Pakistan Economic and Social Review
Volume 53, No. 1 (Summer 2015), pp. 17-46

EXPORTS-GROWTH NEXUS IN PAKISTAN
Cointegration and Causality Analysis

ADEEL SALEEM AND MAQBOOL HUSSAIN SIAL*

Abstract. This study empirically investigates the exports-growth nexus using annual time series data for the period 1973-2013 for Pakistan. Under augmented production function, it examines the effects of exports, human capital (pursuing new growth theory) and capital formation on GDP growth performance. The ARDL approach is employed to determine both the short-run and the long-run relationships. Moreover, the Granger causality test is used to explore causal direction among the variables. The empirical results show that real exports, real gross fixed capital formation, human capital, and real GDP are cointegrated when real GDP, real exports and real gross fixed capital formation are the explained variables. The short-run and the long-run coefficients conform to theoretical anticipation and demonstrate that exports, human capital and capital formation have a substantial and positive effect on GDP growth of Pakistan. The Granger causality analysis reports bi-directional causality, running between exports and GDP growth in the short-run and the long-run. The study verifies the validity of ELG hypothesis in Pakistan. The study, therefore, suggests that a country like Pakistan should implement and enforce export promotion strategies as a part of its appropriate development strategy to get sustainable economic growth.

Keywords: GDP growth, Exports, ARDL, Pakistan

JEL classification: B41, C22, F10, O40

---

*The authors are, respectively, Ph.D. Scholar/Lecturer in Economics at the University of Sargodha, Sargodha; and Professor of Economics/Dean, Faculty of Business and Administrative Sciences at the University of Sargodha, Sargodha (Pakistan).
Corresponding author e-mail: adeelsaleem@uos.edu.pk

I. INTRODUCTION

The importance of export expansion as an engine of economic growth has become a most debated issue in the field of economic development, growth, and trade literature with a little consensus among the experts. Several economists emphasize the significance of exports as a source of economic growth and have argued for various policies, for instance, export-led growth or import substitution strategies. The advocates of economic growth believe that it plays a fundamental role in the welfare of the society by improving the standard of living through an increase in per capita gross domestic product (GDP) of the economy. Increase in exports is perceived as a core determinant of output growth for developing as well as developed countries. Economic growth can be accelerated with the help of exports. Export expansion stimulates the production of goods and services through a variety of different possible channels like diffusion of technical knowledge, efficient allocation of resources, competitive atmosphere among firms, economies of scale, easy access to foreign exchange and higher imports of raw material and capital goods which result in higher capital formation. Hence, it stimulates domestic as well as export production in the economy (Khan *et al.*, 1995; Esfahani, 1991; Begum and Shamsuddin, 1998; Moosa, 1999; Akbar and Naqvi, 2000; Chuang, 2000; Thangavelu and Rajaguru, 2004; Quddus and Saeed, 2005; Afzal, 2006; Awokuse, 2006; Chaudhary *et al.*, 2007). It is known as Export-Led Growth (ELG) hypothesis in economic literature.

The most important question in the exports-growth debate is, whether the export promotion policy is preferable to import substitution policy for the stimulation of economic growth of developing countries. The answer can be sought to analyze the direction of causation between GDP growth and export growth. The causality between output growth and exports has important policy implications for domestic policy makers.

Trade is not only desirable but also inevitable, as countries have to provide for the growing needs of their economies. Several studies suggest a reciprocal relationship between export growth and GDP growth (Ahmed *et al.*, 2000; Balaguer and Cantavella-Jordá, 2004; Chaudhary *et al.*, 2007). Export expansion generates more income, which ultimately supports more trade (Abdulai and Jaquet, 2002). Numerous growing Asian economies got rapid economic growth, for example newly industrialized countries (NICs), *i.e.* Hong Kong, Philippines, Singapore, Taiwan, Indonesia, Malaysia, Thailand, South Korea and India. These countries have introduced various incentives to boost international trade using export-oriented strategies to improve their standard of living in the current era (Shan and Sun, 1998;

Thangavelu and Rajaguru, 2004; Liu *et al.*, 2009). Similarly, the South Asian countries have also achieved the target of economic growth through export-led growth and import substitution policies (Din, 2004). There are several countries that show good examples for export-led growth strategy (Federici and Marconi, 2002; Awokuse, 2003; Hossain and Karunaratne, 2004; Siliverstovs and Herzer, 2006; Chen, 2007; Awokuse, 2008). Therefore, the authenticity of ELG hypothesis is still on the agenda of the researchers in the developing and developed countries alike.

According to endogenous growth theory, the long-run growth rate is determined on the basis of endogenous factors. The physical and human capitals both together are assumed to show increasing returns to scale (Hossain and Karunaratne, 2004) and trade or human capital work as an engine of economic growth (Lucas, 1988; Romer, 1990). The endogenous growth models give more emphasis on the role of research and development in technological change for achieving economic prosperity (Grossman and Helpman, 1991). Krugman (1986) and Lucas (1988) believe that trade promotes innovation, research and development spillovers, and learning by doing that leads to higher productivity growth. The export promotion strategies accelerate the process of human capital formation (Chuang, 2000). The recently emerging endogenous growth models highlight the value of exports towards GDP growth. As the level of exports increases, it is supposed to create more externalities and hence increase domestic production (Sengupta, 1993). However, various empirical studies (*e.g.*, Balassa, 1978; Feder, 1982; Khan *et al.*, 1995; Shan and Sun, 1998; Ahmed *et al.*, 2000; Federici and Marconi, 2002; Awokuse, 2003; Abu-Qarn and Abu-Bader, 2004; Keong *et al.*, 2005; Afzal, 2006; Chen, 2007) have examined this relationship and have concluded that exports have a positive impact on economic growth.

During 1950s to 1960s, Pakistan focused on import substitution policy to improve balance of payment and to promote domestic industry. In 1970s, Pakistan switched over to export promotion policy by expecting optimistic consequences (Afzal, 2006). However, Pakistan shifted to an outward-oriented strategy more extensively in the late 1980s. Pakistan is particularly paying more attention on export promotion policy. To foster export growth, the government has implemented several development programmes for the promotion of export sector over the last decades, for example, exports bonus scheme, export subsidies, effective exchange rate, and export licenses during different times to encourage mostly manufactured exports. The total exports increased at the rate of 7.70 percent annually over the last thirty-four years (Quddus and Saeed, 2005; Afzal, 2006).

The objective of this study is to present a comprehensive and rigorous time series investigation on exports-growth nexus for Pakistan. Given the ambiguity of results from earlier Pakistani studies, this study provides an extension in the empirical research work.

The remaining paper is organized as follows: Section II presents a concise review of literature on exports-growth relationship. Section III explains and discusses data and methodology while empirical findings are presented and discussed in section IV. Finally, the conclusion of the study is provided in section V.

II. REVIEW OF LITERATURE

Exports and Economic Growth Nexus

The ELG hypothesis is among the most discussed topics in economic literature with quite diverse views and findings. Using cross sectional and time series data, various empirical studies verified and tested the validity of the ELG hypothesis with a mixture of outcomes. Several earlier studies (Emery, 1967; Syron and Walsh, 1968; Severn, 1968; Feder, 1982; Ram, 1987; Fosu, 1990) investigated the exports-growth relationship. These studies used rank and simple cross-correlation techniques under bi-variate model and applied ordinary least square (OLS) estimation method. The correlation coefficient explained high correlation between GDP growth and exports. The authors assumed this positive correlation as adequate evidence for ELG hypothesis. Nevertheless, this argument was extremely criticized due to improper econometric technique that generated spurious correlation and misleading outcomes (Ghatak and Price, 1997; Moosa, 1999; Shirazi and Manap, 2004; Keong *et al.*, 2005). The second weakness is, only correlation does not indicate causation. In addition, the exclusion of essential relevant variables and bi-variate models create misspecification problem that produces spurious results regarding exports-growth relationship (Riezman *et al.*, 1996; Shan and Sun, 1998; Ahmed *et al.*, 2000; Abu-Qarn and Abu-Bader, 2004; Chaudhary *et al.*, 2007; Halicioglu, 2007; Jordaan and Eita, 2007; Mahadevan, 2007). In the same way, cross-sectional studies unsuitably assume a common economic structure and identical production functions to verify the ELG hypothesis which is clearly against the reality (Federici and Marconi, 2002; Shirazi and Manap, 2004; Awokuse, 2006; Huang and Wang, 2007).

