Trade Openness and Economic Growth: A Panel Causality Test

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Abstract

The relationship between openness and economic growth is a controversial topic in economics literature. This paper applies the most recently developed Granger non-causality test in heterogeneous panels to reinvestigate the causality relationship between trade openness and economic growth for the G7 countries between 1970 and 2011. The empirical results show there is a bidirectional causality relationship. Thus, as is advocated by the theories of endogenous growth, as openness increases, growth increases in the G7 countries and, subsequently, the increase in growth increases openness.

Keywords: openness, economic growth, panel causality test

1. Introduction

The relationship between trade openness and growth has been an issue queried in the literature for a long time. That is because while openness (usually represented by the ratio of imports, exports, or imports plus exports to the GDP) is believed to be the engine of growth in developing countries, it is acknowledged that openness is an important factor contributing to growth in developed countries (Dar and Amirkhalkhali, 2003:1761). Therefore, the direction of causality between trade openness and economic growth is important in order to establish whether countries' growth rates are internal or external (Akilou, 2013:151).

The causality occurring from trade openness to economic growth means that the growth and industrialization observed in countries have been realized in the form of external learning, together with an increase in trade. Thus, the export-led growth hypothesis in the neoclassical approach is advocated to be valid. This result shall be achieved by an increase in productivity through the exports increasing the economies of scale as the openness, which shows the trade dependence of countries, also increases. In addition, new investments are made and, consequently, an increase occurs in employment and real wages. In that case, it will be possible to anticipate that the countries that determine growth rates are realized externally will increase their openness further by reducing the barriers to exports and imports (Krueger, 1985; Akilou, 2013:151).

It is also possible that the causality is from the economic growth to the openness. That is because high productivity reduces the unit costs that, in turn, increase exports. Moreover, if domestic production increases beyond the domestic demand, then it will be anticipated that the producers will seek to sell their goods in international markets (Liu et al., 1997:1680). The causality from economic growth to trade openness means that the growth observed in the country is realized internally. An internal economic growth rate is explained by investments in physical and human capital as well as research and development (R&D) efforts (Akilou, 2013:151). The countries that achieve growth internally are required to use their scarce resources to increase their investments (Akilou, 2013:151).

If these two conditions are taken into account, a bidirectional (feedback) causality relationship exists between exports and economic growth (Liu et al, 1997:1680). Harrison (1996) advocated for the bidirectional relationship with the idea that as openness increases, growth increases; however, rapid growth further fuels openness-oriented policies. In the following chapters of this study, initially the relationship between openness and economic growth is described. Then the literature review is presented. Following the introduction of the methodology the results are explained and the conclusions are presented.

2. Openness and Economic Growth

Today, openness is largely believed to have a positive influence on growth. This is because, as the countries that have adopted a protectionist administration abandon this approach, the competition they face in the course of opening together with specialization and trade volume is believed to speed growth (Akilou, 2013:151). These ideas have gained wide acceptance upon the failure of inward-looking import substitution policies since the 1980s. However, Rodrik (1999:25) stated that, while import-substitution policies were advocated to be very useful in the previous era, the benefits of openness to growth today are exaggerated (Yanıkkaya, 2003:57).

The relationship between trade openness and economic growth is also mentioned in the traditional models of international trade. Adam Smith and Ricardo advocate that openness would provide specialization and optimal distribution of resources. In the Smith and Ricardian models, with openness, countries specialize in production of goods for which they have comparative labor-productivity advantage, and they export such goods. In addition, the sectors that cannot compete with foreign countries will use factors of production in other sectors and, thus, realize a more optimal allocation of resources. According to the Heckscher-Ohlin model, a country exports the goods that use its abundant factors more intensively. Therefore, as the degree of openness increases, it will be observed that the resources in an economy shift to the sectors that draw upon the abundant factor. Hence, an increase in production will be observed (Lopez, 2005:625). According to the theoretical literature, the rate of growth is likely to affect the openness. The Rybczynski theorem suggests that an external increase in capital will increase capital-intensive goods and reduce labor-intensive goods. If a country is abundantly endowed with labor, an increase in capital stock will decrease trade, whereas trade will increase in a country with plenty of capital (Akilou, 2013:151–52).

