Applicability of Openness-led Growth Hypothesis in Sri Lanka: An ARDL Bounds Test

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Abstract

An openness-led growth hypothesis investigates the causal relationship between trade openness[1] and economic growth. Indeed, trade openness can stimulate economic growth by enhancing the international flow of knowledge and innovation and by allowing economies of specialization, not only in the production of goods, but also in the generation of new knowledge and new inputs into production. The purpose of this article is to empirically examine an openness-led growth hypothesis, using the case of Sri Lanka for the period from 1965 to 2012. The article uses the recently developed autoregressive distributed lag (ARDL) bounds test for cointegration developed by Pesaran et al. (2001). The empirical results confirm the validity of the openness-led growth hypothesis for Sri Lanka.

JEL: C32, F20, F41, O11

Keywords

Openness-led growth, Sri Lanka, ARDL bounds test, Granger causality

Introduction

There is a strong consensus among researchers that trade openness, even if combined with elements of direction and protection, tends to promote economic welfare. Economists (Dollar, 1992; Dollar & Kraay, 2001; Frankel & Romer, 1999; Levine & Renelt, 1992; Sachs & Warner, 1995), political scientists (de Soysa & Oneal, 1999) and sociologists (Firebaugh & Beck, 1994) are among several scholars who have found that countries with more open economies tend to have higher growth rates. Dollar (1992), Dollar & Kraay (2001), Levine & Renelt (1992), and Frankel & Romer (1999) all argue that trade, or trade reform, is an important

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determinant of differences in either incomes or growth. Indeed, trade openness can stimulate economic growth by enhancing the international flow of knowledge and innovation and by allowing economies of specialization, not only in the production of goods, but also in the generation of new knowledge and new inputs into production. This raises the hope of countries to eventually reach a higher level of welfare, whether measured as per capita income or improvement in the living standard of their citizens or the reduction in the number of poor people. Therefore, a high degree of trade openness is likely to speed up the rate of economic growth by leading to larger economies of scale in production due to the positive spillover effects emanating from technological developments in industrial countries. It is probably the failure to achieve this condition in many countries that explains the low level of economic performance (Ravinthirakumaran & Abeysinghe, 2008).

The idea that trade openness is one of the most important determinants of economic growth is becoming increasingly popular among governments of developing countries, and Sri Lanka in particular. Therefore, since the late 1970s and 1980s, many developing countries have adopted trade-oriented growth policies to push their stagnant economies towards rapid growth. As a result, there are a number of countries which have experienced high trade openness with higher levels of economic growth. For instance, formerly closed economies, such as China, India and Vietnam have experienced considerable economic growth and reduction in poverty after modernizing their economies through foreign trade (Ravinthirakumaran, 2008).

The objective of this article is to empirically test the validity of openness-led growth hypothesis, using the case of Sri Lanka for the period from 1965 to 2012. The article uses the recently-developed autoregressive distributed lag (ARDL) bounds test for cointegration, developed by Pesaran et al. (2001). This article pioneers the use of the ARDL bounds test for cointegration in the case of Sri Lankan openness-led growth analysis.

The remainder of this article is structured as follows. The second section reviews the theoretical and empirical literature on openness and economic growth. The third section presents the trade and growth performance of Sri Lanka. While the fourth section summarizes the analytical framework, the fifth section explains the data sources and gives a description of the variables. The sixth section discusses the econometrics methodology and empirical results followed by a conclusion and policy implications in the last section.

Literature Review

Theoretical Literature

The relationship between openness and economic growth has been examined extensively in the trade and growth theoretical literature. Trade and growth theories generally predict a positive relationship between openness to international

trade and economic growth. According to trade theory, the relationship was assessed in the framework of traditional Ricardian–Hecksher–Ohlin trade theory. This theory points out that openness to international trade brings only a one-time increase in output, since the country allocates its resources more efficiently after the openness, conditional on comparative advantage. However, this theory does not suggest any certain implications for long-run growth.

On the other hand, two influential growth theories, namely that of, neoclassical and endogenous growth, provide alternative explanations to economic growth. Neoclassical growth theories highlight technological progress as the engine of economic growth. Of course, openness may impact on the long-run growth rate if there is a technology stimulating effect. However, the neoclassical growth theory did not provide a theoretical framework for the proposition that openness stimulates technological progress. Further, the theory indicates that the competition in international market promotes economies of scale and increases efficiency by concentrating resources in sectors in which the country has a comparative advantage. These positive externalities promote economic growth. The theory also recognized that exports provide the economy with foreign exchange needed for imports that cannot be produced domestically.

Endogenous growth theories provide additional explanations of sustained productivity and output growth, and theories allow for a direct and persistent link between openness and the growth rate, which is missing in the traditional neoclassical growth model (Solow, 1956). They provide enough theoretical support for the positive relationship between trade openness and economic growth (Edwards, 1998). According to endogenous growth theories, openness to trade provides access to imported inputs embodying new technology, increases the size of the market faced by the domestic producers raising the returns to innovation and facilitates a country's specialization in research-intensive production (Harrison, 1996), leading to productivity gains and economic growth.

