zambia, China, India, Australia, United Kingdom, Netherlands, Switzerland, Sweden, Norway, France, Germany, Canada and United States. The selection of the countries depends on the significant volumes of trade and FDI inflows between these countries and Tanzania. The models were estimated based on data from the World Integrated Trade Solution (WITS) integrated database, which combines the data resources of the following organizations: The World Bank, United Nations Conference on Trade and Development (UNCTAD), International Trade Center, United Nations Statistical Division (UNSD) and the World Trade Organization (WTO).⁴ The calculations used data covering the years 1999–2022.

3 EMPIRICAL RESEARCH RESULTS AND DISCUSSION

For the estimation of models (3), the OLS estimator and panel data estimators: fixed effects (FE) and random effects (RE) were taken into account. The Wald test statistic of $F = 8.56114$ ($p < 0.05$) indicates that the use of the OLS estimator is not justified, because the intercepts in Formula (3) are different for individual objects (Tanzania’s trade partner countries). Finally, the results of model estimation using the FE and RE estimators will be presented (see Tables 1 and 2).

Table 1 Gravity model estimation results using the FE estimator for Tanzanian exports

Variables	Coef.	Std. err.	t-stat	p
const	3.7165	1.2443	2.9869	0.0030
LnGDP	0.4539	0.1202	3.7761	0.0002
LnGDP_Tanz	0.0698	0.0292	2.3876	0.0175
LnFDI	-0.2355	0.1024	-2.2990	0.0221
LnIMP	0.7805	0.0788	9.9068	0.0000
LnDIST	-	-	-	-
ComBorder	-	-	-	-
ComLang	-	-	-	-
ColonialTies	-	-	-	-

Source: Authors

⁴ <<https://wits.worldbank.org>>.

The coefficient of determination R^2 for model with fixed effects is equal to 61.67%, which proves that the model fits the empirical data quite well. F test is equal to 66.5692 ($p < 0.05$) so indicates that the model is statistically significant. Tanzania's exports are statistically significantly influenced by: GDP of trade partner countries, Tanzania's GDP, Tanzania's imports, and sharing borders. Tanzanian imports have the strongest impact on Tanzanian exports: their increase by 1% results in an increase in exports on average by approximately 0.78%, *ceteris paribus*. GDP of trade partner countries also has the significant and positive impact on Tanzanian exports: an increase in this variable by 1% results in an increase in the export of Tanzanian goods and services by approximately 0.45% *ceteris paribus*, while GDP in Tanzania has a weaker impact on exports, as its increase by 1% raises the value of exports by approximately 0.07% on average, *ceteris paribus*. Foreign direct investments located in Tanzania are substitutes for exports; an increase in FDI in Tanzania by 1% results in a decrease in the country's exports, on average, by approximately 0.24%, *ceteris paribus*.

The results of estimating the parameters of model (3) in the case using the RE estimators are presented in Table 2.

Table 2 Gravity model estimation results using the RE estimator for Tanzanian exports

Variables	Coef.	Std. err.	t-stat	p
const	1.1593	0.5279	2.1959	0.0288
LnGDP	0.8714	0.1686	5.1689	0.0000
LnGDP_Tanz	0.0785	0.0255	3.0770	0.0023
LnFDI	-0.2746	0.1280	-2.1449	0.0327
LnIMP	0.5414	0.0815	6.6395	0.0000
LnDIST	-2.4824	0.6207	-3.9992	0.0001
ComBorder	-0.1927	130.1670	-0.0015	0.9988
ComLang	0.0330	0.0160	2.0683	0.0394
ColonialTies	0.2297	0.0838	2.7423	0.0064

Source: Authors

In the model with random effects, the coefficient of determination R^2 is equal to 46.51% and $F = 35.9759$ ($p < 0.05$) indicates that the model is statistically significant. The way in which individual explanatory variables affect Tanzanian exports in models with FE and RE estimators is similar. In the RE model, significant export stimulators are the GDP of the trade partner countries, the GDP of Tanzania, imports, the common language and colonial ties of the countries, with the strongest positive impact on exports being the GDP of the partner countries: an increase in this variable by 1% results in an increase in exports by an average of approx. 0.87% *ceteris paribus*. The presence of colonial connections causes an increase in exports by approx. $(e^{0.2297} - 1) \cdot 100\% \approx 25.92\%$ FDI replaces Tanzania's exports: their increase by 1% reduces exports on average by approximately 0.27%, *ceteris paribus*. The *DIST* variable has the strongest negative impact on exports: its increase by 1% results in a decrease in exports on average by approximately 2.48%, *ceteris paribus*. To assess which of the FE or RE models is more appropriate for modeling Tanzania's exports, the Hausman test was used, the result of which was 9.58478 ($p = 0.048034$) indicating that the estimator in the gravity model used to describe the dependence of Tanzania's exports on other variables is FE estimator.

