Does International Trade Promote Economic Growth? An Evidence from Brunei Darussalam

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Does International Trade Promote Economic Growth? An Evidence from Brunei Darussalam

Abstract

Purpose – The purpose of this paper is to explore the potential impact of trade openness on economic growth for the economy of Brunei Darussalam.

Design/methodology/approach - Empirical analyses are conducted using the Autoregressive Distributed Lagged Model (ARDL) procedure and the data utilized were spanning from 1989 to 2018.

Findings - The obtained results indicated a positive and statistically significant relationship between trade openness and economic growth. Similarly, the results also revealed that domestic investment and natural resources positively impacted economic growth. Further, we found that human capital has impacted economic growth both negatively and significantly, which is against our prior expectations. Moreover, in the short run, trade openness and domestic investment have lost its significance level while all other variables have maintained both their significance levels and signs of their coefficients.

Practical implications – This paper has provided comprehensive evidence regarding the relationship between trade openness and economic growth for Brunei Darussalam. Therefore, the policymakers of Brunei are suggested to take practical steps to gear up to trade liberalization and hence attain higher growth. Further, favorable attention is also needed for economic diversification and encouraging domestic investment to accelerate the long-run economic growth.

Originality/value - As this is a comprehensive study on the economy of Brunei Darussalam, therefore, we expect that the policymakers would find it useful while formulating and exercising suitable policies related to trade openness.

Key Words: Brunei Darussalam, Trade Openness, Growth, ARDL, Natural Resources

1. **Introduction**

All economies of the world are continuously exercising various policies, including international trade policy, to secure long-run sustainable economic growth. It is because, higher economic growth matters from the perspective of an improved standard of living which is the end objective of all economic activities (Tahir and Azid, 2015). International trade has helped many developing countries to get access to extended international markets and attain significant competitiveness. In recent decades, no country has witnessed improvements in the standard of living through economic growth without foreign trade (Staff, 2001). The growth experience of East Asian Tigers can also be explained by the open trade policy put in place by policymakers (Tahir and Khan, 2014). Owing to these reasons, world trade has been increased significantly during the last few decades.

Brunei Darussalam is located in South East Asia and is indeed very rich in terms of natural resources. The importance of trade liberalization from the perspective of economic growth has been recognized by policymakers of Brunei Darussalam over the years. Brunei Darussalam joined the World Trade Organization (WTO) in 1995. Besides WTO, Brunei Darussalam is also actively participating in some regional organizations such as ASEAN and APEC. Brunei Darussalam has hosted the summit of APEC in 2000 (Anaman and Al-Kharusi, 2003), which shows that the country is interested in reaping the benefits of international trade. The country targeted to cut down tariffs to zero percent by the end of 2020 see (Cooperation and Committee, 1997). Applied weighted average tariff rates on all products have been decreased from a higher level of 9.51 percent in 2001 to 4.12 percent in 2010. The degree of trade openness measured by the ratio of imports and exports to GDP has also increased from 97.019 percent in 1989 to a record high of 115.679 in 1997, which is indeed remarkable (WDI, 2019). Since then, the Bruneian economy witnessed slight variations in terms of trade openness. However, the current statistics show that the policies of Brunei Darussalam are still in favor of free trade as the trade to GDP ratio in 2018 was 93.896 percent.

Brunei Darussalam has taken various steps over the years to liberalize its economy. Averages tariffs imposed by Brunei Darussalam on its imports from other countries are significantly low. Brunei Darussalam adopted the ASEAN harmonized tariff system and tariff lines were reduced from 10,689 in 2007 to 9,916 lines in 2014. Consequently, the simple average applied MFN rate declined from 4.8% in 2007 to 1.7% in 2014 (WTO, 2015). Similarly, the average tariff was reduced by the Bruneian's policymakers to liberalize foreign trade further. The average tariff rate declined (MFN) significantly from 3.66 % in 2011 to 1.21% in 2016, showing a net decline of 66.93 % (Elisabeth, 2019). These visible steps taken by the Bruneian policymakers are a clear indication that they are earnest in liberalizing their economy in terms of trade openness.

