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EMPIRICAL ANALYSIS OF THE INFLUENCE OF TRADE OPENNESS ON ECONOMIC GROWTH: A CASE STUDY OF YEMEN

In spite of the early promise of the premise that open economies committed to liberated trade reform program are supposed to grow faster than closed economies, recent experience suggests that not all open economies with trade reforms program have been as successful as anticipated. The current study major intend is to conduct further empirical investigation for more factors in relation to this concern and provide new evidence revealing the extent to which the efficiency of trade openness on economic growth in developing countries, is influenced by the implementation of economic reform programs. Therefore, this study aims to explore the empirical relationship between trade openness (liberalisation) and economic growth in the case of Yemen taking into consideration the most modern modelling and econometric specification of trade compositions effects. It incorporates trade openness in the models as endogenous variables, utilising three indicators as proxies for trade openness measures, namely, imports, exports and trade volumes (exports + imports) in the augmented production function framework of Mankiw. It also incorporated more political and social factors. As for the estimation strategy, we initially checked the stationarity properties of the data by the Phillips Perron and augmented Dickey-Fuller unit root tests. Then, we used the autoregressive distributed lag (ARDL) model bounds and Johansen maximum likelihood approaches to test for cointegration. The vector error correction model (VECM) Granger causality was also implied to test the direction of the causality between trade liberalisation and economic growth. ARDL model and Johansen results confirmed the presence of cointegration between economic growth and trade openness and other independent variables. The results of structural analysis prove that the implemented trade reforms in Yemen was mitigated by some political and social factors. Results of VECM Granger causality provides clearer image and found empirical evidence in support of a bidirectional causal relationship between trade volume and imports with the growth of gross domestic product (GDP) of Yemen, but a unidirectional causal relationship was found between exports and GDP growth. The VECM results also show that the effect of trade openness on growth tend to be over the long run with little evidence of a short-run relationship indicating that trade openness is estimated to have long run impact if some policies were implemented. The study recommends encouragement of foreign direct investment and various economic reforms policies shifting towards more imports for more productive uses in the local production and for activating internal exports. This strategy will also be helpful in reallocating economic growth.

Keywords: economic growth; cointegration analysis; cranger causality; trade openness; Yemen.

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ЕМПІРИЧНИЙ АНАЛІЗ ВПЛИВУ ВІДКРИТОСТІ ТОРГІВЛІ НА ЕКОНОМІЧНЕ ЗРОСТАННЯ: ПРИКЛАД ЄМЕНУ

Незважаючи на передумови того що відкрита економіка, завдяки програмі реформування торгівлі, має розвиватися швидше, ніж закрита економіка, досвід останніх років показує, що не всі відкриті економіки з програмою торгових реформ були настільки

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успішними, як очікувалося. Дане дослідження має на меті провести подальший емпіричний аналіз для більшої кількості факторів, пов'язаних із цим занепокоєнням та надати нові докази, що показують, якою мірою на ефективність відкритості торгівлі для економічного зростання в країнах, що розвиваються, впливає впровадження програм економічних реформ. Тому на меті є завдання дослідити емпіричний зв'язок між відкритістю торгівлі (лібералізацією) та економічним зростанням на прикладі Ємену з урахуванням найсучаснішого моделювання та економетричної специфікації ефектів торговельного складу. Це включає відкритість торгівлі на прикладі моделі ендогенних змінних, що використовує три проксі індикатори відкритості торгівлі, а саме: імпорт, експорт та обсяги торгівлі (експорт + імпорт) у структурі розширеної виробничої функції Манкінів. Аналіз також враховує більше політичних і соціальних факторів. Що стосується стратегії оцінки, то спершу перевірено властивості стаціонарності даних за методом Філіпса Перрона та доповнено тести на одиничний корінь Дікі–Фуллера. Наступним кроком стало використання межі моделі авторегресійного розподіленого відставання (ARDL) та підходи максимальної правдоподібності Йохансена для перевірки коінтеграції. Модель векторної корекції помилок (VECM) Причинно-наслідковий зв'язок Грейнджера також враховано, щоб перевірити напрямок причинно-наслідкового зв'язку між лібералізацією торгівлі та економічним зростанням. Модель ARDL та результати Йохансена підтвердили наявність коінтеграції між економічним зростанням і відкритістю торгівлі та іншими незалежними змінними. Результати структурного аналізу доводять, що здійснені торговельні реформи в Ємені були пом'якшені деякими політичними та соціальними факторами. Результати причинно-наслідкового зв'язку VECM Granger забезпечують більш чітке відображення та знайдені емпіричні докази на підтримку двонаправленого причинно-наслідкового зв'язку між обсягом торгівлі та імпортом із зростанням валового внутрішнього продукту (ВВП) Ємену, але було виявлено односпрямований причинний зв'язок між експортом та зростанням ВВП. Результати VECM також показують, що вплив відкритості торгівлі на зростання, як правило, має довгострокову перспективу з незначними доказами короткострокових відносин, які вказують на те, що відкритість торгівлі, за оцінками, матиме довгостроковий вплив, якщо буде впроваджена певна політика. Дослідження рекомендує заохочувати прямі іноземні інвестиції та різні політики економічних реформ, спрямовані на збільшення імпорту для більш продуктивного використання у місцевому виробництві та для активізації внутрішнього експорту. Ця стратегія також буде корисною для перерозподілу економічного зростання.

Ключові слова: економічне зростання; коінтеграційний аналіз; причинно-наслідковий зв'язок Кренгера; відкритість торгівлі; Ємен.

1. Introduction. Empirical research concerning the effect of trade openness on economic growth has long been has long been grappled and specified by the cross-country empirical literature . However, trade openness remains a highly controversial topic. Reported results arrive at many contradicting arguments between supporting and denying effects of trade openness (positive support: Keho, 2017; Zahanogo, 2016); negative support: (Musila et al. 2015; Ula an, 2015). Such paradox in results is subjected to rather esoteric nuances in the statistical specification of econometric techniques or samples and data of countries and the indicator used as proxy for trade openness. Other researchers have stand middle ground, conditioning the positive effect of openness on growth for some factors ; the good implementation of economic reforms and structural adjustment programmes (ERSAPs) of developing countries; as well as, the ratio of less or more open countries' openness ,obtained the most significance of all factors.

As a result, the support from international financial institutions, such as the International Monetary Fund and the World Bank, to the developing economies was conditioned to the degree of commitment to a programme of trade liberation reform. The rationale behind this is fact that economists generally agree on that open economies are supposed to grow faster than their closed economies. Accordingly, it is hypothesized that If openness is indeed positively related to growth of an economy, then more liberalisation reforms are required for sustainable growth (Zahonogo, 2016). In spite of the early promise of this premise and conditions, recent experience suggests that not all trade reforms have been as successful as anticipated (Singh, 2010; Zahonogo, 2016). As a result, further investigation for more factors in this concern formulates academic research need. The current study therefore, intends to investigate more factors in relation to this concern by addressing this issue in the case of Republic of Yemen, which is one of the LDCs and MECs that has never been considered in this stream of literature.

Yemen, one of LDCs, have conducted important procedures to liberalise and integrate its economy to the world. Successive governments have made significant economic reforms in the economic and financial fields, applying economic reforms and structural adjustment programmes (ERSAP)¹ in 1995 by issuing important economic, legislative and investment laws. Yemen also took procedures to improve trade openness by attempting investment environment, attracting foreign direct investment (FDI) and reducing the barriers of foreign trade to achieve the desired objectives of trade openness, FDI and foreign trade to revive economic growth and development. In addition to the 2005 tariff reform, Yemen has also liberalised trade on a preferential basis as a result of implementation of commitments under the Greater Arab Free Trade Agreement (GAFTA), which implies a 48% across-the-board cut in all import duties on goods originating in GAFTA members. The current import weighted average applied tariff is 6.7%, which is not considerably higher than the import weighted average tariffs applied in neighbouring Gulf Cooperation Council (GCC) countries, which range from 3.8% for Oman to 4.7% in the UAE (Bank, 2012; UNCTAD, 2021).

Throughout our reading, we noticed that Yemen is considered a captivating case study as it has most of the characteristics debated in the conflicting views, such as implementing ERSAPs, and it has an extremely high ratio of trade openness reaching to more than 60% in 2014 and 2015 (UNCTAD, 2021; UNCTADstat, 2020). Accordingly, the central question crops up here is to what extent the effectiveness of trade openness on economic growth of Yemen is influenced by the implementation of ERSAPs and various liberation factors and policies, as well as the internal and external shocks. To help answer this question, this study seeks to explore the existence of the long-term relationship between trade openness and economic growth. Specifically, we determine the positive or negative effect of trade openness by using three measures (i.e. export, imports and trade volume) on the economic growth of Yemen in the long and short terms during the period of 1983-2015² and checking the validity of the three hypotheses: growth-led export (GLE), growth-led import and

¹ More detailed statistics of the Yemeni ERSAP are available in Attachment A1.

² This period is necessitated by unavailability of accurate data after 2015 due to the division of political governments into three conflicting governments.

growth-led trade (GLT). The study also seeks to investigate the causality direction between trade openness with its three measures (i.e. export, imports and trade volume) and economic growth to help suggest reliable policy implications.

By achieving these objectives, the current study will contribute to the topic in multiple ways. The first contribution of this study is formulated in terms of providing new evidence, explanation and more effect mechanisms for this argumentative issue. Second, the current study uses three measures as proxies of trade openness to avoid the demerits of the measures of openness and achieve a robust finding. This specification may work to provide new evidence and robust results of the hypothesis that the composite effect of trade (exports + imports) is different from the individual effect of either exports or imports. (Awokuse, 2011; Shahbaz et al, 2011; Sarkar, 2016; Shahbaz, 2012). Moreover, we include more variables to the neoclassical augmented growth model developed by Mankiw et al. (1992) necessitated by the nature of the economic structure and political situation of Yemen. All in all, the aforementioned additional factors may work to help develop a new approach to economic growth theory.

2. Literature Review. The theoretical and empirical nexus between economic growth and trade openness have long been a considerable debate. But, definite results were neither found in the theoretical models nor empirical analyses. Theoretically, the growth literature debate has long been grappling the effects of trade policy on development as a critical matter. Incorporating technological change as exogenous variable was anchored in the neoclassical growth models derived from Solow's (1957) model, assuming that insignificant effects of trade policies on economic growth. Whereas, the assumption of new economic growth theories considered technological change as an endogenous variable and thus trade policies can be combined with those on international trade.

With this in mind, the theoretical causal effect of bidirectional openness-growth debate produced plausible results through three decomposed hypotheses: trade-led growth (TLG), export-led growth (ELG), and import-led growth (ILG)³. The vast volume researches concentrated on the export causal effects on economic growth. The possible debated effects of export on growth were encapsulated in five hypothesis categorised as follows: bidirectional causal relationship, ELG, GLE, negative link and insignificant causal effects of export on growth. As for import growth hypothesis (Awokuse, 2011; Muhammad et al., 2011), number of theoretical reasons indicate that an economy can experience ELG rather than ILG. Imports are always considered a medium of technology transfer by acquiring embodied technology through the import of capital goods; moreover, imports may play a more significant role on economic growth than exports (Awokuse, 2011; Shahbaz, 2012; Taleb, 2017). Referring to TLG hypothesis, the research has produced two hypotheses to better understand the bidirectional relationship between trade openness and growth: TLG and GLT hypotheses. Granted that theoretical assumptions determine causal relationship between openness and economic growth can be bi-directional, such causation channels is ultimately an empirical question (Arnade & Vasavada, 1995). This study, therefore aims to produce empirical evidence for Yemen on the cointegration and causation between growth and trade openness.

³ For brevity more explanation of (TLG), (ELG), and (ILG) is provided in Attachment A2.

Similar to theoretical analyses, empirical results are also controversial. One strand of literature encourage the notion of non- automatic advantages of openness to trade, and their assumption assumes that trade can effectively promote economic growth through improving of particular policies. This includes employing proxies targeted at promoting macroeconomic stability and a must-have favourable reformulating FDI-led policies and ensuring higher degree of capital formation as in Soliu and Ibrahim (2014) and improving quality conflict management institutions as in Ali et al. (2015) and that institutions can help justify the heterogeneity in the trade-growth link, improving export-oriented trade policies that attract FDI as in (Ali et al. 2015; Belderbos et al. 2010) and or by the applying of specific economic reform programmes and preconditions as in Temitope et al. (2015). Supporting this view also includes studies conducted by (Borrmann, et al. 2011; Dollar et al. 2003; Andersen & Babula 2008; Winters, et al 2004).

Other strand of empirical evidences provided robust empirical evidence in support of negative impact of trade openness on growth and that it is not the main engine of economic growth, this includes Trejos and Barboza (2015) for the Asian countries, Ula an (2015) who found that trade openness alone does not promote economic growth and Pigka-Balanika (2013) who conclude more trade openness does not contribute to development of Sub-Saharan African due to dependence of main goods on export, high natural constraints to trade, and poor overland infrastructures. This strand of literature also attributes the negative effects of trade openness to the liberalisation level in terms of sectors as in Freund et al. (2008) who determine how excessive regulations can mitigate development due to preventing resources from influencing the most efficient firms and thus productive sectors within sectors. Falvey et al. (2012) results clarified that post-liberalisation development is influenced by the economic crisis at the time of liberalisation, in a causal direction that relies on the crisis nature.

Empirical studies have also attributes that the strength of the link to possible two-way and/or three-way causality in the trade-growth link. Shahbaz (2012) followed the framework of Mankiw et al. (1992) and applied three indicators of free trade exports, imports and terms of trade, they confirmed that the strength of the link has thoroughly depended on the specification uses data and the measurements of openness. Their mixed findings proposed that more trade liberalisation is high recommended. Egbal and Tanimoune (2014) analysed TLG, ELG and ILG hypotheses and found a positive long-term relationship and bidirectional causality in support of trade and import but a unidirectional causality of export. As for Algeria, Taleb (2017) found a positive coefficient and significant long-term relationship of the export but a negative sign of coefficient and significant effect of trade volume. As for import coefficient were positive but with insignificant effect. Zeren and Ari (2013) revealed positive bidirectional causal links between openness and economic growth for countries.

Critically, we noticed that studies addressing the trade openness on economic growth in LCDs and MECs, including Yemen, are limited, and literature about trade openness in Yemen is not existed. Although most of the studies' concentration is on developed countries, results regarding the effect of openness in developing economies indicate considerably less benefits of trade liberalisation than expected. Other middle-ground studies have conditioned the positive effect to several factors such as suc-

successful economic reform programmes but ignored some model specification and sampling issues. Notably, most studies obtain results based on the stable economic and political situations for developing and developed countries alike. Thus, these results are not necessarily applied on the economies of LDCs, especially those that suffer of economic and political instability. Moreover some studies have relied on ineffective variables and limited methodologies. They also have not adopted all the required modern techniques, which affects the accuracy of the results. This study complements the literature on trade and growth, considering the missed gap and focus of the successful condition for the success of economic reforms programmes and methodological and specification demerits studies reviewed.

3. Methodology. This sections presents data and methodology in three parts, starting with data of the study, followed by model specification and ended by showing of estimation technique framework. First, part describes data of the study. As the issue of causality is dynamic in nature and is best examined using a dynamic time-series modelling framework Awokuse (2011), the scope of temporal research has been identified in a time-series framework from 1983 to 2015. This time period is necessitated by the availability of Yemeni economic data. That is, after 2015, accurate data are unavailable due to the political war that resulted in the division of political systems into three conflicting governments. One government in Sana'a, the capital city of Yemen, and two divided government in the south of Yemen (Aden. As for the period before 1983, data of variable are available because oil exploration started in 1980s. As for the flow of foreign investment, the beginning of the third millennium and beginning of local and foreign private sectors in sharing of FDI projects, they all started increasing in the 1990s. Conversely, the specified period includes significant events such as the implementation of ERSAP in 1995, which has witnessed extensive reforms in the external sector, including investment and foreign trade economic issuing of the investment laws and its amendments during this period. Another event is Yemen's ongoing negotiations to join the WTO, which culminated in joining on December 2013. As a result, we were obliged not to choose longer time-series data. Appendix A1 describes all variables' definitions, proxies, and data sources. It also shows the effect mechanism of each variable interaction within the specified model of the study. The next part of this section details the steps of constructing the study model specifications.

