The Nexus of Trade and Economic Growth in South Korea: An Empirical Analysis

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Abstract

This study examines the nexus between trade and economic growth in South Korea where trade has been an important sector of the country's economy. The causal relationships between trade and economic growth were examined by employing Cobb-Douglas production function under the Vector Error Correction (VEC) model and Granger causality test. Accordingly, this study indicates that uni-directional long-run causality exists between exports and economic growth in Korea while it is bi-directional for imports. Moreover, this study has found uni-directional short-run causality running from exports and imports to economic growth; validating both Export Led Growth (ELG) and Import Led Growth (ILG) hypotheses in Korea. Overall, the implications from this study are that both exports and imports could play a salient role in stimulating economic growth; and that a singular trade policy that accentuates export promotion might experience difficulty in sustaining economic growth.

Key word: Trade and economic growth, Export-led growth, Import-led growth, Vector Error Correction model.

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I. Introduction

A broad consensus prevails among economists that greater openness to international trade has been the basis for sustained and rapid economic growth. This common consent is in line with the assumptions that enhanced trade raises output, creates employment, produces technological innovations, increases economies of scale, and extends markets from autarky (Anderson and Babulla 2008; Dollar and Kraay 2003; Bhagwati and Srinivasan 2002). Provided that trade plays a vital role in economic growth, there are two mechanisms through which trade openness can do so especially in developing countries. First is through static gains from trade that comprises economic stability a country achieve from integration to the rest of the world, and through adoption of trade policies contiguous to market principles. Second and equally important is the dynamic gains from international trade where increased growth ultimately leads to poverty reduction (Bhagwati and Srinivasan 2002).

A Country's involvement in international trade as a decisive factor for sustaining economic growth is under heated debate (see Rodríguez 2007; Wacziarg and Welch 2003; Warner 2003; Dollar and Kraay 2002; and Frankel and Romer 1999), and has been a persistent source of controversy among scholars. For instance, Greenwald and Stiglitz (2000) examined the impacts of freer trade in increasing economic growth and showed that restrictive trade regimes will "enhance rather than impair" economic growth. Similarly, Yanikkaya (2003) argued that countries that impose barriers on trade could grow faster than countries that allow freer trade. However, these points of view are in complete opposition to that of Bhagwati and Srinivasan (2002), who argue that trade openness enhances economic growth and plays a significant role in poverty reduction.

Furthermore, the rapid economic growth recorded in East-Asian countries compared to the gradual growth in Latin American and Sub-Saharan African (SSA) countries have inspired economists to examine the role that international trade plays in promoting economic growth. Accordingly, cross-country assessment on the role of trade in explaining economic growth has revealed divergent results, which complicates the nexus of trade and growth (Yanikkaya 2003; Rodriguez and Rodrik 2001). The larger strand of literature covered the causal relationship and correlation between different measures of trade openness (sum of exports and imports ratio to GDP, average tariff rate, & geographic location) and economic growth. For example, Dollar and Kraay (2003) indicate that increased trade openness ratio is directly concomitant to greater economic growth, suggesting countries that are open to international trade, what they referred as "globalizers," grow faster than closed economies. In addition, Dollar and Kraay (2003) conclude that a long-run relationship exists between rapid economic growth followed by improvement in institutional quality. Similar evidences also show that there are possibilities for an economy to expand ensuing country's greater openness to international trade (Bruckner and Lederman 2012; Berg and Krueger 2003; Warner 2003; Frankel and Romer 1999).

Thus, the aim of this paper is to examine the relationship between exports, imports, and economic growth in Korea, a country that recorded a "miracle economy" according to World Bank (1993), to find whether trade played a role in the rapid economic growth achieved. As a result, uni-directional long-run causal relationship, as shown by significance of the Error Correction (EC) term, exists between exports and economic growth while it is bi-directional causality for imports in Korea. In addition, Granger causality test based on VEC model indicates that there is evidence in support of uni-directional short-term causality running from exports and imports towards economic growth, which reveals ELG and ILG hypothesis in Korea. Notably, the absence long-run causality running from enhanced economic growth to increased exports in Korea might be attributable to the fact that increased outputs were absorbed domestically and diverted away from exports.

II. Literature Review

International trade theories advocate that trade plays an important role in improving economic growth, an "engine" of growth, and welfare gains. To this end, trade can have a significant and positive role in boosting a country's economy, and the choice is not between an open economy and autarky. Nevertheless, disagreement appears from existing trade regimes with varying degrees of liberalization that countries adopt (Stiglitz and Andrew 2005). Therefore, there is no simple and straight forward relationship between trade openness and economic growth. Remarkably, divergent results were found from cross-country studies on the nexus of trade and economic growth which indicate the complexity of the relationship (Yanikkaya 2003). This complexity on the nexus of trade and growth thus demands designing country specific optimum policy that assures positive and significant gains from involvement in international trade.