Another group of studies analyzed this relationship by employing regression equations. A neo-classical production function along with a set of other explanatory variables is used to examine this relationship. The variable of export is used as a regressor in the neo-classical production function. If the coefficient of export variable is significant and positive, it confirms the validity of the ELG hypothesis (Pahlavani, 2005; Siddiqui *et al.*, 2008). However, these studies also have the same weakness, that is, a significant positive relationship does not explain the causal direction between exports and economic growth (Ahmed *et al.*, 2000; Awokuse, 2003).

A number of studies (Chow, 1987; Hsiao, 1987; Bahmani-Oskooee and Alse, 1993; Khan *et al.*, 1995; Riezman *et al.*, 1996; Ghatak and Price, 1997; Shan and Tian, 1998; Moosa, 1999; Chuang, 2000; Abdulai and Jaquet, 2002; Abual-Foul, 2004; Al-Mamun and Nath, 2005; Awokuse, 2006; Fugarolas *et al.*, 2007; Liu *et al.*, 2009; Lean and Smyth, 2010) put emphasis on causality issues between exports and GDP growth together with other variables and applied Granger (1969) and Sims (1980) causality tests.

The Granger causality technique does not work in the absence of cointegration among the variables. This is the major dilemma of this technique. Therefore, the properties of time series data are essential to check before applying the Granger causality test (Ahmed *et al.*, 2000). The most recent group of studies exercised the time series approach to offset the drawbacks and shortcomings observed from previous research work.

The relatively recent studies accomplished by Chuang (2000), Abdulai and Jaquet (2002), Awokuse (2003), Hossain and Karunaratne (2004), Narayan and Smyth (2005), Keong *et al.* (2005), Sharma and Panagiotidis (2005), Herzer and Lehnmann (2006), Chen (2007), Mohan and Nandwa (2007), Awokuse (2008), Onafowora and Owoye (2008), Siddiqui *et al.* (2008), Lean and Smyth (2010), and Pistoresi and Rinaldi (2012) utilized latest econometric methods as compared to previous studies such as cointegration procedures, error correction mechanism (*ECM*) and vector autoregressive (VAR) models. These econometric techniques are essential to analyze the exports-growth relationship. Using these techniques, methods and procedures, several empirical studies (*e.g.*, Federici and Marconi, 2002; Hossain and Karunaratne, 2004; Pahlavani, 2005; Jordaan and Eita, 2007; Siddiqui *et al.*, 2008) examined and reported the existence of cointegration between GDP growth performance and exports. Concomitantly, various empirical studies (Moosa, 1999; Ahmed *et al.*, 2000; Jin, 2002; Abdulai and Jaquet, 2002) showed the absence of cointegration between these two variables. However, most of the research studies have experienced the same judgment that exports work as a hub of economic growth.

The Pakistan Context

Only a few studies have empirically probed the exports-growth nexus with diverse and ambivalent conclusions in the case of Pakistan. These studies investigated this relationship by using different methodologies and econometric techniques. Khan and Saqib (1993) analyzed the exports-growth liaison in Pakistan by employing a simultaneous equation model, and detected a stronger correlation between these two variables. Khan *et al.* (1995) explored the causality and cointegration between GDP growth and export growth. The empirical results confirmed the presence of cointegration between exports and output growth. In the same way, Akbar and Naqvi (2000) examined the GDP growth performance, and diversification and structural change in exports for Pakistan over the period 1973-1998 and found the existence of cointegration among the variables. Based on a longer data set (1970-1997), Ahmed *et al.* (2000) examined the causal relationship between GDP growth, external debt serving and export revenue for Asian countries and found the absence of cointegration among the variables for most of Asian countries, including Pakistan. Using the same methodology, Din (2004) tested the ELG hypothesis for South Asian countries (including Pakistan) by using VAR model and found the presence of cointegration among the variables. Love and Chandra (2004) verified the validity of ELG hypothesis for Pakistan. Shirazi and Manap (2004) applied the causality and cointegration tests to re-investigate the exports-growth relationship. The test inferences show the presence of cointegration among exports, output growth and imports. The authors also found uni-directional causality from export growth to output growth.

In contrast, Quddus and Saeed (2005) probed the same relationship for Pakistan, and found no cointegration and no causal association between exports and GDP, and between net GDP and exports. Similarly, Akbar and Naqvi (2000) provided evidence against the ELG but in favour of growth led export. Afzal (2006) re-investigated this relationship for Pakistan and found a stable and strong correlation between exports and GDP growth. Siddiqui *et al.* (2008) re-examined the ELG hypothesis for Pakistan. The author ignored the causal association but reported the presence of cointegration and positive effect of exports on GDP. Afzal *et al.* (2009) tested the ELG hypothesis in the case of Pakistan. The results show evidence against the ELG hypothesis but in favour of growth-driven exports. Hye and Siddiqui (2011) examined the relationship between export growth and GDP growth for Pakistan. The authors found the presence of cointegration between these two variables. Abbas (2012) examined the causal relationship between economic growth and exports for Pakistan. The authors found a uni-directional causality running from GDP to export growth in the short-run and the long-run.

III. DATA AND METHODOLOGY

Theoretical Framework

As mentioned in the literature review, various empirical studies demonstrated the notion of exports-growth relationship. Several empirical studies (*e.g.*, Feder, 1982; Balassa, 1985; Ram, 1987; Lucas, 1988; Esfahani, 1991; Hutchison and Singh, 1992; Al-Yousif, 1997; Begum and Shamsuddin, 1998; Sun and Parikh, 2001; Ibrahim, 2002; Al-Mawali, 2004; Hameed *et al.*, 2005; Pahlavani, 2005) analyzed the relation between export expansion and economic growth by including exports into an augmented production function framework. Following Feder (1982), Esfahani (1991) and Pahlavani (2005), this study uses a Feder type model approach to facilitate the belief that export growth works as an engine of economic growth for Pakistan. It is assumed in the model specification that economy consists of two sectors, *i.e.* export sector (X) non-export sector (N).

$$Y = N + X \quad (1)$$

and both sectors show different production functions:

$$N = F(K_n, L_n, X) \quad (2)$$

$$X = G(K_x, L_x) \quad (3)$$

According to Feder (1982), Output is produced by using labour (L) and capital (K) in both the sectors. The export sector generates two main effects on non-export sector, *i.e.* externality and productivity differential effect. Export sector works under extremely competitive atmosphere. It utilizes latest production methods, highly skilled labour force, latest means of transportation and communication, technical knowledge and better domestic public infrastructure. As a result, these facilities not only boost export sector but also produce positive production externalities on non export sector. Hence, both sectors together enhance total gross domestic product of the country (Feder, 1982; Esfahani, 1991; Begum and Shamsuddin, 1998; Pahlavani, 2005; Awokuse, 2006; Chaudhary *et al.*, 2007).

A total differentiating of equations (1) to (3) yields:

$$Y = N + X \quad (4)$$

$$N = F_k \cdot K_n + F_L \cdot L_n + F_x \cdot \mathrm{X} \quad (5)$$

$$X = G_k \cdot K_x + G_L \cdot L_x \quad (6)$$

G_i and F_i are marginal productivities of input i in the export and non-export sectors respectively, and F_x is the externality effect of export growth on non-export sector's output. The dot above on each variable shows resultant rate of change in that particular variable.

$$Y = F_k \cdot K_n + F_L \cdot L_n + F_x \cdot X + G_k \cdot K_x + G_L \cdot L_x \tag{7}$$

As Feder (1982) assumed that marginal factor productivity ratio of both sectors (non export and export) is different by the amount of δ. The author argued that factor productivity is higher in the export sector due to improved technical knowledge, and more skilled and qualified staff.

By following Feder (1982) to overcome this problem and assumes,

$$\frac{G_k}{F_k} = \frac{G_L}{F_L} = 1 + \delta \tag{8}$$

The symbol δ is a factor that determines the difference of marginal factor productivities of inputs (G_k, F_k, G_L, F_L) between export and non-export sector.

