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Determining Economic Growth with Trade Flow Analytics

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Abstract - This paper seeks to examine studies that have been conducted mainly in the period of 2015 to 2017 with regards to the analysis of trade flows in understanding their relationship with economic growth. Most studies examined causality relationships and employed co-integration tests and the Augmented Dickney-Fuller (ADF) model. The studies provided evidence that a relationship existed between trade flows and economic growth and this relationship was either bidirectional or unidirectional and existed both in the short-run and long-run depending on other factors other than trade flows. Other studies sought to compare statistical methods to determine which model produced statistically significant results in explaining and predicting trade flows with regards to economic growth.

Index Terms – Trade flow analytics, Economic growth, Gross Domestic Product (GDP)

1. Introduction

Of the many indicators needed for a country to achieve potent economic growth, trade flows are one of those indicators that cannot be ignored. Trade flows refer to the buying and selling of goods from one country to another. Trade flows measure the balance of trade which is simply the exports minus the imports of goods and services. Trade flows play a major role in in influencing the growth of a country. If suppose a country is a major exporter of certain goods, the demand for that country's currency hence increasing the currency's value and in turn a rise in economic growth. With the importance of trade flows been put to light, this paper seeks to investigate studies that have been conducted on the analysis of trade flows i.e. exports and imsport. Quite a substantial amount of studies has been done with regards to analytics on trade flows in

the region and most of these studies have used traditional statistical methods in their analysis. These studies have analysed exports or imports separately and sometimes collectively. The sole purpose of these analysis has been to determine the relationship between trade flows and at times Gross Domestic Product (GDP) with regards economic growth.

2. Materials, Methods and Discussion

With trade being one of the important indicators of economic growth as discussed above, many studies have devoted time to determining the relationship that exists between trade flows and economic growth. Tapsin (2015) conducted a study to ascertain what kind of relationship existed between foreign trade and economic growth in Turkey. To achieve this objective, the Augmented Dickney-Fuller (ADF) and unit root test were performed. The results showed that export and GDP had a bidirectional causality relationship while imports and GDP had a unidirectional causality relationship. The study finally concluded that imports and exports are important factors to consider when one seeks to measure economic growth in Turkey because the variables share a positive and significant relationship. Similarly, Ucan et al. (2016) conducted a study to determine the relationship between exports and economic growth in Turkey. The results from this study were similar to the ones found by Tapsin (2015) though the only notable difference was relationship between exports and GDP had a unidirectional causality relationship. The two results were not consistent because Tapsin (2015) had not considered other factors in the model like exchange rates which could affect trade flows but were considered in the study by Ucan et al. (2016).

Saaed & Hussain (2015) main hypothesis was to test for causality and co-integration between GDP, exports and imports in Tunisia. To test this hypothesis, Tunis annual data from the year 1977 to 2012 with GDP, imports and exports as the attributes was used. The Vector Error Correction Model (VECM) framework which employs the Granger-causality test was used. The study results showed that imports, exports and GDP have a unidirectional causality with imports being the major source of economic growth in Tunisia. The results further showed that imports increased economic growth in the long-run whilst exports did not. The models or techniques used for analysis in this study were traditional methods which have their own drawbacks. Like many traditional statistical analytics, the methods used in this study employed a lot of assumptions. The ADF procedure which was used to test for integration assumes that the error term of Autoregressive (p) process to be white noise which is a less strong assumption than Gaussian noise stationarity. Running the procedure under this assumption is erroneous and leads to less reliable results. Another study conducted in India by Mehta (2015) also primarily focused on testing for causality and co-integration among exports, imports and GDP. Here, time series data from the year 1976 to 2014 was used and the ADF procedure was implemented to test for causality while the VECM was used to test for co-integration.

The results showed that for the ADF to be implemented, the data had to be differenced at least once to attain stationarity. Once the data was stationary, further tests were conducted and it was found that long term GDP lead to increased exports but exports did not lead to a better GDP. It was also found that no causality exists between GDP and imports which implied that GDP does not lead to imports and imports do not lead to a greater GDP.

Similarly, Albiman & Suleiman (2016) conducted a study to determine if a relationship existed among exports, imports and domestic investment. This study used annual time series data from the year 1967 to 2010 for Malaysia and the VECM framework was used to test for causality and co-integration. Unlike the two studies discussed above, Saeed et al. (2015) & Mehta (2015), this study introduced capital formation into the analysis and the results differed in such a way that capital formation affected exports in the long-run while it affected imports in the short-run in determining the levels of domestic growth in Malaysia. Another study conducted by Altaee et al. (2016) to determine the effects of trade flows on economic growth in the Kingdom of Saudi Arabia showed that a fixed capital formation affected imports and exports in both the short-run and long-run. On the other hand, the study results also showed that financial development affected economic growth negatively in the short-run while turning out to have a positive impact in the long-run.