There are two main hypotheses regarding the relationship between trade and economic growth: the Export Led Growth (ELG) and Import Led Growth (ILG) hypothesis. Primarily, the ELG hypothesis postulates the attainment of rapid economic growth through adoption of outward oriented trade policies. The ELG hypothesis labels exports as an "engine of growth," which works as a technology that lubricates the gears of the growth engine. According to Ricardian trade theory, export promotion strategy allow countries to involve in production of goods that they can produce competitively, and trade for goods that others relatively produce with lower cost (Golub and Chang 2000). Consequently, consumers will get products at a competitive price and markets are extended from autarky. However, adoption of export oriented economic development is a means, not an end per se, for achieving sustained and rapid economic growth.

On the other hand, the ILG hypothesis accentuates the role that imports play in increasing economic growth; particularly, in channelling technology and innovations, supplying capital and intermediate goods, and improving competition to enhance efficient resource allocation. Proponents of free trade policy have argued that protection of imports to enhance domestic production results in distortion of resource allocation and production inefficiency. For instance, there has been an opinion that imports of intermediate and capital goods, technological innovations, and productivity raising inputs play a significant role in boosting domestic economy (Thangavelu and Rajaguru 2004).

However, Greenwald and Stiglitz (2000) stated that imports ban or protective policies with high levels of tariffs will primarily result in allocation inefficiency and welfare loss. According to these authors, however, the distortions are only a short-term phenomenon; therefore, allocation efficiency and welfare gain will be ultimately attained in the long-run. As a result, the evidences so far show mixed conclusion regarding the impacts of imports in either enhancing or impairing domestic economy. Consequently it is misleading to conclude that the implications will work under all circumstances, and there might be cases under which the stated scenarios either exist or fail. To this end, it is necessary to consider all the costs and benefits associated with imports under respective conditions, and technology embodied imports should be allowed to increase the benefits from trade.

Static and Dynamic Gains from Trade

The gains from countries participation in international trade can be classified in two major categories: static gains and dynamic gains. The static gains from international trade are related to the benefits that a country get immediately after opening their market to international trade. Moreover, static gains from international trade are consistent to the comparative advantage and the Heckscher-Ohlin theorem (Anderson and Babula 2008; Cruz 2008). Accordingly, when countries liberalize their trade regime, productivity and consumption increases than it was under autarky. Subsequently, trade liberalization will lead countries to use their resources that they have in abundance according to their comparative advantage (Bhagwati and Srinivasan 2002). However, static gain is a one-time attainment that countries enjoy immediate to trade liberalization; and there is no guarantee whether these gains will continue during the post-trade liberalization period (Lawrence and Weinstein 1999). Similarly, the static gains from opening domestic market to international trade emanate from the possible improvements in competition and profitability of domestic firms (Lawrence and Weinstein 1999). Thus, there are possibilities for a country to benefit from international trade after liberalizing trade through the stiff competition that domestic firms might face from foreign firms.

On the other hand, the dynamic gains from international trade are long-run in their nature that a country enjoys through time from increased openness. The benefits could be either positive and/or negative, and there is an ambiguous distinction between the two in trade theory (Lawrence and Weinstein 1999). Bhagwati and Srinivasan (2002) have also stated that the effects of trade to enhance economic growth can also lead to poverty reduction and confirms the "Bhagwati hypothesis," of the early 1960s which asserts economic growth as a principal driver of poverty reduction. The "Bhagwati hypothesis" in relation to dynamic gains from trade states that enhanced trade not only leads to increased income but also towards the ultimate goal of economic growth—that is an equitable distribution of the economic gains. In addition, Anderson and Babula (2008) have indicated that it is of little doubt that trade increases national income; however, this might not necessarily be tracked by rapid economic growth as there might be a negative growth albeit an increase in aggregate income. Largely, countries involvement in international trade has both advantageous and deleterious effects since its affirmation as "an engine of growth." Thus, policy interventions that balance between the two sides, gains and losses, need to be emphasized to achieve rapid and sustained economic growth.

Export Promotion and Import Substitution Trade Policies

There have been different explanations specified regarding the distinctions between export promotion and import substitutions trade policies. Bhagwati (1988) has defined export promotion trade policy based on effective exchange rate regime that countries adopt. According to Bhagwati (1988), export promotion is defined as, "when the home market sales will give a producer as much as exporting will: the incentive structure then implies effective exchange rate of exports and imports are equalized." Here, the incentives that favor either exports or imports are removed as compared to the import substitution regime where incentives are provided to substitute imports, thus a bias-free incentive system exists. Moreover, there might also be circumstances under which the effective exchange rate for exports is greater than that of imports, which could be called the "ultra-export promotion" trade policy (Bhagwati 1988).