Using equation (8), equation (7) becomes:

$$Y = F_k \cdot K_n + F_L \cdot L_n + F_x \cdot X + (1 + \delta) F_k \cdot K_x + (1 + \delta) F_L \cdot L_x \tag{9}$$

By re-arranging

$$Y = F_k [K_n + K_x] + F_L [L_n + L_x] + F_x \cdot X + \delta [F_k \cdot K_x + F_L \cdot L_x] \tag{10}$$

The equation (8) can be expressed in terms of G_s and substituting them into $[F_k \cdot K_x + F_L \cdot L_x]$, and the outcome will be:

$$F_k \cdot K_x + F_L \cdot L_x = \frac{G_k}{(1+\delta)} K_x + \frac{G_L}{(1+\delta)} L_x \tag{11}$$

Furthermore, the equation (6) can also be written as:

$$X = F_k (1 + \delta) \cdot K_x + F_L (1 + \delta) \cdot L_x \tag{12}$$

By multiplying equation (12) with $\frac{1}{(1+\delta)}$, yields:

$$\frac{1}{(1+\delta)} X = F_k \cdot K_x + F_L \cdot L_x \tag{13}$$

Let us now assume that $[K_n + K_x] = K$ and $[L_n + L_x] = L$, then after substituting equation (13) into equation (10) and obtains:

$$\dot{Y} = F_k\dot{K} + F_L\dot{L} + \dot{X}\left[F_x + \frac{1}{1+\delta}\right] \tag{14}$$

Now, it is assumed that $F_k = \alpha$ and $F_L = \beta$ are the marginal productivity of capital and growth rate of labour force respectively. The last term of equation (14), *i.e.* $\left[F_x + \frac{\delta}{1+\delta}\right]$ is equal to θ, which is showing the externality and productivity differential effects from export to non export sector, then following equation is obtain:

$$Y = \alpha K + \beta L + \theta X \tag{15}$$

The equation (15) looks similar to neo-classical production function. It has often been utilized to estimate the relationship among exports, capital, labour and economic growth. This study uses the same equation where GDP is depending on capital formation, human capital and exports. According to Rogers (2003), labour force with a higher level of training, skills, knowledge and education can perform more efficiently and competently. They are more creative and inventive. This way, human capital can work as a factor of production and affects positively to the other factors of production. Hence, this study incorporates human capital (following new growth theory) instead of ordinary labour force together with capital and exports variables.

$$\ln Y_t = \alpha_0 + \alpha_1 \ln (K_t) + \alpha_2 \ln (HC_t) + \alpha_3 \ln (X_t) + \vartheta_t \tag{16}$$

Where t is time, ln indicates natural logarithm, Y_t is real GDP, K_t is real gross fixed capital formation, HC_t is human capital, X_t is real exports of goods and services, and ϑ_t is white noise error term. The expected signs of the parameters are as follows: $\alpha_1, \alpha_2, \alpha_3 > 0$.

Data

The analysis is based on annual data over the period 1973-2013. The data set consists of Pakistani observations on human capital (HC), real exports of goods and services (X), real gross fixed capital formation (GFCF), and real GDP (Y). The data is obtained from *Pakistan Economic Survey* (various issues) and *International Financial Statistics* (IFS). The GDP deflator (base = 2005) is used to obtain the real GDP, real GFCF and real exports. The university student’s enrollment (higher education) divided by total labour force has been utilized as a proxy for human capital. Moreover, all the data has been transformed into natural logarithmic form. The advantage of log transmutation is to condense the heteroscedasticity problem.

ARDL-Bounds Testing Approach to Cointegration Analysis

As discussed in the introduction, this research study applies the most recently developed technique of cointegration, *i.e.* ARDL approach. In order to examine the presence of cointegration among GDP growth, exports, capital formation and human capital, this study employs ARDL approach. Considering each of the variables one by one as regressand, the unrestricted error correction regressions can be expressed as follows:

$$\begin{aligned}\Delta \ln Y_t &= a_{0Y} + \sum_{i=1}^{n} b_{iY}\,\Delta \ln Y_{t-i} + \sum_{i=1}^{n} c_{iY}\,\Delta \ln K_{t-i} + \sum_{i=1}^{n} d_{iY}\,\Delta \ln HC_{t-i} \\ &+ \sum_{i=1}^{n} e_{iY}\,\Delta \ln X_{t-i} + \eta_{1Y}\,\ln Y_{t-1} + \eta_{2Y}\,\ln K_{t-1} + \eta_{3Y}\,\ln HC_{t-1} \\ &+ \eta_{4Y}\,\ln X_{t-1} + \varepsilon_{1t} \end{aligned} \quad (17)$$

$$\begin{aligned}\Delta \ln K_t &= a_{0K} + \sum_{i=1}^{n} b_{iK}\,\Delta \ln K_{t-i} + \sum_{i=1}^{n} c_{iK}\,\Delta \ln Y_{t-i} + \sum_{i=1}^{n} d_{iK}\,\Delta \ln HC_{t-i} \\ &+ \sum_{i=1}^{n} e_{iK}\,\Delta \ln X_{t-i} + \eta_{1K}\,\ln K_{t-1} + \eta_{2K}\,\ln Y_{t-1} + \eta_{3K}\,\ln HC_{t-1} \\ &+ \eta_{4K}\,\ln X_{t-1} + \varepsilon_{2t} \end{aligned} \quad (18)$$

$$\begin{aligned}\Delta \ln HC_t &= a_{0HC} + \sum_{i=1}^{n} b_{iHC}\,\Delta \ln HC_{t-i} + \sum_{i=1}^{n} c_{iHC}\,\Delta \ln Y_{t-i} + \sum_{i=1}^{n} d_{iHC}\,\Delta \ln K_{t-i} \\ &+ \sum_{i=1}^{n} e_{iHC}\,\Delta \ln X_{t-i} + \eta_{1HC}\,\ln HC_{t-1} + \eta_{2HC}\,\ln Y_{t-1} + \eta_{3HC}\,\ln K_{t-1} \\ &+ \eta_{4HC}\,\ln X_{t-1} + \varepsilon_{3t} \end{aligned} \quad (19)$$

$$\begin{aligned}\Delta \ln X_t &= a_{0X} + \sum_{i=1}^{n} b_{iX}\,\Delta \ln X_{t-i} + \sum_{i=1}^{n} c_{iX}\,\Delta \ln Y_{t-i} + \sum_{i=1}^{n} d_{iX}\,\Delta \ln K_{t-i} \\ &+ \sum_{i=1}^{n} e_{iX}\,\Delta \ln HC_{t-i} + \eta_{1X}\,\ln X_{t-1} + \eta_{2X}\,\ln Y_{t-1} + \eta_{3X}\,\ln K_{t-1} \\ &+ \eta_{4X}\,\ln HC_{t-1} + \varepsilon_{4t} \end{aligned} \quad (20)$$

Where $\ln Y$ = log of real GDP, $\ln K$ = log of real GFCF, $\ln HC$ = log of human capital, $\ln X$ = log of real exports of goods and services, Δ = first difference operator, ε_t = white noise error terms, and n = lag length.

The F-test is applied to verify the presence or absence of cointegration. The F-test is highly sensitive to lag length for all first differenced variables

(Bahmani-Oskooee and Nasir, 2004; Narayan and Narayan, 2007). The F-test is applied to all of the models to determine absence or presence of cointegration among the variables under study. The null hypothesis (H_0: $\eta_{1Y} = \eta_{2Y} = \eta_{3Y} = \eta_{4Y} = 0$) shows the absence of cointegration while the alternative hypothesis (H_1: $\eta_{1Y} \neq \eta_{2Y} \neq \eta_{3Y} \neq \eta_{4Y} \neq 0$) confirms the long-run relationship among the variables in equation (17). It is indicated as F_Y (Y | K, HC, X). Similarly, the F-test is applied to verify the presence or absence of cointegrating relationship in the equation (18), which is (H_0: $\eta_{1K} = \eta_{2K} = \eta_{3K} = \eta_{4K} = 0$), ($H_1$: $\eta_{1K} \neq \eta_{2K} \neq \eta_{3K} \neq \eta_{4K} \neq 0$) and it is denoted by F_K (K | Y, HC, X) and so on. The non-standard F-test distribution relies on (*i*) whether, ARDL contains intercept and/or a trend, (*ii*) whether, incorporated variables have different order of integration in ARDL model, (*iii*) the sample size, and (*iv*) the number of regressors. For ARDL approach, a pair of critical bounds values is provided in which each pair shows different values at different level of significance (Pesaran *et al.*, 2001). The set of critical bounds values assume that variables are purely integrated of order zero or one. If the computed F-value is higher than the upper critical bound value then a definite result of cointegration is possible, without knowing that underlying variables are I(0) or I(1). In contrast, the non-existence of cointegration is developed if F-value is smaller relative to lower critical bound value. On the contrary, if the F-value lies within the range of lower and upper critical bounds then the decision of cointegration is indecisive. This study uses both critical bounds values of Pesaran *et al.* (2001) and Narayan (2005). In the presence of long-run relationship among the variables, equation (21) is estimated employing the following long-run ARDL model as:

$$\ln Y_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \ln Y_{t-i} + \sum_{i=0}^{n} \alpha_2 \ln K_{t-i} + \sum_{i=0}^{n} \alpha_3 \ln HC_{t-i} + \sum_{i=0}^{n} \alpha_4 \ln X_{t-i} + \vartheta_{1t} \quad (21)$$