On the other hand, in growth models, the effect of trade liberalization on economic growth is interpreted in various ways. For example, according to neoclassical growth models such as the Solow model (Solow, 1956), the optimal-saving model, or the Ramsey growth model, technological progress and the steady-state rate of growth of output are completely exogenous. Moreover, the steady-state rate of growth of output is equal to the rate of growth of the input that grows exogenously. More precisely, for example, according to the neoclassical growth models pioneered by Solow, the impact of openness on economic growth is temporary. This is true because the economy converges to its free-trade steady-state, the growth rate of output also converges to its autarky steady-state value (Lopez, 2005:625). In short, in neoclassical growth models, since the technology is considered exogenous, the country's trade policy does not have an effect on technology.

Theories of endogenous growth pioneered by Romer (1986, 1990) allowed the relationship between trade openness and growth because, in endogenous growth models, technology is considered internally and such models highlight learning by doing. Thus, together with openness, developing countries increase productivity and efficiency by using new technologies and achieving a rise in production (Jin, 2000). In short, according to the theories of endogenous growth, as emphasized by Grossman and Helpman (1992) and Harrison (1996:419), as the trade openness of a country increases, the technology also will be positively affected. That is because the amount of imported goods and services will increase with openness. These goods and services contain advanced technologies from other countries. Therefore, domestic firms are ensured to specialize in research-intensive production. Thus, an increasing degree of openness advances national technology, improves efficiency and, hence, increases production. In short, countries open to foreign markets will grow faster than countries closed to foreign markets and that apply protectionist policies. Rivera-Batiz and Romer (1991) emphasized that trade openness may lead to an increase in growth through increasing the country's information stock. However, international integration will lead to the scale effect due to the fact that major countries increase the world's research activities. Thus, if the international externalities of knowledge are perfect, then especially developing countries will be able to contribute to growth by transferring knowledge from developed countries.

If international externalities of knowledge are imperfect, then the growth of rich countries will increase further through trade openness. However, if international externalities of knowledge are imperfect, then the growth in poor countries will decrease with the increase in trade openness. In short, open countries are more successful at catching up with the most advanced technologies in the world (Grossman and Helpman, 1991). Indicating that the growth will increase with openness, Chang, Kaltani, and Loayza (2009) summarized the issue as follows: openness (a) ensures efficient distribution of resources owing to the comparative advantages; (b) allows dissemination of information and technology; and (c) increases competition in national and international markets.

On the other hand, it is also indicated that the effect of openness on growth is not unambiguous. For example, Levine and Renelt (1992) asserted that trade openness would encourage foreign direct investments due to the reduction of tariffs; hence, it would only have a positive effect on growth in the long run. Moreover, it is also possible for national enterprises that cannot withstand increasing foreign competition to shut down business. Thus, the effect of openness on growth will depend on which of these effects is greater. Batra and Slottje (1993) suggested that the removal of trade barriers would lead to a decrease in national production due to a reduction in the relative price of domestic manufactured goods. That is because the reduction in the national relative prices will make the imports more attractive (Jin, 2000:7).

Grossman and Helpman (1991, 1995) indicated that trade openness would affect growth positively provided that the decrease in tariffs increased the resources allocated to R&D. If the reduction in tariffs reduces the resources allocated to R&D, then a decrease in growth will be observed. In this regard, Dowrick and Golley (2004) determined that the less-developed countries that were growing rapidly caught up with the developed countries in the 1960s and 1970s. However, after the 1980s, foreign trade affected developed countries much more positively but had a limited effect on the less-developed countries. Rodrik and Rodríguez (2001) are among those who advocate that the impact of openness on growth is uncertain. Lopez (2005), on the other hand, addressed the relationship between openness and economic growth in a micro-framework. In this context, the researcher pointed out that exporting firms were more efficient than non-exporting firms. Thus, exporting firms increase growth more than the others. Many studies conducted in the 1990s, such as that of Bernard and Wagner (1997), also concluded that exporting firms were more productive than firms that focused on the domestic market.

3. Literature Review

Contrary to the view arguing for implementation of import substitution policies in countries, the view that foreign trade would positively affect growth, as is advocated by the classical and neoclassical approach, is also effective (Bahmani, Oskooee, and Niromand, 1999:557). Thus, the existence of theoretically different approaches and interpretations increases the interest in empirical studies in order to determine the findings related to the subject. In this regard, studies researching the causality relationship between openness and economic growth use different methods and data of various countries. However, in these studies, sometimes the causality was observed from openness to growth and sometimes from growth to openness. Other studies identify a bidirectional relationship or find no causality at all. For this reason, new findings are of vital importance.