Similarly, Bhagwati (1988) explained the two concepts based on a country's prevailing effective exchange rate against exports and imports of goods and services. The effective exchange rate adopted here takes into account all incentives: subsidies, preferential loan, tax exemptions, discounted credit, and any form of support provided to exporting and importing firms. Accordingly, Bhagwati defined an import substitution trade policy as, "the adoption of an effective exchange rate for the country's exports which is less than that for imports." Hence, the exchange rate policy adopted discourages exports and imports, which means domestic consumption is favored to depend on domestically produced goods as imports are becoming expensive relative to the domestically produced goods. Stiglitz and Andrew (2005), on the other hand, have defined import substitution trade policy based on barriers (tariffs and quantitative restrictions) erected against imports of goods and services.

Countries have been adopting export promotion and import substitution trade policy in different time period. For instance, the adoption of import substitution trade policy with the assumption of infant industry protection has been widely advocated in the early 1950s while the emphasis shifted to export promotion trade policy recently (Rodriguez 2006). Stigliz and Andrew (2005) revealed that East Asian success has been emphasized to be based on export promotion trade policy albeit this argument is contentious among scholars. In the same token, import substitution trade policy had been also supposed to be one of the root causes for the economic failures of Latin American countries (Rodriguez 2006; Stiglitz and Andrew 2005). However, it should be clear that the trade liberalization adopted in East Asian countries is highly complex and coupled with government intervention. As a result, this might not give sufficient evidence to conclude export promotion trade policy alone as a game changer to achieve rapid economic development.

Empirical Studies

Previous empirical studies on the nexus of trade and economic growth shown a mixed result ranging from the argument that trade causes economic growth to absence of any causal relationship between the two factors or trade hurts an economy. The majority of variations in the result mainly arise from methods of analysis adopted, types of indicator variables employed, and designated regions of analysis. To illustrate, Zang and Baimbridge (2012) analyzed the relationship between exports, imports, and economic growth in Japan and South Korea, and confirmed the ELG hypothesis in Japan while economic growth negatively affected exports in Korea. Similarly, studies in Central and Eastern Europe and Asia have revealed the existence of ELG hypothesis (Awokuse 2007; Mamun and Nath 2005; Shirazi and Manap 2004; Jin 2002; Zestos and Tao 2002). However, there has not been complete agreement among scholars; for example, a study in three South American countries (Argentina, Peru and Columbia) found insignificant support to the ELG hypothesis (Awokuse 2008). Other studies have also reported the absence of any causal relationship between exports and economic growth (Gómez, Álvarez-Ude, and Gálvez 2011; Sharma and Panagiotidis 2005; and Tang 2006).

There are also attempts rendered to examine the relationship between imports and economic growth that have confirmed the ILG hypothesis (Gómez, Álvarez-Ude, and Gálvez 2011; Kim, Lim, and Park 2009; Awokuse 2008; Sharma and Panagiotidis 2005; Thangavelu and Rajaguru 2004; and Jin 2002). Particularly important, however, was the consistency of the results with regard to ILG hypothesis. This broad consensus, therefore, reveal the essential role that imports play in achieving rapid economic growth.

Studies on the nexus of trade and economic growth that considered Korea either as a specific or in a cross-country analysis revealed mixed and even more contradicting results. As an illustration, Zang and Baimbridge (2012) found a negative effect of economic growth on exports; Awokuse (2005) concludes a bi-directional causality between these variables; while Konya (2006) reports no causality between exports and economic growth in Korea. Such variations might arise from analytical methods employed and time span considered in the analysis of the trade growth nexus. In addition, Thangavelu and Rajaguru (2004) used VAR and VEC models and concluded that in an open economy imports play more significant roles than exports, especially in East Asian countries albeit Korea was not part of the analysis. Research by Jin (2002) in Korea based on provincial data points out the validity of an export led growth in all selected four provinces (Seoul, Kyunggee, Kyungnam, and Pusan) using the VAR model.

Moreover, Kim, Lim, and Park (2009) analyzed the relationships between exports, imports, factor productivity, and economic growth in Korea. The authors argued that import Granger cause total factor productivity while exports failed to evidence causality between the two variables. In addition, Kim, Lim, and Park (2009) concluded that import growth has a significant and positive effect on economic expansion, but the opposite holds true for exports. Overall, there is no as such simple and straight forward relationship between trade and economic growth; notwithstanding the evidences that confirm a well-defined causality between the two variables.

III. Analytical Framework

Data

The data set for this study includes real GDP (RGDP), labor force (Labor), real gross capital formation (RGCF), real exports (REXP), and real imports (RIMP). Annual data were collected from International Monetary Fund and the World Bank.

Methodology

Econometric model for analyzing the aggregate growth has been built based on Cobb-Douglas production function. This growth model includes the key determinant variables of economic growth, and below is representation of the standard Cobb-Douglas production function.