All above variables are as formerly described. The leg length of the models underlying ARDL is selected using two criteria such as Schwarz Bayesian criterion (SBC) and Akaike information criterion (AIC). The study also develops an error correction model to estimate short-run elasticities when GDP is taken as the explained variable as shown in equation (22).

$$\Delta \ln Y_t = \phi_0 + \sum_{i=1}^{n} \phi_1 \Delta \ln Y_{t-i} + \sum_{i=0}^{n} \phi_2 \Delta \ln K_{t-i} + \sum_{i=0}^{n} \phi_3 \Delta \ln HC_{t-i} + \sum_{i=0}^{n} \phi_4 \Delta \ln X_{t-i} + \varphi ECM_{t-1} + v_{1t} \quad (22)$$

Where *ECM* = error correction term; which is defined as:

$$ECM_t = \ln Y_t - \alpha_0 - \sum_{i=1}^{n} \alpha_1 \ln Y_{t-i} - \sum_{i=0}^{n} \alpha_2 \ln K_{t-i} - \sum_{i=0}^{n} \alpha_3 \ln HC_{t-i} - \sum_{i=0}^{n} \alpha_4 \ln X_{t-i} \quad (23)$$

Where Δ shows first difference operator, the symbol ϕ shows the short-run elasticities that explain convergence of model towards equilibrium, and the sign φ demonstrates the rate of correction on road to long-run equilibrium.

To determine the appropriateness of ARDL model, the study conducts some diagnostic tests (*e.g.*, serial correlation, heteroscedasticity and normality tests) and parameter stability test. Brown *et al.* (1975) presented an excellent methodology for investigating parameter stability, which is recognized as cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residuals (CUSUMSQ) tests. Pesaran and Pesaran (1997) argue that the short-run dynamics play an important role to examine the long-run parameter stability. Therefore, Pesaran and Pesaran test (1997) is applied. This test involves estimating the *ECM* model (*see* Equation (22)) where real GDP growth is considered as the explained variable, and the rest of all other variables are treated as regressors.

The Granger representation theorem recommends that if two variables say, x_t and y_t are independently integrated of order one and show the existence of cointegration, then both variables must confirm the causal relation at least in one direction. The presence or absence of cointegration helps us to perform Granger causality test correctly. This test is generally performed under VAR framework. As said by Engle and Granger (1987), if the series are I(1) and show the existence of cointegration, then VAR estimation that is carried out in first difference will provide misleading results. Thus, the inclusion of an extra variable is essential in VAR system, for instance, the *ECM* term to determine the cointegration. Therefore, the study utilizes an augmented type of Granger causality test including lagged *ECM* term under ARDL approach. The Granger causality test can be formulated through multivariate p^{th} order *VECM*. It is given by the following equations:

$$\Delta \ln Y_t = \alpha_{01} + \sum_{i=1}^{l} \alpha_{11} \Delta \ln Y_{t-i} + \sum_{j=1}^{m} \alpha_{22} \Delta \ln K_{t-j} + \sum_{k=1}^{n} \alpha_{33} \Delta \ln HC_{t-k} + \sum_{r=1}^{o} \alpha_{44} \Delta \ln X_{t-r} + \eta_1 ECM_{t-1} + \mu_{1i} \quad (24)$$

$$\Delta \ln K_t = \beta_{01} + \sum_{i=1}^{l} \beta_{11} \Delta \ln K_{t-i} + \sum_{j=1}^{m} \beta_{22} \Delta \ln Y_{t-j} + \sum_{k=1}^{n} \beta_{33} \Delta \ln HC_{t-k} + \sum_{r=1}^{o} \beta_{44} \Delta \ln X_{t-r} + \eta_2 ECM_{t-1} + \mu_{2i} \quad (25)$$

$$\Delta \ln HC_t = \phi_{01} + \sum_{i=1}^{l} \phi_{11} \Delta \ln HC_{t-i} + \sum_{j=1}^{m} \phi_{22} \Delta \ln Y_{t-i} + \sum_{k=1}^{n} \phi_{33} \Delta \ln K_{t-i} + \sum_{r=1}^{o} \phi_{44} \Delta \ln X_{t-i} + \eta_3 ECM_{t-1} + \mu_{3i} \quad (26)$$

$$\Delta \ln X_t = \varphi_{01} + \sum_{i=1}^{l} \varphi_{11} \Delta \ln X_{t-i} + \sum_{j=1}^{m} \varphi_{22} \Delta \ln Y_{t-j} + \sum_{k=1}^{n} \varphi_{33} \Delta \ln K_{t-k} + \sum_{r=1}^{o} \varphi_{44} \Delta \ln HC_{t-r} + \eta_4 ECM_{t-1} + \mu_{4i} \quad (27)$$

Where ECM_{t-1} is the lagged error correction term, which is not included in the absence of cointegration. Δ is the difference operator. The symbols u_{1i}, u_{2i}, u_{3i} and u_{4i} are serially uncorrelated disturbance terms. The F-test is applied on lagged explanatory variables of the equations (24) to (27), which shows the short-run causal effect. The t-statistic of lagged *ECM* coefficient explains the long-run causal effect (Narayan and Smyth, 2006).

IV. EMPIRICAL RESULTS AND DISCUSSION

Unit Root Tests

Although the ARDL approach does not rely on integration order of the variables (whether I(0) or I(1)), yet to confirm that time series data set does not have I(2) property. The Augmented Dickey Fuller (ADF) and Phillip-Perron (PP) unit root tests are applied to find out stationarity or non-stationarity of variables. The tests results are presented at their level and first difference in Table 1.

The results suggest that the variables (*Y*, *K*, *HC*, *X*) are non-stationary at their level. On the contrary, all these variables (*Y*, *K*, *HC*, *X*) are found stationary at their first difference and hence, the variables under consideration are I(1). This finding shows the presence of cointegration among the variables. Furthermore, these results confirm the complete absence of integrated of order 2 or higher than 2. Therefore, this study applies ARDL-bounds testing approach as a logical choice for cointegration test.

TABLE 1

Unit Root Tests

Variables	ADF		PP	
	Without Trend	With Trend	Without Trend	With Trend
Levels				
ln *Y*	–2.708	–0.689	–2.392	–0.872
ln *K*	–2.269	–3.257	–2.772	–2.114
ln *HC*	1.197	–0.603	1.197	–0.672
ln *X*	–0.809	–1.386	–0.812	–1.490
First Difference				
Δ ln *Y*	–4.658*	–5.283*	–4.719*	–5.281*
Δ ln *K*	–3.645*	–3.949**	–3.400**	–3.947**
Δ ln *HC*	–5.477*	–5.695*	–5.517*	–5.694*
Δ ln *X*	–5.856*	–5.841*	–5.846*	–5.835*
Critical Values 1% / 5%	–3.61 / –2.94	–4.21 / –3.54	–3.61 / –2.94	–4.21 / –3.52

Source: Author's own calculations. Notations * and ** show significance at the one and five percent level respectively. The symbol Δ is denoted as the first difference operator. The unit root tests have been performed in E-Views 7.

Cointegration Analysis

The first step of ARDL procedure requires estimating equations (17) to (20) in order to examine the cointegration among economic growth, capital, human capital and exports. For this purpose, the F-test is applied when all the variables are taken as the explained variables. The test inferences are presented in Table 2.

The bounds testing results of cointegration corroborate the existence of cointegration when real GDP, real exports and real GFCF are used as the explained variables. This is because, the calculated values of F-statistic for real GDP, real exports and real GFCF are $F_Y (Y \mid K, HC, X) = 5.826$, $F_X (X \mid K, HC, Y) = 4.314$ and $F_K (K \mid Y, HC, X) = 5.506$ respectively. These F-values are greater than the Pesaran upper critical bound values at the one, five and ten percent level of significance. However, the inferences show the absence of cointegration when human capital is taken as the explained variable. The calculated value of F-statistic for human capital is F_{HC} (*HC* | *K*, *Y*, *X*) =1.965. The computed F-value of human capital is smaller than lower critical bound values of Pesaran and Narayan at the one, five and ten percent level of significance. Thus, there are three cointegrating relationships when real GDP, real exports and GFCF are used as the explained variables.

