Journal of Economics and Sustainable Development
ISSN 2222-1700 (Paper) ISSN 2222-2855 (Online)
Vol.11, No.10, 2020

Analysis of the Relationship Between Trade Openness and Economic Growth in the Caribbean: A Case Study of the 3B2GD Countries

Arnetia McIntosh[1] Zhang Songyan[1] Ngozi Helen Oguchi[2*]
1.Zhejiang University of Science and Technology, School of Economics and Management, Hangzhou 310023, Zhejiang, China
2.Central South University of Forestry and Technology, School of Business Management Changsha, Hunan, China

Abstract
In recent times, small island countries in the Caribbean region have been fully devoted to the consolidation and development of both regional and international investments and trade corporations. Likewise, tremendous economic growth has also been witnessed in some of these trade collaborating countries. Thus, it is essential that the effect of the recent boost of economy in the region is empirically analyzed in order to ascertain if this is a product of the recent openness to trade in the region. Therefore, in this study, we applied the Autoregressive Distributed Lag (ARDL) bounds test of cointegration and the Granger causality tests in order to empirically investigate the dynamic relationship between trade openness and economic growth in the Bahamas, Barbados, Belize, Guyana, Grenada and Dominica (3B2GD) for the period from 2000 to 2019. The empirical results show that trade openness has significant effect on economic growth as there exist a long run relationship between trade openness and economic growth. Also, the results of the bounds test of cointegration confirms that in the 3B2GB economies, there is an existence of a bi-directional causality from trade openness to economic growth. Similarly, an evidence of uni-directional causality between trade openness and output growth is observed from the investigation, mostly with regards to Guyana. To further examine the long- and short-run coefficients, we analyzed the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squared residuals (CUSUMQ) plots for the respective 3B2GD economies. The results of the residual plots show that the parameters of the estimated ARDL models are stable.
Keywords - Trade openness, ARDL, economic growth, cointegration, CUSUM, Granger causality.
DOI: 10.7176/JESD/11-10-02
Publication date: May 31st 2020

1. Introduction

According to recent studies, there have been a lot of contention on whether trade related performance has any significant influence on economic growth. Several authors, like, Karras (2003), Kim et al. (2012) and Munir, Kiani, Khan and Jamal (2013) are of the opinions that trade openness has a positive and significant impact on long-run economic growth. Their opinion conforms with the proposals of different endogenous growth studies. On the other hand, some other studies like Fenira (2015) and Rigobon and Rodrik (2005) revealed that trade openness has a negative or no significant impact on economic growth. Sufficiently, it has been proven that trade openness is and essential determinant for an effective and vibrant economy. It enables production across boundaries, which results in industrious advances and fast-tracks the growth of economies.

With the realization of financial liberalization standards in the 1980s, many developing economies began gaining from trade openness after. However, the study of Tornell et al. (2003) show that in general, developing economies earlier began implementation of policies of liberalization with trade liberalization before experiencing an outcome of financial liberalization. During this period, different strategies which enhance export promotion through trade liberalization brought motivations for the allocation of resources domestically and for the production of resourceful output. On the long run, these strategies resulted in an increased productivity and enhancement in trade related activities, leading to the establishment of more industries with relative economic advantages. Likewise, in an export-oriented economy, enhanced allocation of resource results in an improved innovations and output. On the overall, trade openness has become a vital tool towards the promotion of economic structural changes. However, the causality which exists between trade openness and growth of economies needs to be extensively investigated. Thus far, export to growth causality is represented as export-led growth (ELG) hypothesis, that is, a scenario where the expansion of export fast-tracks the growth of an economy by producing positive externalities through enhanced production systems, competition, specialization, efficient resources allocation and management, economies of scale, and also affords foreign exchange to enhance import of capital and conventional goods. Sequentially, this results in an increase of capital establishment and domestic productivity. On the other hand, another causality which exists from economic growth to openness, can be referred as the growth-led export hypothesis Edwards (1998). Generally, it is believed that with an increase in domestic productivity, cost of

production will be diminishing per unit which would result in an increased competitiveness of global export. However, in an open economy, if domestic demand of intermediate goods is less than the quantity of domestic production then, greater international trade will be observed. This will result in internally generated growth, Hye, (2012).

Generally, trade openness is considered as the ratio of the sum of exports and imports to gross domestic product (GDP). In an empirical measurement, GDP is employed as a proxy representation of internationally oriented capital, information and ideas, labor and exchanging goods and services. For instance, the recent research of Gräbner et al. (2018) illustrated trade openness as an effective outward-orientation measurement. Also, it is important to note that higher levels of trade openness correlate with higher levels of international financial markets integration.

Theoretically, different studies have proposed numerous channels by which an improved openness to trade can result in an increased rate of economic growth. Primarily, revenues generated from export forms the basis for foreign exchange, which is very important when internally generated and domestic savings are insufficient for importation of intermediate capital goods. Next, economic growth might also be triggered through export growth with respect to the increase of the vibrant market capacity, which introduces considerable scale of economies that fast-track the rate of capital creation and technical transformation. Also, in order to ensure advanced economic growth, policies based on outward-orientation are projected. These policies might result in an increment in the overall efficiency and output of an economy owing to spillovers of productivity that stem from the importation of quality technologies or by attracting foreign direct investment (FDI). In the study of Hye (2015), the latter factors are summarized as the efficient allocation of scarce resources, effects of technology spillover from developed to developing countries, and effects of learning by doing which signifies a relationship between imitation and innovation.

Based on the submissions of Chang et al. (2009) that the causal relationships that exists between economic growth and trade openness might vary according to the changes in a country's economic structure, this study therefore considers the empirical understanding of the trade-growth for different economic structures that have been witnessed in the 3B2GD countries of the Caribbean with respect to the selected time series data. Thus, the contributions of this study are as follows. First, in contrast to previous investigation that concentrated on specific country in examining the hypothesis, a homogeneous cross-sectional hypothesis is employed in this study in order to investigate the relationship between trade openness and economic growth in the 3B2GD countries of the Caribbean. This approach supersedes the earlier analysis that are based on single-country because the panel data regression methods applied in this study enforces cross-sectional homogeneity on coefficients. Bearing this in mind, the results are anticipated to imply to other developing economies, because, notwithstanding the fact that the economies of these developing countries does not operate at the same level of growth or integration into the global economy system, trade openness does not have much difference with countries. Additionally, the outstanding distinguishing part of this research is that we employed extra explanatory variables like, FDI, labour and capital into the econometric model through the utilization of the ARDL bounds test to cointegration.

The rest of the article is structured as follows: Section 2 presents a detailed review of previous literatures on trade openness and economic growth. In section 3, the research methodology, dataset and variable and model specification is analyzed. Section 4 presents the evaluation metrics and empirical analysis, while section 5 presents the conclusion of findings, recommendations and proposed future work.

2. Literature Review

The relationship between trade openness and economic growth have been extensively investigated both theoretically and empirically by several studies. Although the results of the studies may vary from different authors perspective, the studies are opulently documented on both the theoretical and empirical basis.

On the theoretical perspective, one of the earliest economic theory which concerns trade openness and economic growth is the Heckscher-Ohlin theory as presented by (Heckscher, 1919 & Ohlin, 1933). Their studies argued that for two or more countries to experience smooth transaction based on trade (import and export), the countries must be operating on the same frequency level with respect to constant returns to scale, technology, and a specified factor-intensity relationship between final products. To this effect, the country that has an advantage of better factor endowment over the others should venture into large scale production of commodities. These commodities should in turn be traded with the trade-partner countries and thereby economic growth is assured and boasted.