$Y_{it} = A_{it}L_{it}^{\alpha}K_{it}^{\beta}$ .... (1)

where, Y_{it} is the aggregate output of country i at time t, A represent total factor productivity (technology), L is human capital (labor), K is the physical capital stock, and α and β stand for output elasticity's of labor and capital, respectively.

To computational simplicity of the relationship between the variables, the standard Cobb-Douglas production function can be transformed into natural logarithm terms. Hence, econometric models analogous to the equation (1) above were, therefore, adopted to analyze the nexus of trade and economic growth. Accordingly, country specific model has been developed in order to account for differences in economic, social, and political characteristics among the selected countries. However, before building models that capture the relationship between the variables, there should be plausible economic theory in support of the relationship that exists among the variables included in the model (Lutkepohl and Kratzig 2005). Accordingly, the augmented Cobb-Douglas production function shown below has beenadopted in this study to capture the determinants of aggregate output which has also been widelyused in most of previous studies (see Awokuse 2008, 2007; Yanikkaya 2003; Onafora and Owoye 1998).

$RGDP = f[(LAB, GCF); REXP, RIMP]$ .... (2)

where, RGDP represent real GDP as a proxy for economic growth, and LAB, GCF, REXP, and RIMP represent population between 15 to 64 age ranges as a proxy of labor, gross capital formation as a proxy of capital, real exports and real imports as a proxy of technological innovation, respectively in the augmented Cobb-Douglas production function.

Unit Root Test

The primary precaution before embarking for any econometric analysis that utilize time series data is to check for data stationarity. A time series data is said to be stationary if the distribution of stationary process remains unchanged in different samples of same data with respect to time (Maddala and Kim 1998). Moreover, the central reason for this precaution is to circumvent spurious regression results common in time series data analysis. Spurious or non-sense regression results occur when one finds apparently significant results from unrelated data set. Thus, the Augmented Dickey-Fuller (ADF) test was applied to check for non-stationarity of the time series data used in this study. Subsequent to ADF test either differencing or logarithmic transformation will be done to ensure stationarity of the time series data (Hill, Griffiths, and Lim 2012; Maddala and Kim 1998). Stationarity test of time series data usually prelude co-integration test (Lutkepohl and Kratzig 2005).

Johansen Co-integration Test

Co-integration test determine the validity of long-run relationships between variables, given that all variables are non-stationary at level. If there is co-integration, it means that even if the variables are non-stationary[2] at level, there is a long run relationship between them (Johansen 1988). Moreover, for determining the number of co-integrated vectors Johansen (1988) suggests two tests: Trace test and Maximum Eigen Value test. The trace test examines the hypothesis that there are at most r co-integrating vectors while the Maximum Eigen Value tests the hypothesis that there are r+1 co-integrating vectors (Maddala and Kim 1998). In choosing the test that predicts the number of co-integrating vectors, Johansen and Juselius (1990) suggest that the Maximum Eigen value test is efficient, indeed.

The purpose of identifying the co-integrating vectors is therefore to reveal the existence of long-run relationship among the variables included in the model. In addition, the existence of co-integrated relationship between the variables guides to select between Vector Autoregressive (VAR) and Vector Error Correction (VEC) models for efficient estimation and forecasting (Hill, Griffiths, and Lim 2012; Maddala and Kim 1998; Johansen and Juselius 1990). In this study, Johansen co-integration test will be employed to examine whether the variables are co-integrated, hence identify the rank of the co-integrating vector.

[2]According to Engle and Granger (1987) the components of the vector X_t are said to be co-integrated of order d, b, denoted X_t - CI(d, b) if: (i) all components of X_t are I(d), and (ii) there exists a vector α ($\neq 0$) so that $Z_t = \alpha' X_t$-I(d -b), b>0. The vector α is called the co-integrating vector.

Vector Autoregressive (VAR) Model

The VAR model has been one of the widely utilized analytical tools in econometrics after its first time use by Sims in 1980. The VAR model is estimated by regressing dependent variables against its own lagged values and lagged values of other independent variable included in an economic model. Consequently, the detection for existence of co-integrating vector(s) guide the type of VAR model to be employed, unrestricted VAR or restricted VAR (VEC model) . For instance, if endogenous variables are integrated of order one or *I(1)* and not co-integrated, the unrestricted VAR model will be suitable to adopt using first-order difference of the variables as shown in equation 3 below (Hill, Griffiths, and Lim 2012). As a result, the conventional asymptotic theory is valid for hypothesis testing of the VAR model (Toda and Yamamoto 1995). Nevertheless, there has also been limitation on the validity of VAR estimates as the explanatory variables included in the model suffer from multicollinearity problem. Thus, alternative restricted version of VAR model, the Vector Error Correction (VEC) model, has been suggested for optimal estimation and forecasting (Maddala and Kim 1998).

$$Y_t = \alpha_i + \sum_{i=1}^{p} \beta_i Y_{t-i} + \varepsilon_i \qquad (3)$$

where $Y_t = (GDP, LAB, GCF,\ REXP, RIMP)$ which is a 5×1 vector non-stationary variables, α_i is 5×1 vector of constants, p is the number of lags, β_i is a 5×5 matrix of parameters to be estimated, and ε_i is a 5×1 vector of error terms, and i is the number of co-integrated equations included in the VEC model.