Among the researchers questioning the relationship between openness and economic growth, Dar and Amirkhalkhali (2003) analyzed 19 OECD countries for the 1971–1999 period. In this study, the growth-accounting model was estimated with the random coefficients approach using time series and cross-sectional data. The results suggest that the impact of openness on total and individual factor productivity growth, and subsequently on economic growth, differed for each country. Gries and Redlin (2012) studied a total of 158 countries, and questioned the causality between the growth in GDP per capita and openness in the 1970–2009 period. In this study, the researchers used panel cointegration tests and panel error-correction models (ECM) in combination with GMM estimation to explain the causality relationship between economic growth and openness. Long-term results of the model suggested a positive causality relationship from openness to growth. However, the short-term coefficients identified a negative short-run adjustment. In other words, it was observed that openness could be painful for an economy undergoing short-term adjustments. When the countries were classified according to income groups and analyzed, findings supporting growth-led openness and openness-led growth hypotheses were reached only for the industrialized countries. While the openness-led growth hypothesis was valid for developing countries in the long term, it was determined that growth reduced openness. On the other hand, negative causality was identified in the less-developed countries.

Jung and Marshall (1985) analyzed Southeast Asia for the 1950–1981 period. The findings obtained as a result of the OLS analysis were different for the countries analyzed. For example, in Indonesia exports caused growth while in Thailand growth was the cause of exports. In Korea, exports caused a low rate of growth. On the other hand, no causality relationship was found in Taiwan or the Philippines. Dutt and Gosh (1996) found a causality relationship from exports to growth in Israel and Turkey in the period 1953–1991 and identified bi-directional causality in Morocco. In their study, Dutt and Gosh used a causality test based on the Error Correction Method (ECM). Liu et al. (1997) questioned the causality between trade openness and growth for China and found evidence supporting a bidirectional relationship. In their study, the 1983–1995 period was analyzed using quarterly data. Rodrik (1995) investigated the causality relationship between openness and growth for Korea, Taiwan, Chile, and Turkey. That study showed a causality relationship from growth to openness in Korea. In Taiwan, however, there was evidence of bidirectional causality but there was no causality between growth and openness in Turkey. Akilou (2013) investigated the relationship between trade openness and economic growth for the West African Economic and Monetary Union (WAEMU) countries. According to the findings, apart from the Côte d'Ivoire, and at the 10% level, trade openness did not cause economic growth in those countries. Moreover, it was observed that economic growth did not cause trade openness.

Saad (2012) tested the export-led growth hypothesis for Lebanon, using vector error correction models (VECM) and the Granger causality technique. The results support the validity of the export-led growth hypothesis in the 1970–2011 period. Hatemi (2002) questioned the aforementioned hypothesis for Japan. Bidirectional causality was determined to exist between exports and growth in that study, which employed the augmented Granger-causality tests using the bootstrap simulation technique. Thus, the evidence obtained suggested that exports were an integral part of the growth process in Japan in the 1960–1999 periods. Awokuse (2007) questioned the relationship between the increase in imports and exports and the economic growth for Bulgaria, Czech Republic, and Poland among the Central and Eastern European countries and used the Granger (1969) and the Sims (1972) causality tests. That analysis suggested that trade promoted growth. Using the Granger causality test, Reizman et al. (1996) obtained evidence for the validity of the export-led growth hypothesis for Algeria, Egypt, and Tunisia. In the same study, it was concluded that the export-led growth did not apply to Israel, Jordan, Morocco, Sudan, and Turkey. Kurt and Berber (2008) analyzed Turkey using quarterly data in the 1989–2003 period and considered different openness indicators, such as the ratio of the volume of foreign trade and imports to the GDP and the rate of increase in exports. VAR and variance decomposition methods were preferred in the analyses. As a result of the study, bidirectional causality was found to exist between economic growth and openness.

4. Econometric Methodology

In this paper, we study the panel causality test introduced by Dumitrescu and Hurlin (2012). This test is a simple version of the Granger (1969) non-causality test for heterogeneous panel data models with fixed coefficients. Also, it takes into account two dimensions of heterogeneity: the heterogeneity of the regression model used to test the Granger causality and the heterogeneity of the causality relationships.