This paper tries to examine the impact of trade openness on economic growth in the context of the economy of Brunei Darussalam. Although the trade-growth nexus has been extensively researched, however, it is also a fact that researchers have rarely paid attention to the economy of Brunei Darussalam. Mensah and Abekah-Koomson (2014) have investigated the impact that trade openness has on economic growth for the economy of Brunei Darussalam and they found trade openness has negatively impacted economic growth. The findings of the aforementioned study are indeed surprising as majority of countries located in Southeast Asian regions such as Cambodia, Malaysia, and Vietnam have been benefited significantly from trade openness in terms of economic growth (Mah, 2017, Makun, 2017, Su et al., 2019). The observed negative trade-growth relationship for Brunei Darussalam and positive trade-growth relationship for other economies located in the Southeast Asian region have motivated us to figure out that why trade openness

has not improved economic growth in Brunei Darussalam. If results of the current study are found to be in line with the previous study of Mensah and Abekah-Koomson (2014), then the policy implication would be to restrict foreign trade using trade restrictions. Therefore, detailed empirical investigation is needed to see whether or not trade openness is harmful to the growth of Brunei Darussalam. It is also a fact that empirical literature on the trade-growth relationship is not rich. Consequently, the current study will contribute towards the trade-growth literature slightly in the context of Brunei Darussalam. Further, unlike the previous study of Mensah and Abekah-Koomson (2014), we are also interested to highlight the impact of natural resources on economic growth as Brunei Darussalam is indeed very rich in terms of natural resources. Policymakers of Brunei Darussalam are expected to benefit from this study enormously as they would be in a better position to formulate suitable policies related to foreign trade.

The structure of the paper is as follows. Relevant literature on the trade-growth relationship is discussed in section 2. Model specification and methodology are articulated in section 3. The penultimate section includes results and discussions. The paper ends with a conclusion and implications.

2. Literature Review

Trade openness and its importance from the perspective of economic growth have been discussed and researched in the literature by many researchers over the years. For example, Intisar et al. (2020) provided evidence about the positive relationship between trade openness and economic growth. Similarly, the study of Keho (2017) also demonstrated a positive relationship between trade openness and economic growth not only in the long run but also in the short run. The observed positive relationship between trade openness and economic growth is an indication of the superiority of outward-oriented policies. There are several channels by which trade openness affects the economic growth of the host economy. Trade openness increases foreign reserves owing to increased exports, provides access to an expanded market, and further increases productivity due to which overall economic growth will be influenced (Çevik et al., 2019).

Trade openness is although important from the perspective of economic growth, however, its role may be dependent on some other factors as well. For example, Ramzan et al. (2019), used a sample of 82 countries for the period 1980-2014 and showed that the role of trade openness in the process of economic growth is dependent on the level of total factor productivity. It implies that economies with higher TFP may be in a much better position to grab the benefits of trade openness as compared to economies where total factor productivity is relatively low. Huchet-Bourdon et al. (2018) found a positive impact of high-quality exports on growth. Similarly, the role of institutions is also important for the positive trade-growth relationship.

Calderón and Fuentes (2006) pointed out that economies where institutions are strong gains more from both trade and financial openness.

Previous literature was very optimistic about the positive effect of trade on growth. For example, studies carried out by renowned and influential authors such as Dollar (1992), Sachs et al. (1995), Warner (2003), Edwards (1998) have provided significant empirical evidence about the positive trade-growth relationship. Similarly, Frankel and Romer (1999) addressed the endogeneity of trade openness and demonstrated a positive and significant impact of trade openness on growth. However, Rodriguez and Rodrik (2000) criticized the aforementioned studies on methodological and measurement grounds. Consequently, the earlier evidence about the positive trade-growth nexus turned questionable.

The criticism of Warner (2003) again showed that open developing economies grew much faster. Similarly, some other influential studies have also demonstrated that trade openness matters from improving growth. For example, Wacziarg and Welch (2008) demonstrated that from 1950 to 1998, liberalized economies achieved 1.5 percent higher economic growth after trade liberalization. Subsequent papers have also shown convincing evidence regarding the positive effects of trade openness on growth (Tahir and Azid, 2015, Tahir and Khan, 2014). Moreover, Adeel-Farooq et al. (2017) also demonstrated a positive and significant relationship between trade openness and economic growth. The evidence provided in the aforementioned studies about the trade-growth nexus is clear and comprehensive.