From followers of neoclassical theories to new endogenous growth, many theories have been developed giving many theoretical implications for openness on growth with most of them for a positive effect. Theoretical studies by Barro & Sala-i-Martin (1995), Coe & Helpman (1995), Edwards (1992), Grossman & Helpman (1991) and Romer (1994), among others, argue that countries that are more open have a greater ability to catch up to leading technologies in the rest of the world. Chang et al. (2009) indicate that openness promotes the efficient allocation of resources through comparative advantage, allows the dissemination of knowledge and technological progress, and encourages competition in domestic and international markets. The theories have been tested in much empirical literature with mostly in favour of a positive relationship. However, there exists also the opposing position. For example Krugman (1994) and Rodrik & Rodríguez (2001) argue that the effect of openness on growth is doubtful. According to Krugman, the effect of openness on economic growth could be, at best, very tenuous, and at worst, doubtful. Further, Krugman highlights that the degree of trade openness, particularly the magnitude of tariff and non-tariff

barriers, only can affect the volume of trade, not necessarily the link between exports, imports, and economic growth. Rodrik and Rodriguez argue that methodological problems with the empirical strategies employed in openness-led growth literature leave the results open to diverse interpretations. According to them, the indicators of openness used by researchers are poor measures of trade barriers or are highly correlated with other sources of bad economic performance. They also pointed out that the methods used to ascertain the link between trade openness and growth have serious shortcomings.

Empirical Literature

The relationship between trade openness and growth is a highly debated topic. Although several studies covering different groups of countries and different periods have found that trade openness is an important determinant of economic growth, the evidence reveals ambiguous results about this relationship. While a majority of the studies (Afzal, 2007; Ahmed & Anoruo, 2000; Chimobi, 2010; Edwards, 1992, 1998; Georgios, 2003; Hassan, 2005; Lee et al., 2004; Nourzad & Powell, 2003; Yanikkaya, 2003) provide a positive link between trade openness and economic growth, a few studies (Dudley & Karski, 2001; Kingsley et al., 2004; Sarkar, 2007; and Sinha & Sinha, 1996) fail to demonstrate this connection.

Edwards (1992) investigated the relationship between trade openness and GDP growth of 30 developing countries over the period 1970 to 1982. By using two basic sets of trade policy indicators[2], constructed by Leamer (1988), the results, estimated by ordinary least squares (OLS) revealed that all the four openness indicators were positively related with real per capita GDP growth. Subsequently, Edwards (1998) used data for 93 countries to examine the relationship between openness and total factor productivity growth. By using nine indexes[3] of trade policy to examine the relationship between trade policy and total factor productivity growth for the period 1980 to 1990, the results of the OLS model, confirmed that there is a significant positive relationship between openness and productivity growth. These studies support the hypothesis that countries with a more open trade regime have tended to grow faster, and a more distorted trade regime will tend to grow slower. Ahmed & Anoruo (2000) examined the long-run relationship between openness and economic growth for five South East Asian countries for the period 1960 to 1997. They used export plus import growth rates as proxy of openness. The empirical result shows the bi-direction causality between openness and economic growth.

Georgios (2003) studied the impact of trade openness on economic growth using two panel data set; one of 56 countries covering the period 1951–1998, and another of 105 countries over 1960–1997. The results show that the impact is positive, permanent, statistically significant and economically sizable. Thus, he added that developing countries benefit more from increased openness than developed

ones because technology is transferred from developed to developing economies. Nourzad & Powell (2003) selected 47 developing countries to examine and estimate the relationship between trade openness and economic growth. Applying the two-stage least squares method he found that there is a positive relationship between openness and economic growth. Yanikkaya (2003) used data of 100 developed and developing counties to investigate the link between trade openness and economic growth for the period 1970 to 1997. He used two types of trade openness indicators, one using trade shares and another one using the ratio of imports plus exports to GDP. The study finds evidence of a positive relationship when trade volumes are used as an indicator of openness.

Lee et al. (2004) used identification through heteroskedasticity to address potential endogeneity of trade openness for 100 countries over the 1961 to 2000 period and the ARDL bound test confirmed that trade openness has a positive impact on economic growth, although this effect is small in magnitude. Hassan (2005) investigated the casual relationship between trade openness and economic growth and the structure of international trade for Bangladesh. The article finds that there is long-run equilibrium relationship and there is unidirectional causality from trade openness to economic growth. Afzal (2007) has evaluated the impact of trade openness on economic growth with reference to Pakistan for the data span from 1960 to 2006. He strived to establish a reason for the relationship among trade openness, financial integration and financial growth applying the Johnson cointegration method. The study confirmed a positive relationship among the chosen variables. More recently, Chimobi (2010) investigated the causal relationship among financial development, trade openness and economic growth in Nigeria over 1970–2005. The Granger causality empirical findings suggest that trade openness and financial development does have causal impact on economic growth in Nigeria.

However, some of the studies fail to prove the relationship between openness and economic growth. A study by Sinha & Sinha (1996) examined this based on evidence from 29 Asian countries during 1951–1990. They have performed three types of analysis in their paper. Their cross-section study for various decades as well as for the entire sample period indicates that the growth of openness exerts a positive influence on the growth of GDP. Then, they pursued a causality test between openness and economic growth for selected countries. The result confirmed no causality for even a single country in any direction. Finally, they conducted time series analyses for those countries for which causality test were performed. They found that there was a positive relationship between the growth of openness and the growth of GDP. Dudley & Karski (2001) investigated the link using panel regression during a period of 20 years from 1969 to 1989 for 10 developing countries. Their results show that in three of the 10 countries, the degree of openness has a positive effect, on another three it has a negative effect and has no effect on the remaining four. Kingsley et al. (2004) investigated the impact of openness on Nigeria's long-run growth during 1980–2003 using the cointegration approach. They tested for the number of cointegrating relationships between

openness and economic growth and concluded that there is no significant relationship. Likewise, Sarkar (2007) studied the link using cross-country panel data analyses of a sample of 51 developing and developed countries during 1981–2002. In his panel data analysis, he found out that 11 rich and highly trade-dependent countries had higher real growth associated with a higher trade share. His time series study of individual country experiences shows that the majority of least developed countries (LDCs) including the East Asian countries experienced no positive long-term relationship between openness and growth during 1961–2002. Extending his study to cover various regions and groups shows that only the middle-income group experienced a positive long-term relationship.