This part shows the generation of the model needed to test the long-term and causality connecting trade openness and growth. Most available empirical studies that aim to measure the effect of trade openness on economic growth in developing economies have relied on some versions of neoclassical and/or new growth theory, assuming export, import and trade as the key factors to enhance production (Balassa, 1978; Shahbaz, 2012). This study also follow the so called endogenous growth theory. It uses the Cobb-Douglas production function to measure the effect of trade openness on Yemeni economic growth.

Theoretically, endogenous growth models also consider the sources of technological progress and human capital (role of government liberal policy). According to these models, developing countries can achieve a long-term economic growth, which is possible under the assumption of increasing returns to scale. Thus, given the major objective of the study, trade openness (export and import) can be added to economic

growth models as it directly contributes to the growth of modern technology, as well as indirectly through the development of human capital, infrastructure and institutional development. Therefore, we include some proxies to control for trade openness in our empirical model as potential sources of the effect of trade openness on economic growth. These variables are empirically depicted in our model. Empirically, the model of this study is in the line with that of Olasode et al. (2015) model, which took a leap from Mankiw et al. (1992), who used the Cobb-Douglas production function and treated economic growth as endogenous. Following the steps of Mankiw et al. (1992), we use a Cobb-Douglas production function in aggregate form and assume a marginal contribution of capital and labour in production function in period t , this is illustrated in the following equation:

$$G(t) = A(t) K(t)^{\beta} L(t)^{1-\beta} \quad 0 < \beta < 1 \quad (1)$$

Where G represents domestic output, A is a technological progress, K is capital stock, L is labour and β is the output elasticity of capital. Then we expand Cobb-Douglas production function through the assumption that technological progress can be indicated by opening to trade, international trade, FDI and skilled human capital. The increase of international trade is highly associated with rise of FDI. According to the modernization hypothesis, FDI helps promoting economic growth by providing external capital and spreads the benefits throughout economy by enhancing capital formation. Thus, the increased domestic capital accumulation contributes to economic growth by the proliferation and expansion of infrastructure, provision of basic services and the education development, which, in turn, improve the efficiency of workers, attract more FDI and lead to increasing employment opportunities, and high level of income and improved welfare. It also helps increase the competitiveness of the economy that will enable DCs and LDCs to catch up with progress and growth.

Well-developed FDI and government spending policies (e.g. setting up budget targets, adjusting taxation, increasing public expenditure and public works) are highly effective tools in influencing economic growth. Thus, they enhance the capacity of an economy to reap fruits from trade openness international trade by diffusing technological development to stimulate economic growth. International trade also contributes to economic growth by efficient allocation of internal and external resources and shift of technological development from developed countries to developing economies. Hence, less developed countries such as Yemen exploit innovations by developed countries (i.e. learning by doing effects). Therefore, our model incorporates these factors into the aggregate production function of our model, as illustrated in the following equations:

$$A(t) = \varphi \cdot TR(t)^{\delta} \quad (2)$$

Where φ is a time-invariant constant, and TR is an indicator of trade openness (whether exports, imports or trade). Substituting Equation (2) into Equation (1) yields:

$$A(t) = \varphi \cdot TR(t)^{\delta} \quad (3)$$

The model is represented implicitly in Olasode et al. (2015), as follows:

$$RGDP = F(TRO, FDI, CAP, LAF, GEX) \quad (4)$$

Furthermore, the study include one more variable, which is dummy variable. It is considerably important factor for measuring the economic reform programmes and the nature of Yemeni political background. Thus, it is functioned to reverse the privacy of the Yemeni economy representing the internal political and economic reforms and security situations, as well as foreign political situations associated with Yemen before and after achieving unity in the country. Moreover, the study functional model employs three measures of trade openness in order to generate robust findings, avoid the demerits of trade openness measures and incorporate the causal link between openness and GDP growth. The three specified indicators of trade openness are exports/GDP, imports/GDP and (exports + imports)/GDP, this is similar to (Awokuse, 2011; Sarkar, 2016; Shahbaz, 2011, 2012; Taleb, 2017). Therefore, the functional form of the model is presented as follow:

$$RGDP = F(TROi, FDI, CAP, LAB, GEX, DUM) \quad (5)$$

Where TROi is the degree of openness in its three measures, including TRO1, which is proxied by Trade (Export + Import)/GDP ratio, TRO2, which is proxied by Export/GDP ratio, and TRO3, which is measured by Import/GDP ratio; and DUM represents the dummy variables for Yemen political and economic reform cases. The mathematical form is expressed as follows:

$$(RGDPt) = \beta_0 + \beta_1(TROit) + \beta_2(CAPt) + \beta_3(GEXt) + \beta_4(FDI t) + \beta_5(LAF t) + \beta_6(EXG t) \quad (6)$$

To allow for the inexact relationship amongst the variables, as in the case of most economic variables, stochastic error term ' μt ' is added to the equation. Thus, we can express the econometrics form of the model as :

$$(RGDPt) = \beta_0 + \beta_1(TROit) + \beta_2(CAPt) + \beta_3(GEXt) + \beta_4(FDI t) + \beta_5(LAFt) + \mu t \quad (7)$$

By taking the natural logarithm of both sides of the equation, we have

$$\begin{aligned} LOG (GDPT) = & \beta_0 + \beta_1 LOG (TROit) + \beta_2 LOG (CAP t) + \\ & + \beta_3 LOG (GEX t) + \beta_4 LOG (FDI t) + \beta_5 LOG (LAF t) + \\ & + \beta_6 LOG (EXG t) + \mu t \end{aligned} \quad (8)$$

To obtain an explicit estimable function, we should add a constant parameter and denote the log by L in Equations (5) and (6) to yield the following:

$$(GDP_t) = \beta_0 + \beta_1(TRO_{it}) + \beta_2 L(CAP_t) + \beta_3 LOG(GEX_t) + \beta_4 LOG(FDI_t) + \beta_5 (LAF_t) + \mu_t' \quad (9)$$

By adding the dummy variable, Equation (9) will represent the basic model of the current study, as shown as follows:

$$\ln GDP_t = \beta_0 DUM_t + \beta_1 \ln TRO_{i,t} + \beta_2 \ln CAP_t + \beta_3 \ln GEX_t + \beta_4 \ln FDI_t + \beta_5 \ln LAB_t + \mu_t' \quad (10)$$

Where:

$$\ln GDP_t = \beta_0 DUM_t + \beta_1 \ln TRO1_t + \beta_2 \ln CAP_t + \beta_3 \ln GEX_t + \beta_4 \ln FDI_t + \beta_5 \ln LAB_t + \mu_t' \quad (10.1)$$

represents the volume of trade equations, and

$$\ln GDP_t = \epsilon_0 DUM_t + \epsilon_1 \ln TRO2_t + \epsilon_2 \ln CAP_t + \epsilon_3 \ln GEX_t + \epsilon_4 \ln FDI_t + \epsilon_5 \ln LAB_t + \mu_t' \quad (10.2)$$

which represents export equation, whereas

$$\ln GDP_t = \epsilon_0 DUM_t + \epsilon_1 \ln TRO2_t + \epsilon_2 \ln CAP_t + \epsilon_3 \ln GEX_t + \epsilon_4 \ln FDI_t + \epsilon_5 \ln LAB_t + \mu_t' \quad (10.3)$$

which represents the export equation.

In the above equations, TRO_i is the degree of openness in its three measures, including $TRO1$, which is proxied by Trade (Export + Import)/GDP ratio, $TRO2$, which stands for Export/GDP ratio, and $TRO3$, which is measured by Import/GDP ratio. $LRGDP$ is the logarithm of the real GDP. $LFDI$ is the logarithm of FDI as another capital flow associated with trade openness. $LCAP$ represents the logarithm of gross fixed capital formation, and $LGEX$ is the total amount of government spending at all levels as a portion of GDP (between 0 and 100). α is a coefficient to control for variation amongst scores (set at 0.03). The minimum component score is zero. $LLAF$ is the logarithm of labour force, which measures the effect of human capital. The dummy variable (DUM) measures the unstable political states of the country. ε stands for stochastic error term. β_1 , β_2 , β_3 , β_4 and β_5 are parameters for independent variables under estimation; and t denotes time from 1983 to 2015.

For the estimation techniques⁴, this study adopts some modern econometrics methodologies to accurately address time-series data problems. The first step before testing the cointegration and causality is to test the stationarity of the variables. Therefore, the augmented Dickey-Fuller (ADF) and P. Pearson unit root test for the eight variables are used to test the stationarity of the variables and determine the coin-

⁴ More description of estimation technique is found in attachemne A3

tegration tests accordingly. The ADF and the P. Pearson tests are based on containment of intercept (constant), given the dynamic nature of the variables of the study. The lag lengths of the models are auto-selected by Schwartz information criterion (SIC), and the maximum lag length is auto-selected and set to seven.

Thereafter, cointegration test approach is used, namely, autoregressive distributed lag (ARDL) model bound testing approach. To have robust findings and overcome some of the demerits of the Johansen maximum likelihood and traditional cointegration approaches, we use the ARDL model bound testing. Firstly, this method allows the estimation of the long-term level relationship between variables, and its choice is motivated by the key benefits it has over the strictly I(1) stationary variable dependent cointegration test. Secondly, the method is asymptotically efficient in finite and small sample studies and applicable even in the case where the regressors are endogenous. This method is appropriate for the present paper with only 33 observations. More importantly, it allows simple linear transformation (Narayan, 2005; Shahbaz, 2012) by driving dynamic unrestricted error correction model (UECM). Using UECM help generate more robust results for our study as it integrates the short-term dynamics with the long-term equilibrium without losing any information for the long term, taking each of the variables in turn as a dependent variable. Thus, we estimate six dynamic UECMs, taking each of the variables in turn as a dependent variable. This setup is presented as.

$$\begin{aligned} \Delta \ln GDP_t = & \alpha_1 + \alpha_{GDP} GDP_{t-1} + \alpha_{TROi} TROi_{t-1} + \alpha_{CAP} CAP_{t-1} + \alpha_{LF} LF_{t-1} \\ & + \alpha_{FDI} FDI_{t-1} + \alpha_{GEX} GEX_{t-1} + \sum_{i=1}^p \alpha_i \Delta \ln GDP_{t-i} \\ & + \sum_{j=0}^q \alpha_j \Delta \ln TROi_{t-j} + \sum_{k=0}^r \alpha_k \Delta \ln CAP_{t-k} + \sum_{l=1}^s \alpha_l \Delta \ln LF_{t-l} \\ & + \sum_{m=1}^t \alpha_m \Delta \ln FDI_{t-m} + \sum_{n=1}^u \alpha_n \Delta \ln GEX_{t-n} + \varepsilon_t \end{aligned} \quad (11)$$

$$\begin{aligned} \Delta \ln TROi_t = & \alpha_1 + \alpha_{GDP} GDP_{t-1} + \alpha_{TROi} TROi_{t-1} + \alpha_{CAP} CAP_{t-1} + \alpha_{LF} LF_{t-1} \\ & + \alpha_{FDI} FDI_{t-1} + \alpha_{GEX} GEX_{t-1} + \sum_{i=1}^p \alpha_i \Delta \ln TROi_{t-i} \\ & + \sum_{j=0}^q \alpha_j \Delta \ln GDP_{t-j} + \sum_{k=0}^r \alpha_k \Delta \ln CAP_{t-k} + \sum_{l=1}^s \alpha_l \Delta \ln LF_{t-l} \\ & + \sum_{m=1}^t \alpha_m \Delta \ln FDI_{t-m} + \sum_{n=1}^u \alpha_n \Delta \ln GEX_{t-n} + \varepsilon_t \end{aligned} \quad (12)$$

$$\begin{aligned}
\Delta \text{LnCAP}_t = & \alpha_1 + \alpha_{\text{GDP}} \text{GDP}_{t-1} + \alpha_{\text{TROI}} \text{TROI}_{t-1} + \alpha_{\text{CAP}} \text{CAP}_{t-1} + \alpha_{\text{LF}} \text{LF}_{t-1} \\
& + \alpha_{\text{FDI}} \text{FDI}_{t-1} + \alpha_{\text{GEX}} \text{GEX}_{t-1} + \sum_{i=1}^p \alpha_i \Delta \text{LnCAP}_{t-i} + \sum_{j=0}^q \alpha_j \Delta \text{LnGDP}_{t-j} \\
& + \sum_{k=0}^r \alpha_k \Delta \text{LnTROI}_{t-1} + \sum_{l=1}^s \alpha_l \Delta \text{LnLF}_{t-1} + \sum_{m=1}^t \alpha_m \Delta \text{LnFDI}_{t-1} \quad (13) \\
& + \sum_{n=1}^u \alpha_n \Delta \text{LnGEX}_{t-1} + \varepsilon_t
\end{aligned}$$

$$\begin{aligned}
\Delta \text{LnLF}_t = & \alpha_1 + \alpha_{\text{GDP}} \text{GDP}_{t-1} + \alpha_{\text{TROI}} \text{TROI}_{t-1} + \alpha_{\text{CAP}} \text{CAP}_{t-1} + \alpha_{\text{LF}} \text{LF}_{t-1} \\
& + \alpha_{\text{FDI}} \text{FDI}_{t-1} + \alpha_{\text{GEX}} \text{GEX}_{t-1} + \sum_{i=1}^p \alpha_i \Delta \text{LnLF}_{t-i} + \sum_{j=0}^q \alpha_j \Delta \text{LnGDP}_{t-j} \\
& + \sum_{k=0}^r \alpha_k \Delta \text{LnTROI}_{t-1} + \sum_{l=1}^s \alpha_l \Delta \text{LnCAP}_{t-1} + \sum_{m=1}^t \alpha_m \Delta \text{LnFDI}_{t-1} \\
& + \sum_{n=1}^u \alpha_n \Delta \text{LnGEX}_{t-1} + \varepsilon_t \quad (14)
\end{aligned}$$

$$\begin{aligned}
\Delta \text{LnFDI}_t = & \alpha_1 + \alpha_{\text{GDP}} \text{GDP}_{t-1} + \alpha_{\text{TROI}} \text{TROI}_{t-1} + \alpha_{\text{CAP}} \text{CAP}_{t-1} + \alpha_{\text{LF}} \text{LF}_{t-1} + \\
& \alpha_{\text{FDI}} \text{FDI}_{t-1} + \alpha_{\text{GEX}} \text{GEX}_{t-1} + \sum_{i=1}^p \alpha_i \Delta \text{LnFDI}_{t-i} + \sum_{j=0}^q \alpha_j \Delta \text{LnGDP}_{t-j} + \\
& \sum_{k=0}^r \alpha_k \Delta \text{LnTROI}_{t-1} + \sum_{l=1}^s \alpha_l \Delta \text{LnCAP}_{t-1} + \sum_{m=1}^t \alpha_m \Delta \text{LnLF}_{t-1} + \\
& \sum_{n=1}^u \alpha_n \Delta \text{LnGEX}_{t-1} + \varepsilon_t \quad \dots \quad (15)
\end{aligned}$$

$$\begin{aligned}
\Delta \text{LnGEX}_t = & \alpha_1 + \alpha_{\text{GDP}} \text{GDP}_{t-1} + \alpha_{\text{TROI}} \text{TROI}_{t-1} + \alpha_{\text{CAP}} \text{CAP}_{t-1} + \alpha_{\text{LF}} \text{LF}_{t-1} + \\
& \alpha_{\text{FDI}} \text{FDI}_{t-1} + \alpha_{\text{GEX}} \text{GEX}_{t-1} + \sum_{i=1}^p \alpha_i \Delta \text{LnGEX}_{t-i} + \sum_{j=0}^q \alpha_j \Delta \text{LnGDP}_{t-j} + \\
& \sum_{k=0}^r \alpha_k \Delta \text{LnTROI}_{t-1} + \sum_{l=1}^s \alpha_l \Delta \text{LnCAP}_{t-1} + \sum_{m=1}^t \alpha_m \Delta \text{LnLF}_{t-1} + \\
& \sum_{n=1}^u \alpha_n \Delta \text{LnLF}_{t-1} + \varepsilon_t \quad \dots \quad (16)
\end{aligned}$$