We consider the following linear model:

$$y_{i,t} = \alpha_i + \sum_{k=1}^{K} \gamma_i^{(k)} y_{i,t-k} + \sum_{k=1}^{K} \beta_i^{(k)} x_{i,t-k} + \varepsilon_{i,t} \quad , \qquad i = 1,2,...,N : t = 1,2,...,T$$

where x and y are two stationary variables observed for N individuals in T periods. $\beta_i = \left(\beta_i^{(1)},...,\beta_i^{K}\right)'$ and the individual effects α_i are assumed to be fixed in the time dimension. We assume that lag orders of K are identical for all cross-section units of the panel. We also allow the autoregressive parameters $\gamma_i^{(k)}$ and the regression coefficients $\beta_i^{(k)}$ to vary across groups.

Under the null hypothesis, we assume that there is no causality relationship for any of the units of the panel. This assumption is called the Homogeneous Non-Causality (HNC) hypothesis, which is defined as:

$$H_0 : \beta_i = 0 \qquad \forall i = 1,...,N$$

The alternative is specified as the Heterogeneous Non-Causality (HENC) hypothesis. Under this hypothesis, we allow for two subgroups of cross-section units.

There is a causality relationship from x to y for the first one, but it is not necessarily based on the same regression model. For the second subgroup, there is no causality relationship from x to y. We consider a heterogeneous panel data model with fixed coefficients (in time) in this group. This alternative hypothesis is as follows:

$$H_1 : \beta_i = 0 \qquad \forall i = 1,\ldots,N_1$$
$$\beta_i \neq 0 \qquad \forall_i = N_1 + 1,\ldots,N$$

We assume that β_i may vary across groups and there are $N_1 \langle N$ individual processes with no causality from x to y. N_1 is unknown but it provides the condition $0 \leq N_1/N \langle 1$.

We propose the average statistic $W_{N,T}^{HNC}$, which is related with the null Homogeneous Non-Causality (HNC) hypothesis, as follows:

$$W_{N,T}^{HNC} = \frac{1}{N}\sum_{i=1}^{N} W_{i,T} \tag{1}$$

where $W_{i,T}$ indicates the individual Wald statistics for the i^th^ cross-section unit corresponding to the individual test $H_0 : \beta_i = 0$.

Let $Z_i = [e : Y_i : X_i]$ be the $(T, 2K+1)$ matrix, where e indicates a $(T,1)$ unit vector and $Y_i = \left[y_i^{(1)} : y_i^{(2)} : \ldots : y_i^{(K)}\right]$, $X_i = \left[x_i^{(1)} : x_i^{(2)} : \ldots : x_i^{(K)}\right]$. $\theta_i = (\alpha_i \; \gamma_i' \; \beta_i')$ is the vector of parameters of the model. Also let $R = [0 : I_K]$ be a $(K, 2K+1)$ matrix.

For each $i = 1,\ldots,N$, the Wald statistic $W_{i,T}$ corresponding to the individual test $H_0 : \beta_i = 0$ is defined as

$$W_{i,T} = \hat{\theta}_i' R' \left[\hat{\sigma}_i^2 R (Z_i' Z_i)^{-1} R'\right]^{-1} R \hat{\theta}_i \tag{2}$$

Under the null hypothesis of non-causality, each individual Wald statistic converges to a chi-squared distribution with K degrees of freedom for $T \to \infty$.

$$W_{i,T} \to \chi^2(K), \quad \forall i = 1,\ldots,N$$

The standardized test statistic $Z_{N,T}^{HNC}$ for $T, N \to \infty$ is as follows:

$$Z_{N,T}^{HNC} = \sqrt{\frac{N}{2K}}\left(W_{N,T}^{HNC} - K\right) \to N(0,1) \tag{3}$$

Also, the standardized test statistic $\tilde{Z}_N^{HNC}$ for fixed T samples is as follows:

$$\tilde{Z}_N^{HNC} = \sqrt{\frac{N}{2 \times K} \times \frac{(T-2K-5)}{(T-K-3)}} \times \left[\frac{(T-2K-3)}{(T-2K-1)} W_{N,T}^{HNC} - K\right] \to N(0,1) \tag{4}$$

In (3) and (4), $W_{N,T}^{HNC} = (1/N)\sum_{i=1}^{N} W_{i,T}$. The detailed information about these statistics can be found in the study of Dumitrescu and Hurlin (2012).