This brief review of the findings confirmed that though the relationship between openness and economic growth has largely supported the view that openness has a favourable impact on economic growth, the evidence on the openness-led growth is mixed. This mix arises because of the different data sets, the alternative econometric methods, and the different country characteristics. To address this issue in the literature, this article tests the validity of an openness-led growth hypothesis using Sri Lanka as a case study.

Trade and Growth Performance of Sri Lanka

Trends of Trade Openness

Before examining the openness-led growth hypothesis in Sri Lanka, it is appropriate to review the trade and growth performance of the country since independence. During the first decade after independence in 1948, Sri Lanka continued as an open trading nation with only relatively minor trade and exchange rate restrictions (Athukorala, 2012, 2014). As a result, the country began its post-independence development history with high trade dependence ratio/trade openness, measured by the share of exports and imports to GDP. For instance, in the early 1950s, trade dependency ratio accounted for 70 per cent of GDP. The open trade regime that prevailed in the 1950s was partly responsible for the high dependency ratio which indicated a high degree of trade openness during that time. However, in response to the change in political power and the deterioration of terms of trade and an unfavourable trend in imports led to the adoption of a new economic policy regime which emphasized import substitution industrialization was introduced in the late 1950s. As a consequence of the new policy regime, except for the phase of partial liberalization in the late 1960s, the period from 1960 to 1977 was characterized by an inward-looking trade regime. There have been many controls on international trading activities. Within a period of about 25 years from 1950 to 1977, the dependency ratio was declined to their minimum average of around 52 per cent of GDP (Abeyratne & Rodrico, 2002). The lowest trade dependency ratio recorded in 1972 at 46 per cent of GDP. However, there was an increase in the trade dependency ratio after the introduction of a trade liberalization policy in 1977.

The economic policy reforms introduced in 1977 marked the beginning of a new phase which emphasized the export promotion industrialization strategy. Sri Lanka was the first country in South Asia to undergo an extensive economic liberalization process due to the dismal economic outcome of the protectionist import-substitution trade policies pursued over previous three decades (Athukorala, 2014; Panagariya, 2002). Trade barriers were gradually removed and export favourable policies adopted. Private sector investment was triggered by export oriented economic activities. Imports have been increased mainly due to the high requirement of intermediate products due to industrial development. Garments and other finished textiles were the major export items that contributed higher income to the economy. Further, Sri Lanka has engaged in many multi-lateral and bi-lateral trade negotiations during 1980–2010. This has directly increased international trade and indirectly caused the development of the financial service sector in the country. This has even positively impacted on reducing tariffs and non-tariff restriction on international trade. Fiscal policies in favour of promoting exports, incentive for exporters, trade promotional activities, strategic trade policies and developing infrastructure facilities have significant impact on trade dependency ratios in the country. This resulted in an increasing trend in the trade dependency ratio which reached 67 per cent of GDP in 1980s and 78 per cent of GDP in 1990s. The highest trade dependency ratio was recorded in 2000 at 88 per cent of GDP. Since then, in the midst of a series of internal and external shocks along with the continuation of the separatist war in the North, the ratio declined to 70 per cent during 2001–2010 and 60 per cent during 2011–2012. The graph and scatter diagram (Figure 1) present the trends and relationships between trade openness and growth performance of Sri Lanka.

Trends of Economic Growth

In the early years of independence, Sri Lanka continued the colonial economy with its dependence on the export of three primary commodities (tea, rubber and coconut). As a result of the World War price boom, its financial assets accumulated, resulting in some measure of prosperity. Consequently, the GDP growth rate was 4.3 per cent during 1951–1955. In the late 1950s, however, when declining commodity prices in the world market resulted in deterioration in the terms of trade and depletion of assets, there was a decline in the average economic growth rate with 2.9 per cent occurring during 1956–1965. The upward trend in economic growth was maintained by policy revisions aimed at gradual and partial liberalization during 1966–1970. Since the 1970s, there has been a major breakthrough in growth trends in the country, because the economy moved to a 'hard' phase of import substitution in a highly controlled regime. Sri Lanka recorded a –0.4 per cent GDP growth in 1972, the lowest since independence to 1977. The lowest rate was attributed to the adverse impact of youth insurrection. Further, the global