TABLE 2

Bounds Testing for Cointegration

Panel A	
Dependent Variable	F statistics
	With intercept and no trend
FY (*Y* | *K*, *HC*, *X*)	5.826*
FX (*X* | *K*, *HC*, *Y*)	4.314***
FK (*K* | *Y*, *HC*, *X*)	5.506**
FHC (*HC* | *K*, *Y*, *X*)	1.965

Panel B							
Critical Values		90% level		95% level		99% level	
	K	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
	3	2.72	3.77	3.23	4.35	4.29	5.61

Panel C							
Critical Values		90% level		95% level		99% level	
	K	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
	3	2.933	4.020	3.548	4.803	5.018	6.610

Note: Notations *, ** and *** denote the presence of cointegration at the one, five and ten percent level of significance in accordance with Pesaran *et al.* (2001) respectively. The critical values (panel B) are taken from Pesaran *et al.* (2001), p. 300, while the critical values (panel C) are obtained from Narayan (2005), p. 1988. The symbol '*k*' represents the number of regressors.

Long Run Coefficients Results

Having determined the presence of cointegration for equation (17), the long-run elasticities have been estimated launching the SBC on equation (21). The maximum lag length is set equal to one to determine lag order. The empirical results are reported in Table 3.

TABLE 3

Estimated Long Run Coefficients
ARDL (1, 0, 0, 0) Dependent Variable: (*Y*)

Regressor	Coefficient	Standard Error	t-Ratio	Prob-Values
ln *K*	0.271*	0.089	3.021	[0.005]
ln *HC*	0.137*	0.025	5.439	[0.000]
ln *X*	0.405*	0.070	5.779	[0.000]
Constant	5.279*	0.467	11.309	[0.000]

Note: Notations *, ** and *** show statistical significance at the one, five and ten percent level respectively.

Table 3 shows that all long-run coefficients have expected theoretical signs which are positive for all the variables. The coefficients of real GFCF, human capital and real exports are highly significant at the one percent level. The results show that other things remaining unchanged, a one percent increase in real GFCF results in approximately a 0.27 percent increase in real gross domestic product. It confirms the theoretical relationship between economic growth and capital inputs. It further reveals that rise in real GFCF has potential to stimulate economic growth of Pakistan. From the table, the coefficient of human capital explains that a one percent increase in human capital results in approximately a 0.14 percent increase in real GDP, ceteris paribus. It shows that human capital has a substantial effect on GDP performance of Pakistan. Considering the effect of real exports, one percent increase in real exports results in approximately a 0.40 percent increase in real GDP, ceteris paribus. The results demonstrate that export growth is the most significant factor in contributing economic growth in Pakistan. It shows a large and ample effect on GDP growth and verifies the ELG hypothesis in Pakistan.

The Estimated Results of Error Correction Model

The short-run elasticities have been estimated within ARDL framework. The short-run estimation is based on the SBC, and the results are shown in Table 4.

TABLE 4

Estimated Error Correction Model
ARDL (1, 0, 0, 0) Dependent Variable: (ΔY)

Regressor	Coefficient	Standard Error	t-Ratio	Prob-Values
ΔK	0.052*	0.018	2.745	[0.009]
ΔHC	0.026*	0.007	3.586	[0.001]
ΔX	0.077*	0.024	3.255	[0.003]
Constant	1.011*	0.196	5.165	[0.000]
ECM_{t-1}	–0.191*	0.395	–4.843	[0.000]
Akaike Information Criterion = 107.238			R-Squared = 0.481	
Schwarz Bayesian Criterion = 103.016			R-Bar-Square = 0.422	
Durbin-Watson Statistic = 1.968			F-statistic = 8.121 [0.000]	

Note: Notations *, ** and *** show statistical significance at the one, five and ten percent level respectively.

The short-run elasticities demonstrate the same signs and level of statistical significance for real GFCF, human capital and real exports that have been derived in the long-run results. The empirical results show that real GFCF has greater effect than human capital. Besides, export growth has a highest effect on GDP growth when we compared with the other two. The *ECM* coefficient shows how rapidly or gradually variables converge to equilibrium path. The value of *ECM* coefficient must be significant statistically with a negative sign. The highly significance of *ECM* coefficient further verifies the presence of cointegration (Banerjee *et al.*, 1998). The results indicate that the lagged *ECM* value is highly significant statistically with a negative sign. This term implies a moderate speed of convergence towards equilibrium. The lagged *ECM* value (–0.19) explains that approximately 19 percent disequilibrium from the last year is corrected in the present year.

Parameter Stability and Model Diagnostic Tests

At the final stage, this study applies some diagnostic tests on the estimated parameters underlying ARDL approach. The results of diagnostic tests are shown in Table 5.

TABLE 5

Diagnostic Tests Based on ARDL Methodology

Lagrange Multiplier Statistic			F-Version	
Diagnostics	Statistic's Value	p-value	Statistic's Value	p-value
Serial Correlation	0.005	[0.942]	0.004	[0.947]
Heteroscedasticity	0.001	[0.971]	0.001	[0.972]
Normality	0.560	[0.755]	Not applicable	

* Figures in square parentheses are probability values.

In Table 5, all diagnostic tests are applied to the model. The test results do not indicate any symptom of autocorrelation or heteroscedasticity. The fitted regression model passes the normality test, which implies that the errors are normally distributed. The CUSUM and CUSUMSQ tests are utilized to the residuals of equation (22) to ascertain the long-run parameter stability of the model. The results can be explained through the following graphs.

FIGURE 1

CUSUM Plot of Stability Test

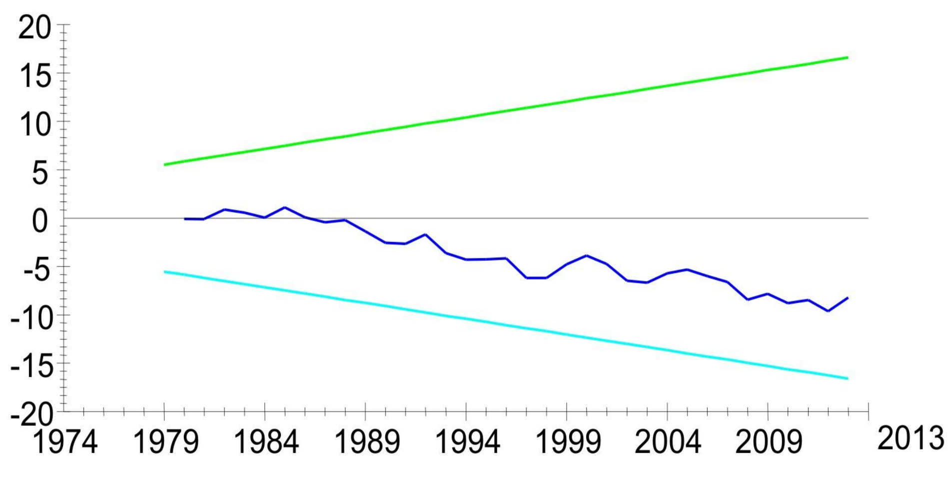
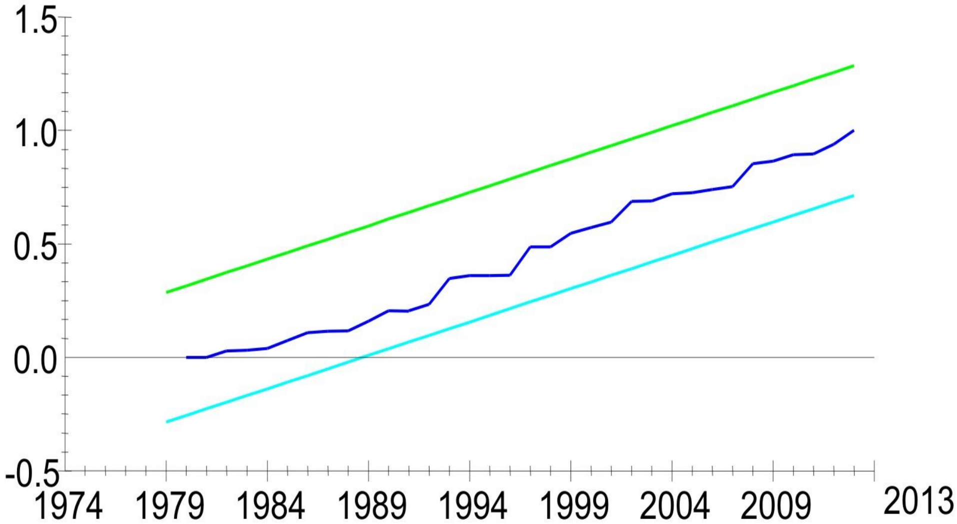


FIGURE 2

CUSUMSQ Plot of Stability Test



In both the Figures 1 and 2, the upward sloping straight lines indicate the critical upper and lower bounds at the five percent level of significance. The graphs do not provide any proof of fluctuations in the residuals because CUSUM and CUSUMSQ residuals move between five percent upper and lower critical bounds. It is the clear-cut indication of long-run parameter stability of the model over the entire sample period.