Since, we have specified three models in our study, we estimate the above setup for each model (i.e. six equations per each model, totalling 18 equations). Any of the 18 equations of the three models are selected and estimated by the ARDL model. F-test is used to examine the existence of a long-term relationship between the variables of interest, following the null hypothesis (i.e. $H_0: G = \alpha \text{TROI} = \alpha \text{CAP} = \alpha \text{LF} = \alpha \text{FDI} = \alpha \text{GEX} = 0$) against the alternate hypothesis of cointegration (Pesaran et al., 2001) for Equation (10). If cointegration exists in Equations (4)–(15) where trade openness (TROI), and other independent variables are used as forcing variables, then an established long-term relationship exists between the variables that can be modelled in the following equation:

$$\begin{aligned} \text{LnGDP}_t = & \Phi_0 + \Phi_1 \text{TROI}_{t-1} + \Phi_2 \text{CAP}_{t-1} + \Phi_3 \text{LF}_{t-1} + \\ & + \Phi_4 \text{FDI}_{t-1} + \Phi_5 \text{GEX}_{t-1} + \varepsilon_i. \end{aligned} \quad (17)$$

where

$$\begin{aligned} \theta_0 &= -\alpha_1/\alpha_{\text{GDP}}, \theta_1 = -\alpha_{\text{TROI}}/\alpha_1, \\ \theta_2 &= -\alpha_{\text{CAP}}/\alpha_1, \theta_3 = -\alpha_{\text{LF}}/\alpha_1, \\ \theta_4 &= -\alpha_{\text{GEX}}/\alpha_1 \text{ and } \theta_5 = -\alpha_{\text{FDI}}/\alpha_1 \end{aligned}$$

and μ is the error term assumed to be normally distributed (Egbal & Tanimoune, 2014; Shahbaz, 2012). These long-term estimates are computed using the real GDP growth (GDP) in logarithm form is used as a dependent variable.

Finally, after confirming cointegration of the series, the VECM is used to investigate the direction of the causality between the variables. We test the direction of causality between the variables following the error correction representation, as shown as follows:

$$\begin{aligned} (1-L) \begin{bmatrix} \text{LnGDP}_t \\ \text{LnTROI}_t \\ \text{LnCAP}_t \\ \text{LnLF}_t \\ \text{LnFDI}_t \\ \text{LnGEX}_t \end{bmatrix} &= \begin{bmatrix} a_1 \\ a_2 \\ a_3 \\ a_4 \\ a_5 \\ a_6 \end{bmatrix} + \sum_{i=1}^p (1-L) \begin{bmatrix} b_{11i} & \cdots & b_{16i} \\ \vdots & \ddots & \vdots \\ b_{61i} & \cdots & b_{66i} \end{bmatrix} \times \\ &\times \begin{bmatrix} \text{LnGDP}_{t-1} \\ \text{LnTROI}_{t-1} \\ \text{LnCAP}_{t-1} \\ \text{LnLF}_{t-1} \\ \text{LnFDI}_{t-1} \\ \text{LnGEX}_{t-1} \end{bmatrix} + \begin{bmatrix} \alpha \\ \beta \\ \gamma \\ \delta \\ \theta \\ \sigma \end{bmatrix} \end{aligned} \quad (18)$$

Where the difference operator ECT_{t-1} is a lagged residual term from the long-term relationship; and ε_{1t} , ε_{2t} , ε_{3t} , ε_{4t} , ε_{5t} and ε_{6t} are error terms assumed to be normally distributed with mean zero and finite covariance matrix. The causality between variables in the long term is estimated by the significance of t-statistic connecting the coefficients of the error term (ECT_{t-1}) Shahbaz (2012).

4. Result Analysis and Discussion. Our analysis starts with the basic descriptive statistics of the study data, as shown in Appendix A2. It shows the averages values, standard deviation, skewness, kurtosis and Jarque-Bera values of the selected variables. Appendix A3 summarises the unit root test results for the variables of the study in their levels, as well as their first differences in Augmented Fully Dicker test and Philip Pearson tests. All variables are stationary at their first differences in real terms and they are said to be integrated of order one (I(1)), together with the real GDP growth.

4.1. ARDL Bound Testing Approach Results. The unit root tests show no possibility of I(2) variables and that none of the variables are integrated of order 2 or beyond.

Thus, we implement the ARDL procedures⁵. We first implement impose the orders of the lags in the ARDL model.

Table 1. ARDL bound testing cointegration approach analysis, *author's*

Estimated models	Bound testing to cointegration		Diagnostic tests					
	F-statistics	Normality	Serial	Hetero	Auto	Reset	Test	
F[GDP] (TRO1, FDI, CAP, LF, GEX)	3.4959**	0.54	0.2784	0.3549	0.994	0.2877	0.7766	
F[TRO1] (GDP, FDI, CAP, LF, GEX)	1.9669	0.89	(0.04)	0.1343	0.664	1.2307	0.2334	
F[FDI] (TRO1, GDP, CAP, LF, GEX)	2.1668	0.94	0.7704	0.6285	0.263	0.1295	0.8982	
F[CAP] (TRO, FDI, GDP, LF, GEX)	3.1336**	0.54	0.2434	0.6230	0.967	0.8234	0.4205	
F[Lf] (TRO1, FDI, CAP, GDP, GEX)	22.8647*	0.15	0.1174	0.0803	0.943	1.1989	0.2453	
F[GEX] (TRO1, FDI, CAP, LF, GDP)	3.8775**	0.71	0.8110	0.3370	0.362	0.8381	0.4118	
F[GDP] (TRO2, FDI, CAP, LF, GEX)	4.38863*	0.17	0.2806	0.8700	0.984	1.0522	0.3046	
F[CAP] (TRO2, FDI, GDP, LF, GEX)	3.2037***	0.62	0.1942	0.9102	0.492	1.0533	0.3061	
F[TRO2] (TRO2, FDI, CAP, LF, GEX)	0.9725	0.03	0.2368	0.2486	0.998	1.5259	0.1420	
F[Lf] (TRO2, FDI, CAP, GDP, GEX)	25.8211*	0.22	0.0482	0.0322	0.901	1.7757	0.1660	
F[GEX] (TRO2, FDI, CAP, LF, GDP)	3.8779**	0.75	0.8489	0.3398	0.480	0.9249	0.3660	
F[FDI] (TRO2, GDP, CAP, LF, GEX)	3.1390***	0.69	0.2809	0.2205	0.479	0.2068	0.8382	
F[GDP] (TRO3, FDI, CAP, LF, GEX)	2.6474	0.22	0.5433	0.4042	0.998	0.5525	0.5870	
F[TRO3] (GDP, FDI, CAP, LF, GEX)	3.3566***	0.87	0.0123	0.4622	0.770	1.2698	0.2195	
F[CAP] (TRO2, FDI, GDP, LF, GEX)	3.1388***	0.54	0.2339	0.6321	0.970	0.8037	0.4315	
F[Lf] (TRO2, FDI, CAP, GDP, GEX)	26.4486*	0.21	0.9936	0.0955	0.865	1.0593	0.3027	
F[FDI] (TRO2, GDP, CAP, LF, GEX)	2.1687	0.94	0.7699	0.0901	0.258	0.0771	0.9393	
F[GEX] (TRO2, FDI, CAP, LF, GDP)	3.8777*	0.72	0.8200	0.3359	0.370	0.8490	0.4059	
CV Bounds								
Significance	10 Bound	11 Bound						
10%	2.08	3						
5%	2.39	3.38						
2.5%	2.7	3.73						
1%	3.06	4.15						

Note: *, **, *** represent significance at 1%, 5% and 10% levels respectively. Between the square brackets the optimal lag length is selected for each of the autocorrelation and RESET diagnostic tests. The appropriate lag is selected using SIC.

⁵ Before ARDL procedures we used Johansson cointegration test and results are available in Appendix A4.

Moreover, given that the computation of the ARDL bound testing is sensitive with lag length selection, we follow the AIC for the selection of lag length as (Shahbaz et al., 2011; Shahbaz, 2012). A maximum of one lag on each first differenced variable is auto-selected by SIC. The results of the bound testing on cointegration are displayed in Table 1. We reach our decision regarding the presence of the long-term relationship between the variables of the specific model with a simple comparison. That is, the bound testing approach compares the calculated F-statistics against the CVs generated by LCB and UCB developed by Narayan (2005). This approach is more appropriate for our small sample.

The bound testing results on cointegration reported in Table 1 show that the calculated F-statistic for the term of trade model reveals four cointegrating vectors, with a higher upper bound CV at 10% and 5% levels, once trade volume, FDI, capital fixed formation, GDP, labour force and government spending taken as predicted variables. Furthermore, the same inference is shown in the export model results. However, we find five cointegrating vectors higher than the upper bound critical at 1%, 5% and 10% levels; whereas the import model shows three cointegrating vectors higher than the upper bound CV at 5% and 10% levels. Therefore, the presence of cointegration validates the existence of long-term relationship between economic growth and the three trade openness measures in the case of Yemen over the study period of 1983–2015. the results of reliability tests of the dynamic UECMs are shown in Table 1 above.

The next task in ARDL bound testing procedure is to investigate the extent (amount) of the long-term effects of trade openness and related variables on economic growth in the case of Yemen. However, before that, we apply the Gregory and Hansen (1996) structural break cointegration approach to test the robustness of cointegration relation among economic growth, trade openness and other independent variables in the long run because the results of the ARDL bound test may be inefficient and unreliable, once the series has a structural break point.

Once considering for Gregory and Hansen (1996) structural break cointegration approach, as shown in Table 6, the results of the three models show a significant long-term relationship. The results indicate significant cointegration for long-term relationship among economic growth, trade openness and other independent variables once trade (exports + imports) was treated as an indicator of trade openness after allowing for the break of 2011. The break point was due to the events of 2011 in which revolution and protest against the ruling political and governmental system and the ruling party took place in Yemen. As for import, when treated as a measure of trade openness, it also shows a significant long cointegration after allowing a break of 1990. This break point in the trade series was due to the announcement of Yemeni unity in 1990, which highly affected the ratio of imports. The export model also reveals statistically significant cointegration after allowing the break point of 2001, in which Yemen started implementing the trade reforms in removing trade deficit under the umbrella of SAP, which was suggested by the five-year plans for social and economic development and poverty alleviation from 2000 to 2025. This finding implies that the long-term results are robust.

The ADF statistics show the Gregory and Hansen tests of cointegration with an endogenous break in the intercept.

After considering the structural breaks, the results of ARDL documented in Table 3 show that export is positively linked to economic growth and it is not statistically significant at the 5% significance level.

Table 2. Results of Gregory and Hansen cointegration test, *author's*
Dependent variable = GDP

Dependent variable = GDP						
Estimated model	Trade volume model		Export model		Import model	
	t. statistics		t. statistics		t. statistics	
ADF test	-4.4647	0.0000	-3.6537	0.0000	-4.5989	0.0000
Break year	2011		2000		1990	

Thus, keeping other factors constant, a 0.0500% economic growth is not stimulated by a 1% growth in exports, this could be due to the implementation of the five-year plans for social and economic development and poverty alleviation from 2000 to 2025, but these modulated effects don't seem to have significant effect in the long run. That is because of the fact that Yemeni exports faced some demerits such as the lack of diversifications of non-exports commodities, and for a long time activities export sectors of Yemen was directed to the local market rather than international market this in return lead to importing some basic commodities in order to meet the basic consuming needs (Al-Jabry 2013; Bank 2002) .

Table 3. Extent of long-term effect of trade openness on economic growth, *author's*
Dependent variable = GDP

Dependent variable = GDP						
Variables	Trade volume model		Import model		Export model	
	Coefficients	t-stat	Coefficients	t-stat	Coefficients	t-stat
@TREND	-0.0690	-0.1122	0.8556	0.3287	4.6922	0.9156
TRO1 (trade volume)	-0.0741	-0.0664				
TRO3 (imports)			-0.4987	-0.2328		
TRO2 (exports)					3.8256	0.1083
CAP	-0.1334	-0.4317	3.2797	0.3765	6.0797	0.9106
GEX	0.3488	0.5098	-0.3082	-0.3073	-0.5245	0.9194
LF	-1.5598	-0.3395	-4.0926	-0.2771	-16.3781	0.9198
FDI	1.8705	0.6356	0.3706	0.3187	0.7746	0.9172
R-squared	0.9954		0.9954		0.9957	
Adj R-squared	0.9919		0.9920		0.9929	

Note: The 1%, 5% and 10% levels of significance are indicated by *, ** and ***, respectively.

These findings are not consistent with those of (Muhammad et al. 2011; Shahbaz 2012; TALEB 2017) who reported a positive effect of export on economic growth. However, the effect of import on economic growth exerts negative and statistically insignificant effects, these results are inconsistent with (Muhammad et al. 2011; Shahbaz 2012; TALEB 2017), such estimated results of imports are caused due to the high unbalanced ratio between productive and non-productive imported goods and services after the unity of south and north of Yemen in 1990 as reported by (Musibah et al, 2015; Ula an et al. 2015).

The estimated effects of terms of trade are also found to be insignificantly negative, the attributed reasons for such findings are in high degree, due to the events of 2011 (protests and revolutions), which caused unstable political conditions and closed the economy ;moreover such findings are caused by gradual effects of export and import prices of mineral fuels, lubricants and related materials. These results are in the line with Duasa (2011) in the case of Malaysia. On contrary, the findings of (Hye 2011; Muhammad et al. 2011; Shahbaz 2012; TALEB 2017) reported positive estimated coefficient of term of trade.

Finally, diagnostic tests results including Values of adjusted R2 , Durbin Watson statistics. CUSUM and CUSUMQ stability and normality test tests are found in Appendix 5A. After UECMs estimation confirm the long term link between trade openness measures and growth ,the next task apply the Granger causality approach under VECM to test the direction of casual relation between the series which is shown in the next section.

4.2. Granger Causality Results under VECM Approach. This section aims to determining the exact direction of causality between the study variables to help policy-making authorities sustain economic growth, attaining fruitful effect of trade openness. Tables 4-6 report the results of Granger causality tests based on the VECM Granger causality approach. The tables represent exports, imports and trade as indicators of trade openness. Since we apply three model indicators for trade openness (exports, import and term of trade), we estimate 18 equations, 6 for each of exports, imports and trade (imports + exports) models. Each row of Tables 4-6 represents ECM equations for each of the 6 variables in each model.

The first column in each table is the dependent variables for the ECM equations, and the rest of the columns are the independent ones. All variables are used in a logarithm form. The column in the middle of Tables 4-6 (labelled long term) contains the coefficients, t-statistics and probability in parentheses for the lagged error correction terms (ECTt -1). A significant lagged error correction term coefficient represents the speed of adjustment towards a long-term equilibrium, which implies that past equilibrium errors plays a role in determining current outcomes. Thus, the causality between the variables in the long term is estimated by the significance of t-statistic connecting the coefficients of lagged error correction terms (ECTt-1) equal zero for any of the 16 equations in the system.