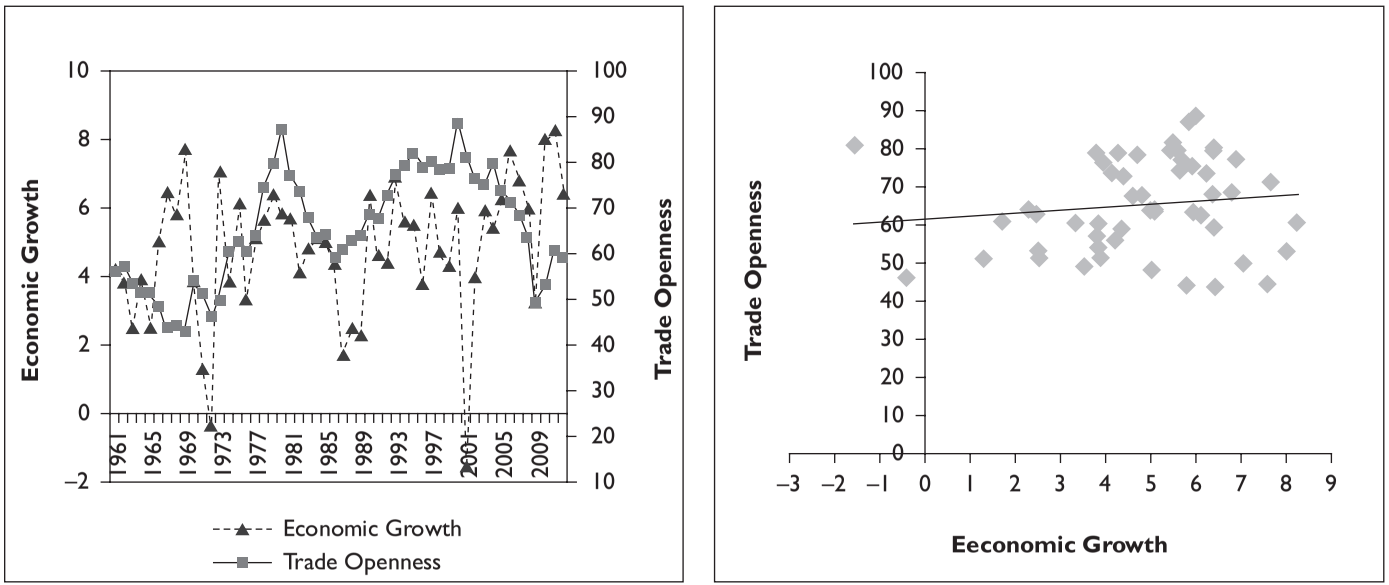

Figure 1. Trends and relationship between Trade openness and Economic growth in Sri Lanka, 1961–2012

Source: World Bank (2013).

energy, food and exchange rate crises as well as bad weather conditions also contributed to this adverse spell (Abeyratne & Rodrico, 2002).

Following policy reforms in 1977 which aimed at achieving export promotion in a liberalized trade regime, there was a reasonable increase in the average growth rates to the level of about 5.3 per cent, from 1978 to 1985. But in the latter half of the 1980s, due to the macroeconomic and political instability of the country, the growth rate slowed down to 2.7 per cent in the period 1986–1989 (Abeyratne & Rodrico, 2002). With the initiation of a second wave of trade liberalization process in 1989, the economy was able to regain its growth momentum to a moderate level though ethnic conflict continued in the Northeast Province of the country. Since then, the economy has been able to regain its growth momentum to a moderate level of 5.4 per cent from 1990 to 2012 ranging from the highest of 8.2 per cent in 2011 (the highest annual rate of growth recorded in the last three decades), to the lowest of –1.5 per cent in 2001.[4] The long-term growth performance is characterized by an increase in the share of manufacturing and service sectors with a decline in the share of the agriculture sector. Evidently, the increasingly restrictive policy regime failed in bringing about a significant rate of economic growth in Sri Lanka. In contrast, the liberalized policy regime produced a higher growth performance, except during the period 1986–1990. Even though the policy change could explain the growth trend of GDP, its annual fluctuations could be attributed to a series of random events, domestically as well as internationally.

An assessment of the degree of trade openness in different periods in the development practice exposed some crucial elements of the link between policy option and growth performance in Sri Lanka. Obviously, the increasingly closed economic policy regime failed in bringing about significant structural changes in the economy and dragged the economy into a deep and prolonged stagnancy (Snodgras, 1988). In contrast, the open economic regime produced a substantial increase in investment and manufactured export expansion, resulting in higher growth performance.

Analytical Framework

After reviewing the theoretical and empirical work, the model to examine the impact of trade openness on economic growth is derived using the production function framework. The production functions in general form as follows:

$$Y = f(A, L, K) \tag{1}$$

where Y is the real gross domestic product, L is the labour force, K is the capital stock and A is the total factor productivity. It has been assumed that effect of trade openness on economic growth operates through A (Jawaid & Raza, 2012; Kohpaiboon, 2003).

$$A = g\,(OPN) \tag{2}$$

Substituting Equation (2) in Equation (1)

$$Y = f\,(L, K, OPN) \tag{3}$$

The empirical models for estimations are specified in a log form and it can be illustrated as follows:

$$\ln GDPPC = \beta_0 + \beta_1 \ln EMP + \beta_2 \ln GFCF + \beta_3 \ln OPN + \varepsilon_t \tag{4}$$

where, ε_t is the error term, *GDPPC* is the GDP per capita, *GFCF* is the gross fixed capital formation, *EMP* is the employment (number of people engaged) and *OPN* represents the trade openness.

Of course, Equation (4) may omit variables which are crucial to explaining growth. Macroeconomic stability is one of the most important variables which can affect many other macroeconomic indicators including economic growth. To capture the influence of macroeconomic stability on economic growth, we include inflation as an additional variable in the model.

$$\ln GDPPC = \beta_0 + \beta_1 \ln EMP + \beta_2 \ln GFCF + \beta_3 \ln OPN + +\beta_4 INF + \varepsilon_t \tag{5}$$

Data Source and Description of Variables

Annual time series data on GDP per capita, trade openness, gross fixed capital formation, employment and inflation, which cover the 1965–2012 period, have been used in this study. Gross fixed capital formation has been used as a proxy for capital investment because of unavailability of data of capital stock (see, Balasubramanyam, Salisu & Sapsford, 1996; Barro, 1999; and Kohpaiboon, 2003). As mentioned, inflation has been used as a proxy for macroeconomic stability of the country. The expected signs for labour and capital stock are positive while, the sign of trade openness is to be determined. For inflation, the expected sign is negative. Reviewing the existing literature on trade and growth shows that there is not a clear definition of trade openness. Many different measures of trade openness[5] have been proposed and used in empirical analyses of the relationship between openness and growth. Some authors constructed different indices to measure the trade openness such as an openness index by Leamer (1988), price distortion and variability index by Dollar (1992) and openness index of Sachs & Warner (1995). This article identifies these estimation problems and agrees with earlier researchers that different openness measures capture different aspects of openness. However, Harrison (1996) argues that, regardless of the many openness measures that exist in the literature, the simplest ones are those based on actual trade flows, such as the sum of exports and imports as percentage of GDP. This

measure is used as a proxy for trade openness. All data have been gathered from the official database of the World Bank.[6]