Granger Causality Based on Error Correction Mechanism

This stage applies Granger causality test augmented with a lagged *ECM* term. It includes only those error correction terms where these variables are found to be cointegrated. The presence of cointegration among real exports, real GDP, real GFCF and human capital reveals that there must be a sign of causal relationship at least in one direction. However, it does not show a temporal causal association between the variables. The causality results are presented in Table 6.

In Table 6, the Wald F-test explains the joint significance of lagged differences independent variables of the error correction model. The t-statistic shows the significance of ECM_{t-1} coefficients. The Wald F-test and t-statistic demonstrate the short-run and the long-run causal effects respectively. Starting with the long-run results, the lagged *ECM* coefficients are found to be significant at the one percent level with a negative sign in real GDP, real exports and real GFCF equations. The lagged *ECM* coefficients confirm the presence of cointegration and demonstrate that real GDP, real exports and real GFCF are a function of disequilibrium in cointegration involvement. Furthermore, the values of lagged *ECM* coefficients (–0.19, –0.48 and –0.26) suggest that deviation from equilibrium for real GDP, real exports and real GFCF during the current period would be corrected by 19, 48 and 26 percent respectively in the next period. Thus, the long-run causal inferences explain that human capital, real exports and real GFCF Granger cause economic growth while economic growth, human capital and real exports Granger cause real GFCF. Similarly in the long-run, human capital, real GFCF and economic growth Granger cause real exports. The direction of causality runs interactively via *ECM* term in the cointegrating equations.

TABLE 6

Results of Short-Run and Long-Run Granger Causality

F-statistics					
Dependent Variables	Independent Variables				
	ΔY	ΔX	ΔK	ΔHC	ECM_{t-1} (t-statistic)
ΔY	–	10.596* [0.001]	7.534* [0.006]	12.858* [0.000]	–0.191* (–4.843)
ΔX	14.118* [0.000]	–	0.416 [0.519]	12.008* [0.001]	–0.484* (–4.105)
ΔK	5.057** [0.025]	0.025 [0.873]	–	0.130 [0.718]	–0.265* (–2.628)
ΔHC	6.242* [0.012]	5.990* [0.014]	0.526 [0.468]	–	–

Note: Notations *, ** and *** show statistical significance at the one, five and ten percent levels respectively. Figures in small parenthesis indicate t-statistic for ECM_{t-1} while figures in square [ ] brackets are probability values for Wald F-test. The optimal lag length is one as per SBC. The summary of the short-run causal inferences: $X \Leftrightarrow Y$, $K \Leftrightarrow Y$, $HC \Leftrightarrow Y$, and $HC \Leftrightarrow X$.

Turning towards short-run causality results, the Wald F-test for explanatory variables indicates a bi-directional Granger causality, *i.e.* running between economic growth and export growth, real GFCF and economic growth, human capital and economic growth, and between real exports and human capital. Furthermore, neutrality is observed between real GFCF and real exports and between human capital and real GFCF.

V. CONCLUSION

The importance of foreign trade and economic growth is remained under the debate with little consensuses among experts over the decades. It is a widely held belief that export expansion has a positive and considerable impact on GDP growth performance of developing and developed countries. Empirical research investigating exports-growth nexus provides contradictory, ambiguous and mixed results in this regard. Given such vagueness of outcomes, this study contributes to probe the exports-growth friendship in Pakistan using cointegration and causality testing under ARDL methodology. Under augmented production function framework; the study evaluates the key role of exports, human capital (pursuing new growth theory) and capital formation on GDP growth of Pakistan. The major objective of the study is to analyze the role of export growth towards output growth for Pakistan. The empirical results show that all variables are stationary at their first difference. The cointegration results verify that human capital, exports, capital formation and GDP growth are cointegrated when real GDP, real exports and real GFCF are used as the explained variables but not cointegrated when human capital is the dependent variable. The short-run and the long-run inferences show that exports, human capital and capital formation have a significant and positive impact on GDP growth of Pakistan. The causality inferences show two-way causality between exports and GDP growth in the short-run and the long-run. Thus, the findings of this study provide a confirmation in support of ELG hypothesis in both the short-run and the long-run for the Pakistan economy. The study, therefore, recommends that Pakistan should adopt and enforce export promotion policies in order to bolster GDP growth. The production of commodities with export potentialities should be increased. Pakistan should give priority to improve and establish its trade relations with other countries. The modern and improved physical infrastructure and human capital accumulation are essential for domestic development strategies. The government should emphasize especially on public investment projects, primary, secondary, technical education and job training programmes, and allocate sufficient amount of budget for the improvement and development of human capital. In terms of further research, it would be interesting to investigate separate relationship between decomposition of exports (primary and manufactured exports) and GDP growth. It may provide more appealing results. Therefore, further research on this relationship is highly needed to derive stronger policy implications.

REFERENCES

Abbas, S. (2012), Causality between exports and economic growth: Investigating suitable trade policy for Pakistan. *Eurasian Journal of Business and Economics*, Volume 5(10), pp. 91-98.

Abdulai, A. and P. Jaquet (2002), Exports and economic growth: Cointegration and causality evidence for Côte d'Ivoire. *African Development Review*, Volume 14(1), pp. 1-17. http://dx.doi.org/10.1111/1467-8268.00043

Abual-Foul, B. (2004), Testing the export-led growth hypothesis: Evidence from Jordan. *Applied Economics Letters*, Volume 11(6), pp. 393-396. http://dx.doi.org/10.1080/1350485042000228268

Abu-Qarn, A. S. and S. Abu-Bader (2004), The validity of the ELG hypothesis in the MENA region: Cointegration and error correction model analysis. *Applied Economics*, Volume 36(15), pp. 1685-1695. http://dx.doi.org/10.1080/0003684042000266865

Afzal, M. (2006), Causality between exports, world income and economic growth in Pakistan. *International Economic Journal*, Volume 20(1), pp. 63-77. http://dx.doi.org/10.1080/10168730500515399

Afzal, M., A. R. Butt, H. Rehman and I. Begum (2009), A dynamic analysis of the relationship among human development, exports and economic growth in Pakistan. *The Pakistan Development Review*, Volume 48, No. 4 (Winter), Part II, pp. 885-920. http://www.jstor.org/stable/41261354

Aghion, P. and P. Howitt (1992), A model of growth through creative destruction. *Econometrica*, Volume 60(2), pp. 323-351. http://www.jstor.org/stable/2951599

Ahmed, Q. M., M. S. Butt and S. Alam (2000), Economic growth, export, and external debt causality: The case of Asian countries. *The Pakistan Development Review*, Volume 39, No. 4 (Part II), pp. 591- 608. http://www.jstor.org/stable/41260286

Akbar, M. and Z. F. Naqvi (2000), Export diversification and structural dynamics in growth process: The case of Pakistan. *The Pakistan Development Review*, Volume 39, No.4 (Part II), pp. 573-589. http://www.jstor.org/stable/41260285

Al-Mamun, K. A. and H. K. Nath (2005), Export-led growth in Bangladesh: A time series analysis. *Applied Economics Letters*, Volume 12(6), pp. 361-364. http://dx.doi.org/10.1080/13504850500068194

Al-Mawali, N. (2004), Revisiting the trade-growth nexus: Further evidence from Egypt. *Review of Middle East Economics and Finance*, Volume 2(3), pp. 211-218. http://dx.doi.org/10.1080/1475368042000299659

Al-Yousif, Y. K. (1997), Exports and economic growth: Some empirical evidence from the Arab Gulf countries. *Applied Economics*, Volume 29(6), pp. 693-697. http://dx.doi.org/10.1080/000368497326624

Awokuse, T. O. (2003), Is the export-led growth hypothesis valid for Canada? *Canadian Journal of Economics*, Volume 36(1), pp. 126-136. http://dx.doi.org/10.1111/1540-5982.00006

Awokuse, T. O. (2006), Export-led growth and the Japanese economy: Evidence from VAR and directed acyclic graphs. *Applied Economics*, Volume 38(5), pp. 593-602. http://dx.doi.org/10.1080/00036840600619594

Awokuse, T. O. (2008), Trade openness and economic growth: Is growth export-led or import-led? *Applied Economics*, Volume 40(2), pp. 161-173. http://dx.doi.org/10.1080/00036840600749490