5. Data

In this study, we investigated the causality relationship between trade openness and economic growth in the G7 countries (Germany, France, Canada, Japan, Italy, United States, United Kingdom) for the period 1970–2011. Economic growth (EG) is measured using per capita GDP with constant 2000 US dollars, and trade openness (TO) is measured exports plus imports as a share of GDP. The data used in the paper are sourced from the World Development Indicators (WDI) provided by the World Bank (WB). Both variables are employed with their natural logarithms.

6. Empirical Findings

In order to determine the causality relationship between trade openness and economic growth according to the test of Dumitrescu and Hurlin (2012), the panel variables should be stationary. For this reason, we initially studied the stationarity using the panel unit root test. We used Peseran's CIPS statistic for this purpose because the variables contain cross-section dependence. We tested the cross-section independence using the LM tests developed by Breusch and Pagan (1980) and Pesaran (2004). The results of the cross-section dependence tests of the variables are given in Table 1.

According to the results in Table 1, the cross-section independence hypothesis is rejected at 1% and 5% significance levels. In that case, the unit root test suggested by Pesaran (2007) can be used to study the stationarity of the variables. As is known, this is one of the tests used in the presence of cross-section dependence. Peseran's (2007) unit root test results and the CIPS statistics obtained are given in Table 2.

The CIPS statistics in Table 2 are compared to the values in Table 2b and 2c of Pesaran (2007). Since the values of these statistics are not less than the critical values in the tables, H_0 was not rejected, and it was decided that the unit root existed in the variables that comprised the panel. The first difference of the variables is used for the causality tests. DH panel causality test results were determined according to the bootstrap critical values. That is because the presence of cross-section dependence was found in models explaining the causality relationship. The results of the cross-section dependence tests conducted for the models are given in Table 3.

DH panel causality test results are given for $k = 3$ in Table 4. When the test statistics in Table 4 are compared to the bootstrap critical values in Table 4 of the study of Dumitrescu and Hurlin (2012), it is observed that these test statistics are significant. Thus, a bidirectional causality relationship exists between trade openness and economic growth. For the G7 countries there is a causality relationship, both from trade openness to economic growth and from economic growth, to trade openness.

7. Conclusion

The relationship between openness and economic growth is a controversial issue in the economics literature. In this context, it is generally believed that as openness increases, economic growth will increase with the increase in technological innovation and productivity. However, there are different interpretations of the causality relationship between openness and growth in the related growth theories. Studies seeking empirical evidence on the subject reached different conclusions. In this study, we investigated the causality relationship between trade openness and economic growth. For this purpose, we used the Granger non-causality test for heterogeneous panel data developed by Dumitrescu and Hurlin (2012). The test statistic depends on the individual Wald statistics of Granger non-causality averaged across the cross-section units. The results of our empirical analyses show that there is bidirectional causality between TO and EG.

This evidence supports the hypothesis that openness increases economic growth, as is suggested by the endogenous growth theory; however, it also reveals that there is a feedback relationship between the two variables. The increase in openness, which also indicates how important foreign trade is for the country and informs about the country's dependence on foreign markets, increases growth in the G7 countries and the increase in growth increases openness in return. Therefore, international trade integration in the G7 countries will be a useful policy to boost growth. However, since growth also causes openness, high economic performance is considered among the causes of high openness levels.

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Table 1: The Results of Cross-Section Dependence Test for the Variables

Tests	TO		EG	
	Intercept	**Intercept and Trend**	**Intercept**	**Intercept and Trend**
CD LM1	72.354	66.706	120.609	123.205
	(0.000)	(0.000)	(0.000)	(0.000)
CD LM2	7.924	7.053	15.370	15.771
	(0.000)	(0.000)	(0.000)	(0.000)

Note: The values in the parenthesis indicate the p values

Table 2: The Results of Peseran Unit Root Tests

Variables	Intercept	Intercept and Trend
TO	-2.0219	-2.4924
EG	-2.0160	-1.8896

Table 3: The Results of Cross-Section Dependence Tests for Models

Tests	TO→EG	EG→TO
CD LM1	279.485	255.183
	(0.000)	(0.000)
CD LM2	39.885	36.135
	(0.000)	(0.000)

Note: The values in the parenthesis indicate the p values

Table 4: The results of DH panel causality test

Tests	TO→EG	EG→TO
$W_{N,T}^{HNC}$	6.811^{*}	5.937^{*}
$Z_{N,T}^{HNC}$	12.351^{*}	9.519^{*}
$\tilde{Z}_{N}^{HNC}$	3.411^{*}	2.588^{*}

Note:* significant at the % 5.