The main purpose of the study is to empirically examine the openness-led growth hypothesis for Sri Lanka by testing causality between trade openness, economic growth with inclusion of capital, labour and inflation. Little attention has been paid to the econometric analysis of the relationship between these variables. In openness–growth literature, bivariate causality analysis leaves out some other relevant variables such as capital, labour and inflation that could have significant relationship with the two variables in question. For that reason we find many empirical studies that improved the openness-growth relationship by including in their models one or more relevant macroeconomic variables. For instance, Bajwa & Siddiqi (2011) provide a study which tests the causal relationship among economic growth, openness, labour force and gross fixed capital formation. Other researches introduce different variables such as inflation (Afzal et al., 2013), foreign direct investment (Sulaiman et al., 2012), investment and government expenditure (Nduka, 2013), etc. Therefore, that the omission of capital, labour and inflation could, for instance, seriously bias the empirical causality results between trade openness and economic growth in the case of Sri Lanka since all three variables are major disbursement items.

Econometrics Methodology and Empirical Results

Numerous econometric studies have been conducted different techniques[7] to analyze the impact of trade openness on economic growth. However, this article uses the recently-developed ARDL bounds test for cointegration developed by Pesaran et al. (2001). The ARDL modelling approach was originally introduced by Pesaran & Shin (1999) and further extended by Pesaran et al. (2001). Due to the low power and further problems associated with other test methods, the ARDL approach to cointegration has become popular in recent years. It is observed that ARDL has a number of advantages over other cointegration techniques.

First, the ARDL technique can be applied whether the regressors are I(0) and/or I(1), while conventional cointegration techniques require that all the variables in the system be of equal order of integration. This means that the ARDL can be applied irrespective of whether underlying regressors are purely I(0), purely I(1) or mutually cointegrated and thus there is no need for unit root pre-testing. Second, the ARDL procedure is a statistically more significant approach to determine the cointegration relation in small or finite samples while other cointegration techniques require large data samples for the purposes of validity. Third, the ARDL procedure allows that the variables may have different optimal lags, while it is impossible with conventional cointegration procedures. Fourth, the ARDL estimates the short- and long-run components of the model simultaneously,

removing problems associated with omitted variables and autocorrelation. Fifth, this technique generally provides unbiased estimates of the long-run model and valid t-statistic even when some of the regressors are endogenous (Harris & Sollis, 2003). Finally, the ARDL procedure employs only a single reduced form equation, while the conventional cointegration procedures estimate the long-run relationships within a context of system equations. The above advantages of the ARDL technique over other standard cointegration techniques validate the application of ARDL approach in the present study to investigate the applicability of openness-let growth hypothesis in Sri Lanka. Therefore, it is expected that this article will make a modest contribution to empirical literature.

Unit Root Test

Before we proceed with the ARDL bounds test, we test for the stationarity status of the selected time series data to determine their order of integration. This is to ensure that the variables should not be stationary at an order of I(2) because the computed F-statistics provided by Pesaran et al. (2001) are valid only when the variables are I(0) or I(1). For this purpose, in this current study we use the conventional ADF tests and the Phillips–Perron test and the results are presented in Table 1.

The results of the unit roots tests are reported in Table 1 and indicate that all variables are non-stationary in their levels except inflation, but stationary in their first difference at the 1 per cent level of significance. Therefore, all the variables of interest are integrated of order one or I(1) except inflation I(0). The ARDL bounds test is then applied to the model.

Table 1. Augmented Dickey–Fuller and the Phillips–Perron Unit Root Test

	Augmented Dickey–Fuller Test		Phillips–Perron Test	
Variables	Level	First Difference	Level	First Difference
ln(GDPPC)	–2.7602	–5.3988	–2.9605	–5.3731
	(–0.2187)	(–0.0003)	(–0.1540)	(–0.0003)
ln(OPN)	–1.4124	–6.0910	–1.5469	–6.2508
	(–0.8444)	(0.0000)	(–0.7986)	(0.0000)
ln(GFCF)	–2.2833	–4.5615	–1.9347	–4.5485
	(–0.4342)	(0.0035)	(–0.6207)	(–0.0036)
ln(EMP)	–2.1974	–5.0086	–1.6185	–4.8762
	(–0.4797)	(–0.0010)	(0.7705)	(–0.0014)
ln(INF)	–6.70313	–	–6.70313	–
	(0.0000)		(0.0000)	

Source: World Bank (2013).
Note: Values in parentheses are p-value.

ARDL Bound Test for Cointegration

The ARDL model for the standard log-linear functional specification of long-run relationships among GDP per capita (*GDPPC*), openness (*OPN*), gross fixed capital formation (*GFCF*) Employment (*EMP*) and inflation (*INF*) may follow as:

$$\begin{aligned}\Delta \ln(GDPPC_t) = {} & \alpha_{01} + \alpha_{11} \ln(GDPPC_{t-1}) + \alpha_{21} \ln(OPN_{t-1}) + \alpha_{31} \ln(GFCF_{t-1}) \\ & + \alpha_{41} \ln(EMP_{t-1}) + \alpha_{51} \ln(INF_{t-1}) + \sum_{i=1}^{l} \beta_{1i} \Delta \ln(GDPPC_{t-i}) \\ & + \sum_{i=0}^{m} \beta_{2i} \Delta \ln(OPN_{t-i}) + \sum_{i=0}^{n} \beta_{3i} \Delta \ln(GFCF_{t-i}) \\ & + \sum_{i=0}^{o} \beta_{4i} \ln(EMP_{t-i}) + \sum_{i=0}^{p} \beta_{5i} \ln(INF_{t-i}) + \varepsilon_t \end{aligned} \quad (6)$$

where Δ is the first-difference operator, ln (.) is the logarithm operator and ε_t is the white-noise disturbance term. The coefficients of α_s show the long-run, whereas the β_s are the parameters that show the short-run dynamics of the model. The structural lags *l, m, n*, *o* and *p* are determined by using minimum Schwarz's Bayesian Criteria (SBC).