In recent times, several other authors such as Zarra-Nezhad, Hosseinpour, and Arman (2014) and Nduka et al. (2013) argued that in order for a country to experience rich and stable economic boost, the rate of exports should be considered more than import. Their research suggested that domestically based industry should be protected from import competition for improved economic growth.

From a classical economic standpoint, several authors are of the opinion that it is impossible for any country to maintain stable, positive and steady trade balance, indefinitely, (Keho, 2017 and Olasode et al., 2015). They

further suggested that in order to achieve a consistent trade balance, countries productivity should give more attention to export supplies with minimal cost advantages, meanwhile, that same country should import more of high cost disadvantaged supplies. The summary of their research states that involvement in foreign trade can contribute to a vibrant and positive growth of a country's economy.

On the other hand, several authors applied different variables in order to empirically established different arguments on the relationship between trade openness and economic. The result of the empirical study of Levine and Renelt, (1992), indicates that economic growth is a product of trade openness through foreign direct investments (FDI). It emphasized that trade liberalization paves way for investment of goods and offers motivations for FDI, resulting to a rapid long-run economic growth. In the works of (Bahmani-Oskooee and Niroomand, 1999; Frankel and Romer, 1999; Karras, 2003; Yanikkaya, 2003; Dollar and Kraay, 2004; Wang, Liu, and Wei, 2004; Freund and Bolaky, 2008; Das and Paul, 2011; Marelli and Signorelli, 2011; ZarraNezhad, Hosseinpour, and Arman, 2014; and Nowbutsing, 2014), a positive impact of trade openness on economic growth is confirmed. Contrarily, Vamvakidis, (2002) and Ulaşan, (2015) failed to establish an upholding prove for the hypothesis of the trade-led growth which they studied. Rigobon and Rodrik (2005) established that trade has significant negative impact of on income levels. While Fenira (2015) studied and observed a feeble relationship between trade openness and economic growth.

The investigation of Rassekh (2007) employed trade-growth relationship for 150 countries. The result of his investigation indicates that lower income developing economies has a lot to benefit from international trade as compared to higher income economies. Chang et al., (2009) studied 82 countries and established an existence of a positive relationship between trade openness and economic growth. Using the instrument-variable threshold regression method, Kim and Lin (2009) studied trade and economic performance for 61 countries. Their study observed an income threshold level above which larger trade increases the rate of economic growth. However, at a below threshold level, trade openness has negative and deteriorating effects on economic growth. The causal relationship investigated by Afzal and Hussain (2010) found no nexus between imports and growth likewise between exports and economic growth in Pakistan. However, in a later study, Klasra (2011) and Shahbaz (2012) challenged this finding as their results upheld the trade-led growth hypothesis for Pakistan.

Using five different openness indicators, Dufrenot et al., (2010) established the existence of a significant and positive relationship between openness and growth for the period between 1970 to 1989. Statistically, the conclusion of their study presented that the index of openness and rate of growth for GDP per capita displayed significant positive relationship. Harrison, (1996) employed the use of panel data approach in studying the effect of trade openness on economic growth. The result observed a bi-directional causality nexus between trade openness and economic growth. Due to frail theoretical basis, unsuitable econometric methods and poor quality of database, the research of Srinivasan and Bhagwati, (1999) rejected a cross-country regression methodology. Their investigation also contended that the validity of the findings of Rodriguez and Rodrik, (2001) was only for the normal Solow model but not for the Harrod-Domar model. The research preferred export promotion approach against import exchange approach, which according to their conclusion will diminish social returns and create social loss.

Furthermore, several authors (such as, Parikh and Stirbu, 2004; Huchet-Bourdon, Mouël and Vijil, 2011; Marelli and Signorelli, 2011; Busse and Königer, 2012), and Gries and Redlin, 2012) utilized the dynamic panel data approach to establish that a positive relationship exists between trade openness and economic growth. Likewise, Zeren and Ari (2013), employed causality and panel data analysis to establish a bi-directional causality between openness and economic growth. Alternatively, some other studies (like, Harrison (1996); Yanikkaya, 2003; Pahlavani, 2005 and Ulaşan, 2012) applied a cross-sectional analysis and realized a positive relationship between trade openness and economic growth. Using a time series procedure, the researches of Yucel (2009), and Munir, Kiani, Khan and Jamal (2013) determined that trade openness positively affects economic growth. Even so, several empirical analysis employed causality with the time series data techniques to derive that causality that exist between openness and growth is either uni-directional (Jaychandran & Seilan, 2010; Herath, 2010; Chaudhary et al., 2010 and Kahya, 2011) or bi-directional (Hatemi-J & Irandoust, 2001; Rahmaddi and Ichihashi, 2011 and Ajmi, 2013). By utilizing the other methods, for instance, the correlation and regression approach, different studies have observed the existence of a positive relationship between trade openness and growth (Zhang, Ondrich, & Richardson, 2003; Pernia and Quising, 2003; Dobre, 2008; Dufrénot, Mignon, & Tsangaride 2009). The recent study of Yosoff and Nuh (2015), applied the Granger causality test techniques to establish how positively international trade contributes to the economic growth in Thailand. In the same way, Srinivasan and Ravindra (2015), employed a time series investigation to establish that the existence of a long-run relationship between trade and economic growth in India.

3. Econometric Methodology

3.1. Data source and variables

In this section. with respect to the existing economic growth rate as reviewed in the literature, an economic growth

model is estimated in line with the model that was presented in the study of Shahbaz M (2012). We further extended our model to incorporated the recently developed version as designed by Olasode et al. (2015).

The time series dataset employed in this research were obtained from (word trade organization (WTO) and the World Bank database), respectively. These data are related to the panel economic growth of six (6) countries in the Caribbean for the period from 2000 to 2019. The study period selection is necessitated based on the evaluation of the pre- and post-economic performance of the selected and unselected Caribbean countries with respect to their trade-economic-growth classification.

3.2. Model Specification

In the overall research, real gross domestic product (GDP) per capita represents the proxy of economic growth. Thus, considering the determinants of economic variables, we formulated our economic growth as follows:

$$InX_{cp}=\alpha_0+\mathrm{b}InX_{cp-1}+\beta InX_{cp}+I_c+n_p+a_{cp} \quad (1)$$

where, InX_{cp} = logarithm of real GDP per capita

c = country in study

p = period of study.

Based on the conditional convergence hypothesis we denoted the original GDP InX_{cp}, while denoting Y_{cp} as the factors which determine InX_{cp}. All the determinants are expressed based on the model of augmented Solow growth (ASG). Based on the ASG model, we further formulated our econometric model for this study as:

$$\begin{aligned} InX_{cp} &= \beta_0 + \beta_1 InX_{cp-1} + \beta_2 InTO_{cp} + \beta_3 (InTO_{cp} * InX_{cp-1}) \\ &+ \beta_4 J_{cp} + \beta_5 K_{cp} + \beta_6 \mathrm{Rex}_{cp} + \beta_7 \mathrm{FDI}_{cp} + l_c + n_p + a_{cp} \end{aligned} \quad (2)$$

where $InTO_{cp}$ represents the logarithm of trade openness in the specific country c and at the period of study p. Because our research could not cover all the countries in the Caribbean, likewise, not all the periods that captures any global shocks of economic growth indexes was studied. Therefore, our model also considered the unobserved countries and periods. These were represented as λ_c, which represents the proxy of unobserved country while, σ_p represents the unobserved period when any global shocks was witnessed. The error correction term is represented as ε_{cp}.