From results above we have seen there is a positive relationship between Tanzania export and GDP of trade partners. We were expected to get such relationship because Tanzania exports more raw materials such as cotton, coffee, tea, sisal, cloves, tobacco and cashew nuts. Those commodities are used to feed the partners' industries to produce GDP. The more the trade partners produce the more Tanzania exports for them. Tanzania exports also minerals such as gold, diamond, and gemstones such as Tanzanite. This non-traditional export strengthens trade between Tanzania and its partner countries. Tanzania imports more than exports from its partner countries. The relationship is also positive between export and import. Tanzania imports products such as chemicals and related products, machinery and transport equipment, animals and vegetable oils, fats & waxes and crude materials, inedible except fuels. We were expecting to get positive sign between export from Tanzania and import of Tanzania from its partner countries.

Distance is a proxy for cost due to transport charges which is incorporated in products. We were expecting to get negative relationship between export and distance. The two trade-resistance variables, tariff and distances, adversely affect trade flows between countries, so their coefficient is expected to be negative. With regard to the distance variable, for example, long distance between trading countries, *ceteris paribus*, leads to higher costs and lower profit margin to the importer. Long distance also leads to increased "Psychic distance" between trading countries. All these elements of distance will reduce trade flows between countries, Hansen and Rand (2014).

It is widely recognized that trade and FDI are vital factors of the economic growth process. Past empirical studies such as Balasubramanyam et al. (1999) have mostly concluded that both FDI inflows and trade promote economic growth. However, there are clear indications that the growth enhancing effects from FDI and trade vary from country to country. In some country FDI and trade can even negatively affect the growth process. The growth enhancing effect of FDI and trade interaction is not automatic but depends on various country specific factors such as the trade openness. In this study unfortunately the relationship between trade and FDI is negative. Other hypotheses such as unbalanced distribution of FDI in favor of mining sub-sector and construction industry can also be considered. From this results require profound study to investigate the reasons of this negative relationship.

CONCLUSIONS

Exports goods and services are an important element of Tanzania's economy. The income obtained from exports allows to finance imports and the internal needs of the economy. This paper argues that in gravity models, FDI inflow limits Tanzanian exports. Factors that have a significant and positive impact on Tanzania's exports are GDP of partner countries, GDP of Tanzania, imports of Tanzania, the common language and colonial ties with partner trading countries. Despite the identified negative impact of FDI on exports, it can be expected that adequate saturation of the market with foreign investments will also make them more pro-export, because they will improve production efficiency and strengthen the economies of scale, which will not only improve supply on the internal market but also increase the competitiveness of exported goods and services in the future. Therefore, it is important for the Tanzanian government to gradually introduce further tax, legal and institutional facilitations and incentives for potential foreign investors. In the interim, the situation in Tanzania's exports may be improved by the government's creation of a broader package of tools to strengthen the position of companies exporting goods and services (an appropriate certification system, appropriate promotional activities, guarantees and insurance of export credits, diplomatic activities). Long-term improvement of the competitiveness of Tanzanian exports also requires modernization of the country's communication infrastructure (expansion of railway lines, sea ports, power lines), increasing the share of processed goods in the export structure (it is more advantageous to export processed products than raw materials in their original state), increasing attention to the quality of agricultural products intended for export, so that they better meet international phytosanitary standards. Tanzania's export competitiveness can also be improved

by developing its human resources employed in agriculture, industry, and services, the sectors that provide export products. Qualified, aware staff facilitates more efficient and qualitatively better production. This effect can be achieved through further improvement of education, investments in vocational education, as well as supporting innovation and technology transfer.

The gravity model used here is one of the most effective tools for analyzing international trade, which has been confirmed by research by other authors. However, one must bear in mind its limitations, such as the inability to determine the direction of causality of variables, rigid assumptions as to the constancy of variables over time, which may not reflect dynamic changes in trade, such as technological changes or changes in trade policy, omission of some qualitative factors, such as value chains, economic crises, etc. This opens the way to further in-depth research on Tanzania's exports also using other econometric models.

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