According to Pesaran & Pesaran (1997), the ARDL approach to cointegration involves three steps for estimating long-run relationship (Pesaran et al., 2001). The first step in the ARDL bounds testing approach is to estimate Equation (6) by ordinary least squares (OLS) in order to test for the existence of a long-run relationship among the variables by conducting an *F*-test for the joint significance of the coefficients of the lagged levels variables, that is, $H_0 : \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = 0$ against the alternative one: $H_1 : \alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq \alpha_5 \neq 0$.

An estimated F-test statistic has a non-standard distribution which depends upon (*a*) whether variables included in the ARDL model are I(0) or I(1); (*b*) the number of regressors; (*c*) whether the ARDL model contains an intercept and/or a trend; and (*d*) the sample size.

The computed F-statistic is compared with sets of critical values for the bound test. Pesaran et al. (1996) have tabulated two sets of critical values for the bound test and were reproduced by Pesaran & Pesaran (1997) and Pesaran et al. (2001). The first set assumes that all variables to be I(0), the lower critical bound (LCB) and the other set assume that all are I(1), upper critical bound (UCB). However, these CVs are generated for sample sizes of 500 and 1,000 observations and 20,000 and 40,000 replications respectively. Narayan (2004, 2005) argues that existing critical values, because they are based on large sample sizes, cannot be used for small sample sizes. Given the relatively small sample size in the present study (47 observations) critical values are calculated specific to the sample size. In testing for the long-run relationship, we compare the sets of critical values suggested by Narayan (2005) and reject the null in favour of the alternative that there

Table 2. Results from the Bound Test

Lower Bound Value	Upper Bound Value B	Critical Value
4.394	5.914	1% significance level
3.178	4.45	5% significance level
2.638	3.772	10% significance level

Source: World Bank (2013).

Note: Computed F-statistics = 27.5320. The upper and lower bounds were obtained using unrestricted intercept with no trend. The critical values are obtained from Narayan (2005) Table: Case III.

exists a long-run relationship between trade openness and economic growth when our test statistic exceeds the relevant upper critical value. On the other hand, we fail to reject the null hypothesis at a particular significance level when our sample test statistic is below the associated lower critical value. Similarly, The null is then accepted regardless of whether the underlying orders of integration of trade openness and growths are I(0) or I(1). Finally, when the reported test statistic falls in between the upper and lower bounds value, we interpret the results as being inconclusive at the given significance level.

The bound test statistics reported in Table 2 shows that the null hypothesis is rejected at the 5 per cent significance level in favour of the alternative that, there exists a long-run relationship between trade openness and economic growth.

In the second step, once cointegration is established, the conditional ARDL long-run model for *ln(GDPPC)* can be estimated as:

$$\ln(GDPPC_t) = \alpha_0 + \sum_{i=1}^{p} \alpha_{1i} \ln(GDPPC_{t-i}) + \sum_{i=1}^{q_1} \alpha_{2i} \ln(OPN_{t-i}) + \sum_{i=1}^{q_2} \alpha_{3i} \ln(GFCF_{t-i}) + \sum_{i=1}^{q_3} \alpha_{4i} \ln(EMP_{t-i}) + \sum_{i=1}^{q_4} \alpha_{5i} \ln(INF_{t-1}) + \varepsilon_t \quad (7)$$

The orders of the ARDL (p, q_1, q_2, q_3, q_4) model in the five variables are selected by using SBC. Equation (7) is estimated using the following ARDL (1, 0, 0, 0, 1) specification. The estimated long-run coefficients of the model given in Equation (7) are reported in Table 3.

Table 3 presents the long-run results of the model. By the model given in Equation (7), the long-run test statistics indicate that the estimated coefficients of the long-run relationship are significant for all but in different significant levels. The estimated coefficient of trade openness (*ln OPN*) has a positive significant impact on economic growth (*ln GDPPC*) at the 5 per cent level. This suggests, in the long-run, for a 1 per cent increase in the trade openness, the economic growth, on average, increases by about 0.60 per cent. The investment variable (*ln GFCF*) and labour force variable (*ln EMP*) have the expected positive sign and are significant at the 1 per cent level. The macroeconomic

Table 3. Estimated Long-run Coefficients using the ARDL Model Selected Based on SBC

Variable	Coefficient	t-statistics	Probability
C	–26.6407	–3.8671	0.000
ln(OPN)	0.5956**	2.2547	0.030
ln(GFCF)	0.7343*	16.2781	0.000
ln(EMP)	1.2592**	2.5625	0.014
ln(INF)	–0.4803***	–1.8691	0.069

Source: World Bank (2013).
Note: *, **, *** indicates significance at the 1%, 5% and 10% respectively.

stability variable, (*ln INF)*, has an expected negative sign and is significant at the 10 per cent level in the long-run. The long-run relationship between the variables indicates that there is Granger-causality in at least one direction which is determined by the F-statistic and the lagged error-correction term.