According to the law of diminishing marginal revenues on capital asserts as stated by Barro and Martin (1995), it is expected that countries with low GDP per capita will undergo quicker growth rates unlike countries with higher per capita GDP. Based on this, the coefficient InX_{cp} is expected to be negative and significant. The ratio of imports and exports indicators to GDP represents the coefficient of trade openness which is stated as $InTO_{cp}$ and is forecasted to be either positive or negative hence there is an existence of uncertainty observed as an effect on the trade-growth.

The advantage of these import-export indicators is for an easy accessibility of data; thus, it is assumed that a lower value represents the maximum phase of policy interference in trade. The share of import in GDP (I/X) is expressed as the proxy of trade openness which describes the estimation of openness that is related to improved global trade cooperation. Subsequently since the effect of resources allocation is obtained through the level of export, therefore the share of exports in GDP (E/X) is expressed as the proxy of trade openness to understudy the measurement of trade openness associated to scale economies. Additionally, the overall share of the trade (addition of imports and exports) (I+E)/X in GDP offers the illustration of trade openness with respect to the technological spillover. All three proxy indicators of are observed to be positively associated to each other. Therefore, in a single model like ours, all three cannot be apply as trade openness indicators. But, if we one indicator is randomly selected, then discarding the other two might result in information loss. Thus, in this study, we first build a merged index of trade openness index $InTO$ for the Caribbean region. Therefore, by utilizing the Principal Component Analysis (PCA) approach, we calculated and developed the weights of the indicators. The results of the eigenvalues indicate that the first principal component establishes about 89.5%, while the second describes about 9.2% and last 1.3% standardized cumulative amount of the variation, respectively as seen in Table 1. Evidently, we can observe that the first principal component performs higher than the other cumulative of variables as it displays higher level of variability. Accordingly, we employed the values of the first eigenvector as a weight to establish a complex estimate of trade openness which is denoted as $InTO$. In standardized variance of the first principal component, the discretely contributions of (E)/X, (I)/X and (E + I)/X; are 56.1, 52.1 and 53.3%, respectively.

Table 1. Analysis of principal components

Eigen values: (Sum=3, Average =1)					
PC	Value	Proportion	Difference	Cumulative value	Cumulative proportion
1	1.542	0.895	1.402	1.542	0.811
2	0.142	0.092	0.121	1.732	0.864
3	0.036	0.013	-	2.001	1
Eigenvectors:					
Variables	**PC-1**	**PC-2**	**PC-3**		
(E+I)X	0.561	-0.221	-0.582		
(E/X)	0.521	0.632	0.186		
(I/X)	0.533	-0.442	-0.231		
Correlation matrix					
	(E+I)X	(E/X)	(I/X)		
(E+I)X	1.000				
(E/X)	0.921	1.000			
(I/X)	0.911	0.825	1.000		

The graph of Figure 1 indicates the performance of the composite index of trade openness index ($InTO$), and the three indicators of trade openness in the Caribbean. Data for each indicator is sourced from the world trade organization (WTO, 2019) database. Notice that in between 2003 – 2006, $InTO$ witnessed a moderate increment, while a sharp decline is observed in 2007 – 2010. This was the period the region witnessed a severe economic crisis. From 2011, international trade started getting strong, thus an increase is witnessed from 2011 with slight fluctuations in 2012 – 2014, between 2015 and 2019, the indicators of trade openness have exponentially increased.

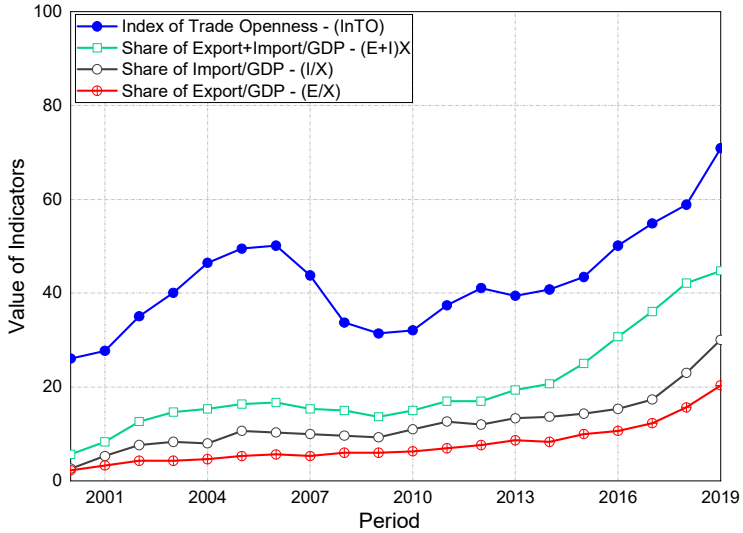

Figure 1: Performance of Trade Openness Index

In the model, we also included the collaboration which exists between country's original level of income and trade openness. This is represented as, while $*InX_{cp-1}$ is used in the model to represent economic growth determinant with respect to the country's original income level considering openness to trade and to determine which country's economy is inclined towards more benefits from trade openness. In the end, the result of this investigation is expected to show that the coefficient of physical capital accumulation, (J_{cp}) is positive. Using the share of gross fixed capital development to GDP per capita, we proxied the physical capital accumulation. The variable K_{cp} represents the country's economically active population or the workforce and according to Qazi Muhammad AH et al., (2009) this variable is also expected to have either positive or negative impact on economic growth. Finally, the model further considers the coefficients of foreign direct investment as (FDI_{cp}) and that of real exchange rate (REX_{cp}). Just like the workforce coefficient and as stated in the study of Roberto C et al., (2005), it is predicted that the results of both variables will either be positive or negative.

3.3. Evaluation techniques

This study employed empirical evaluation technique for data analysis. The technique is considered in three different levels. Firstly, panel tests of unit root were employed in evaluating the variables stationarity. The panels

tests of unit root considered in this research are, the Im, Pesaran and Shin (IPS) test and the Levin, Lin and Chu (LLC) test. Secondly, by using the bounds cointegration technique which was established by Pesaran et al., (2001), we further tested the long run relationships that exists between the different variables in the study. Different economic literatures that were earlier reviewed have shown several interesting features of this cointegration testing technique. One of these interesting features is that it permits the evaluation of I(0) or I(1) variables, however, does not support those with I(2). The implication is that this method avoids the difficulties relating to low power and inconsistent results of the traditional unit root tests approaches. Hence, the autoregressive distribution lag (ARDL) cointegration tests is further employed to annihilate the endogeneity glitches and also, the failure to test hypotheses on the projected coefficients in the long-run related with the EngleGranger two-step technique. Based on these reasons, the ARDL bounds test is used to examine both the long and short run relationship which exists between economic growth and trade openness in the 3B2GD countries. Thirdly, by using the Granger causality tests approach, we performed a causal relationships tests between the evaluated variables. As stated by Gujarati, (2004), when applying and establishing bounds test, the exit point is always to clearly stipulate the levels of the vector autoregressive (VAR) as follows:

$$X_{cp}=\sigma_p+\sum_{k=1}^{t}\Phi_k X_{cp}+\varepsilon_{cp} \tag{3}$$

Considering X_{cp} as the equivalent of $\left[c_{cp},\Pi_{cp}\right]$, while $\varepsilon_{cp}=\left[\varepsilon_p,\varepsilon_\Pi\right]\sim N(0,\partial)$ represents the error terms vector. Thus, ∂ is positive and is expressed as:

$$\partial=\begin{Bmatrix}\varphi_{cc} & \varphi_{i\pi}\\ \varphi_{i\pi} & \varphi_{\pi\pi}\end{Bmatrix} \tag{4}$$

By transforming the VAR model which is present in (3) we will achieve the following vector error correction (VEC) model:

$$\Delta X_{cp}=\sigma_{cp}+\lambda X_{cp-1}+\sum_{k=1}^{t-1}x_k\Delta X_{t-j}+\varepsilon_{cp}\,. \tag{5}$$

Thus, we denote the short run relationship coefficients as:

$$-\sum_{j=k+1}^{t}\Phi_j=x_k=\begin{bmatrix}x_{cc,k} & x_{c\pi,k}\\ x_{\pi k} & x_{\pi\pi,k}\end{bmatrix}, \tag{6}$$

while the variable λ denotes the matrix off the long-run multiplier and is presented as:

$$\lambda=\begin{bmatrix}\lambda_{cc} & x_{c\pi}\\ \lambda_{\pi c} & x_{\pi\pi}\end{bmatrix}=-\left(I_2-\sum_{k=1}^{t}\Phi_k\right) \tag{7}$$

From (7), I_2 signifies a 2 × 2 matrix representation, hence, the transverse elements of the matrix λ are kept unobstructed, therefore, accommodating the I(0) or I(1) prospects of the variables.