The results of trade volume model are shown in Table 4. The results of all t- statistics for long run causality (ECTt-1) appear to be negative and statistically significant for all variables once set as dependent variables , these findings firstly suggest long run bidirectional causality running from trade volumes and all the independent variables in the model to GDP growth and from GDP to trade volumes. Such findings validate TLG and GLT hypotheses which is consistent with Shaheen et al. (2011) for the case of Pakistan, but inconsistent to Shahbaz (2012) who only confirmed growth-led trade hypothesis.

Table 4. VECM Granger causality analysis: Trade volume as an indicator of trade openness, *author's*

Direction of causality													
Short term: Chi-square and stat (prob)							Long term: coeff. (t-stat) (prob)						
Dependent variables	$\Delta \ln$ GDpt-1	$\Delta \ln$ TRO1t-1	$\Delta \ln$ CAPT-1	$\Delta \ln$ FDI t-1	$\Delta \ln$ Lft-1	$\Delta \ln$ GEXT-1	$\Delta \ln$ ECT-1	$\Delta \ln$ GDpt-1 ECT-1	$\Delta \ln$,TRO2t-1, ECT-1	$\Delta \ln$ CAPT-1, ECT-1	$\Delta \ln$ FDI t-1, ECT-1	$\Delta \ln$ Lft-1, ECT-1	$\Delta \ln$ GEXT-1, ECT-1
LN GDP	-----	0.5407 0.7631	0.4690 0.7910	1.5568 1.6472	0.4591 0.4388	3.1057 0.2116	-0.4782** (2.3166) (0.0325)	-----	0.0337(0.8543)	0.1149(0.7345)	3.0303* (0.0817)	1.3727 (0.2566)	1.8095 (0.1786)
LN TRO1	7.8637* 0.0196	-----	6.9463** 0.0310	3.7983 0.1497	9.0257* 0.0110	1.4475 0.4849	-0.5253* (-2.5587) (0.0266)	8.5558** (4.2779)	-----	-5.2491 (2.6245)	10.7658** (5.3829)	3.5811 (1.7905)	2.5106 (1.2553)
LN CAP	9.9075* 0.0071	29.2520* 0.0000	-----	13.0687* 0.0015	2.8805 0.2369	3.6575 0.1606	-0.5182* (-2.7355) (0.0131)	1.2216 0.2063	.2216 (.2063)	-----	1.6444 1.6391	-----	1.2216 0.2063
LN FDI	12.8696* 0.0016	3.4685 0.1765	7.8413* 0.0198	-----	2.7937 0.2474	5.7033** 0.0577	-0.1698** (1.9964) (0.0612)	0.5553** (0.5627)	0.1946 (.110)	0.20.3381 (0.3508)	-----	0.7418 (0.7456)	0.4603 (0.4698)
LN LF	0.4208* 0.0016	0.5075 0.1765	1.0341* 0.0198	1.3090 0.2474	-----	0.4208* 0.0016	0.1116** (0.5177) (0.6149)	0.8312 (0.8338)	0.5975 (0.6112)	0.8039 (0.8073)	0.9187 0.9187	-----	0.9507 (0.9509)
LN GEX	24.1495* 0.0000	4.3776 0.1121	15.6664* 0.0004	28.0590* 0.0000	46.3165* 0.0000	-----	-1.0472* (-5.9014) (0.0000)	0.6203 0.6263	0.0126* (0.0225)	0.0006* (0.0029)	0.0004* (0.0000)	0.0006* (0.0029)	-----

Note: The 1%, 5% and 10% levels of significance are indicated by *, ** and ***, respectively.

Table 5. VECM Granger causality analysis: Exports as an indicator of trade openness, *author's*

Direction of causality													
Short term: Chi-square and (prob)				Long term: Joint-long-run and short run: Chi-square, t. stat and (prob)									
Dependent variables	$\Delta \ln$ GDpt-1	$\Delta \ln$ TRO2	$\Delta \ln$ CAPt-1	$\Delta \ln$ FDI-1	$\Delta \ln$ Lft-1	$\Delta \ln$ GEXT-1	ECT _{t-1}	$\Delta \ln$ 1, ECT _{t-1}	GDpt-1, ECT _{t-1}	$\Delta \ln$ TRO2t- $\Delta \ln$ ECT _{t-1}	CAPT-1, ECT _{t-1}	FDIt-1, $\Delta \ln$ ECT _{t-1}	Lft-1, $\Delta \ln$ GEXT-1 ECT _{t-1}
LN GDP	0.7349 0.6925		0.8973 0.6385	2.4232 0.2977	0.0256 0.9873	1.4136 0.4932	-0.0884 (-0.9104) (0.4945)	----	0.9885 0.9887)	0.8194 0.8220	0.0155* 0.0263)	0.7396 (0.7396)	0.1515 (0.1687)
LN TRO1	11.7290 0.0028		7.8716 0.0195	1.0971 0.5778	10.1340 0.0063	0.0732 0.9641	-0.1245* (-2.5587) (0.0266)	0.7556 (0.7556)	----	2.286742 (2.286742)	1.214171 (1.214171)	0.1288 (0.1288)	1.9354 (9354)
LN CAP	1.5220 0.4672	0.0433 0.9786		0.0090 0.9955	0.2309 0.8910	0.3010 0.8603	-0.5182 (-2.7355) (0.3746)	0.3097 (0.3232)	0.5984 (0.6048)	----	0.6600 0.6652	0.7828 (0.7860)	0.9298 (0.9308)
LN FDI	7.4353* 0.0243	1.8296 0.4006	6.5397** 0.0380		4.5446 0.1031	0.3898 0.8229	-0.6377* (-4.0351) (0.0008)	0.6248 (0.6307)	0.0205* (0.0324)	0.8146 (0.8172)	----	0.2145 (0.2304)	0.6615 (0.6667)
LN LF	1.0063 0.6046	0.3094 0.8567	0.6626 0.7180	7.6825** 0.0215		0.0938 0.9542	0.0587* (2.6648) (0.0158)	0.8510 (0.8531)	0.6551 (0.6604)	0.3783 (0.3783)	0.5783 (0.5783)	0.9434 (0.9442)	
LN GEX	1.9230 0.3823	7.4919* 0.0236	15.8680* 0.0004	9.5185* 0.0086	3.9180 0.1410		-0.8880* (-4.6067) (0.0002)	0.4957 (0.5044)	0.8215 (0.8241)	0.0589*** (0.0751)	0.0000* (0.0002)	0.0101* (0.0192)	

Note: The 1%, 5% and 10% levels of significance are indicated by *, ** and ***, respectively.

Interestingly, while findings also indicate bidirectional long-term Granger causality relationship among trade openness, labour force LF and GEX, CAP, FDI and GDP growth once set as dependent variables, the findings of short run casualty as well as significance of joint-long-run and short run verify the nature of this relationship. Such findings imply that, the past performance may positively affect future possible gradual effects of trade openness on growth in case of implementing reforms related to FDI policies in correspondence with liberalisation of foreign trade as indicated in the joint-long-run and short run findings. The positive estimated coefficient FDI on GDP growth, trade openness and government spending shown in the joint-long-run and short run findings, confirm that FDI helps promoting economic growth by providing external capital for domestic production enhancement and the capacity of Yemeni economy can be fully enhanced and reap the fruits of trade openness through well-developed FDI and government spending policies (e.g. reducing tariffs for local production, setting up budget targets, adjusting taxation, increasing public expenditure and public works). These results are in the line with demand-side hypothesis.

In Table 5, the t -statistic of ECT_{t-1} suggest unidirectional causality running from growth and other independent variables to export validating the GLE hypothesis whereas the ELG hypothesis is not supported the export model. This implies the validation of supply-side hypothesis suggesting that productivity gains induced by improved labor skills and technology leads to export growth caused by the increased efficiency that create comparative advantage for higher participation in the international market to Yemen that facilitate exports.

This is sketched in the exited bidirectional long run causality between GDP growth labour force, FDI and government spending as well as the unidirectional long run casualty running from exports to labour force, FDI, and government spending. Such results might be due to the implementation of structural reforms witnessed in 1995 that shift the economic policy towards a more export growth-oriented stance. Our findings are contrary to Shahbaz (2012) who found bidirectional long run causality between export and growth. But they are in the line with Klasra (2011) who proved GLE hypothesis.

The results of the import model in (Table 6), show bidirectional long run casualty running from imports and all independent variables to GDP growth and vice versa, validating the ILG and GLI hypotheses. This reflects the extent to which increased imports contribute to promote the capital demand innovation needs, and the positive response of Yemeni local productivity to the foreign technological completion in order to meet the required factors of production for local market demand needs and that can also be employed in the export sector. Such intuition is verified in the feedback hypothesis of the bidirectional long run casualty between exports FDI, labour force, government spending and growth. Therefore, our findings imply that imports shares relatively more significantly long-term effects to GDP growth than exports which is similar to Awokuse (2008) who found that imports can contribute to growth more than exports through importing capital goods by transferring the gained embodied technology. In contrary, such findings are in opposite line with Shahbaz (2012) who only found GLI hypothesis.

Table 6. VECM Granger causality analysis: Imports as an indicator of trade openness, *author's*

Direction of causality													
Short term: Chi-square and stat (prob)							Long term: coeff. (t-stat) (prob)						
Dependent variables	$\Delta \ln$ GDp _{t-1}	$\Delta \ln$ TRO3 _{t-1}	$\Delta \ln$ CAP _{t-1}	$\Delta \ln$ FDI _{t-1}	$\Delta \ln$ LFT-1	$\Delta \ln$ GEXT-1	$\Delta \ln$ ECT _{t-1}	$\Delta \ln$ GDP _{t-1} , ECT _{t-1}	$\Delta \ln$, TRO3 _{t-1} , ECT _{t-1}	$\Delta \ln$ CAP _{t-1} , ECT _{t-1}	$\Delta \ln$ FDI _{t-1} , ECT _{t-1}	$\Delta \ln$ LFT-1, ECT _{t-1}	$\Delta \ln$ GEXT-1, ECT _{t-1}
LN GDP	0.734907 0.6925	0.897264 0.6385	2.423172 0.2977	0.025590 0.9873	1.667759 0.4344	-0.5637* (-2.4663) (0.0239)	0.7951 (0.7980)	0.0762*** (0.0931)	0.2415 (0.2568)	0.2415 (0.2568)	0.2415 (0.2568)	0.2415 (0.2568)	0.1911 (0.2075)
LN TRO3	11.72904* 0.0028	7.871592* 0.0195	1.097113 0.5778	10.13402* 0.0063	2.643370 0.2667	-0.2688** (-2.0869) (0.0514)	0.7556 (0.7550)	2.2867 (2.2867)	1.2141 (1.2141)	1.2141 (1.2141)	0.1288 (0.1288)	1.9354 (1.9354)	
LN CAP	1.522035 0.4672	0.043318 0.9786	0.008996 0.9955	0.230908 0.8910	0.229684 0.8915	-0.1658 (-0.7366) (0.4709)	0.9705 (0.9708)	0.0095* (0.0183)	0.3170 (0.3302)	-0.0095* (0.0183)	0.3170 (0.3302)	0.3302 (0.3302)	
LN FDI	7.435332* 0.0243	1.829589 0.4006	6.539650** 0.0380	4.544577 0.1031	0.389779 0.8229	-0.6377*** (-0.6377) (0.0728)	0.9300 (0.9309)	0.2171 (0.2330)	0.6462 (0.6517)	0.6462 (0.6517)	0.3350 (0.3478)	0.7013 (0.7058)	
LN LF	1.006259 0.6046	0.309402 0.8567	7.682468* 0.0215	0.093807 0.9542	0.1673* (2.5169) (0.0215)	0.1673* (2.5169) (0.0215)	0.7998 (0.8026)	0.5450 (0.5525)	0.2969 (0.3107)	0.6658 (0.6709)	0.6658 (0.6709)	0.6365 (0.6422)	
LN GEX	1.923039 0.3823	7.491870* 0.0236	15.86798* 0.0004	9.518507** 0.0086	3.917967 0.1410	-1.0389* (-4.6067) (0.0002)	0.1982 (0.2145)	0.0144* (0.0249)	0.0000* (0.0004)	0.0007* (0.0031)	0.0219* (0.0341)	0.0219* (0.0341)	

Note: The 1%, 5% and 10% levels of significance are indicated by *, ** and ***, respectively.

5. Conclusion and Policy Implications. Our major area of debate is providing empirical evidence revealing whether or to what extent the efficiency of trade openness on economic growth in developing countries, is influenced by implementation of economic reform programmes and the degrees of less and more open economies for trade. To answer the central question of the study, the study presents an empirical analysis that the effect of trade openness on economic growth, taking Yemen as a captivating case study due to the existence of the various openness characteristics and economic reform programmes, as well as the internal and external shocks. The evidence is based on a time-series framework for the period of 1983-2015 using various above mentioned estimation techniques and three indicators as proxies for trade openness measures to accurately answer each part of the study objectives and avoid the demerits and problem of specification issues found in previous literature.

Our main results collaborate with our main argument confirming that economic reforms play a considerably important role in the effectiveness of trade openness in Yemen, as clarified in the structural break analysis results, which shed light on how Yemen obtains benefits of trade due to the economic reform programme of five-year plans. However, these effects were diminished due to internal political conflicts. The results also assured the assumption that the composition impact of trade (exports + imports) is not the same as the individual estimates of either exports or imports. The empirical findings of VECM Granger causality support the premise of a bidirectional causal relationship between trade volume and imports with GDP growth of Yemen, but a unidirectional causal relationship between exports and GDP growth. Accordingly, the study concludes several policy implications for promoting Yemeni economy.

Our empirical findings offer several innovative and fruitful policy implications. This study concluded that obtaining economic growth sustainability is possible if a comprehensive programme of trade openness is applied, therefore we recommend working on liberalisation of foreign trade, specifically by reviewing legislation, regulations and laws to reach the goals of increasing exports and mitigating excessive rise in the external debt levels and higher average debt service by achieving equitable integration into the international economy. This can be achieved through activating Yemeni bilateral and regional agreements and economic bloc. Trade and FDI are proved, in the literature and study findings, to show extent of mutual substitution and mutual promotion, and they should be considered. Therefore, paying attention to establishment foreign affiliates to localise foreign business group firms in Yemen, will lead to greater propensity to import capital goods from Yemen, attract FDI and increase its exports Belderbos et al., (2010).

This study also vindicates the ILG hypothesis in Yemen, and vice versa, thus the various economic reform policies that shift towards imports for the purpose of being productive to support exports is proved to be helpful to Yemeni economy, thereby reallocating its resources to more productive uses is highly recommended. Nevertheless, causation from imports to economic growth in short term doesn't exist in this study, this imply that past performance may affect future results, therefore Yemen's policy should adopts rather more internal sources than external sources to meet most of the productive sector's needs. On the other hand, Yemeni government should reduce the extremely high percentage of consumption goods that is reported in the index of commercial density.