In the third and final step, we obtain the short-run dynamic parameters by estimating an error correction model associated with the long-run estimates. This is specified as follows:

$$\Delta \ln(GDPPC_t) = \beta_0 + \sum_{i=1}^{p} \beta_{1i} \Delta \ln(GDPPC_{t-i}) + \sum_{i=0}^{q} \beta_{2i} \Delta \ln(OPN_{t-i})$$
$$+ \sum_{i=0}^{r} \beta_{3i} \Delta \ln(GFCF_{t-i}) + \sum_{i=0}^{s} \beta_{4i} \ln(EMP_{t-i}) + \phi ECT_{t-1} + \varepsilon_t \quad (8)$$

where, β_s are the short-run dynamic coefficients of the model's convergence to equilibrium and ϕ is the speed of adjustment parameter and ECM is the error correction term that is derived from the estimated equilibrium relationship of Equation (6). The results of short-run dynamic coefficients associated with the long-run relationships obtained from the ARDL–ECM Equation (8) are presented in Table 4. The optimal lag length for the selected error correction representation of the ARDL (1, 0, 0, 0, 1) model is determined by the Schwarz Bayesian Criterion. The following ECM is derived from the ARDL to be used for carrying out the Granger causality test. The generated ECM contains only one lag of each regressor in first difference form and, as a result, a parsimonious specification of the ECM is chosen.

$$\Delta \ln GDPPC = 0.053 \Delta \ln OPN^{**} + 0.083 \Delta \ln GFCF^{**} +$$
$$0.138 \Delta \ln EMP - 0.053 \Delta \ln INF^{***} - 0.110 ECT_{-1}^{**} \quad (9)$$

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

Beginning with the results for the long-run, the coefficient on the lagged error-correction term is significant at the 1 per cent level with the expected sign, which

Table 4. Error Correction Representation for ARDL Model (1,0,0,0,1) on SBC

Variable	Coefficient	t-statistics	Probability
Δln (*OPN*)	0.0532	9.0153	0.000
Δln (*GFCF*)	0.0826	2.7104	0.010
Δln (*EMP*)	0.1379	1.6273	0.111
Δln (*INF*)	–0.0526	–1.8319	0.074
ECT (–1)	–0.1096	–2.6312	0.012
R^2	0.8082		
$\bar{R}^2$	0.7794		
F-statistics	33.7125		0.000
DW - statistics	1.8514		

Source: World Bank (2013).

confirms the result of the bounds test for cointegration. The value of the ECT is estimated at –0.110 indicating that the speed of adjustment to equilibrium after a shock is approximately 11 per cent from previous year's shock. This result implies that causality runs interactively through the error-correction term from openness, labour, capital and inflation to growth. In the short-run, openness and capital investment are significant at the 5 per cent level and has an important impact on growth. Employment has a positive impact but not significant. The impact of inflation is negative but significant only 10 per cent.

Granger Causality Tests

Results of short-run Granger causality tests are shown in Table 5. As can be seen in the table, in the short run, the F-statistics on the explanatory variables suggest that at the 1 per cent level or better there is a unidirectional Granger causality running from capital investment to economic growth, economic growth to employment, and capital investment to employment. Further, at the 5 per cent level there is also a unidirectional Granger causality running from openness to economic growth, openness to employment and openness to inflation.

In the meantime, there is unidirectional Granger causality running from economic growth to capital investment and inflation to employment at the 10 per cent significance level. Finally, there are bidirectional causality between inflation and economic growth at the 1 per cent significance level and between openness and capital investment at the 5 per cent level. The findings of this article reveal that trade openness which promotes economic growth, capital investment and employment in the short-run for Sri Lanka. It also influence on macroeconomic stability of the country as well. We find that the reported results confirm the validity of openness-led growth hypothesis for Sri Lanka. That is, openness indeed leads to higher economic growth.

Table 5. Results of Short-run Granger Causality

Dependent Variable	F- statistics					Direction of Causality
	Δln(*GDPPC*)	Δln(*OPN*)	Δln(*GFCF*)	Δln(*EMP*)	Δln(*INF*)	
Δln(*GDPPC*)	–	3.3557** (0.047)	7.3464* (0.007)	2.648 (0.104)	81.2750* (0.000)	OPN → GDPPC GFCF → GDPPC INF → GDPPC
Δln (*OPN*)	1.197 (0.274)	–	5.4946** (0.019)	2.927 (0.087)	0.53196 (0.466)	GFCF → OPN
Δln (*GFCF*)	3.1333*** (0.077)	5.4946** (0.019)	–	1.5527 (0.213)	0.79204 (0.373)	GDPPC → GFCF OPN → GFCF
Δln (*EMP*)	24.5637* (0.000)	6.0801** (0.014)	20.7641* (0.000)	–	2.8910*** (0.089)	GDPPC → EMP OPN → EMP GFCF → EMP INF → EMP
Δln (INF)	81.2750* (0.000)	4.2141** (0.040)	0.71315 (0.398)	0.01647 (0.898)	–	GDPPC → INF OPN → INF

Source: World Bank (2013).
Notes: *, **, *** indicates significance at the 1%, 5% and 10% respectively.

Table 6. Diagnostic Test

Test Statistics	LM Version	F Version
A: Serial Correlation	CHSQ (1) = 0.1430 (0.705)	F(1,39) = 0.1190 (0.732)
B: Functional Form	CHSQ (1) = 5.9137 (0.015)	F(1,39) = 5.6134 (0.023)
C: Normality	CHSQ (2) = 0.0340(0.983)	Not applicable
D: Heteroskedasticity	CHSQ (1) = 2.0183 (0.155)	F(1,45) = 2.0191 (0.162)

Source: World Bank (2013).