One other interesting feature of the bounds test technique is that it permits that one long-run relationship existing between the variables be tested at most, thus a no restriction is needed on one of the diagonals of the matrix λ. In order to realize the cointegration test between the variables, all the lagged levels variables ($\beta_0=\beta_1=\beta_2=\beta_3=\beta_4=\beta_5=\beta_6=\beta_7=0$) which were captured in (3) were restricted. F-test is employed in testing the hypothesis. Considering the huge amount of data samples that is involved in the dataset of the 3B2GD countries, we employed the study of Pesaran et al., (2001), to provide the essential asymptotic values. Also, their study proposes the use of the cumulative sum (CUSUM) of recursive residuals and the cumulative sum squares (CUSUMSQ) of recursive residuals tests in evaluating and measuring the reliability of the model's parameter. Because these approaches have been tested and proven to give accurate results in testing and analysis, therefore, we adopted these approaches for testing our model.

4. Evaluation metrics and analysis

The empirical evaluation of our study began with the descriptive statistics analysis of the time series data. All the econometric computations in this study are performed using E-view8 econometric software. According to Table 1, this analysis is performed to establish the data skewness, kurtosis and distribution. In the study of Brooks, (2008), kurtosis is described as the climax of the distribution or flatness of the series. A series which distributed normally contains a kurtosis of 3, but if the value of the kurtosis is less than 3, then the series has a platykurtic (flat) distribution comparative to the normal distribution. On the other hand, if the kurtosis value is greater than 3, then the series has a leptokurtic (climaxed) distribution comparative to the normal. With reference to the results in Table 2, it is observed that all the variables are leptokurtically distributed in comparative the normal distribution, except Grenada and Dominica which has a platykurtic distribution comparative to normal. Also, another significant

descriptive statistic employed in this research is the skewness of the series.

Table 2: Descriptive statistical analysis of variables for 3B2GD economies

Variables	Bahamas	Barbados	Belize	Grenada	Guyana	Dominica
Mean	15.562	21.546	14.231	10.219	6.872	12.139
Median	13.672	11.452	12.341	8.932	5.525	10.083
Maximum	52.452	95.891	23.101	21.651	21.873	21.456
Minimum	5.178	3.452	8.001	2.001	1.002	5.000
Std. Deviation	5.891	23.340	2.945	4.901	3.991	4.615
Kurtosis	4.512	10.602	2.502	3.783	2.425	2.023
Skewness	2.011	4.872	2.809	2.641	1.829	0.521
Jarque-Bera	131.125	623.291	75.9	68.902	19.321	23.892
Probability	0	0.000	0.000	0.001	0.001	0.007
Observations	285	285	285	285	285	285

According to Brooks, (2008), skewness simply implies the evenly distribution of a series around its mean. His research upholds that a series that distributed normally has zero (0) skewness. Thus, in a descriptive analysis, series skewness can either be negative or positive. The former indicates a long left-tail distribution, while the later necessitates a long right-tail distribution. The analysis in Table 1 shows that all the series long right-tail distribution form. This implies that for the variables of these country's economies, the normal distribution null hypothesis cannot be rejected. Furthermore, all the countries in the study is greater than 5% level of significance with respect to their Jarque-Bera values, this implies that the null hypothesis of the normal distribution of the series is accepted. After analyzing the descriptive statistics, the next stage of our empirical analysis is to use the panel unit root tests Pesaran et al., (2001), to test the integration order of the series. This is a very vital stage of our investigation for the reason that the ARDL bounds test necessitates the variable and regress to be I(1) and the regressors to be I(0) or I(1). The results of our F-test will be considered to be biased if any of the variables appears to be I(2) or more. In Table 2, the results of the panel unit root tests are presented. It is observed that all the panel unit root tests applied show that the variables assume I(0) procedures, hence, the initial condition to use the bounds cointegration test is satisfied. Since we have ascertained the order of integration of the variables, we advanced to employ the bounds test to practically establish the long run relationship between the variables. Table 3 shows the results of this test. Having ascertained that the bounds cointegration test is classically subtle to the utilized optimal lag order standard, we further applied a combination of the Akaike Information Criterion (AIC) and the general-to-specific modelling technique proposed by Ali et al., (1982) to ascertain p=4 as the optimal lag structure.

The optimal lag structure p=4 of the estimated F-statistics testing is used in realizing the results stated in Table 2. In the analysis, $H_0(^{1,2 \text{ and } 3})$ represents all series that contain unit roots, while $H_0(^4)$ describes the common unit root process where significance at 1%, 5% and 10% is denoted by (** and **), respectively. A null hypothesis of no cointegration against the substitute that there is long run relationship (cointegration) is observed from the results. In computing the F-statistics in the ARDL regression, economic growth and trade openness are used interchangeably as a variable and regress.

Table 3: Panel unit root tests

Tests	t-statistic	P-value
[1]IPS	-5.655	0.005***
[2]ADF-Fisher Chi Square	126.601	0.004***
[3]PP-Fisher Chi Square	102.201	0.036**
[4]LLC	-7.211	0.001***

Based on the results obtained in Table 4, the null hypothesis of no cointegration cannot be accepted, somewhat, the null hypothesis is rejected, while the substitute hypothesis which states that a long run relationship exists between the variables is accepted. The analysis of the result indicates that the critical value bounds F-stats are according to Pesaran et al. (2001) while β is used to represent the long run coefficient and (*) implies significance at the 5% level of significance.

Furthermore, notwithstanding that the cointegration which exists between trade openness, economic growth, capital and labour, is in line with the previously developed endogenous growth theories as proposed by Sakyi et al., (2015), Shahbaz M (2012). and Kim et al. (2012), it still does not conform to the results established by Afzal and Hussain (2010), whose study which covered economic growth in Pakistan proved that no long run relationship exists between trade openness and economic growth. A look at Dominica, it is observed that a unit adjustment in trade openness will warrant in an average of about 53.6% increase in growth output which is seemingly higher than the observations of Shahbaz M, (2012) whose conclusion was that a unit adjustment in trade openness results in about 24.6% increase in the growth of the Pakistan economy, however, the same study observed that the hypothesis of trade-growth hypothesis for Ghana is weak.

Table 4: Results of bounds test cointegration.