Bahmani-Oskooee, M. and A. B. M. Nasir (2004), ARDL approach to test the productivity bias hypothesis. *Review of Development Economics*, Volume 8, Issue 3, pp. 483-488. http://dx.doi.org/10.1111/j.1467-9361.2004.00247.x

Bahmani-Oskooee, M. and G. G. Goswami (2003), A disaggregated approach to test the J-curve phenomenon: Japan versus her major trading partners. *Journal of Economics and Finance*, Volume 27, Issue 1 (Spring), pp. 102-113. http://dx.doi.org/10.1007/BF02751593

Bahmani-Oskooee, M. and J. Alse (1993), Export growth and economic growth: An application of cointegration and error-correction modeling. *Journal of Developing Areas*, Volume 27, No. 4, pp. 535-542. http://www.jstor.org/stable/4192260

Balaguer, J. and M. Cantavella-Jordá (2004), Structural change in exports and economic growth: Cointegration and causality analysis for Spain (1961-2000). *Applied Economics*, Volume 36(5), pp. 473-477. http://dx.doi.org/10.1080/00036840410001682179

Balassa, B. (1978), Exports and economic growth: Further evidence. *Journal of Development Economics*, Volume 5(2), pp. 181-189. http://dx.doi.org/10.1016/0304-3878(78)90006-8

Balassa, B. (1985), Exports, policy choices, and economic growth in developing countries after the 1973 oil shock. *Journal of Development Economics*, Volume 18(1), pp. 23-35. http://dx.doi.org/10.1016/0304-3878(85)90004-5

Banerjee, A., J. Dolado and R. Mestre (1998), Error-correction mechanism tests for cointegration in single-equation framework. *Journal of Time Series Analysis*, Volume 19(3), pp. 267-283. http://dx.doi.org/10.1111/1467-9892.00091

Begum, S. and A. F. M. Shamsuddin (1998), Exports and economic growth in Bangladesh. *Journal of Development Studies*, Volume 35(1), pp. 89-114. http://dx.doi.org/10.1080/00220389808422556

Brown, R. L., J. Durbin and J. M. Evans (1975), Techniques for testing the constancy of regression relations over time. *Journal of the Royal Statistical Society*, Series B, Volume 37(2), pp. 149-192. http://www.jstor.org/stable/2984889

Chaudhary, M. A., N. S. Shirazi and M. A. S. Chaudhary (2007), Trade policy and economic growth in Bangladesh: A revisit. *Pakistan Economic and Social Review*, Volume 45(1), pp. 1-26. http://www.jstor.org/stable/25825302

Chen, S. (2007), Exactly what is the link between export and growth in Taiwan? New evidence from the Granger causality test. *Economics Bulletin*, Volume 6(7), pp. 1-10.

Chow, P. C. Y. (1987), Causality between export growth and industrial development: Empirical evidence from the NICs. *Journal of Development Economics*, Volume 26(1), pp. 55-63. http://dx.doi.org/10.1016/0304-3878(87)90051-4

Chuang, Y. (2000), Human capital, exports and economic growth: A causality analysis for Taiwan, 1952-1995. *Review of International Economics*, Volume 8(4), pp. 712-720. http://dx.doi.org/10.1111/1467-9396.00252

Dickey, D. A. and W. A. Fuller (1979), Distribution of estimators for autoregressive time series with unit root. *Journal of the American Statistical Association*, Volume 74(366a), pp. 427-431. http://dx.doi.org/10.1080/01621459.1979.10482531

Dickey, D. A. and W. A. Fuller (1981), Likelihood ratio statistics for autoregressive time series with a unit root. *Econometrica*, Volume 49(4), pp. 1057-1072. http://www.jstor.org/stable/1912517

Din, M. (2004), Exports, imports, and economic growth in South Asia: Evidence using a multivariate time-series framework. *The Pakistan Development Review*, Volume 43, No. 2, pp. 105-124. http://www.jstor.org/stable/41260615

Emery, R. F. (1967), The relation of exports and economic growth. *Kyklos*, Volume 20(4), pp. 470-486. http://dx.doi.org/10.1111/j.1467-6435.1967.tb00859.x

Engle, Robert F. and C. W. J. Granger (1987), Co-integration and error correction: Representation, estimation, and testing. *Econometrica*, Volume 55(2), pp. 251-276. http://www.jstor.org/stable/1913236

Esfahani, H. S. (1991), Exports, imports, and economic growth in semi-industrialized countries. *Journal of Development Economics*, Volume 35(1), pp. 93-116. http://dx.doi.org/10.1016/0304-3878(91)90068-7

Feder, G. (1982), On exports and economic growth. *Journal of Development Economics*, Volume 12(1-2), pp. 59-73. http://dx.doi.org/10.1016/0304-3878(83)90031-7

Federici, D. and D. Marconi (2002), On exports and economic growth: The case of Italy. *Journal of International Trade and Economic Development*, Volume 11(3), pp. 323-340. http://dx.doi.org/10.1080/09638190210151428

Fosu, A. K. (1990), Exports and economic growth: The African case. *World Development*, Volume 18(6), pp. 831-835. http://dx.doi.org/10.1016/0305-750X(90)90005-I

Fugarolas, G., I. Mañalich and D. Matesanz (2007), Are exports causing growth? Evidence on international trade expansion in Cuba, 1960-2004. MPRA Paper # 6323.

Ghatak, S. and S. W. Price (1997), Export composition and economic growth: Cointegration and causality evidence for India. *Review of World Economics*, Volume 133(3), pp. 538-553. http://dx.doi.org/10.1007/BF02707502

Government of Pakistan (Various Issues), *Pakistan Economic Survey*. Finance Division, Islamabad, Pakistan.

Granger, C. W. J. (1969), Investigating causal relations by econometric models and cross-spectral methods. *Econometrica*, Volume 37(3), pp. 424-438. http://www.jstor.org/stable/1912791

Grossman, G. M. and E. Helpman (1991), Trade, knowledge spillovers, and growth. *European Economic Review*, Volume 35(2-3), pp. 517-526. http://dx.doi.org/10.1016/0014-2921(91)90153-A

Halicioglu, F. (2007), A multivariate causality analysis of export and growth for Turkey. MPRA Paper # 3565.

Hameed, A., M. A. Chaudhary and K. Y. Khan (2005), The growth impact of exports in South Asian countries. *The Pakistan Development Review*, Volume 44, No. 4 (Part II), pp. 901-919. http://www.jstor.org/stable/41261137

Herzer, D. and F. Nowak-Lehnmann (2006), What does export diversification do for a growth? An econometric analysis. *Applied Economics*, Volume 38(15), pp. 1825-1838. http://dx.doi.org/10.1080/00036840500426983

Hossain, M. and N. D. Karunaratne (2004), Exports and economic growth in Bangladesh: Has manufacturing exports become a new engine of export-led growth? *The International Trade Journal*, Volume 18(4), pp. 303-334. http://dx.doi.org/10.1080/08853900490518190

Hsiao, M. C. W. (1987), Tests of causality and exogeneity between exports and economic growth: The case of Asian NICs. *Journal of Economic Development*, Volume 12(2), pp. 143-159.

Huang, T. and M. Wang (2007), A test for the export-led growth hypothesis in possibly integrated vector autoregressions. *Applied Economics Letters*, Volume 14(13), pp. 999-1003. http://dx.doi.org/10.1080/13504850600706073

Hutchison, M. and N. Singh (1992), Exports, non-exports and externalities: A Granger causality approach. *International Economic Journal*, Volume 6(2), pp. 79-94. http://dx.doi.org/10.1080/10168739200000013

Hye, Q. M. A. and M. M. Siddiqui (2011), Export-led growth hypothesis: multivariate rolling window analysis of Pakistan. *African Journal of Business Management*, Volume 5(2), pp. 531-536. http://dx.doi.org/10.5897/AJBM10.761

Ibrahim, M. H. (2002), An empirical note on the export-led growth hypothesis: The case of Malaysia. *Economic Analysis and Policy*, Volume 32(2), pp. 221-232. http://dx.doi.org/10.1016/S0313-5926(02)50030-8

Jin, J. C. (2002), Exports and growth: Is the export-led growth hypothesis valid for provincial economies? *Applied Economics*, Volume 34(1), pp. 63-76. http://dx.doi.org/10.1080/00036840010025632

Jordaan, A. C. and J. H. Eita (2007), Export and economic growth in Namibia: A Granger causality analysis. *South African Journal of Economics*, Volume 75(3), pp. 540-547. http://dx.doi.org/10.1111/j.1813-6982.2007.00132.x

Keong, C. C., Z. Yusop and V. L. K. Sen (2005), Export-led growth hypothesis in Malaysia: An investigation using bounds test. *Sunway Academic Journal*, Volume 2, pp. 13-22.