In the Asian context, some of the researchers have carried out comprehensive studies to study the relationship of trade openness with economic growth. For example, Tahir and Khan (2014) have utilized data for the period 1990-2009 for 22 developing countries and provided evidence in favor of a positive and significant impact of trade openness on economic growth. It implies that the adoption of open trade policies will contribute to the growth process of developing countries. Similarly, some of the researchers have focused on individual economies to investigate the impact of trade openness on growth. Utilizing data for the Chinese economy for the period 1975-2009, Hye et al. (2016) have demonstrated that trade openness has improved economic growth both in the short and long run. Moreover, the studies of Chatterji et al. (2014) and Makun (2017) highlighted a positive impact that trade openness has on the economic growth of Indian and Malaysian economies respectively.

Specifically, in the context of Brunei Darussalam Mensah and Abekah-Koomson (2014) have carried out a time-series study and reported that trade openness has adversely affected economic growth. The current study, therefore, uses updated data and comprehensive tools of analysis to explore the potential influence that trade openness has on economic growth. If real trade openness turns out harmful for growth, then the

policy implication would be to restrict foreign trade using trade restrictions. On the other hand, if trade openness turns out an important contributor to growth, then policymakers would be suggested to liberalize foreign trade extensively. Therefore, this study will contribute to the literature on Brunei Darussalam enormously.

3. Methodology

3.1 Data collection and transformation

The data for the period 1989 to 2018 for the economy of Brunei Darussalam was retrieved from the "World Bank Indicators" (WDI, hereafter) and the Penn World Tables (PWT, hereafter). Real GDP and human capital are extracted from PWT while statistics on trade openness, investment, and natural resources are obtained from WDI. The objective of this article is to test the impact of trade openness and economic growth. There is sound literature support regarding about the trade-growth relationship (Intisar et al., 2020, Keho, 2017, Çevik et al., 2019, Dollar, 1992, Frankel and Romer, 1999). Although, the core objective of the paper is to the trade-growth nexus, however, other factors are also important from improving growth. For example, Bal et al. (2016) demonstrated a positive relationship between domestic investment and growth and pointed out that increased investment is necessary for maintaining higher growth. Similarly, Kartal et al. (2017) showed that human capital impacts economic growth positively and documented that it matters for economic development and technological advancement. Brunei Darussalam is indeed very rich in terms of its natural resources; therefore, we have also added one additional variable to capture the impact of natural resources on growth. Therefore, based on previous literature, an empirical macroeconomic model is proposed which takes into consideration the interdependence among trade openness, domestic investment, human capital, natural resources, and economic growth.

$$lnzgdp_t = b_0 + b_1 lnopen_t + b_2 lnnr_t + b_3 lnedu_t + b_4 lninv_t + U_t \quad (1)$$

Where $(lnzgdp_t)$ represents real GDP. The term $(lopenk_t)$ denotes trade openness, and it is measured as the ratio of exports plus imports to GDP. For domestic investment $(linv_t)$, "gross fixed capital formation as a ratio of GDP" is used. Human capital $(lnedu_t)$ in the economy is approximated by an index which is based on "years of schooling and returns to education". Finally, "natural resources rent as a ratio of GDP" is taken as a proxy natural resource. The ordinary disturbance term is denoted by the term (U_t) in expression 1.

3.2 Estimating framework

The first step in time series modeling is to check the unit root problem. Macroeconomic variables are non-stationary in most of the cases. Akçay and Demirhan (2005) commented that stationary variables could be

modeled in levels and granger causality tests can be used while non-stationary variables can be handled through cointegration techniques.

There are different cointegration models developed by researchers over the years for modeling non-stationary variables. Engle and WJ (1987)'s bivariate, and Johansen (1988)'s multivariate cointegration tests are suited for analyzing non-stationary time series variables. Both of the mentioned tests require that the order of integration shall be the same for all variables. However, in applied economic research, the order of integration may be mixed. In such circumstances, only the "Autoregressive Distributed Lagged Model (ARDL, hereafter)" developed by Pesaran et al. (2001) works well. The idea behind using the cointegration approach is to explore a stable long-run stationary relationship between the non-stationary variables. The ARDL approach of cointegration has been utilized widely over the years due to multiple associated benefits.