Country	F-statistics	t-statistics	5%		10%		β
			I(0)	I(1)	I(0)	I(1)	(Δ-technique)
Bahamas	3.213	-3.032	5.65	6.23	5.49	5.21	0.691
Barbados	4.001*	2.491	7.43	8.54	6.32	7.60	1.521*
Belize	15.231	-6.336*	5.67	6.45	5.32	5.89	0.896*
Grenada	6.426	-4.280	7.66	8.32	6.56	7.45	1.532*
Guyana	3.004	-3.456	4.23	5.46	7.89	7.45	0.574
Dominica	4.520*	2.319	6.51	7.32	5.34	6.88	0.536*

Regarding the rate at which trade openness provokes the growth of an economy, the results in Table 4 shows that Bahamas, Guyana and Dominica still lag behind. The table also show that Grenada has remained the highest trade-growth medium, with a 1% adjustment in trade openness which results in an average of 153.2% increase in economic growth. With respect to the Caribbean region, Grenada has become one of the foremost economies in trade and growth amongst all developing island countries in the region.

In Table 5, the short- and long- run causality analysis of the variables are presented. Core attention is significantly placed on the causal relationship which exists between economic growth and trade openness in the 3B2GD countries. The results in the table display indications that the error correction term t-statistics (ARDL_{t-1}) coefficients for all economies are extremely substantial except that of Belize where economic growth is the dependent variable. Therefore, we can, certainly conclude that in the long term, a bi-directional causality exists between economic growth and trade openness in the 3B2GD countries. Also, Table 5 shows that there is an indication of unidirectional long run causality from economic growth to trade openness particularly with respect to Barbados and Grenada economies. In this regard, our observations are in accordance with the findings of Frankel and Romer (1999) and Bolaky (2008). In the analysis, ARDL_{t-1} signifies the error correction term t-statistics, while (*) denotes 5% or 10% significance.

More so, along with the above econometric tests and in line with the CUSUM and the CUSUMSQ tests as developed by Brown T (1975), we further performed a test of stability for the proposed ARDL regression model. It is observed that the plots of these tests fall within the stated 5% critical bound, thus, showing prove that for the period of this study, there is no form of structural instability with the variables and their coordinating parameters. For the residual diagnostic tests, we observed that the R^2 is greater than 5% level of significance, thus, the null hypotheses which states that there are no traces of heteroskedasticity and consecutive correlation in the model is not rejected. Finally, considering that the R^2 =82% is greater than the standard of 60%, our model is considered to be stable and suitable.

Table 5: Granger causality test results.

Country	Null Hypothesis	F-statistics	Short run causality P-values	∑coefficient	Long run causality ARDL_{t-1}	t-statistics
Bahamas	H_0: TO>>X	0.036	0.680	-0.532	-0.209*	-1.752
	H_0: X>>TO	0.027	0.454	-	-0.475*	-3.512
Barbados	H_0: TO>>X	5.211*	0.000	-0.421	-0.321*	-3.362
	H_0: X>>TO	2.102*	0.023	-3.332	-0.767*	-4.112
Belize	H_0: TO>>X	0.621	0.321	-	-	-
	H_0: X>>TO	0.052	0.711	-	-0.522*	-0.562
Grenada	H_0: TO>>X	3.437*	0.042	-0.185	-0.582	-1.650
	H_0: X>>TO	0.048	0.638	-0.209	-0.591*	-3.381
Guyana	H_0: TO>>X	1.321*	0.021	-	-0.321*	-2.226
	H_0: X>>TO	0.026	0.732	-	-0.418*	-1.852
Dominica	H_0: TO>>X	0.621	0.023	-0.291	-	-4.331
	H_0: X>>TO	0.052	0.553	-0.031	-0.221*	-2.451

With the estimation and establishment of the long- and short-run coefficients, we further examined the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squared residuals (CUSUMQ) plots for the respective 3B2GD economies. In Figures 2a-7a, the plots for CUSUM is presented for the individual economies, while, Figures 2b-7b shows the CUSUMQ plots. The plots provide in-depth understanding on the stability of the model with respective to economic growth of the respective six developing 3B2GD Caribbean countries we studied. For all the plots, the straight lines represent the critical bound levels at 5% significance. Notice that the CUSUM plots for all six countries are satisfactory as the residual plots do not cross the boundaries at 5 per cent level of significance. The results of the residual plots show that the parameters of the estimated ARDL models are stable.