1. Ali, Wajahat, and Azrai Abdullah. 2015. "The Impact of Trade Openness on the Economic Growth of Pakistan: 1980-2010." *An International Journal* 7(2):120–29.
2. Awokuse, Titus O. 2007. "Trade Openness and Economic Growth: Is Growth Export-Led or Import-Led?" *Applied Economics* 40(2):161–73.
3. Awokuse, Titus O. 2011. "Trade Openness and Economic Growth: Is Growth Export-Led or Import-Led?" *Applied Economics* 40(2):161–73.
4. Balassa, Bela. 1978. "Exports and Economic Growth: Further Evidence." *Journal of Development Economics* 5(2):181–89.
5. Bank, World. 2012. "Yemen : Towards Deeper Trade Integration."
6. Belderbos, Rene, Ryuhei Wakasugi, and Jianglei Zou. 2010. "Business Groups, Foreign Direct Investment, and Capital Goods Trade: The Import Behavior of Japanese Affiliates." MERIT Working Papers.
7. Borrmann, Axel, Matthias Busse, and Silke Neuhaus. 2011. "Institutional Quality and the Gains from Trade." SSRN Electronic Journal.
8. Dollar, David, Aart Kraay, David Dollar, and Aart Kraay. 2003. "Institutions, Trade, and Growth." *Journal of Monetary Economics* 50(1):133–62.
9. Egbal Eltahir and Tanimoune, N. A. 2014. "Does Trade Openness Promote Long-Run Growth in Egypt? ARDL Bounds Testing Approach for Co-Integration and Impulse Response (GIRF) Analysis for Causality." *Semantic Scholar*.
10. Falvey, Rod, Neil Foster, and David Greenaway. 2012. "Trade Liberalization, Economic Crises, and Growth." *World Development* 40(11):2177–93.
11. Freund, Caroline, Bineswaree Bolaky, Caroline Freund, and Bineswaree Bolaky. 2008. "Trade, Regulations, and Income." *Journal of Development Economics* 87(2):309–21.
12. Hye, Qazi Muhammad Adnan. 2011. "Long Term Effect of Trade Openness on Economic Growth in Case of Pakistan." *Quality & Quantity* 46:4 46(4):1137–49.
13. J Duasa 2011. n.d. "Terms of Trade and Economic Growth: An Estimate of the Threshold Level of Terms of Trade for Malaysia." *International Journal Economic of Perspectives*.
14. Keho, Yaya. 2017. "The Impact of Trade Openness on Economic Growth: The Case of Cote d'Ivoire." [Http://www.editorialmanager.com/cogentecon](http://www.editorialmanager.com/cogentecon) 5(1).
15. Klasra, Mushtaq Ahmad. 2009. "Foreign Direct Investment, Trade Openness and Economic Growth in Pakistan and Turkey: An Investigation Using Bounds Test." *Quality & Quantity* 45:1 45(1):223–31.
16. Lill Andersen and Ronald Babula. 2008. "The Link Between Openness and Long-Run Economic Growth." *Journal of International Commerce, Economics and Policy* 20(1793–9933).
17. Mankiw Gregory, N., David Romer, and David N. Weil. 1992. "A Contribution to the Empirics of Economic Growth." *Quarterly Journal of Economics* 107(2):407–37.
18. Muhammad, Shahbaz, Azeem Pervaz, and Khalil Ahmad. 2011. "Exports-Led Growth Hypothesis in Pakistan: Further Evidence." MPRA Paper 33617.
19. Musibah, Anwar Salem, Arfan Shahzad, and Faudziah Hanim Bt Fadzil. 2015. "Impact of Foreign Investment in the Yemen's Economic Growth: The Country Political Stability as a Main Issue." *Asian Social Science* 11(4):102–16.
20. Musila, Jacob W, Zelealem Yiheyis, Jacob W. Musila, and Zelealem Yiheyis. 2015. "The Impact of Trade Openness on Growth: The Case of Kenya." *Journal of Policy Modeling* 37(2):342–54.
21. Narayan, Paresh Kumar, and Seema Narayan. 2005. "Estimating Income and Price Elasticities of Imports for Fiji in a Cointegration Framework." *Economic Modelling* 22(3):423–38.
22. Narayan, Seema, and Paresh Kumar Narayan. 2005. "An Empirical Analysis of Fiji's Import Demand Function." *Journal of Economic Studies* 32(2):158–68.
23. Pesaran, M. Hashem, Yongcheol Shin, and Richard J. Smith. 2001. "Bounds Testing Approaches to the Analysis of Level Relationships." *Journal of Applied Econometrics* 16(3):289–326.
24. Pigka-Balanika, Vasiliki. 2013. "The Impact of Trade Openness on the Economic." 1–32.
25. Rao, B. Bhaskara, and Maheshwar Rao. 2010. "Openness and Growth in Fiji: Some Time Series Evidence." *Applied Economics* 41(13):1653–62.
26. Romer, P. 1986. "Increasing Returns and Long-Run Growth on JSTOR." *Increasing Returns and Long-Run Growth. Journal of Political Economy*, 94(5) 94(5):1002–37.
27. Samuel Olasode, Olaleye, Olajide Alde Raji, Abikoye Olubukunola Adedoyin, and Ishola Saheed Ademola. 2015. "TRADE OPENNESS AND ECONOMIC GROWTH A REFLECTION FROM NIGERIA (1981-2012)." *International Journal of Economics, Commerce and Management United Kingdom* III(5).

28. Sarkar, Prabirjit. 2016. "Trade Openness and Growth: Is There Any Link?" *Journal of Economic Issues* 42(3):763–86.
29. Shahbaz, Muhammad. 2012. "Does Trade Openness Affect Long Run Growth? Cointegration, Causality and Forecast Error Variance Decomposition Tests for Pakistan." *Economic Modelling* 29(6):2325–39.
30. Shaheen, Safana, Masood Sarwar Awan, Muhammad Waqas, and Muhammad Amir Aslam. 2011. "Financial Development, International Trade and Economic Growth: Empirical Evidence from Pakistan."
31. Soliu, Adegboyega, and \ Odusanya Ibrahim. 2014. "Empirical Analysis of Trade Openness , Capital Formation , FDI , and Economic Growth : Nigeria Experience ." *Valley International Journals* 1(1):36–50.
32. TALEB, Dalila. 2017. "The Dynamic Interactions Among Trade Openness and Economic Growth: Evidence from Algeria." *International Journal of Economic Behavior and Organization* 5(6):167.
33. Temitope Sunday, Olowe, and Ibraheem Ademola Ganiyu. 2015. "An Assessment of the Impact of Trade Liberalization on the Nigeria Economic Growth (1970-2012)." *Quest Journals Journal of Research in Business and Management* 3(10):2347–3002.
34. Ula an, Bьlent. 2015. "Trade Openness and Economic Growth: Panel Evidence." *Applied Economic Letter* 22(2):163–67.
35. UNCTAD 2021. n.d. "UNCTADstat." Retrieved August 5, 2021 (<http://unctadstat.unctad.org/EN/>).
36. UNCTADstat 2020. n.d. "UNCTADstat - General Profile." Retrieved November 12, 2021 (<https://unctadstat.unctad.org/countryprofile/generalprofile/en-gb/887/index.html>).
37. Winters, L. Alan, Neil McCulloch, and Andrew McKay. 2004. "Trade Liberalization and Poverty: The Evidence So Far." *Journal of Economic Literature* 42(1):72–115.
38. Yan kkaya, Halit, Yan kkaya, and Halit. 2003. "Trade Openness and Economic Growth: A Cross-Country Empirical Investigation." *Journal of Development Economics* 72(1):57–89.
39. Zahonogo, Pam. 2016. "Trade and Economic Growth in Developing Countries: Evidence from Sub-Saharan Africa." *Journal of African Trade* 3(1–2):41–56.

1. Ali, Wajahat, and Azrai Abdullah. 2015. "The Impact of Trade Openness on the Economic Growth of Pakistan: 1980-2010." *An International Journal* 7(2):120–29. [English].
2. Awokuse, Titus O. 2007. "Trade Openness and Economic Growth: Is Growth Export-Led or Import-Led?" *Applied Economics* 40(2):161–73. [English].
3. Awokuse, Titus O. 2011. "Trade Openness and Economic Growth: Is Growth Export-Led or Import-Led?" *Applied Economics* 40(2):161–73. [English].
4. Balassa, Bela. 1978. "Exports and Economic Growth: Further Evidence." *Journal of Development Economics* 5(2):181–89. [English].
5. Bank, World. 2012. "Yemen : Towards Deeper Trade Integration. [English].
6. Belderbos, Rene, Ryuhei Wakasugi, and Jianglei Zou. 2010. "Business Groups, Foreign Direct Investment, and Capital Goods Trade: The Import Behavior of Japanese Affiliates." *MERIT Working Papers*. [English].
7. Borrmann, Axel, Matthias Busse, and Silke Neuhaus. 2011. "Institutional Quality and the Gains from Trade." *SSRN Electronic Journal*. [English].
8. Dollar, David, Aart Kraay, David Dollar, and Aart Kraay. 2003. "Institutions, Trade, and Growth." *Journal of Monetary Economics* 50(1):133–62. [English].
9. Egbal Eltahir and Tanimoune, N. A. 2014. "Does Trade Openness Promote Long-Run Growth in Egypt? ARDL Bounds Testing Approach for Co-Integration and Impulse Response (GIRF) Analysis for Causality." *Semantic Scholar*. [English].
10. Falvey, Rod, Neil Foster, and David Greenaway. 2012. "Trade Liberalization, Economic Crises, and Growth." *World Development* 40(11):2177–93. [English].
11. Freund, Caroline, Bineswaree Bolaky, Caroline Freund, and Bineswaree Bolaky. 2008. "Trade, Regulations, and Income." *Journal of Development Economics* 87(2):309–21. [English].
12. Hye, Qazi Muhammad Adnan. 2011. "Long Term Effect of Trade Openness on Economic Growth in Case of Pakistan." *Quality & Quantity* 46:4 46(4):1137–49. [English].
13. J Duasa. 2011. n.d. "Terms of Trade and Economic Growth: An Estimate of the Threshold Level of Terms of Trade for Malaysia." *International Journal Economic of Perspectives*. [English].

14. Keho, Yaya. 2017. "The Impact of Trade Openness on Economic Growth: The Case of Cote d'Ivoire." <http://www.editorialmanager.com/cogentecon> 5(1). [English].
15. Klasra, Mushtaq Ahmad. 2009. "Foreign Direct Investment, Trade Openness and Economic Growth in Pakistan and Turkey: An Investigation Using Bounds Test." *Quality & Quantity* 45:1 45(1):223–31. [English].
16. Lill Andersen and Ronald Babula. 2008. "The Link Between Openness and Long-Run Economic Growth." *Journal of International Commerce, Economics and Policy* 20(1793–9933). [English].
17. Mankiw Gregory, N., David Romer, and David N. Weil. 1992. "A Contribution to the Empirics of Economic Growth." *Quarterly Journal of Economics* 107(2):407–37. [English].
18. Muhammad, Shahbaz, Azeem Pervaz, and Khalil Ahmad. 2011. "Exports-Led Growth Hypothesis in Pakistan: Further Evidence." MPRA Paper 33617. [English].
19. Musibah, Anwar Salem, Arfan Shahzad, and Faudziah Hanim Bt Fadzil. 2015. "Impact of Foreign Investment in the Yemen's Economic Growth: The Country Political Stability as a Main Issue." *Asian Social Science* 11(4):102–16. [English].
20. Musila, Jacob W., Zelealem Yiheyis, Jacob W. Musila, and Zelealem Yiheyis. 2015. "The Impact of Trade Openness on Growth: The Case of Kenya." *Journal of Policy Modeling* 37(2):342–54. [English].
21. Narayan, Paresh Kumar, and Seema Narayan. 2005. "Estimating Income and Price Elasticities of Imports for Fiji in a Cointegration Framework." *Economic Modelling* 22(3):423–38. [English].
22. Narayan, Seema, and Paresh Kumar Narayan. 2005. "An Empirical Analysis of Fiji's Import Demand Function." *Journal of Economic Studies* 32(2):158–68. [English].
23. Pesaran, M. Hashem, Yongcheol Shin, and Richard J. Smith. 2001. "Bounds Testing Approaches to the Analysis of Level Relationships." *Journal of Applied Econometrics* 16(3):289–326. [English].
24. Pigka-Balanika, Vasiliki. 2013. "The Impact of Trade Openness on the Economic." 1–32. [English].
25. Rao, B. Bhaskara, and Maheshwar Rao. 2010. "Openness and Growth in Fiji: Some Time Series Evidence." *Applied Economics* 41(13):1653–62. [English].
26. Romer, P. 1986. "Increasing Returns and Long-Run Growth on JSTOR." *Increasing Returns and Long-Run Growth. Journal of Political Economy*, 94(5) 94(5):1002–37. [English].
27. Samuel Olasode, Olaleye, Olajide Alde Raji, Abikoye Olubukunola Adedoyin, and Ishola Saheed Ademola. 2015. "TRADE OPENNESS AND ECONOMIC GROWTH A REFLECTION FROM NIGERIA (1981-2012)." *International Journal of Economics, Commerce and Management United Kingdom* III(5). [English].
28. Sarkar, Prabirjit. 2016. "Trade Openness and Growth: Is There Any Link?" *Journal of Economic Issues* 42(3):763–86. [English].
29. Shahbaz, Muhammad. 2012. "Does Trade Openness Affect Long Run Growth? Cointegration, Causality and Forecast Error Variance Decomposition Tests for Pakistan." *Economic Modelling* 29(6):2325–39. [English].
30. Shaheen, Safana, Masood Sarwar Awan, Muhammad Waqas, and Muhammad Amir Aslam. 2011. "Financial Development, International Trade and Economic Growth: Empirical Evidence from Pakistan." [English].
31. Soliu, Adegboyega, and \ Odusanya Ibrahim. 2014. "Empirical Analysis of Trade Openness, Capital Formation, FDI, and Economic Growth: Nigeria Experience." *Valley International Journals* 1(1):36–50. [English].
32. TALEB, Dalila. 2017. "The Dynamic Interactions Among Trade Openness and Economic Growth: Evidence from Algeria." *International Journal of Economic Behavior and Organization* 5(6):167. [English].
33. Temitope Sunday, Olowe, and Ibraheem Ademola Ganiyu. 2015. "An Assessment of the Impact of Trade Liberalization on the Nigeria Economic Growth (1970-2012)." *Quest Journals Journal of Research in Business and Management* 3(10):2347–3002. [English].
34. Ula an, Ḃlent. 2015. "Trade Openness and Economic Growth: Panel Evidence." *Applied Economic Letter* 22(2):163–67. [English].
35. UNCTAD 2021. n.d. "UNCTADstat." Retrieved August 5, 2021 (<http://unctadstat.unctad.org/EN/>). [English].
36. UNCTADstat 2020. n.d. "UNCTADstat - General Profile." Retrieved November 12, 2021 (<https://unctadstat.unctad.org/countryprofile/generalprofile/en-gb/887/index.html>). [English].

37. Winters, L. Alan, Neil McCulloch, and Andrew McKay. 2004. "Trade Liberalization and Poverty: The Evidence So Far." *Journal of Economic Literature* 42(1):72–115. [English].
38. Yan kkaya, Halit, Yan kkaya, and Halit. 2003. "Trade Openness and Economic Growth: A Cross-Country Empirical Investigation." *Journal of Development Economics* 72(1):57–89. [English].
39. Zahonogo, Pam 2016. 2016. "Trade and Economic Growth in Developing Countries: Evidence from Sub-Saharan Africa." *Journal of African Trade* 3(1–2):41–56. [English].