3.3 ARDL modeling

The ARDL modeling approach is a recent and effective cointegration test introduced by Pesaran et al. (2001). It has been used extensively in applied research owing to multiple benefits. Expression 1 is converted into the ARDL framework.

$$\Delta lnzgdp_t = \beta_0 + \sum_{i=1}^{n1} \beta_{1i} \Delta lnzgdp_{t-i} + \sum_{i=0}^{n2} \beta_{2i} \Delta lnopen_{t-i} + \sum_{i=0}^{n3} \beta_{3i} \Delta lnnr_{t-i} +$$
$$\sum_{i=0}^{n4} \beta_{4i} \Delta lnedu_{t-i} + \sum_{i=0}^{n5} \beta_{5i} \Delta lninv_{t-i} + \gamma_1 lnzgdp_{t-1} + \gamma_2 lnopen_{t-1} +$$
$$\gamma_3 lnnr_{t-1} + \gamma_4 lnedu_{t-1} + + \gamma_5 lninv_{t-1} + \varepsilon_t \quad (2)$$

$$\Delta lnopen_t = \beta_0 + \sum_{i=1}^{n1} \beta_{1i} \Delta lnopen_{t-i} + \sum_{i=0}^{n2} \beta_{2i} \Delta lnzgdp_{t-i} + \sum_{i=0}^{n3} \beta_{3i} \Delta lnnr_{t-i} +$$
$$\sum_{i=0}^{n4} \beta_{4i} \Delta lnedu_{t-i} + \sum_{i=0}^{n5} \beta_{5i} \Delta lninv_{t-i} + \gamma_1 lnzgdp_{t-1} + \gamma_2 lnopen_{t-1} +$$
$$\gamma_3 lnnr_{t-1} + \gamma_4 lnedu_{t-1} + + \gamma_5 lninv_{t-1} + \varepsilon_t \quad (3)$$

$$\Delta lnnr_t = \beta_0 + \sum_{i=1}^{n1} \beta_{1i} \Delta lnnr_{t-i} + \sum_{i=0}^{n2} \beta_{2i} \Delta lnzgdp_{t-i} + \sum_{i=0}^{n3} \beta_{3i} \Delta lnopen_{t-i} + \sum_{i=0}^{n4} \beta_{4i} \Delta lnedu_{t-i} +$$
$$\sum_{i=0}^{n5} \beta_{5i} \Delta lninv_{t-i} + \gamma_1 lnzgdp_{t-1} + \gamma_2 lnopen_{t-1} + \gamma_3 lnnr_{t-1} + \gamma_4 lnedu_{t-1} +$$
$$+ \gamma_5 lninv_{t-1} + \varepsilon_t \quad (4)$$

$$\Delta lnedu_t = \beta_0 + \sum_{i=1}^{n1} \beta_{1i} \Delta lnedu_{t-i} + \sum_{i=0}^{n2} \beta_{2i} \Delta lnzgdp_{t-i} + \sum_{i=0}^{n3} \beta_{3i} \Delta lnopen_{t-i} +$$
$$\sum_{i=0}^{n4} \beta_{4i} \Delta lnnr_{t-i} + \sum_{i=0}^{n5} \beta_{5i} \Delta lninv_{t-i} + \gamma_1 lnzgdp_{t-1} + \gamma_2 lnopen_{t-1} +$$
$$\gamma_3 lnnr_{t-1} + \gamma_4 lnedu_{t-1} + + \gamma_5 lninv_{t-1} + \varepsilon_t \quad (5)$$

$$\Delta lninv_t = \beta_0 + \sum_{i=1}^{n1} \beta_{1i} \Delta lninv_{t-i} + \sum_{i=0}^{n2} \beta_{2i} \Delta lnzgdp_{t-i} + \sum_{i=0}^{n3} \beta_{3i} \Delta lnopen_{t-i} + \sum_{i=0}^{n4} \beta_{4i} \Delta lnnr_{t-i} +$$

$$\sum_{i=0}^{n5} \beta_{5i} \Delta lnedu_{t-i} + \gamma_1 lnzgdp_{t-1} + \gamma_2 lnopen_{t-1} + \gamma_3 lnnr_{t-1} + \gamma_4 lnedu_{t-1} +$$

$$+\gamma_5 lninv_{t-1} + \varepsilon_t \qquad\qquad (6)$$

Expression 2-6 are the ARDL representation of expression 1. The parameters $(\beta_1 - \beta_5)$ measures the short-run relationship. Similarly, the parameters $(\gamma_1 - \gamma_5)$ associated with lagged terms captures the long-run relationships. Expressions 2-6 will be estimated through OLS. In the second step, the Wald test will be employed to obtain F-test. In the third step, the hypothesis shown below will be tested.

$$H_0: \gamma_1 = \gamma_2 = \gamma_3 = \gamma_4 = \gamma_5 = 0 \qquad\qquad (a)$$
$$H_1: \gamma_1 \neq \gamma_2 \neq \gamma_3 \neq \gamma_4 \neq \gamma_5 = 0 \qquad\qquad (b)$$

For the cointegration to be present, the F-test value should exceed the upper bound critical value endorsed by (Narayan and Smyth, 2006). Similarly, the presence of cointegration will not be accepted if the F-test value is less than the lower bound critical value. Lastly, if the F-test value does not exceed the upper bound but is greater than the lower bound, evidence regarding cointegration would be termed as inconclusive.