Diagnostic and Stability Tests

Diagnostic tests for serial correlation, normality, heteroskedasticity and structural stability of the models are considered in this study. As can be seen in Table 6, the model generally passes all diagnostic tests in the first stage. These tests show that there is no evidence of autocorrelation and that the models pass tests for normality and thus proving that the error is normally distributed. The adjusted R bar shows (Table 6) that around 78 per cent of the variation in economic growth is explained by the regress in the model. Finally, the stability of the long-run coefficient is tested by the short-run dynamics. Once the ECM model given by Equation (8) has been estimated, the cumulative sum of recursive residuals (CUSUM) and the CUSUM of square (CUSUMSQ) tests are applied to assess the parameter stability (Pesaran & Pesaran, 1997). Figures 2 & 3 plot the results for CUSUM and CUSUMSQ tests. The results indicate the absence of any instability of the coefficients because the plot

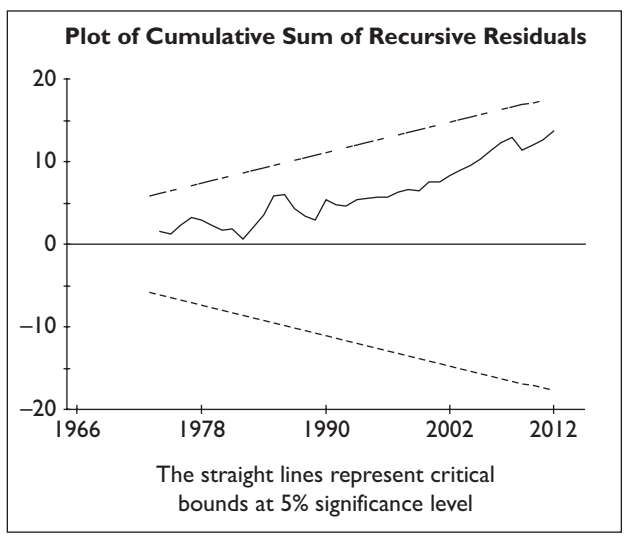

Figure 2. Plot of CUSUMS test for Eq. (10)

Source: World Bank (2013).

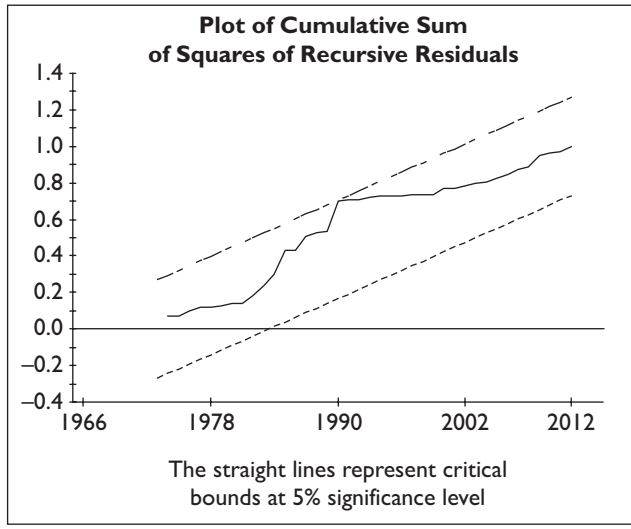

Figure 3. Plot of CUSUMQ test for Eq. (10)

Source: World Bank (2013).

of the CUSUM and CUSUMSQ statistic fall inside the critical bands of the 5 per cent confidence interval of parameter stability.

Conclusion and Policy Implications

In this article we empirically examined the validity of openness-led hypothesis for Sri Lanka by testing causality between trade openness, economic growth with inclusion of capital, labour and inflation. There are many studies that have examined the openness–growth nexus, but the findings are questionable. The reasons for the inconsistencies mainly include sample bias, the selection of appropriate proxies for variables, methodological deficiencies and the quality of data. Our article overcomes these shortcomings by using the recently developed ARDL bounds test for cointegration. The findings of this article reveal that trade openness which promotes economic growth, capital investment and employment in the short- and long-run for Sri Lanka. We find that the reported results confirm the validity of openness-led growth hypothesis for Sri Lanka. That is, openness indeed leads to higher economic growth.

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Notes

1. Throughout this article, we will use openness, trade openness and economic openness interchangeably.
2. The first set refers to openness and measures of trade policy (tariff and non-tariff barriers—NTB) which restrict imports. The second set measures trade intervention and captured the extent to which trade policy distorted trade.
3. Among these nine indexes, three were related to openness, a higher value of which denotes a lower degree of policy intervention in international trade. The other six were related to trade distortions, for which higher values denote a greater departure from free trade.
4. This negative growth was caused by several factors such as the political unrest that prevailed in the country (particularly the terrorist attack at the Katunayaka international airport), prolonged drought and subsequent power cuts, the terrorist attack on the World Trade Centre and the subsequent global recession.
5. Trade policy orientation (such as average tariff rates, average coverage of quantitative barriers and frequency of non-tariff barriers or collected tariff ratios), set of other domestic policies (such as macroeconomic policies or institutional ones) and all other non-policy factors (such as geography and infrastructure).
6. The web link of data source is http://data.worldbank.org/indicator.
7. For instance, conventional regression analysis (Barro & Lee, 1994; Dollar, 1992; Dollar & Kraay, 2003; Edwards, 1998; Easterly & Levine, 2001; Harrison, 1996; Irvin & Tervio, 2002; Islam, 1995; Sachs & Warner, 1995; and Sala-i-Martin, 1997), Granger causality based tests (Ahmad & Kwan, 1991; Bahmani-Oskooee & Shabsign, 1991; Chow, 1987; and Jung & Marshall, 1985), cointegration and error-correction (Bouoiyour, 2003; Islam, 1998) and panel data setting (Awokuse, 2007).

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