Similarly, if the endogenous variables in equation (3) are co-integrated for instance *CI(1,1)*, i.e. co-integrated of order one-one, the VEC model will be an efficient estimation technique (Toda and Yamamoto 1995; Maddala and Kim 1998; Lutkepohl and Kratzig 2005). The VEC model is a modified VAR model which restricts the long run behaviour of endogenous variables to converge to their co-integrating relationship while adjusting for short-run dynamics. Hence, if $\mathrm{Y_t}$ is co-integrated, equation (3) can be generated by a VEC model that considers variables in the regression as potentially endogenous variables, and relate each variable to its own and other variables lagged value. The VEC model with co-integrating rank (r) is shown as follows; and hasalso been employed by Zang and Baimbridge (2012), Kogna (2006), Awokuse (2008,2007), Thangavelu and Rajaguru (2004); Onafowora and Owoye (1998).

$$\Delta Y_t = \alpha_i + \mu\beta Y_{t-1} + \sum_{i=1}^{p-1} \prod_i \Delta Y_{t-i} + \varepsilon_t \quad \text{......} (4)$$

where the error correction coefficient μ and the co-integrating vector $\boldsymbol{\beta}$ are $(p \times r)$ matrices, and α_i is a vector of constants.

The coefficients of variables in equation (4) represent a VEC model to be estimated in this study and constitute two main parts which are particularly noteworthy. The first part ($\mu\beta Y_{t-1}$) is the Error Correction term (EC_{t-1}) which represent the long-run causal relationship between co-integrated variables of the estimated model (Lutkepohl and Kratzig 2005, Maddala and Kim 1998). Hence, the long-run causality is determined by the error correction term. If the coefficient (EC_{t-1}) is significant, then it means that there is a long run causal relationship between the estimated variables. According to Johansen and Jesulius (1990), the error correction term can be interpreted as the speed of adjustment of the deviation of the dependent variables from their long-run values. However, in multivariate causality test it is difficult to interpret the error correction coefficients as there are more than two variables to which the causality can be attributed.

The second part of equation 4 constitutes the coefficients of the lagged explanatory variables ($\sum_{i=1}^{p-1} \prod_i \Delta Y_{t-i}$), represent the short-run causal relationship among endogenous variables included in the model. Short-run causality can also be determined by joint significance of the coefficients of the lagged explanatory variables. In order to determine the short-run causal relationship among the endogenous variables it is evident to estimate Granger causality or block exogeneity Wald test based on the estimated VEC model (Toda and Yamamoto 1995). In multivariate model, Granger causality test determines the short-run causality between variables. For instance, if X_t and Y_t are two time series variable, if the past and present values X_t can help to predict the future values of Y_t, say Y_{t+1}, then we can say X_t Granger cause Y_t ($X_t \xrightarrow{Gr} Y_t$), and vice versa (Maddala and Kim 1998).

Moreover, the Generalized Impulse Response (GIR) function could also help to capture the dynamic effect of one-time shock to one of the innovations transmitted to the endogenous variables estimated in VEC model. The GIR function analysis is a conceptual experiment in which the current and future response of the variables can be interpreted as a response to impulses hitting a system (Luktepohl and Kratzig 2005). The long-run dynamic relationship or correlation among the endogenous variables can be forecasted (response) based on conceptually built positive macroeconomic shock (impulse) towards the dependent variables based on VEC model under the setting of GIR functions (Awokuse 2008; Sharma and Panagiotidis 2005).

Thus, by adopting previously estimated Vector Error Correction model the GIRF could be generated. Through GIRF, a shock to the i^{th} variable not only directly affects the i^{th} variable, but it is also transmitted to all the other endogenous variables $(\sum_{i=1}^{p-1}\prod_{i}\Delta Y_{t-i})$ through the dynamic (lag) structure of the VAR model (Awokuse 2008; Sharma and Panagiotidis 2005). Moreover, a GIRF traces the effect of a one-time shock to one of the innovations on current and future values of the endogenous variables based on experimentally generated macroeconomic shocks. Accordingly, if the innovations $\varepsilon_t$are contemporaneously uncorrelated, the interpretation of the impulse response is straightforward that currently generated macroeconomic shocks, impulse of one Standard Deviation (SD), will generate the forecast of current and future values of the endogenous variables, response (Luktepohl and Kratzig 2005; Sharma and Panagiotidis 2005).