Bakari & Mabrouki (2017) sought to investigate the relationship between exports, imports and economic growth in Panama. Data ranging from 1980 to 2015 was tested for co-integration using the Vector Auto Regressive (VAR) Model and for causality using the Granger-Causality tests. A few adjustments were made to the analysis like the introduction of a second test called the Phillips Perron (PP) test to validate the results produced by the Granger-Causality tests. Another alteration was the introduction of the augmented function which was the aggregate production function of exports and imports expressed in logarithms. The study results from the VAR model showed that there was an absence of co-integration among exports and economic growth in Panama. This indicated that exports had no effect on the economic growth of Panama. On the other hand, a bidirectional causality existed among the variables imports and economic growth, hence imports were seen as a source of economic growth in Panama. With the same model and techniques used in the analysis of Panama trade flows conducted by Bakari & Mabrouki (2017), this time, Bakari (2017), used Germany annual data ranging from 1985 to 2015. In this study, one alteration was made, and this was the differencing of the export and imports data by using logarithms in order to make the model stationary before testing for causality and co-integration. The results were similar to the ones found in the Panama study though the only difference was that this study found a unidirectional causality between exports and imports. These results still provided evidence that exports and imports where a source of economic growth in Germany. A unidirectional causality between exports and imports was also found in another study and the results proved that

exports and imports were a major source of economic growth in Pakistan, Raza & Ying (2017).

Bakari (2016), again conducted an empirical study using Egypt annual data ranging from 1965 to 2015 to ascertain the relationship between exports, imports and economic growth. He used the VAR to test for co-integration and the Granger-Causality tests to test for causality. In this study, the variable domestic investment was introduced in the analysis to test against each of the three variables export, import and economic growth. The results showed that the introduction of domestic investment in the analysis significantly affected each variable differently. The co-integration results provided evidence that domestic investment, import and exports had no effect on economic growth while the causality results indicated that imports and domestic investment had a significant effect on the economic growth in Egypt. With Libya being one of the major exporters of petroleum in the world, Abdulhakim & Tarek (2016) conducted a study to determine the relationship between Foreign Direct Investment (FDI) and economic growth in Libya. This study focused solely on how foreign investments affect petroleum exports in relation to economic growth. Note that imports were not considered in this study. Annual export data ranging from 1992 to 2010 was gathered and the VAR model was used in the testing of this data to achieve the desired objectives of the study. Co-integration and causality between the variables was tested in this study. The results indicated that a long-term relationship existed between FDI and petroleum exports. The other results also showed that a unidirectional causality existed between FDI and petroleum exports. Though, it should be noted that one of the results provided evidence that there was no significant relationship between FDI and economic growth. This result was different from one of the deliverables of this study for it was expected that a significant relationship would exist between FDI and economic growth. One could assume that this output was a result of the researchers not controlling or putting into consideration other factors that could affect FDI like tax rate, wage rate, exchange rate, political situation to mention but a few.

In addition to analysis on exports, Verter & Becvarova (2016) conducted an analysis to determine the impact of agricultural exports on economic growth in Nigeria. Granger Causality, Odinary Least Square (OLS) regression, Impulse Response Function (IRF) and Variance Decomposition analysis were the statistical techniques employed in this study whilst considering annual time series data ranging from 1980 to 2012. Since the data was a time series data, ADF and unit tests were additional tests which were run to make the data stationary and this was achieved after the first difference. The results from the IRF where not constant thus showing a fluctuation of an upward and backward shock of agriculture exports in relation to economic growth. A shock to agricultural exports affecting economic growth was also seen in the results from the Variance Decomposition analysis. Both results from the OLS and the Granger Causality tests provided evidence that agricultural exports did lead to economic growth in Nigeria. Nevertheless, these results contradicted to the previous works done by Ojide et al. (2014) who conducted a

study to evaluate the impact on non-oil exports on economic growth in Nigeria. By performing the Autoregressive Distributed Lag (ARDL) model and co-integration tests on annual time series data ranging from 1970 to 2011, the study found that an inverse relationship existed between non-oil exports and economic growth. This difference between the results of the two studies can be attributed to the trade deficit in agricultural products which Nigeria which has incurred for the past six years. At the time Ojide et al. (2014) conducted the study, Nigeria Imported more goods than it exported hence the value for Nigerian currency was not high and this affected its exchange rate and in return resulting in an inverse relationship between non-oil exports and economic growth.