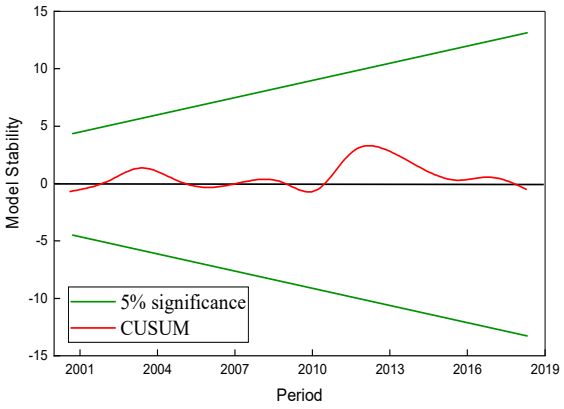

Figure 2(a): Plot of cumulative sum of recursive residuals for Bahamas

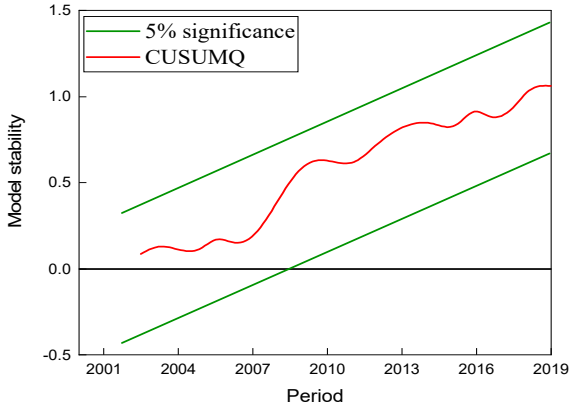

Figure 2(b): Plot of cumulative sum of squares recursive residuals for Bahamas

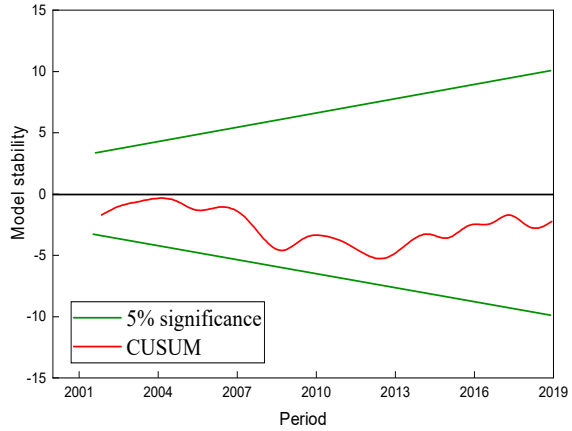

Figure 3(a): Plot of cumulative sum of recursive residuals for Barbados

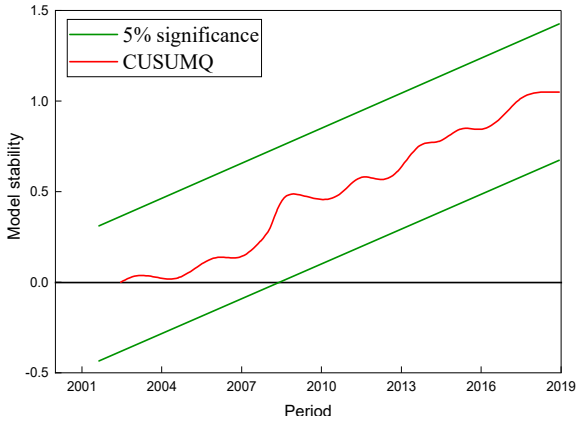

Figure 3(b): Plot of cumulative sum of squares recursive residuals for Barbados

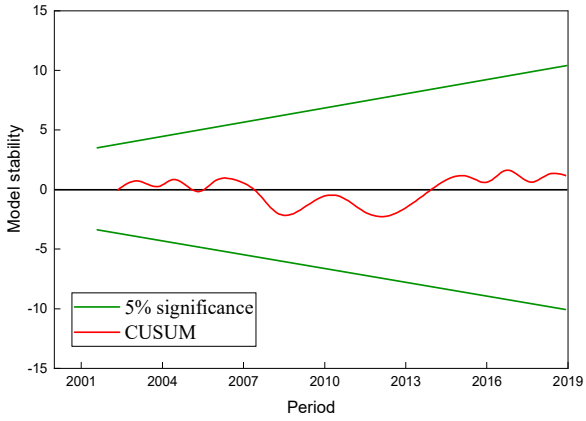

Figure 4(a): Plot of cumulative sum of recursive residuals for Belize

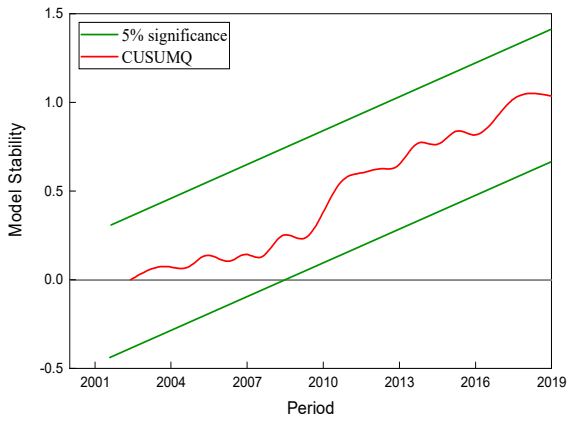

Figure 4(b): Plot of cumulative sum of squares recursive residuals for Belize

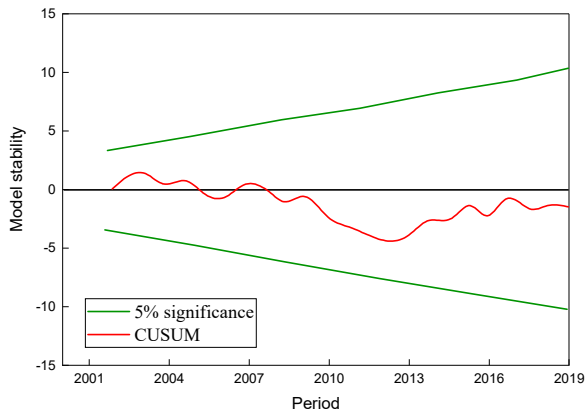

Figure 5(a): Plot of cumulative sum of recursive residuals for Guyana

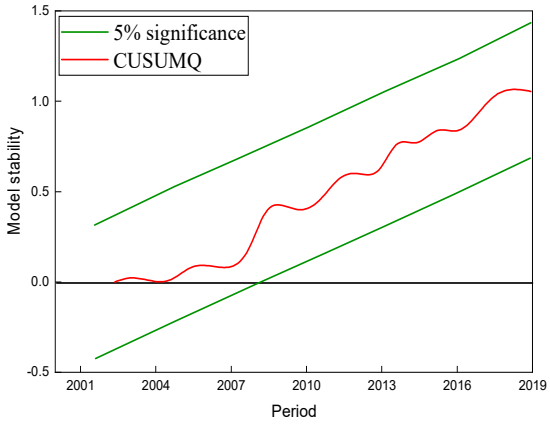

Figure 5(b): Plot of cumulative sum of squares recursive residuals for Guyana

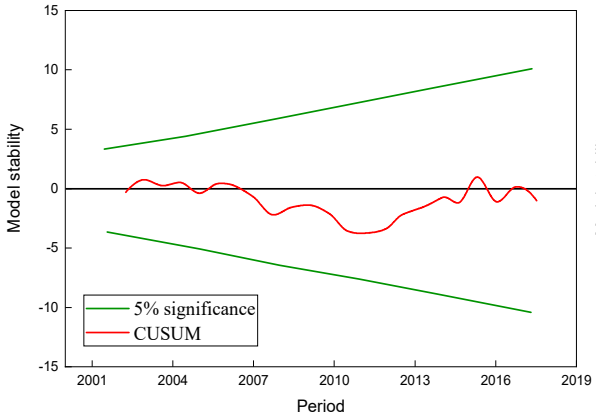

Figure 6(a): Plot of cumulative sum of recursive residuals for Grenada

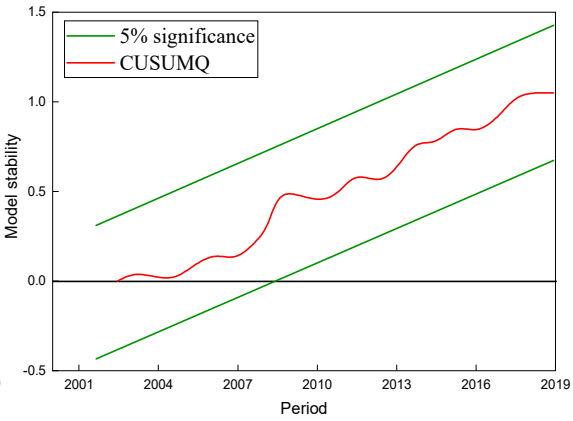

Figure 6(b): Plot of cumulative sum of squares recursive residuals for Grenada

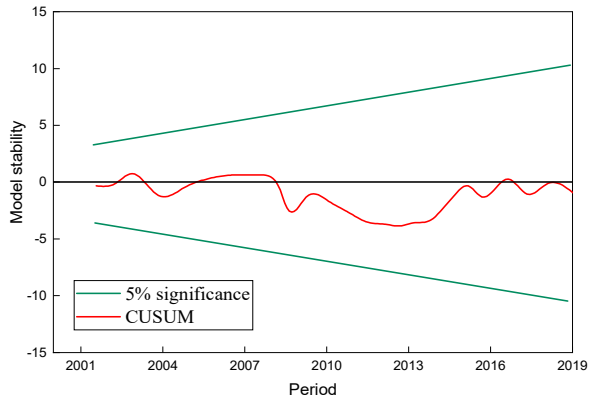

Figure 7(a): Plot of cumulative sum of recursive residuals for Dominica

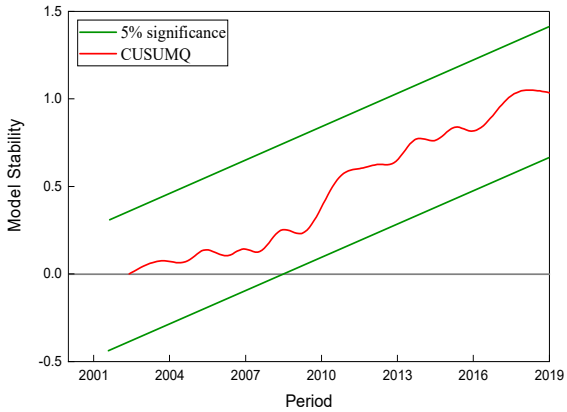

Figure 7(b): Plot of cumulative sum of squares recursive residuals for Dominica

5. Conclusion, Recommendations and Future work

In this paper, we have attempted to empirically examine the relationship between economic growth and trade openness in the 3B2GD Caribbean countries. Obviously, as seen in previous empirical literatures, there have been compromise on the trade-growth link since there results incorporate diverse countries, empirical approaches and data. However, this study considered only developing countries in the Caribbean region. Six economically-vibrant countries of this region were selected and tagged as the 3B2GD economies. So as to complete this study, different econometric tests were carried out on the variables and their respective parameters. Firstly, we employed panel unit root tests on the utilized panel data. Particularly, the IPS and LLC panel root tests were employed. The outcome of the tests from these panel unit root tests indicates that all variables are I(0) processes, thus, we expanded

our research by engaging the Granger causality test and the bounds approach of cointegration.