Appendix A1 : All variables' definitions, proxies, and data sources

Variables	Variable type	Proxy	Variables code	Description of the variables' effect mechanism	Data source
Economic growth	Dependent	Real GDP	LGDP		UNCTAD
Capital flow/Trade openness	Independent	Trade openness export + Import/GDP	TRO1	Openness may affect long-term growth and increase efficiency and enhance the growth rate through various channels. For example, operating as technological diffusion trade decreases the redundancy effect of research duplication and enlarges the size of the market in which the typical firm operates. This phenomenon raises the monopoly rents allocated to innovators by encouraging research-intensive production that spurs economic growth. The second channel operates as a transmission mechanism of technological progress and spillovers that are generated by improvements in knowledge in trade partner countries. The third channel is related to the indirect effect of international trade occurring via competition amongst firms in outward-oriented countries.	UNCTAD
	Independent	Exports/GDP	TRO2	Exports of goods and services represent one of the most important sources of foreign exchange income that ease the pressure on the balance of payments and create employment opportunities. Exports play an important role in providing opportunities for producers with incentives to export their goods through various economic and governmental policies. They also increase the capability of producing goods and services that can compete in the world market by using advanced technology to provide foreign exchange needed to import capital goods.	UNCTAD
	Independent	Imports/GDP	TRO3	Imports of capital goods and machinery accelerate and improve economic productivity in the long run. Imports are important to productivity because increased imports of competing products advocate innovation as domestic producers respond to the technological competitive pressure from foreign competition.	
Human capital	Control variable	Labour Force	LF	The labour force in Yemen represents real wealth and the main resource available with limited natural resources. The expected result for labour forces in this study indicates a positive and unidirectional relationship with GDP, because the labour cost is cheap in Yemen.	
Domestic capital	Control	Real gross fixed capital formation	LCAP	Gross fixed capital formulation increases the domestic capital accumulation, which contributes to economic growth by the proliferation and expansion of infrastructure, provision of basic services and the spread of education. In turn, this phenomenon attracts FDI and contributes to increasing employment opportunities, improving the efficiency of workers, addressing the problem of unemployment, high level of income, and improved welfare. It also helps increase the competitiveness of the economy that will enable DCs and LDCs to catch up with progress and growth (Momo, 2013).	CBY and CSOY
Foreign capital	Control	Real inward FDI	LFDI	According to the modernisation hypothesis, FDI promotes economic growth by providing external capital and through growth and spreads the benefits throughout the economy.	CBY and CSOY
	Control	Exchange rate	EXG	When the real effective exchange rate appreciates, domestic products become more expensive for the rest of the world and their demand thus decreases. In turn, this phenomenon induces the need to generate a depreciation in the real exchange rate.	
	Control	Government spending	GEX	The government is a major component of the GDP. Government spending policies, such as setting up budget targets, adjusting taxation, increasing public expenditure and public works, are highly effective tools in influencing economic growth. This component considers the level of government expenditures as a percentage of GDP. Government expenditures, including consumption and transfers, account for the entire score.	
Dummy	Control	Internal political and security situation, as well as regional political and security situation	DUM	The dummy variable represents regional political and security situation (Gulf Wars I–III), internal security situation (civil wars and wars with terrorist groups) and internal political situation (popular protests and the Revolution Youth on February 11, 2011). Applied studies have indicated that the most important causes of underdevelopment in many DCs and LDCs are the political and social unrest prevailing in these countries, as well as the economic variables involved in the political sensitivity of the positive or negative internal and external environment surrounding; however, some of them have a great direct influence. The expected result for DUM in this study is negative.	UNCTAD CBY and CSOY Historical data from reality
Source; Author's titration					

Appendix A2: Descriptive analysis of variable data

	Y	TRO3	TRO2	TRO1	LF	GEX	FDI	CAP
Mean	23.24061	-0.7997	-1.35939	22.44152	15.19909	16.23364	20.18545	21.40242
Median	23.32	-0.93	-1.19	22.43	15.21	16.18	20.48	21.53
Maximum	23.88	0.12	-0.94	22.88	15.89	18.77	21.48	21.93
Minimum	22.51	-1.19	-2.4	22	14.53	12.97	18.12	20.02
Std. Dev.	0.466509	0.373769	0.396421	0.240067	0.424296	1.175207	0.965486	0.451532
Skewness	-0.18786	0.871914	-1.40063	0.157229	0.001685	-0.51397	-0.6281	-1.02355
Kurtosis	1.488962	2.546715	3.672055	2.102779	1.708999	3.628535	2.421971	3.739117
Jarque-Bera	3.333543	4.463807	11.4108	1.242846	2.291707	1.996091	2.629219	6.513219
Probability	0.188856	0.107324	0.003328	0.537179	0.317952	0.368599	0.268579	0.038519
Sum	766.94	-26.39	-44.86	740.57	501.57	535.71	666.12	706.28
Sum Sq. Dev.	6.964188	4.470497	5.028788	1.844224	5.760873	44.19556	29.82922	6.524206
Observations	33	33	33	33	33	33	33	33

Our analysis starts with the basic descriptive statistics of the study data, as shown in Table 1. The descriptive statistics consists of the procedures used to summarise and describe the characteristics of a set of data. The table shows the averages values, standard deviation, skewness, kurtosis and Jarque–Bera values of the selected variables.

Appendix A3: Unit Root Tests Results

VARIABLES	ADF		P. Pearson	
	T. Stat	P. value	T. Stat	P. value
Levels:				
GDP	-1.0241	0.7315	-1.0742	0.7486
TRO1	-1.9657	0.2995	-2.0660	0.2589
TRO2	-2.0090	0.4362	-1.8345	0.8582
TRO3	-2.4343	0.3248	-3.4745	0.3311
FDI	-1.8836	0.5145	-0.8154	0.4107
CAP	-0.9355	0.7626	-0.8154	0.4107
LF	0.0914	0.9585	0.4576	0.9822
GEX	-3.6185	0.1113	-3.4945	0.1052
1st Difference				
GDP	-3.8697*	0.0063	-3.8822*	0.0061
TRO1	-5.9960*	0.0000	-6.9761*	0.0000
TRO2	-5.7200*	0.0004	-4.5613*	0.0000
TRO3	-5.3478*	0.0000	-5.7504*	0.0000
FDI	4.7810*	0.0000	-4.7899*	0.0006
CAP	-5.1492 *	0.0003	-3.8499*	0.0282
LF	-3.4760*	0.0189	-4.7119*	0.0250
GEX	-7.446	* 0.0000	0.9887*	0.0910

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

Table (3) summarises the unit root test results for the variables of the study in their levels, as well as their first differences. By applying these tests, we investigate the time-series properties of the data. We reach the decision by comparing the ADF and P. Pearson statistics to their CVs (Egbal & Tanimoune, 2014; Shahbaz, 2012; Taleb, 2017). We find that the ADF statistics are less than the CVs in their first levels but greater than their first differences (in absolute values). Thus, the ADF test reveals that real GDP growth, exports, trade, imports, fixed capital formation, labour force, FDI and government expending in logarithm forms are all non-stationary at their levels. Conversely, all variables are stationary at their first differences in real terms. We reject the null hypothesis for ADF the test for the existence of the unit root. Thus, the variables are said to be integrated of order one ($I(1)$), together with the real GDP growth.

Appendix A4: Johansen Cointegration Test Results

Cointegrating rank (r) (H0)	Trace statistics	CV (5%)	Cointegrating rank (r) (H0)	λ -max statistics	CV (5%)
(r = 0)	141.5981*	95.7536	(r = 0)	48.0799*	40.0775
(r ≤ 1)	93.5181*	69.8188	(r ≤ 1)	35.1640*	33.8768
(r ≤ 2)	0.6304*	58.3541	(r ≤ 2)	28.8679*	27.5843
(r ≤ 3)	0.4487	29.7970	(r ≤ 3)	17.2709	21.1316
(r ≤ 4)	29.4861	15.4947	(r ≤ 4)	11.9264	14.2646
(r ≤ 5)	0.2888	3.8414	(r ≤ 5)	0.2888	3.8414

Notes: *Denotes rejection of the null hypothesis of cointegration rank r at the 1% significance level. r denotes the number

Before ARDL procedures we used Johansson cointegration test and results are available in appendix A4.

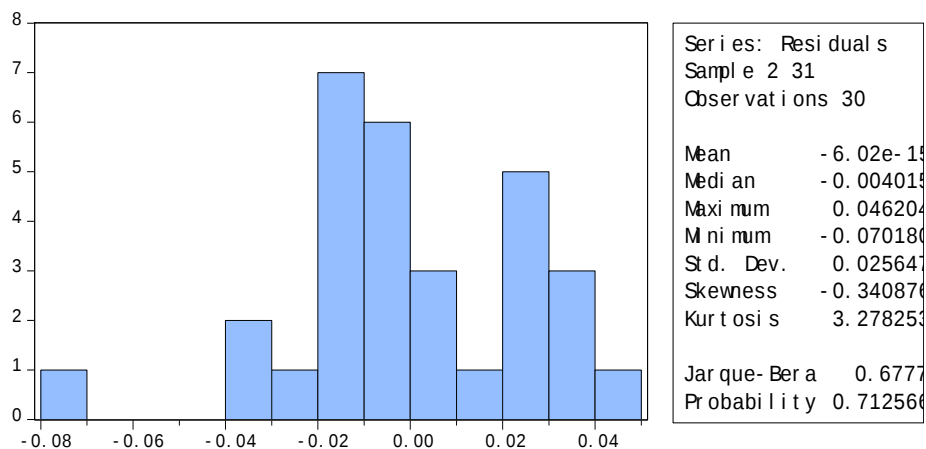
Given the dynamic nature of the variables of the study and that the series does not evolve around zero, the model is a random walk. Table 3 shows the Johansen cointegration test results. The trace statistic reveals that the null hypothesis of the absence of cointegrating relation at (r = 0), (r ≤ 1), (r ≤ 2) and (r ≤ 3) can be rejected at 1% level of significance. That is, trace testing shows three cointegrating equations. Similarly, the maximum eigenvalue test statistics indicates the same results that a cointegration of rank (r = 0), (r ≤ 1), (r ≤ 2) and (r ≤ 3) is presented for Yemen. Thus, a long-term stationary relationship exists between all the variables. We reach these results by comparing the computed values of the test statistics for trace and maximal eigenvalues, with the corresponding CVs to indicate the rejection of null hypothesis of no cointegration. Therefore, the real GDP growth, exports, imports, trade, fixed capital formation, government expending and labour force are cointegrated. Specifically, a long-term relationship exists between all the series for Yemen. These results are consistent with Negem (2008), but inconsistent with Sarkar (2005) for India and Deme (2002) for Nigeria. As a result, a stable relationship exists between economic growth and any of the trade openness variables. On the basis of economic theory, trade induces economic growth by enhancing capital formation efficiency and increasing the supply of scarce resources. For Yemen, the results in this study show these types of link.

Appendix 5A: Results of diagnostic tests

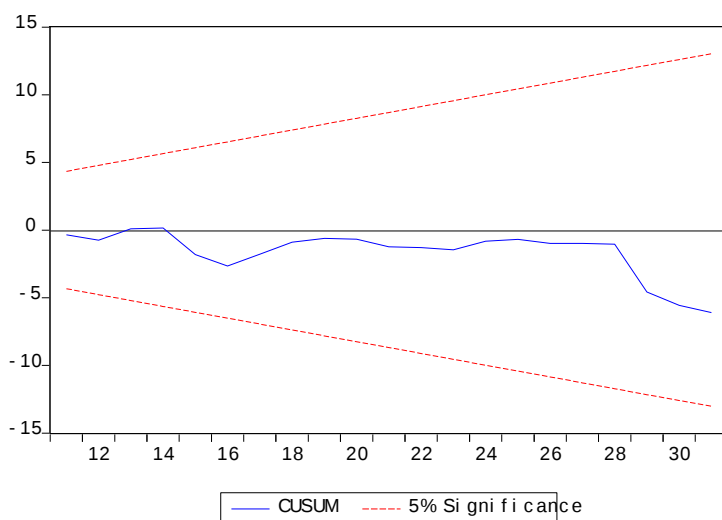
Diagnostic tests	Trade openness model	Import model	Export model
R2	0.9951	0.9442	0.9999
Adjusted R	0.8648	0.7979	0.9999
F-statistic	7.6336	6.7791**	6.4550*
Durbin Watson	1.7743	1.5699	1.6739
CUSUM	Stable	Stable	Stable
CUSUMQ	Stable	Stable	Stable
Normality	0.53	0.10	0.22

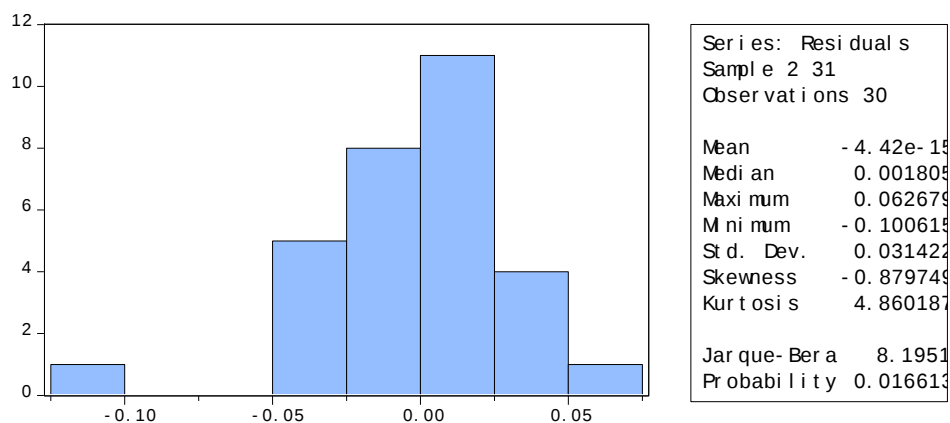
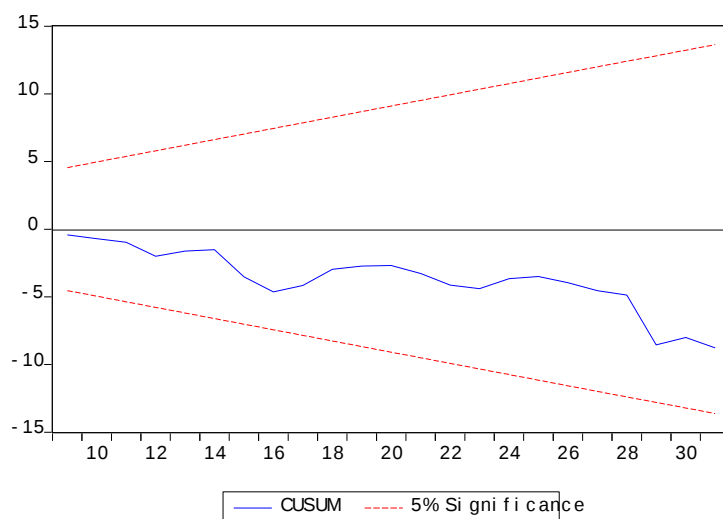
Diagnostic tests for the equations are applied to check the accuracy of the models, as shown in Table 5. We do not find evidence of any data problem for all the models, and no autocorrelation exists in the disturbance of the error term. Values of adjusted R2 are greater than Durbin Watson statistics (Table 6); thus, the models are no spurious. The estimated equations remain stable over the period of study, as indicated by CUSUM and CUSUMQ stability tests (generated in graphical formats), which are used for more robust results. Hence, we can reasonably say that the models are well-behaved. The models pass the Jarque-Bera normality test, suggesting that the errors are normally distributed.