The other important consideration in estimating VEC model is selection of the optimum lag length. To determine the lag order of VEC model, sequential testing that starts with the highest lag length and selecting the optimal based on certain criteria might be adopted (Lutkepohl and Kratzig 2005). Accordingly, optimal lag order that minimize Akaike Information Criterion (AIC) and Schwarz Bayesian Criteria (SBC) were adopted in this study to avoid the possibility of autocorrelation problem of the estimated model. Toda and Yamamoto (1995) have suggested that estimation of VAR model at levels; even if the variables are non-stationary, will be valid to suggest the optimum lag length. Thus, VAR model has been estimated at levels for each selected countries to determine the optimum lag length that will be used in the Johansen co-integration test and VEC model estimated in this study. However, it should be noted that the number of observation in this study is relatively smaller, which is also annual data, to fix the maximum lag-length freely. As a result, for this study optimum lag length that ranges from two to six were chosen for each country based on AIC and SBC estimated from VAR at levels; unless and otherwise the number of coefficients to be estimated becomes greater than the number of observations.

IV. Empirical analysis

Unit Root Test

Data stationarity were checked before embarking on further analysis of the time series data which also helps to circumvent spurious regression results. Accordingly, ADF unit root test was carried out for each variable on which time series data is obtained. As can be seen from Table 1 below, all variables were found to be non-stationary at levels. Subsequently, testing for unit root on differenced data, there is evidence that all the variables are stationary at first difference at conventional level of significance. Moreover, the stationarity of time series data at first difference indicatives that the data exhibits *I(1)*, integrated of order one. Thus, all data on macroeconomic variables included in the Cobb-Douglas production function could be used as it follows to be stationary at first difference at conventional level of significance[3].

Table 1 Augmented Dickey Fuller Test for Unit Root

Variables	*Levels*		*First difference*	
	Test statistic	ρ-value	Test statistic	ρ-value
$LnGDP$	-2.883	0.177	-6.177	0.000
$LnLAB$	-2.357	0.397	-4.083	0.012
$LnGCF$	-3.209	0.100	-6.134	0.000
$LnEXP$	-2.401	0.602	-5.377	0.000
$LnIMP$	-3.054	0.129	-6.431	0.000

Note: critical values are -3.96(1%), 3.41 (5%), and -3.13 (10%) with constant and trend, R. Davidson and J. G. MacKinnon (1993) as cited in Hill, Griffiths, and Lim (2012).
Source: Author's computation, based on data collected from WB (2012), IMF (2009, 2012).

Johansen Co-integration Test

Johansen co-integration test based on Trace and Maximum Eigen statistic will be used to infer whether there exists long-run relationship among the endogenous variables. The existence of co-integrated vectors also helps to determine the type of VAR model to be used, either restricted or unrestricted VAR (i.e. VEC model). Co-integration is usually tested prior to estimation of VAR model. Table 2 shows Johansen co-integration test for the output growth model based on data

[3] Conventional level of statistical significance denotes a cut-off point of accepting 1%, 5%, and 10% error in hypothesis testing.

from Korea. Accordingly, both the Trace and Maximum-Eigen value test confirms the rejection of the null hypothesis of “no co-integrated vectors” at 5% level of significance; thus existence of long run relationship among the variables. Furthermore, both Trace and Maximum-Eigen value test showed the existence of one co-integrating equation which will be includedin the VEC model estimation.

Table 2. Johansen Co-integration Test

Co-integrating rank (r)	*Trace test*			
	Eigen value	Trace Statistic	Critical Value**	Prob.
$\mathrm{r} = 0$*	0.539	72.557	69.819	0.030
$\mathrm{r} \leq 1$	0.288	35.351	47.856	0.430
$r \leq 2$	0.234	19.043	29.797	0.490
$r \leq 3$	0.115	6.217	15.495	0.670
$r \leq 4$	0.007	0.343	3.841	0.558
Co-integrating rank (r)	*Maximum Eigen (λ-max) Value test*			
	Eigen value	*λ-max* Statistic	Critical Value**	Prob.
$\mathrm{r} = 0$*	0.539	37.206	33.877	0.019
$\mathrm{r} \leq 1$	0.288	16.307	27.584	0.640
$\mathrm{r} \leq 2$	0.234	12.827	21.132	0.468
$\mathrm{r} \leq 3$	0.115	5.874	14.265	0.630
$\mathrm{r} \leq 4$	0.007	0.343	3.841	0.558

Note: Trace and Maximum Eigen test indicates one co-integrating equation. *, ** denotes rejection of the null-hypothesis and critical values at 5% level of significance, respectively.
Source: Author’s computation, based on data collected from WB (2012), IMF (2009, 2012).

Vector Error Correction (VEC) Model Estimates

A VEC model for co-integrated variables was estimated based on annual data for Korea to examine short-run and long-run causal relationship between co-integrating variables. The long-run relationship is shown by the significance of the Error Correction (EC) term, and the short-run causal relationship is shown by the sum of the lagged coefficients independent variables at conventional level of significance.