4.Estimation Results

4.1 Descriptive statistics

Before moving to the analysis, in this section, we have provided descriptive statistics. Data is averaged for the selected variables for the entire period. According to the statistics provided, it is observed that the real GDP of Brunei is 20567.31 (in mil. 2011 US $) with the standard deviation of 6860.19. The trade openness index is quite reasonable as it is more than 100 on average. It implies that the policies of Brunei Darussalam have adopted relatively liberalized policies. Similarly, domestic investment is 24.838 percent of GDP on average with the maximum and minimum values of 41.314 and 10.464 percent respectively. Human capital has a value of 2.629 with a minimum and maximum values of 2.392 and 2.774 respectively. The standard deviation is witnessed to be 0.100. Finally, natural resources rent which is expressed as a percentage of GDP is on average 24.260 with a standard deviation of 6.567. The maximum and minimum values of rents are observed as 38.373 and 13.287 respectively.

Table 1: Descriptive Statistics

	ZGDP	OPENK	INV	EDU	NR
Mean	20567.31	102.396	24.838	2.629	24.260
Median	20341.87	103.695	23.394	2.634	22.486
Maximum	31870.57	120.574	41.314	2.774	38.373
Minimum	11678.19	84.897	10.465	2.392	13.287
Std. Dev.	6860.252	8.516	9.785	0.1001	6.567
Observations	30	30	30	30	30

Note: Authors own calculations

4.2 Unit root

To explore the unit root, the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are used. Both the tests assume the unit root problem under the null hypothesis. Table 2 includes results for the aforementioned tests.

Table 2 Unit root results

Variables	ADF Test		PP Test		Decision
	Level	First Difference	Level	First Difference	
$lnzgdp_t$	-1.522	-5.419***	-1.509	-5.420***	I(1)
$lnopenk_t$	-4.010**	-4.872***	-3.987**	-5.534***	I(0)
$lnedu_t$	-6.572***	-2.698*	-5.887***	-2.735*	I(0)
$linv_t$	-1.205	-4.366***	-1.495	-4.351***	I(1)
$lnnr_t$	-2.400	-5.654***	-2.026	-5.866***	I(1)

Note: Where (***), (**) and (*) represents 1 percent, 5 percent and 10 percent level of significance. Lag orders used in tests are selected automatically according to Akaike Information Criterion (AIC) and Schwarz Information Criterion (SIC).

The ADF and PP tests have confirmed the unit root problem associated with real GDP, domestic investment, and natural resources at the level. Similarly, trade openness and education are stationary at a level based on the ADF and PP tests. However, the non-stationary variables turned stationary by taking the first difference.

Both ADF and PP tests demonstrated that the chosen variables have a different order of integration. The mixed integration order of variables has motivated us to adopt the ARDL approach, framework of cointegration, as the Johansen test cannot be used in the present situation.

4.3 Bound testing results

We have estimated the unrestricted error correction model in the ARDL framework. All variables are treated as dependent step by step. The results are provided in the following Table 3.

Table 3 The bound testing

Dependent Variables	F-test	Decision
F (LNZGDP/LNOPENK, LNEDU, LNINV, LNNR)	10.044	Co-integrated
F (LNOPENK/LNZGDP, LNEDU, LNINV, LNNR)	3.707	Not Co-integrated
F (LNEDU/LNZGDP, LNOPENK, LNINV, LNNR)	4.202	Co-integrated
F (LNINV/LNZGDP, LNOPENK, LNEDU, LNNR)	1.659	Not Co-integrated
F (LNNR/LNZGDP, LNOPENK, LNEDU, LNINV)	6.340	Co-integrated
Critical Values	Lower Bound I (0)	Upper Bound I (1)
1 %	(4.40)	(5.72)
5 %	(3.47)	(4.57)
10 %	(2.03)	(4.06)

Note: Author's calculation from EViews

Table 3 reports the results of the cointegration test. The null hypothesis of the absence of cointegrating can be rejected for the equations where economic growth and natural resources are treated as dependent variables, as the calculated F-test value is higher than the critical value. Similarly, a weak cointegrating relationship at a 10 percent level is observed for the equation where human capital is used as a dependent variable. Lastly, the presence of a cointegration relationship is rejected in the expressions where trade openness and domestic investment are treated as dependent variables.