TRO1 NORMALITY TESTS

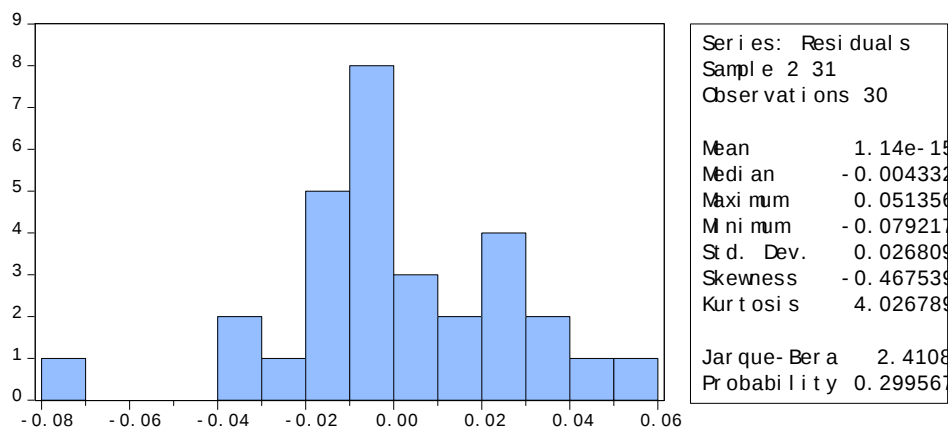


TRO1 CUSUM TEST

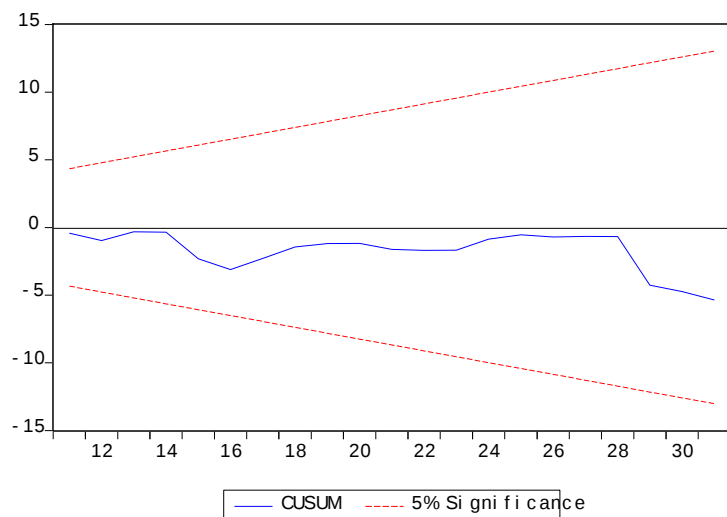


TRO2 NORMALITY TEST**TRO2 CUSUM TEST**

TRO3 NORMALITY TEST



TRO3 CUSUM TEST



Attatment1: More detailed statistics of the Yemeni ERSAP

Several studies have attempted to answer the question of how the trade openness is linked with economic growth of a country in a better word how openness of trade can bring benefits to the developing countries in DCs and LDCs including Yemen. However there is yet no conclusive evidence about the economic impact of trade liberalization on economic growth of countries. Some suggested that trade openness policies and foreign trade open up the opportunity for countries' economies to enhance growth and foster overall development. Moreover, as noted generalized trade liberalization in form of unilateral tariff reductions or the reduction of non-tariff barriers to trade improves growth performance. Most of suggested obstacles includes Excessive regulations, government interventions and uncertain economic policies play their role as constraints to growth everywhere. To this end, there was a need for this study to examine the impact of trade Openness on Yemen's economic growth output. This study therefore promised to fill the gap in literatures on International Trade studies in Yemen.

In the context of Yemen ,Yemen's economy before unity and prior to 1990 ,1995 economic reforms programs the economy of Yemen was a closed and highly protected economy characterized by high tariffs and prohibition of foreign goods with the trade policy geared towards generating revenues for the government and relatively small trade interactions with other countries.

The successive governments (before and after achieving Yemeni unity) have a major goal represented in developing external and internal sources of growth in order to achieve high economic growth that is acceptable sustainability. That is also the main orientation which revolved around the two-states (YAR and PDRY) plans before achieving unity durin1980-1990. After achieving Yemeni unity on May 22, 1990 the successive governments conducted several economic plans ,reforms and programs including 1990-1995 program and the ERSAP 1996-2000 first-year plan, most importantly including five-years plans for social and economic development and poverty alleviation from 2000 -2025.

Achieving this goal required taking several significant procedures including the implementation of a comprehensive ERSAP in 1995, most importantly ,the framework of Yemen's strategic vision long-term 2001- 2025 ,it targeted to achieve an average annual growth rate of GDP by 9% per year over the next twenty-five years, through strengthening the growth capacities in productive and service sectors by available policies and strategies .Of these strategies : regulating both foreign trade in the context of free trade, as well as regulating competition and market mechanisms through: improving and developing economic and legislative aspects relating to the foreign trade and Large facilities (tax and customs exemptions) accorded to imports of capital and intermediates goods. Also it aimed at strengthening the partnership in housing and tourism projects. A special unit is a coordination with the Ministry of Planning and International Cooperation with a view to promote the private sector and to enable creating and managing core infrastructure services, a number of laws issued to complement other aspects related to investment.(Live databases of UNC-TAD, as well as FYPs: First 1996-2000, Second 2001-2005, Third 2006-2010 and Forth 2011-2015).

However, after spending more than thirty years striving to achieve the targeted growth through: the two-state plans before achieving unity, programs of successive governments, the implementation of a comprehensive ERSAP, the Preparation of five year plans (first, second, third and fourth) for economic and social development and poverty alleviation, and implementation a variety of economic reforms related to trade policy ,investment and foreign trade, referred to above, it was noted the following:

Currently, in term of liberalization Yemen is one of the most trade-liberalized countries in the MENA region. Its ratio of tax revenues on international trade to total imports as a proxy for a nominal effective mean tariff is 5.2%, far lower than MENA' reformers such as Jordan (6.5%),Tunisia (5.9%), and Egypt (12.2%),(WB Report, 2002, p92).

In term of economic reforms and trade policies strategies, international donors put pressure on the country after 1994 crisis towards promoting reforms for the conceived failing state. However, there were no tangible results of these programs due to setbacks in the unsettling political structure which continuously backed up the poor economic situation.

During the period of 1997-2010, Yemen strived to implement reform program. Reflecting a significant reform program that was implemented in 1997, Yemen's trade policy regime got to be quite liberal. At that time the tariff structure was simplified to span only five bands: 0, 5, 10, 15 and 25 percent, with two-thirds of all products subject to duties of either 0, 5 or 10 percent. Applied tariffs were reduced further in 2005 with the elimination of the 15 percent band .In addition to the 2005 tariff reform, Yemen has also liberalized trade on a preferential basis as a result of implementation of commitments under the Greater Arab Free Trade Agreement (GAFTA). This has implied a 48 percent across-the-board cut in all importduties on goods originating in GAFTA members.

The government of Yemen initiated an economic reform program in 2006 but declining oil production, terrorist attacks, kidnappings, tribal rivalries and water shortages greatly weakened tourism, foreign investment and growth. Reform initiatives like the National Agenda for Reform, related to management, economic and political issues or the Ten priorities of 2009, which mainly focuses on economic issues, have yielded minimal results. The country tried to diversify its economy through bolstering non-oil sector and foreign investment. In 2009, the country exported its first liquefied natural gas. In 2010, the international community established the Friends of Yemen group to support Yemen's efforts towards political and economic reforms. Legal reforms in the economic field took place in 2009-2012 but were offset by setbacks in the political arena.

In term of economic indicator ,it was noted that ,the trade balance is suffering from permanent deficit except for 2000, 2001, 2004 and 2005 because imports growth rate is greater than exports growth rate at real price during the study period, where imports have grown an annual average compound (6.24%) while exports have grown at an average annual compound (0.81%), this deficit in turn is reflected in the current account balance and the balance of payments, thus contributes to the low rate of economic growth ,more importantly the average relative importance of imports reached to GDP at real price during the period 1983-2012(47.76%) versus (27.16%) for

exports. Also, it was noted that the volume of FDI was very low despite the relentless pursuit by the government to attract and encourage this type of investment, as well as increasing the volume of imports significantly and decreasing the non-oil exports, which caused permanent disability in the balance of payments. However, Republic of Yemen still suffers from a precipitous decline in the rate of economic growth.

Throughout our reading we noticed that ,the introduction of the economic reforms and programs(1990,1995 and 2005) , and other existed trade policies and the recent open door policies have made Yemen a very captivating case study, we therefore seek to expose to what extant is the impact of Trade openness on economic growth of Yemen .

2. Attachment2: more explanation of (TLG), (ELG), and (ILG) is

On this subsection thus we hold theoretical bi-directional openness-growth debate through discussing export-led growth, import led growth and trade led growth, here is export led growth.

Export Led-Growth (ELG)

Based on Kruger's definition and the focus on exports, researchers began to test export Led growth (ELG) hypothesis. In a while, the vast majority of this literature focuses on the causal effect of export on economic growth. There are five possible thoughts with regarding the relationship between exports and economic growth can be categorized as follows: export-Led Growth, growth-led export, the bidirectional causal relationship, negative correlation and no causality (feedback) between the two variables.

There are a number of reasons within trade theory to support the first vision, the Export Led Growth (ELG) proposition. First, export growth may represent an increase in demand for the country's output and thus serves to increase real output. Second, an expansion in exports may promote specialization in the production of export products, which in turn may boost the productivity level and may cause the general level of skills to rise in the export sector. Third, an increase in exports may loosen a foreign exchange constraint (e.g. Chenery and Strout 1966), that allows for increasing levels of the import of intermediate goods that in turn raises capital formation and thus fuels output growth. Also, the export development of certain goods based upon a country's comparative advantage may allow for the exploitation of economies of scale, which may lead to increased growth (Balassa 1978; Egbal Eltahir and Tanimoune 2014; Prabirjit Sarkar 2005)

Alternatively, there are many additional reasons for other researcher to support the second thought, the hypothesis that causality runs from economic growth (productivity) to exports or Growth-Led Export Hypothesis (GLE). Economic theories also suggest that economic growth influences, or causes, export expansion. This can happen when domestic markets become well developed, for example due to an increase in capital formation and technological change, which then enhances international competitiveness of tradable goods and in turn improves export performance Ghartey (1993). Also, Bhagwati (1988) noted that an increase in GDP generally results in a corresponding expansion of trade. While, Jung and Marshall (1985) argued that economic growth may have little to do with government policy to promote exports, rather than being related to the accumulation of human capital, cumulative production experience, technology transfer from abroad or physical capital accumulation. Shahbaz (2012)

The third thought is the recognition of the potential for bidirectional (feedback) causality between economic growth and exports indicating that they may be interrelated in a cumulative process, Sharma and Dhakal (1994). According to Bhagwati (1988) argued that an increased trade produces more income which facilitates more trade, thus creating a virtuous circle. Also, Thirlwall (2003) supported this model if output growth, which mainly results from export growth, induces productivity growth; this makes goods more competitive and therefore accelerates export growth.

The fourth thought is that negative correlation exists between exports and eco-

economic growth. Exports and economic growth are both the result of the process of development. Jung and Marshall (1985) suggested that increased exports arising from some types of inward foreign direct investment might lower the domestic output due to various distortions. According to Dodaro (1993) exported growth might lead to a decline in output growth when exports are promoted at the expense of domestic consumption and efficiency. (Muhammad et al 2011; Sarkar 2016; TALEB 2017)

In addition to the contradicting thought is potential for no causal relationship between exports and economic growth such that the growth paths of the two variables are determined by other unrelated variables in the economic system Giles and Williams (2000). Alternatively, Yaghmaian (1994) argued that both exports and economic growth may be 3-caused by the process of development and structural change whereby exports and economic development are both the result of the same forces. Thus, no causal relationship may exist between them. (Muhammad et al. 2011; Sarkar 2016).

Imports Led Growth

Rodrik's definition concluded that imports are as important as exports for economic performance. As a result, the definition of trade openness has changed over-time, where import became a proxy of trade openness. There are a number of theoretical reasons to believe that an economy could experience Import-Led Growth (ILG), rather than Export-Led Growth (ELG). It can be argued, however, that imports are a very important determinant of economic growth if they are used as a means to ensure the supply of key raw materials. Nonetheless, imports are traditionally treated as functions of national income Afrentiou et al. (1992). Also, imports are essential to stimulating overall economic performance. Import growth is always connected to export growth since imports offer much needed factors of production employed in the export sector. 1-Imports are always considered as a medium of technology transfer by acquiring embodied technology through the import of capital goods and may play a more significant role on economic growth than export (Awokuse 2011; Shahbaz 2012; TALEB 2017)

In particular, this emphasizes the process of modernization and transfer of advanced technology through acquisition of sophisticated capital and materials which boosts domestic production and leads to economic growth Marwah and Tavakoli (2004). Moreover, cumulative causation effects between imports and economic growth from the unbundling of new technologies would also be expected, whereby higher output will increase the incentive for producers to take advantage of foreign technology by increasing imports into the domestic economy Thangavelu and Rajaguru (2004).

Import can also affect productivity growth through its effect on local innovation through import competition. Imports are important to productivity growth because increased imports of competing products advocate innovation as domestic producers respond to the technological competitive pressure from foreign competition Lawrence and Weinstein (1999). As a result, there can be a bidirectional causality between imports and economic growth Liu et al. (1997).

Trade-Led Growth

Since the emergence of those definitions, for example the definition by Harrison (1996), trade openness as an engine of economic growth is now well established in literature. The research produced two hypotheses better to understand the bi-direction-

al relationship between trade openness and growth: Trade-Led Growth and Growth-Led Trade hypotheses (Liu et al.1997; Bahmani et al.1999; Yanikkaya 2003; Wang et al. 2004 and Tsen 2006).

Since theoretical considerations indicate that causation between openness and economic growth can be in either direction, the nature of this causality is essentially an empirical question Arnade and Vasavada (1995). The current study seeks to generate empirical evidence for Yemen on the co-integration and causality between trade openness and growth. As mentioned before the theoretical literature does not poster a clear cut answer, it is academically a must to address more empirical work in order to resolve the debate over the causality between economic growth and openness.

3. Estimation Techniques: Estimation Strategies and Techniques

This study adopts some modern econometrics methodologies to accurately deal with time-series data problems. The first step before testing the co-integration and causality, is to test the stationarity of the variables. Therefore the Augmented Dickey-Fuller (ADF) and P-Pearson unit roots test for the eight variables are employed to test the stationarity of variables and accordingly determine the cointegration tests. The data series must be stationary to avoid instantaneous causation. The ADF and the P-Pearson tests are based on containment of intercept (constant), given the dynamic nature of the variables of the study. The lag lengths of the models are auto-selected by Schwartz Information Criterion (SIC); the maximum lag length is auto-selected and set to seven. These tests showed that all variables are stationary at their first differences in real terms, therefore all variables are said to be integrated of order one, $I(1)$, together with real GDP growth.

After that, two Cointegration Test Approaches are used including: Johansen Maximum Likelihood Approach and The ARDL Bounds Testing Approach. The Johansen-Juselius (1990) maximum likelihood approach is employed to test for the presence of co-integration..In the Johansen technique, we apply two statistics tests to assess the number of co-integrating vectors (the co-integrating rank r). The first test is a trace test, which tests the null hypothesis that there are at most r co-integrating vectors. The second test is the maximal eigenvalue test (λ -max). The null is that there are r co-integrating vectors, against the alternative hypothesis of $r+1$ co-integrating vectors. Table 1 reports the results of trace and λ -max, along with the critical values and the probabilities. But Johansen maximum likelihood, among others, relies on strictly $I(1)$ stationary variables. The reason being that, if all the variables are $I(1)$ stationary, then there are special cases where a linear combination result in an $I(0)$ stationary variable and hence co-integration Asterius and Hall (2007). Therefore, the requirement of $I(1)$ variables often makes estimates of these co-integration test subject to bias

In order to have robust findings and overcome some of the demerits of the Johansen maximum likelihood and traditional cointegration approaches, we employ the Autoregressive Distributed Lag Model (ARDL) bounds testing. This method also allows the estimation of the long run level relationship between variables and its choice is motivated by the key benefits it has over the strictly $I(1)$ stationary variables dependent co-integration test. The method yields valid results irrespective of whether the underlying variables are $I(0)$, $I(1)$, or a combination of both. This is important when it becomes difficult to treat a variable as either $I(0)$ or $I(1)$ stationary, although it may not necessarily be $I(2)$ stationary. Secondly, the method is asymptotically efficient in finite and small sample studies and applicable even in the case where the regressors are endogenous. This is appropriate for the present paper with only 31 observations. Thirdly, the method allows the introduction of optimal lags of both the dependent and independent variables. Thus, different variables are allowed to have their optimal speed of adjustment to equilibrium. Also, OLS is easily employed to estimate the co-integration relationship.