As can be seen from table 3 below, the long-run relationship, as verified by the significance of the EC term, implies existence of uni-directional causality between exports and economic growth, running from exports to economic growth, while it is bi-directional for imports. In addition, there has been uni-directional short-run causal relationship between exports, imports, and economic growth in Korea. The direction of causality runs from exports and imports to economic growth both in long-run and short-run which signals the validity of ELG and ILG hypothesis in Korea. Remarkably, the absence of long-run causality from

GDP to exports, however, has an important implication that increased economic growth had not been tracked by enhanced export growth in Korea.

Table 3. Estimates of Vector Error Correction Model, Korea

Explanatory Variables	Dependent variables				
	$\Delta LnGDP$	$\Delta LnLAB$	$\Delta LnGCF$	$\Delta LnEXP$	$\Delta LnIMP$
EC_{t-1}	-0.427***	-0.152	-0.376***	-0.134	-0.439***
	(24.339)	(0.814)	(9.273)	(1.935)	(14.756)
$\sum \Delta LnGDP$	-0.339	-0.684	-0.367	-0.326	-0.556
	(0.628)	(1.571)	(0.299)	(0.349)	(0.758)
$\sum \Delta LnLAB$	0.316*	0.204	0.353	0.332**	0.480**
	(2.780)	(0.845)	(1.622)	(3.633)	(4.486)
$\sum \Delta LnGCF$	0.692**	0.673	1.043**	0.374	0.892**
	(3.423)	(0.878)	(4.864)	(1.228)	(4.319)
$\sum \Delta LnEXP$	0.999***	1.231	1.586***	0.628**	1.326***
	(7.203)	(2.930)*	(8.686)	(4.358)	(7.556)
$\sum \Delta LnIMP$	-1.164***	-1.052	-1.967***	-0.760***	-1.478***
	(8.942)	(2.277)	(10.460)	(5.611)	(7.806)
Statistics:					
R^2	0.568	0.222	0.561	0.446	0.576
S.D.	0.139	0.201	0.196	0.136	0.185
σ	0.105	0.204	0.149	0.116	0.138
D.W.	1.991	1.961	1.790	1.766	1.821

Note: values in the table are summed regression coefficients and F-statistic in parenthesis. R^2 is the coefficient of determination, S.D. is the stand. error of the dependent variable, σ is stand. error of regression, D.W. is the Durbin Watson statistic. *, **, *** shows significance at 10%, 5%, and 1% level.
Source: Author's computation, based on data collected from WB (2012), IMF (2009, 2012).

Granger Causality Test Based on VEC Model

The Granger causality test elucidates the evidence whether there is short-run causal relationship between exports and imports, and economic growth. Table 4 below reports, the results of Granger causality test between the endogenous variables included in the estimated VEC model. As a result, both exports and imports Granger cause economic growth uni-directionally in the short-run according to Granger causality test based on VEC model in Korea. The uni-directional causality that runs from exports to GDP, thus absence of reverse causality, might be attributable to the fact that exportable items were diverted towards domestic market away from exports in Korea. Moreover, the results imply that singular trade policy that only focuses on exports might not be effective to enhance economic growth. Interestingly, the absence of causality that runs from economic growth to exports in Korea could be attributable to the fact that some of the baskets of tradable goods were diverted towards domestic market and away from exports in Korea. Perhaps, it also signals the importance of production for domestic consumption and partial absorption of exportable baskets towards domestic market. This assertion could be conceivable because of the fact that economic growth which is ultimately followed by expansion of the industrial sector, but not necessarily, might be expected to lead towards improved performance of the export sector. However, this causality from economic growth to exports had not been shown in this study conforming to "vent-for-surplus" theory[4]; and signifies an important policy implication that as an economy booms domestic markets play a vital role in sustaining growth.