Our investigation with respect to the results of the cointegration test confirmed that there is an existence of a long run relationship between the economic variables, especially trade openness and economic growth. Likewise, the results obtained from the bounds test of cointegration confirmed an existence of a bi-directional causality from trade openness to economic growth in virtually all 3B2GD economies we studied. Similarly, an evidence of uni-directional causality between trade openness and output growth is observed from the investigation, mostly with regards to Guyana. This is assumed to the fact that Guyana out of most countries of the Caribbean is well endowed with natural resources, fertile agricultural lands, bauxite, gold, and extensive tropical forests that cover more than 80 percent of the country and have been a major trade-link country in the region. To further examine the long- and short-run coefficients, we analyzed the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squared residuals (CUSUMQ) plots for each respective 3B2GD economies. The results of the residual plots show that the parameters of the estimated ARDL models are stable.

Generally, the results of our investigation indicate that trade alliance between the countries in the Caribbean region is a major factor towards improved trade relationship and economic growth in the region. Therefore, with respect to all the reports of our investigations, we recommend that regional governments enact viable policies that will enhance intra-trade between the Caribbean countries and also encourage better international trade practices. These policies and standards should not only be targeted at fortifying local and international trade relations or capital flows, but will also serve as viable platform for the regional countries to economically develop concurrently through engorged openness to trade prospects. Also, infrastructural development should be more emphasis as a key factor to swift openness to trade and economic growth in the region.

Finally, the countries should adequately utilize the numerous of import and export prospects that are accessible by the cooperative efforts of these countries. Notwithstanding of the auspicious outcomes of this investigation, we maintain that this paper only offers a significant leap in the direction of establishing a more intensive research based on empirical analysis. Therefore, the future work is expected to incorporate more dataset, variables, and empirical methods for a more comprehensive and robust investigation on the subject matter.

Reference

Afzal M, Hussain I (2010) Export led growth hypothesis: Evidence from Pakistan. J Quant Econ 8: 130-147.

Ajmi, A. N. (2013). Causality between exports and economic growth in South Africa: Evidence from linear and nonlinear tests (Working Paper Series No. 2013-39). Pretoria:

Ali P, Muhammed S, Ijaz UR, Saqlin LS (1982) Revisiting linkages between financial development, trade openness and economic growth in South Africa: Fresh evidence from combined cointegration test. Qual Quan 49: 785-803.

Bahmani-Oskooee, M., & Niroomand, F. (1999). Openness and economic growth: An empirical investigation. Applied Economics Letters, 6, 557–561. https://doi.org/10.1080/135048599352592

Barro RJ, Martin XS (1995) Technological diffusion, convergence, and growth. J Econ Growth 2: 1-26.

Brooks C (2008) Introductory to Econometrics for Finance. Cambridge: Cambridge University Press.

Brown T (1975) Statistical Inference in Vector Auto Regressions with Possibly Integrated Processes. J Econ 66: 225-250.

Busse, M., & Königer, J. (2012). Trade and economic growth: A re-examination of the empirical evidence (Research Paper No. 123). Hamburg: Hamburg Institute of International Economics.

Chang, Roberto, Linda Kaltani, and Norman V. Loayza. 2009. Openness can be good for growth: The role of policy complementarities. *Journal of Development Economics* 90: 33–49.

Chaudhry, I. S., Ali M., & Muhammad, Z. F. (2010). Exploring the causality relationship between trade liberalization, human capital and economic growth: Empirical evidence from Pakistan, Journal of Economics and International Finance, 2(8), 175–182.

Das, A., & Paul, B. P. (2011). Openness and growth in emerging Asian economies: Evidence from GMM estimations of a dynamic panel. Economics Bulletin, 31, 2219–2228.

Dobre, C. (2008). The relationship between openness to trade and economic growth. Analele Stiintifice ale Universitatii "Alexandru Ioan Cuza" din Iasi-Stiinte Economice 55, 237–247.

Dollar, D., & Kraay, A. (2004). Trade. Growth and Poverty. Economic Journal, 114, 22–49.

Dufrenot, G., Mignon, V., & Tsangarides, C. (2010). The trade-growth nexus in the developing countries: A quantile regression approach. Review of World Economics, 146, 731–761. https://doi.org/10.1007/s10290-010-0067-5

Edwards S (1998) Openness, productivity and growth: What do we really know? Econ J 108: 383-398.

Frankel, J. A., & Romer, D. (1999). Does trade cause growth? American Economic Review, 89, 379–399. https://doi.org/10.1257/aer.89.3.379

Fenira, M. (2015). Trade openness and growth in developing countries: An analysis of the relationship after comparing trade indicators. Asian Economic and Financial Review, 5, 468–482

Freund, C., & Bolaky, B. (2008). Trade, regulations, and income. Journal of Development Economics, 87, 309–321. https://doi.org/10.1016/j.jdeveco.2007.11.003

Gräbner, Claudius, Philipp Heimberger, Jakob Kapeller, and Florian Springholz. 2018. *Measuring Economic Openness: A Review of Existing Measures and Empirical Practices*. Institute of the Comprehensive

Gries, T., & Redlin, M. (2012). Trade openness and economic growth: A panel causality analysis (Working Paper Series No. 2011-06). Canberra: Centre for International Economics.

Gujarati DN (2004) Basic Econometrics. 4th ed. New York: McGraw Hill.

Harrison, A. (1996). Openness and growth: A time-series, cross-country analysis for developing countries. *Journal of Development Economics*, *48*(2), 419–447.

Hatemi-J, A., & Irandoust, M. (2001). Productivity performance and export performance: A time series perspective. Eastern Economic Journal, 27(2), 149–164.

Heckscher, E. (1919). The Effect of Foreign Trade on the Distribution of Income. *Ekonomisk Tidskrift*, 497-512. Reprinted as Chapter 13 in A.E.A. (1949). Readings in the Theory of International Trade, 272-300 (Philadelphia: Blakiston) with a Translation in H. Flam and M. J. Flanders (Eds.). 1991. Heckscher-Ohlin Trade Theory 43-69. Cambridge: MIT Press.

Herath, H. M. P. S. (2010). Impact of trade liberalization on economic growth of Sri Lanka: an econometric investigation. Proceeding of 1st Internal Research Conference on Business and Information, University of Kelaniya, Sri Lanka. Retrieved from http:// repository.kln.ac.lk/handle/123456789/7144

Hye, Qazi Muhammad Adnan, and Wee-Yeap Lau. 2015. Trade openness and economic growth: Empirical evidence from India. *Journal of Business Economics and Management* 161: 188–205. Analysis of the Economy (ICAE) Working Paper Series—No. 84; Linz: Johannes Kepler University.

Huchet-Bourdon, M., Mouël, C. L., & Vijil, M. (2011). The relationship between trade openness and economic growth: Some new insights on the openness measurement issue. Paper presented at XIIIème Congrès de association Européenne des Economistes Agricoles (EAAE), Zürich

Jayachandran, G., & Seilan, A. (2010). A causal relationship between trade, foreign direct investment and economic growth for India. International Research Journal of Finance and Economics, 42, 74–88.