More importantly, a dynamic unrestricted error correction model (UECM) can be derived from the ARDL through a simple linear transformation (Narayan 2005;

Rao and Rao 2010; Shahbaz 2012). The UECM integrates the short run dynamics with the long run equilibrium without losing any information for long run, taking each of the variables in turn as a dependent variable. So using UECM would help generating more robust results for our paper, we estimate six dynamic unrestricted error correction model (UECMs) taking each of the variables in turn as a dependent variable. That is, dependent variables are log of real GDP growth ($\ln G_t$), log of trade openness indicators ($\ln TRO_i$), log of fixed capital formation ($\ln CAP$) and labour force ($\ln LF$) foreign direct investment ($\ln FDI$), such setup is presented in the following equations:

$$\begin{aligned} \Delta \ln GDP_t = & \alpha_1 + \alpha_{GDP} GDP_{t-1} + \alpha_{TROi} TROi_{t-1} + \alpha_{CAP} CAP_{t-1} + \alpha_{LF} LF_{t-1} \\ & + \alpha_{FDI} FDI_{t-1} + \alpha_{GEX} GEX_{t-1} + \sum_{i=1}^p \alpha_i \Delta \ln GDP_{t-i} \\ & + \sum_{j=0}^q \alpha_j \Delta \ln TROi_{t-j} + \sum_{k=0}^r \alpha_k \Delta \ln CAP_{t-l} + \sum_{l=1}^s \alpha_l \Delta \ln LF_{t-1} \\ & + \sum_{m=1}^t \alpha_m \Delta \ln FDI_{t-1} + \sum_{n=1}^u \alpha_n \Delta \ln GEX_{t-1} + \varepsilon_t \end{aligned} \quad (11)$$

$$\begin{aligned} \Delta \ln TROi_t = & \alpha_1 + \alpha_{GDP} GDP_{t-1} + \alpha_{TROi} TROi_{t-1} + \alpha_{CAP} CAP_{t-1} + \alpha_{LF} LF_{t-1} \\ & + \alpha_{FDI} FDI_{t-1} + \alpha_{GEX} GEX_{t-1} + \sum_{i=1}^p \alpha_i \Delta \ln TROi_{t-i} \\ & + \sum_{j=0}^q \alpha_j \Delta \ln GDP_{t-j} + \sum_{k=0}^r \alpha_k \Delta \ln CAP_{t-l} + \sum_{l=1}^s \alpha_l \Delta \ln LF_{t-1} \\ & + \sum_{m=1}^t \alpha_m \Delta \ln FDI_{t-1} + \sum_{n=1}^u \alpha_n \Delta \ln GEX_{t-1} + \varepsilon_t \end{aligned} \quad (12)$$

$$\begin{aligned} \Delta \ln CAP_t = & \alpha_1 + \alpha_{GDP} GDP_{t-1} + \alpha_{TROi} TROi_{t-1} + \alpha_{CAP} CAP_{t-1} + \alpha_{LF} LF_{t-1} \\ & + \alpha_{FDI} FDI_{t-1} + \alpha_{GEX} GEX_{t-1} + \sum_{i=1}^p \alpha_i \Delta \ln CAP_{t-i} + \sum_{j=0}^q \alpha_j \Delta \ln GDP_{t-j} \\ & + \sum_{k=0}^r \alpha_k \Delta \ln TROi_{t-1} + \sum_{l=1}^s \alpha_l \Delta \ln LF_{t-1} + \sum_{m=1}^t \alpha_m \Delta \ln FDI_{t-1} \\ & + \sum_{n=1}^u \alpha_n \Delta \ln GEX_{t-1} + \varepsilon_t \end{aligned} \quad (13)$$

$$\begin{aligned}
\Delta \text{LnLF}_t = & \alpha_1 + \alpha_{\text{GDP}} \text{GDP}_{t-1} + \alpha_{\text{TROI}} \text{TROI}_{t-1} + \alpha_{\text{CAP}} \text{CAP}_{t-1} + \alpha_{\text{LF}} \text{LF}_{t-1} \\
& + \alpha_{\text{FDI}} \text{FDI}_{t-1} + \alpha_{\text{GEX}} \text{GEX}_{t-1} + \sum_{i=1}^p \alpha_i \Delta \text{LnLF}_{t-i} + \sum_{j=0}^q \alpha_j \Delta \text{LnGDP}_{t-j} \\
& + \sum_{k=0}^r \alpha_k \Delta \text{LnTROI}_{t-1} + \sum_{l=1}^s \alpha_l \Delta \text{LnCAP}_{t-1} + \sum_{m=1}^t \alpha_m \Delta \text{LnFDI}_{t-1} \\
& + \sum_{n=1}^u \alpha_n \Delta \text{LnGEX}_{t-1} + \varepsilon_t
\end{aligned} \tag{14}$$

$$\begin{aligned}
\Delta \text{LnFDI}_t = & \alpha_1 + \alpha_{\text{GDP}} \text{GDP}_{t-1} + \alpha_{\text{TROI}} \text{TROI}_{t-1} + \alpha_{\text{CAP}} \text{CAP}_{t-1} + \alpha_{\text{LF}} \text{LF}_{t-1} + \\
& \alpha_{\text{FDI}} \text{FDI}_{t-1} + \alpha_{\text{GEX}} \text{GEX}_{t-1} + \sum_{i=1}^p \alpha_i \Delta \text{LnFDI}_{t-i} + \sum_{j=0}^q \alpha_j \Delta \text{LnGDP}_{t-j} + \\
& \sum_{k=0}^r \alpha_k \Delta \text{LnTROI}_{t-1} + \sum_{l=1}^s \alpha_l \Delta \text{LnCAP}_{t-1} + \sum_{m=1}^t \alpha_m \Delta \text{LnLF}_{t-1} + \\
& \sum_{n=1}^u \alpha_n \Delta \text{LnGEX}_{t-1} + \varepsilon_t \dots
\end{aligned} \tag{15}$$

$$\begin{aligned}
\Delta \text{LnGEX}_t = & \alpha_1 + \alpha_{\text{GDP}} \text{GDP}_{t-1} + \alpha_{\text{TROI}} \text{TROI}_{t-1} + \alpha_{\text{CAP}} \text{CAP}_{t-1} + \alpha_{\text{LF}} \text{LF}_{t-1} + \\
& \alpha_{\text{FDI}} \text{FDI}_{t-1} + \alpha_{\text{GEX}} \text{GEX}_{t-1} + \sum_{i=1}^p \alpha_i \Delta \text{LnGEX}_{t-i} + \sum_{j=0}^q \alpha_j \Delta \text{LnGDP}_{t-j} + \\
& \sum_{k=0}^r \alpha_k \Delta \text{LnTROI}_{t-1} + \sum_{l=1}^s \alpha_l \Delta \text{LnCAP}_{t-1} + \sum_{m=1}^t \alpha_m \Delta \text{LnLF}_{t-1} + \\
& \sum_{n=1}^u \alpha_n \Delta \text{LnLF}_{t-1} + \varepsilon_t \dots
\end{aligned} \tag{16}$$

Since, we specified three models in our study which are trade volume model (imports+exports/GDP) equations, exports/GDP model equation, and imports/GDP model equations, we estimate the above setup for each model i.e. six equations per each model totaling 18 equations. Any of the 18 equations of the three models are selected and estimated by the ARDL Autoregressive Distributed Lag Model. The results of each equation are displayed in tables 3 and 4.

The transformations of variables in each of the three model are set as follows: First, The transformations for the trade volume model are six equations as follows: FGDP[G] (TRO1, FDI, CAP, LF, GEX), FTRO1[E] (GDP, FDI, CAP, LF, GEX), FFDI (GDP, Tro1, CAP, LF, GEX), and FCAP (GDP, Tro1, FDI, LF, GEX), FLF (GDP, Tro1, FDI, CAP, GEX) FGEX (GDP, Tro1, FDI, CAP, GEX, LF) where, in square brackets natural log of real GDP growth (ln GDP), log of trade openness trade volume (TRO1), log of Fixed capital formation (CAP), log of labor force (lnLF), log of government expending (LnGEX) or, log of foreign direct investment are used as dependent variables for each of the equations in logarithm form respectively. Next, the transformations for the exports model are: FGDP[G] (TRO2, FDI, CAP, LF, GEX), FTRO2[E] (GDP, FDI, CAP, LF, GEX), FFDI (GDP, Tro2, CAP, LF, GEX), and FCAP (GDP, Tro2, FDI, LF, GEX), FLF (GDP, Tro2, FDI, CAP, GEX) FGEX (GDP, Tro2, FDI, CAP, GEX, LF) where, in square brackets natural log of real GDP growth (lnGDP), log of exports/GDP (TRO2), log of Fixed capital formation (CAP), log of labour force (lnLF), log of government expending (LnGEX) or, log of foreign direct investment (LnFDI) are dependent variables for each of the

equations respectively. Then, the transformations for the imports model are: FGDP[G] (TRO3, FDI, CAP, LF, GEX), FTRO3[E] (GDP, FDI, CAP, LF, GEX), FFDI (GDP, Tro3, CAP, LF, GEX), and FCAP (GDP, Tro1, FDI, LF, GEX), FLF (GDP, Tro1, FDI, CAP, GEX), F GEX (GDP, Tro3, FDI, CAP, GEX, LF) where, in square brackets natural log of real GDP growth(lnGDP), log of trade openness trade volume(TRO1), log of fixed capital formation (CAP) ,log of labour force (lnLF), log of government expending (LnGEX) or , log of foreign direct investment are used as dependent variables respectively. All the variables in parentheses are independent variables for all the equations in a logarithm form.

We also use F-test to examine the existence of a long run relationship between the variables of interest following the null hypothesis i.e. $H_0: G = \alpha TRO_i = \alpha CAP = \alpha LF = \alpha FDI = \alpha GEX = 0$ against alternate hypothesis of co-integration Pesaran et al. (2001) for Eq. (10). The F-test has a nonstandard distribution which depends upon; (i) whether variables included in the ARDL model are I (0) or I (1), (ii) the number of regressors and (iii) whether the ARDL model contains an intercept and/or a trend. The critical values (CVs) reported in this study followed S. Narayan and Narayan (2005) rather than Pesaran et al. (2001) So, the F-statistic will be computed in our study to compare with critical bounds generated by Lower critical Bound (LCB) and Upper Critical Bound (UCB) developed by Narayan (2004)), because it is more appropriate for small samples than the table generated by Pesarane al. (2001). There is cointegration if the computed F-statistic is more than Upper Critical Bound (UCB) and no cointegration if the value of the F-statistic below the Lower Critical Bound (LCB).

We also used the ARDL bounds testing approach to estimate the extent of the long run relationships between the variables. If there is co-integration in Eq. (4-15) where trade openness (TROi), fixed capital formation (CAP) and skilled force (LF) government expending (GEX) foreign direct investment (FDI) are used as forcing variables, then there is an established long run relationship between the variables that can be molded in following equation given below.

$$\begin{aligned} \text{LnGDP}_t = & \Phi_0 + \Phi_1 \text{TRO}_{i,t-1} + \Phi_2 \text{CAP}_{t-1} + \Phi_3 \text{LF}_{t-1} + \\ & + \Phi_4 \text{FDI}_{t-1} + \Phi_5 \text{GEX}_{t-1} + \varepsilon_i. \end{aligned} \quad (17)$$

Where

$$\begin{aligned} \theta_0 &= -\alpha_1/\alpha_{\text{GDP}}, \theta_1 = -\alpha \text{TRO}_i/\alpha_1, \\ \theta_2 &= -\alpha \text{CAP}/\alpha_1, \theta_3 = -\alpha \text{LF}/\alpha_1, \\ \theta_4 &= -\alpha \text{GEX}/\alpha_1 \text{ and } \theta_5 = -\alpha \text{FDI}/\alpha_1 \end{aligned}$$

and μ_t is the error term assumed to be normally distributed (Egbal and Tanimoune 2014; Shahbaz 2012)

These long run estimates are computed using ARDL bounds testing approach to cointegration when real GDP growth (GDP) in logarithm form is used as a dependent variable. The results of the bounds testing to co-integration and the extent of the long run effect of trade openness on economic growth are displayed in tables (3) and (5) respectively.

Finally as soon as the co-integration of the series is confirmed, the Vector Error Correction Model (VECM) will be employed to investigate the direction of the causality between the variables. Exact direction of causality between the variables help providing more explanation for the previous results and help us suggesting more policies implications for decision-making authorities to sustain economic growth attaining fruitful impacts of trade openness through sound financial developing and improving the quality of human capital.

It is documented by Granger (1969) that the VECM Granger causality test is appropriate once variables are integrated at the same level of integration. To test the direction of causality between the variables following error correction representation:

$$\begin{aligned}
 (1-L) \begin{bmatrix} \text{LnGDP}_t \\ \text{LnTROi}_t \\ \text{LnCAP}_t \\ \text{LnLF}_t \\ \text{LnFDI}_t \\ \text{LnGEX}_t \end{bmatrix} &= \begin{bmatrix} a_1 \\ a_2 \\ a_3 \\ a_4 \\ a_5 \\ a_6 \end{bmatrix} + \sum_{i=1}^p (1-L) \begin{bmatrix} b_{11i} & \cdots & b_{16i} \\ \vdots & \ddots & \vdots \\ b_{61i} & \cdots & b_{66i} \end{bmatrix} \times \\
 &\times \begin{bmatrix} \text{LnGDP}_{t-1} \\ \text{LnTROi}_{t-1} \\ \text{LnCAP}_{t-1} \\ \text{LnLF}_{t-1} \\ \text{LnFDI}_{t-1} \\ \text{LnGEX}_{t-1} \end{bmatrix} + \begin{bmatrix} \alpha \\ \beta \\ \gamma \\ \delta \\ \theta \\ \sigma \end{bmatrix} \quad (18)
 \end{aligned}$$

Where the difference operator, ECT_{t-1} is a lagged residual term from the long run relationship and ε_{1t} , ε_{2t} , ε_{3t} , ε_{4t} , ε_{5t} and ε_{6t} are errors term assumed to be normally distributed with mean zero and finite covariance matrix. The causality between variables in the long run is estimated by the significance of t-statistic connecting the coefficients of the errors term (ECT_{t-1}) Shahbaz (2012). However, the short run causality are indicated by the significance of the chi-square in the first differences of the variables of equation 13. The chi-square is calculated using WALD-test, the null hypothesis is whether the coefficients of lagged independent variables together equal zero, for any of the 16 equations in the system. WALD test for Granger is a non-causality test introduced by Toda and Phillips (1994). In addition, the joint significance of both long and short runs causality are indicated by the joint significance of both ECT_{t-1} and the estimate of lagged independent variables. Rejection of the null implies a rejection of Granger non-causality. The tables (7), (8) and (9) report the results of VECM analysis: using exports, import and trade are as an indicator of trade openness respectively.

The VECMs are estimated using symmetric lag of one, given the small sample size of our study. Then, each ECM will be estimated using the ordinary least squares (OLS) technique including constant and time, given the dynamic nature of our variables (as displayed in figure 1). The general theme of the equations of the ECM is pro-

vided above (equation 17.). Using Eviews9 software the constant or linear trend term should not be included in the Exogenous Series edit box. The constant specification for VECs should be specified in the Co-integration table. We must choose from one of the five trend specifications in that tab. So we choose intercept no trend in VAR. By default, EViews will compute the critical values for the test using the computer programme associated with MacKinnon, Haug and Michelis (1999) (MHM) and is appropriate for case 1 of Osterwald-Lenum (1992), which allow an intercept no trend in the VCEM which is capable of generating a trend regardless (Turner 2007). Also, we must specify the number of co-integrating relations in the appropriate edit field which will be 3 according to eigenvalue and trace Maximum likelihood.