Table 4 Granger Causality Test Based on VEC Model

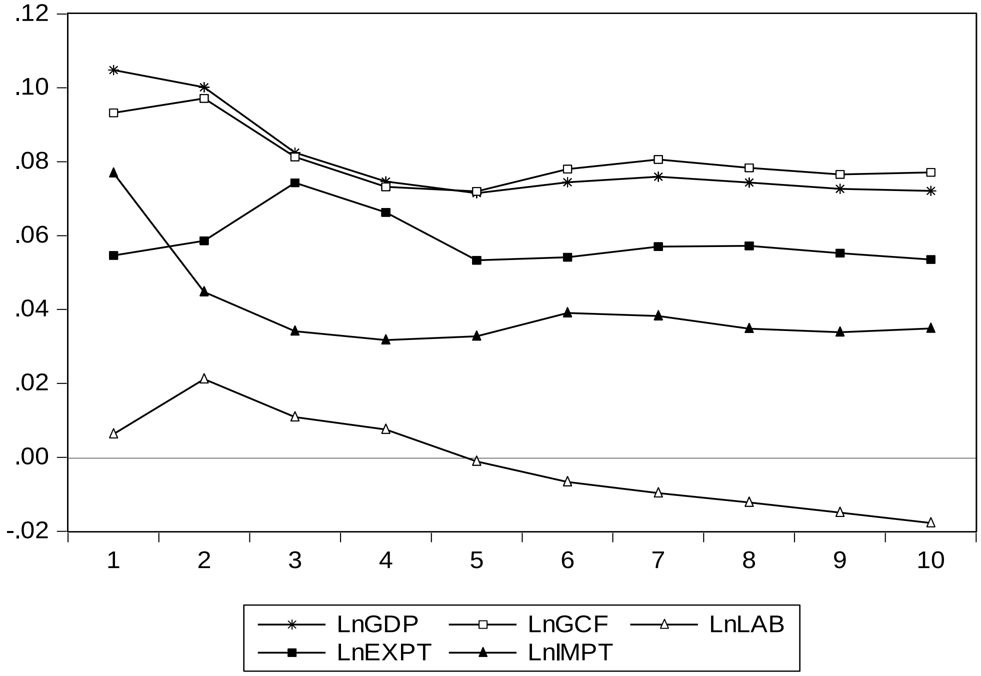
	Dependent Variable				
	$\Delta LnGDP$	$\Delta LnLAB$	$\Delta LnGCF$	$\Delta LnEXP$	$\Delta LnIMP$
$\Delta LnGDP$	—	3.144 (0.208)	0.598 (0.741)	0.699 (0.705)	1.516 (0.468)
$\Delta LnLAB$	5.560* (0.062)	—	3.244 (0.197)	7.265** (0.026)	8.972** (0.011)***
$\Delta LnGCF$	6.847** (0.033)	1.757 (0.415)	—	2.456 (0.295)	8.637** (0.011)
$\Delta LnEXP$	7.714*** (0.000)	5.859 (0.053)	17.372*** (0.000)	—	15.112 (0.000)
$\Delta LnIMP$	17.884*** (0.000)	4.555 (0.103)	20.919*** (0.000)	11.222*** (0.004)	—

Note: values in parenthesis are estimated P-values, all other values are asymptotic Granger causality χ^2 values. *, **, *** shows significance at 10%, 5%, and 1* level, respectively.
Source: Author's computation, based on data collected from WB (2012), IMF (2009, 2012).

In addition, Generalized Impulse Response (GIR) function has been run to examine the response of GDP to a shock of generalized one Standard Deviation (S.D.) innovations. Figure 1 below shows the response of GDP to a generalized one S.D. innovation introduced through the GIR function for a period of ten years. Consequently, there exists evidence that GDP growth responds positively and modestly to generalized one S.D. innovations from exports and imports which reinforces existence of the ELG and ILG hypothesis in Korea.

[4] As a consequence of the ensuing increase in aggregate demand, growth may create a situation whereby more of the nation's output is absorbed domestically leaving relatively less for exports (Dolado 1993).

Figure 1. Generalized Impulse Responses of GDP to One S.D. Shock, Korea



Source: Author's based on data collected from WB (2012), IMF (2009, 2012).

V. Conclusion

Based on significance and appropriate sign of the EC term, there exists a unidirectional causality running from exports to economic growth in Korea while the causality was found to be bi-directional for imports in Korea. There has been also an evidence for short-run uni-directional causality between exports, imports and economic growth in Korea as shown by Granger causality test. Thus, there is evidence in support of both the ELG and ILG hypothesis. The findings of this study, therefore, robustly show that not only exports but also imports appeared to play an economically meaningful role in promoting economic growth in Korea. This result could be attributable to the fact that Korea is one of resource scarce country; thus importation of raw materials is inevitable.

Moreover, the results imply that singular trade policy that only focuses on exports might not be effective to enhance economic growth. Interestingly, the absence of causality that runs from economic growth to exports in Korea might draw an important attention. This absence of causality could be attributable to the fact that some of the baskets of tradable goods were diverted towards domestic market and away from exports in Korea. Perhaps, it also signals the importance of production for domestic consumption and partial absorption of exportable baskets towards domestic market.

Particularly important was the consistency of the results with reference to ILG hypothesis as evidenced in the literature. Accordingly, imports are more growth defining compared to that of exports based on evidences from previous studies (see Gómez, Álvarez-Ude, and Gálvez 2011;Kim, Lim, and Park 2009; Awokuse 2008; Sharma and Panagiotidis 2005; Thangavelu and Rajaguru 2004; and Jin 2002).This study also revealed that imports play a salient role in sustaining economic growth in Korea. The evidence in favour of relative significance of imports in stimulating economic growth is based on the assumption that the larger proportions of imports contain capital and intermediate goods that will be utilized as inputs for further industrial production in the domestic market.

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