Khan, A. H. and N. Saqib (1993), Economic development and international trade. *International Economic Journal*, Volume 7(3), pp. 53-64. http://dx.doi.org/10.1080/10168739300000005

Khan, A. H., A. Malik and L. Hasan (1995), Exports, growth and causality: An application of co-integration and error-correction modelling. *The Pakistan Development Review*, Volume 34, No. 4 (Part III), pp. 1001-1012. http://www.jstor.org/stable/41259918

Krugman, P. R. (1986), *Strategic Trade Policy and International Economics*. Cambridge: The MIT Press.

Lean, H. H. and R. Smyth (2010), Multivariate Granger causality between electricity generation, exports, prices and GDP in Malaysia. *Energy*, Volume 35(9), pp. 3640-3648. http://dx.doi.org/10.1016/j.energy.2010.05.008

Liu, X., C. Shu and P. Sinclair (2009), Trade, foreign direct investment and economic growth in Asian economies. *Applied Economics*, Volume 41(13), pp. 1603-1612. http://dx.doi.org/10.1080/00036840701579176

Love, J. and R. Chandra (2004), Testing export-led growth in India, Pakistan and Sri Lanka using a multivariate framework. *The Manchester School*, Volume 72(4), pp.483-496. http://dx.doi.org/10.1111/j.1467-9957.2004.00404.x

Lucas, Robert E. (1988), On the mechanic of economic development. *Journal of Monetary Economics*, Volume 22(1), pp. 3-42. http://dx.doi.org/10.1016/0304-3932(88)90168-7

Mahadevan, R. (2007), New evidence on the export-led growth nexus: A case study of Malaysia. *The World Economy*, Volume 30(7), pp. 1069-1083. http://dx.doi.org/10.1111/j.1467-9701.2007.01030.x

Mohan, R. and B. Nandwa (2007), Testing export-led growth hypothesis in Kenya: An ARDL bounds test approach. *MPRA* Paper # 5582.

Moosa, I. A. (1999), Is the export-led growth hypothesis valid for Australia?. *Applied Economics*, Volume 31(7), pp. 903-906. http://dx.doi.org/10.1080/000368499323869

Narayan, P. K. (2005), The saving and investment nexus for China: Evidence from cointegration tests. *Applied Economics*, Volume 37(17), pp. 1979-1990. http://dx.doi.org/10.1080/00036840500278103

Narayan, P. K. and R. Smyth (2005), Trade liberalization and economic growth in Fiji. An empirical assessment using the ARDL approach. *Journal of the Asia Pacific Economy*, Volume 10(1), pp. 96-115. http://dx.doi.org/10.1080/1354786042000309099

Narayan, P. K. and R. Smyth (2006), Higher education, real income and real investment in China: Evidence from Granger causality tests. *Education Economics*, Volume 14(1), pp. 107-125. http://dx.doi.org/10.1080/09645290500481931

Narayan, P. K. and S. Narayan (2007), Modelling oil price volatility. *Energy Policy*, Volume 35(12), pp. 6549- 6553. http://dx.doi.org/10.1016/j.enpol.2007.07.020

Onafowora, O. A. and O. Owoye (2008), Exchange rate volatility and export growth in Nigeria. *Applied Economics*, Volume 40(12), pp. 1547-1556. http://dx.doi.org/10.1080/00036840600827676

Osman, M. A. and S. R. Evans (2002), Time series analysis of the Somalian export demand equations: A co-integration approach. *Journal of Economic and Social Research*, Volume 4(2), pp. 71-92.

Pahlavani, M. (2005), Cointegration and structural change in the exports-GDP nexus: The case of Iran. *International Journal of Applied Econometrics and Quantitative Studies*, Volume 2(4), pp. 37-56.

Perron, P. (1997), Further evidence on breaking trend functions in macroeconomic variables. *Journal of Econometrics*, Volume 80(2), pp. 355-385. http://dx.doi.org/10.1016/S0304-4076(97)00049-3

Pesaran, M. H. and B. Pesaran (1997), *Working with Microfit 4.0*: I*nteractive Econometric Analysis*. Oxford: Oxford University Press.

Pesaran, M. H., Y. Shin and R. J. Smith (2001), Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, Volume 16(3), pp. 289-326. http://dx.doi.org/10.1002/jae.616

Phillips, P. C. B. and P. Perron (1988), Testing for a unit root in time series regression. *Biometrika*, Volume 75(2), pp. 335-346. http://www.jstor.org/stable/2336182

Pistoresi, B. and A. Rinaldi (2012), Exports, imports and growth: New evidence on Italy: 1863-2004. *Explorations in Economic History*, Volume 49(2), pp. 241-254. http://dx.doi.org/10.1016/j.eeh.2011.11.003

Quddus, M. A. and I. Saeed (2005), An analysis of exports and growth in Pakistan. *The Pakistan Development Review*, Volume 44, No. 4 (Part II), pp. 921-937. http://www.jstor.org/stable/41261138

Ram, R. (1987), Exports and economic growth in developing countries: Evidence from time-series and cross-section data. *Economic Development and Cultural Change*, Volume 36(1), pp. 51-72. http://www.jstor.org/stable/1153992

Riezman, R. G., C. H. Whiteman and P. M. Summers (1996), The engine of growth or its handmaiden? A time-series assessment of export-led growth. *Empirical Economics*, Volume 21(1), pp. 77-110. http://dx.doi.org/10.1007/BF01205495

Rogers, M. (2003), A survey of economic growth. *Economic Record*, Volume 79(244), pp. 112-135. http://dx.doi.org/10.1111/1475-4932.00082

Romer, Paul M. (1990), Endogenous technological change. *Journal of Political Economy*, Volume 98(5), pp. S71-S102. http://www.jstor.org/stable/2937632

Sengupta, J. K. (1993), Growth in NICs in Asia: Some tests of new growth theory. *Journal of Development Studies*, Volume 29(2), pp. 342-357. http://dx.doi.org/10.1080/00220389308422277

Severn, A. K. (1968), Exports and economic growth. *Kyklos*, Volume 21(3), pp. 546-548. http://dx.doi.org/10.1111/j.1467-6435.1968.tb00132.x

Shan, J. and F. Sun (1998), On the export-led growth hypothesis: The econometric evidence from China. *Applied Economics*, Volume 30(8), pp. 1055-1065. http://dx.doi.org/10.1080/000368498325228

Shan, J. and G. G. Tian (1998), Causality between exports and economic growth: The empirical evidence from Shanghai. *Australian Economic Papers*, Volume 37(2), pp. 195-202. http://dx.doi.org/10.1111/1467-8454.00015

Sharma, A. and T. Panagiotidis (2005), An analysis of exports and growth in India: Cointegration and causality evidence (1971-2001). *Review of Development Economics*, Volume 9(2), pp. 232-248. http://dx.doi.org/10.1111/j.1467-9361.2005.00273.x

Shirazi, N. S. and T. A. Manap (2004), Exports and economic growth nexus: The case of Pakistan. *The Pakistan Development Review*, Volume 43, No. 4 (Part II), pp. 563-581. http://www.jstor.org/stable/41261014

Siddiqui, S., S. Zehra, S. Majeed and M. S. Butt (2008), Export led growth hypothesis in Pakistan: A reinvestigation using the bounds test. *The Lahore Journal of Economics*, Volume 13(2), pp. 59-80.

Siliverstovs, B. and D. Herzer (2006), Export-led growth hypothesis: Evidence for Chile. *Applied Economics Letters*, Volume 13(5), pp. 319-324. http://dx.doi.org/10.1080/13504850500407293

Sims, C. A. (1980), Macroeconomics and reality. *Econometrica*, Volume 48(1), pp. 1-48. http://dx.doi.org/10.2307/1912017

Sun, H. and A. Parikh (2001), Exports, inward foreign direct investment (FDI) and regional economic growth in China. *Regional Studies*, Volume 35(3), pp. 187-196. http://dx.doi.org/10.1080/713693805

Syron, R. F. and B. M. Walsh (1968), The relation of exports and economic growth: A note. *Kyklos*, Volume 21(3), pp. 541-545. http://dx.doi.org/10.1111/j.1467-6435.1968.tb00131.x

Thangavelu, S. M. and G. Rajaguru (2004), Is there an export or import-led productivity growth in rapidly developing Asian countries? A multivariate VAR analysis. *Applied Economics*, Volume 36(10), pp. 1083-1093. http://dx.doi.org/10.1080/0003684042000246795