Kahya, M. (2011). An analysis of the relationship between foreign trade and economic growth in Turkey over the period 1980–2009 (Master thesis) Master Programme in Economic Growth, Innovation and Spatial Dynamics, Lund University, Lund.

Karras, G. (2003). Trade openness and economic growth: Can we estimate the precise effect? *Applied Econometrics and International Development*, 3(1): 7–26.

Keho, Y. (2017). The impact of trade openness on economic growth: The case of Cote d'Ivoire.*Cogent Economics & Finance*, 5(1): 1-14.

Kim, D.-H., & Lin, S. (2009). Trade and growth at different stages of economic development. Journal of Development Studies, 45, 1211–1224. https://doi.org/10.1080/00220380902862937

Kim, Dong-Hyeon, Shu-Chin Lin, and Yu-Bo Suen. 2012. The simultaneous evolution of economic growth, financial development, and trade openness. *The Journal of International Trade & Economic Development* 2: 513–37.

Klasra, M. A. (2011). Foreign direct investment, trade openness and economic growth in Pakistan and Turkey: An investigation using bounds test. Quality and Quantity, 45, 223–231. https://doi.org/10.1007/s11135-009-9272-5

Levine, R., & Renelt, D. (1992). A sensitivity analysis of cross-country growth regressions, *American Economic Review*, *82*(4), 942–963.

Marelli, E., & Signorelli, M. (2011). China and India: Openness, trade and effects on economic growth. The European Journal of Comparative Economics, 8, 129–154.

Munir, S., Kiani, A. K., Khan, A., & Jamal, A. (2013). The relationship between trade openness and income inequalities: Empirical evidences from Pakistan. Academic Journal of Management Science, 2(1), 21–35.

Nduka, E.K., Chukwu, J.O. Kalu, I. K & Nwakaire, O.N. (2013). Trade Openness and Economic Growth: A Comparative Analysis of the Pre and Post Structural Adjustment Programme (Sap) Periods in Nigeria. *Asian Journal of Business and Economics*, 3(3): 1-12.

Nowbutsing, B. M. (2014). The impact of openness on economic growth: Case of Indian Ocean Rim countries. *Journal of Economics and Development Studies*, 2(2): 407–427.

Ohlin, B. (1933). *Interregional and International Trade*. Cambridge, MA: Harvard.

Olasode, S. O., Raji, O., Adedoyin, O.A., Ademola, I.A. (2015). Trade Openness and Economic Growth A Reflection from Nigeria (1981-2012). *International Journal of Economics, Commerce and Management*, 3(5): 1-820.

Pahlavani, M. (2005). The relationship between trade and economic growth in Iran: An application of a new cointegration technique in the presence of structural breaks. (Working Paper Series No. 28). Australia: Department of Economics, University of Wollongong.

Parikh, A., & Stirbu, C. (2004). Relationship between trade liberalization, economic growth and trade balance: An econometric investigation (Discussion Paper No. 282). Hamburg: Hamburgisches Welt-Wirtschafts-Archiv (HWWA).

Pernia, E. M., & Quising, P. F. (2003). Trade openness and regional development in a developing country. The Annals of Regional Science, 37(3), 391–406.

Pesaran, H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships, Journal of Applied Econometrics, 16, 289–326. https://doi.org/10.1002/(ISSN)1099-1255

Qazi Muhammad AH, Shahida W, Wee YL (2009) The impact of trade openness on economic growth in China: An empirical analysis. J Asian Finance, Econ Bus 3: 27-37.

Rahmaddi, R., & Ichihashi, M. (2011). Exports and economic growth in Indonesia: A causality approach based on multi-variate error correction model. Journal of International Development and Cooperation, 27(2), 53–73.

Rassekh, F. (2007). Is international trade more beneficial to lower income economies? An empirical inquiry.

Review of Development Economics, 11, 159–169. https://doi.org/10.1111/rode.2007.11.issue-1

Rigobon, R., & Rodrik, D. (2005). Rule of law, democracy, openness, and income: Estimating the interrelationships. The Economics of Transition, 13, 533–564. https://doi.org/10.1111/ecot.2005.13.issue-3

Roberto C, Linda K, Norman VL (2005) Openness can be good for growth: The role of policy complementarities. Journal of Development Economics 90: 33-49.

Rodriguez, F., & Rodrik, D. (2001). Trade policy and economic growth: A skeptics guide to the cross-national evidence. In B. Bernanke & K. Rogoff (Eds.), *NBER Macroeconomics Annual 2000* (Vol. 15), 261–325. Cambridge, MA: MIT Press.

Sakyi D, Villaverde J, Maza A (2015) Trade openness, income levels, and economic growth: The case of developing countries 1970–2009. J Int Trade Econ Development 24: 860-882.

Shahbaz, M. (2012). Does trade openness affect long-run growth? Cointegration, causality and forecast error variance decomposition tests for Pakistan. Economic Modelling, 29, 2325–2339. https://doi.org/10.1016/j.econmod.2012.07.015

Srinivasan, T. N., & Bhagwati, J. (1999). *Outward-orientation and development: Are revisions, right?* (Centre Discussion Paper No. 806). New Haven: Economic Growth Centre, Yale University.

Srinivasan, P., & Ravindra, I. S. (2015). Causality among energy consumption, CO2 emission, economic growth and trade: A case of India. *Foreign Trade Review*, *50*(3), 168–189.

Tornell, Aaron, Frank Westermann, and Lorenzo Martinez. 2003. Liberalization, Growth, and Financial Crises: Evidence from the Developing World. *Brookings Papers on Economic Activity* 2: 1–112.

Ulaşan, B. (2012). Openness to international trade and economic growth: a cross-country empirical investigation (Discussion Paper No. 2012-25). Economics Open Access E-Journal. Retrieved from http://www.economics-ejournal.org/economics/ discussion papers/2012-25

Vamvakidis, A. (2002). How robust is the growth-openness connection: Historical evidence? Journal of Economic Growth, 7, 57–80. https://doi.org/10.1023/A:1013418610712

Wang, C., Liu, X., & Wei, Y. (2004). Impact of openness on growth in different country groups. The World Economy, 27, 567–585

World Bank. (2019). World data bank: world development indicators. The World Bank. Retrieved 28th January, 2020, from https://datacatalog.worldbank.org/dataset/worlddevelopment-indicators

WTO. (2019). Trade profiles, world trade organization. Retrieved from http://stat.wto.org/ CountryProfile/WSDBCountryPFReporter.aspx?Language=E

Yanikkaya, H. (2003). Trade openness and economic growth: A cross-country empirical investigation. Journal of Development Economics, 72, 57–89. https://doi.org/10.1016/S0304-3878(03)00068-3

Yucel, F. (2009). Causal relationship between financial development, trade openness and economic growth: The case of Turkey. Journal of Social Sciences, 5(1), 33–42.

Yusoff, M. B., & Nuh, R. (2015). Foreign direct investment, trade openness and economic growth: Empirical evidence from Thailand. Foreign Trade Review, 50(2), 73–84.

Zarra-Nezhad, M., Hosseinpour, F., & Arman, S. A. (2014). Trade-growth nexus in developing and developed countries: An application of extreme bounds analysis. Asian Economic and Financial Review, 4, 915–929.

Zeren, F., & Ari, A. (2013). Trade openness and economic growth: A panel causality test. International Journal of Business and Social Science, 4(9), 317–324.

Zhang, S., Ondrich, J., & Richardson, J. D. (2003). The link between trade and income: Export effect, import effect, or both? Retrieved from http://faculty.maxwell.syr.edu/ jondrich/PapersOnLine/shuo.jan.dave-10.pdf