With exports playing an important role in influencing Uganda's economic growth, Karamuriro & Karukuza (2015) conducted a study to determine if the influence on economic growth by exports was statistically significant using the Gravity Model analysis. Since Uganda is a member state in the international organisations Common Market for Eastern and Southern Africa (COMESA) and East African Community (EAC), the two organisations were added to the model as dummy variables to determine if a significant relationship existed between Uganda's exports and its affiliation to these organisations. Other variables included in the model were exchange rate and common language. Annual panel data ranging from 1980 to 2012 was used. Since the data was of time series nature, the ADF test had to be conducted first in order to test for stationarity before any other analysis could be done. The data was found to be stationary after the second difference. The results of this study showed that exports had a statistically significant effect on economic growth. The variable common language as well showed a statistically significant effect on the exports. This meant that exporting goods from Swahili speaking countries like Kenya and Tanzania had a major effect on Uganda's economy. The results further showed that Uganda's affiliation to the two international organisations had a significant positive effect on the exports because the two organisations provided intra-trade among member states which came with prized benefits such as reduced tax rates. Another study to determine Egypt's intra-trade intensity with COMESA member states was conducted by Elmorsy (2015). The study objective was to determine which variables play a major role in promoting trade in Egypt with relation to COMESA member states. To achieve the objective, the Gravity Model analysis was employed and data from 2005 to 2011 regarding COMESA total imports, Egypt's total exports and world total exports was used. The results gave evidence that intra-trade agreement among COMESA member states contributed to the economic growth in Egypt. Nevertheless, a few obstacles such as political, social and infra-structural issues were also identified as potential threats that would affect trade flows negatively in the long-run. Alkhateeb et al. (2016) further conducted a study on Egypt's intra-trade agreements and their effects on agricultural trade flows. The study results were similar to the ones achieved by Elmorsy (2015) but added that population size and exchange rate also had a significant contribution on economic growth in Egypt.

Additionally, Abedini & Darabi (2015) conducted a study in which they examined the relationship between GDP, exports, imports, inflation and insurance and how all these variables affect economic growth. This study used annual data ranging from 2003 to 20111 and focused only on Organization of Petroleum Exporting Countries (OPEC) member states. The regression analysis was the statistical technique used in achieving the desired objective of this study. The results indicated that all the variables in the study had a positive and significant relationship with each other and thus implied that whsen productivity increases, insurance would increase too and that lead to a rise in economic growth. Similarly, Belke et al. (2014) sought to determine the relationship between exports and domestic demand in six European countries which are part of the European Union. A smoothing transition regression model was the main statistical technique used but other models were also employed like the sunk-cost model used in capturing non-linear hysteresis dynamics and the unit root tests to test for stationarity. The data was sourced from national statistical offices of each of the six countries in the study ranging from 1980 to 2012. The results from the smooth transition regression provided evidence that domestic demand is a necessity in the short-run to improving exports. The results further indicated that the non-linear relationship between domestic trade and exports was extreme during some stages of the business cycle. This indicated that paying sunk costs for shifting sales would give rise to the performance of the export market in the long-run and would still remain high even in an economic turmoil.

Not all trade analysis studies have been based on determining the relationship between trade flows and economic growth. Some of the studies have been based on analysing and comparing models to determine which one is better at achieving the desired objectives or testing how effective a statistical technique can perform at analysing trade flows. Milad et al. (2015) conducted a study to determine which model was better in forecasting Malaysia's imports of crude material by comparing two composite models. The first composite model was one with regression processing whilst the second model was one without regression processing. Data ranging from 1991 to 2013 was used and unit root tests were performed on the dataset to make it stationary. The results indicated that the model with regression processing outperformed the model without regression processing. The model with regression processing was able to reduce forecasting errors better than the other model. This is because the model with a regression process had a lower percentage of U-statistics which meant that it provided a best fit with highly significant p-values than the other model. Additionally, Kompas & Che (2016) conducted a study to determine if the structural and stochastic optimal model was significant in forecasting imports and exports of liquefied natural gas (LNG) in Asia-Pacific. The results from this study indicated that LNG exports in Asia-Pacific would increase by 90% in a period of 15 years starting from 2015 onwards. The results also projected an increase in LNG demand that would in turn increase imports of LNG within Asia-Pacific. Therefore, the study provided evidence that the structural and stochastic optimal model was reliable in forecasting trade flows. Similarly, Mladenovic et al. (2016)

conducted a study to determine which Artificial Neural Network (ANN) algorithm between Extreme Learning Machine (ELM) and the Back Propagation (BP) was more accurate in predicting GDP based on trade flows. Data from 28 European countries acquired from EUROSTAT was used in this study. The results showed that the ELM algorithm outperformed the BP in prediction accuracy and it had very small number of underestimated values as compared to the BP algorithm.

3. Conclusions

The studies have shown that trade flows can be used in determining economic growth in the short-run and long-run. When it comes to modelling, causality and stationarity tests should be the very first tests one should undertake when analysing trade flows for the data is of time series nature. This helps in the reduction of errors and provides very reliable results. It is very important to also take note that other variables like exchange rate, domestic investments, sunk costs etc. should be considered when modelling for they tend to affect trade flows differently hence omitting them would lead to erroneous results that would not be generalizable. It was also noted from some of the studies that affiliating to international organisations proves helpful for the intra-trade agreements tend to improve economic growth for affiliated countries by providing certain incentives like reduced tax rates. It can be further noted that not many works have been done where big data analytics and the use of machine learning algorithms is incorporated. Future studies would do well to venture in that direction in order to describe, predict or prescribe trade flows with a much greater accuracy and minimised errors.

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