After, confirming the presence of cointegration based on the ARDL approach, in the next step, the "error correction model" (ECM, hereafter) is estimated. There are two purposes of estimating the ECM. Firstly, it helps to investigate the short-run dynamics. Secondly, the ECM also provides information about the speed of adjustment of the model. Keeping in mind the benefits, we have specified the following ECM models.

$$\Delta lnzgdp_t = \beta_0 + \sum_{i=1}^{n1}\beta_{1i}\Delta lnzgdp_{t-i} + \sum_{i=0}^{n2}\beta_{2i}\Delta lnopen_{t-i} + \sum_{i=0}^{n3}\beta_{3i}\Delta lnnr_{t-i} +$$
$$\sum_{i=0}^{n4}\beta_{4i}\Delta lnedu_{t-i} + \sum_{i=0}^{n5}\beta_{5i}\Delta lninv_{t-i} + \gamma_1 ECT_{t-1} + \varepsilon_t \quad (7)$$

$$\Delta lnopen_t = \beta_0 + \sum_{i=1}^{n1}\beta_{1i}\Delta lnopen_{t-i} + \sum_{i=0}^{n2}\beta_{2i}\Delta lnzgdp_{t-i} + \sum_{i=0}^{n3}\beta_{3i}\Delta lnnr_{t-i} +$$
$$\sum_{i=0}^{n4}\beta_{4i}\Delta lnedu_{t-i} + \sum_{i=0}^{n5}\beta_{5i}\Delta lninv_{t-i} + \gamma_2 ECT_{t-1} + \varepsilon_t \quad (8)$$

$$\Delta lnnr_t = \beta_0 + \sum_{i=1}^{n1}\beta_{1i}\Delta lnnr_{t-i} + \sum_{i=0}^{n2}\beta_{2i}\Delta lnzgdp_{t-i} + \sum_{i=0}^{n3}\beta_{3i}\Delta lnopen_{t-i} + \sum_{i=0}^{n4}\beta_{4i}\Delta lnedu_{t-i} +$$
$$\sum_{i=0}^{n5}\beta_{5i}\Delta lninv_{t-i} + \gamma_3 ECT_{t-1} + \varepsilon_t \quad (9)$$

$$\Delta lnedu_t = \beta_0 + \sum_{i=1}^{n1}\beta_{1i}\Delta lnedu_{t-i} + \sum_{i=0}^{n2}\beta_{2i}\Delta lnzgdp_{t-i} + \sum_{i=0}^{n3}\beta_{3i}\Delta lnopen_{t-i} +$$
$$\sum_{i=0}^{n4}\beta_{4i}\Delta lnnr_{t-i} + \sum_{i=0}^{n5}\beta_{5i}\Delta lninv_{t-i} + \gamma_4 ECT_{t-1} + \varepsilon_t \quad (10)$$

$$\Delta lninv_t = \beta_0 + \sum_{i=1}^{n1}\beta_{1i}\Delta lninv_{t-i} + \sum_{i=0}^{n2}\beta_{2i}\Delta lnzgdp_{t-i} + \sum_{i=0}^{n3}\beta_{3i}\Delta lnopen_{t-i} + \sum_{i=0}^{n4}\beta_{4i}\Delta lnnr_{t-i} +$$
$$\sum_{i=0}^{n5}\beta_{5i}\Delta lnedu_{t-i} + \gamma_5 ECT_{t-1} + \varepsilon_t \quad (11)$$

In all expressions (7-11), the term (ECT_{t-1}) denotes the error correction term, and its coefficient captures the speed of adjustment. All other variables in the above expressions are already defined.

4.4 Results and analysis

Findings are demonstrated in the following Table 4. The upper and lower portions of Table 4 include the long-run and short-run results, respectively.

Table 4 Long and Short run Results

Variables	Coefficients	Standard Errors	T-test
Long run			
$lnopenk_t$	0.739***	0.295	2.502
$lnedu_t$	-10.681***	2.700	-3.955
$linv_t$	0.191***	0.036	5.253
$lnnr_t$	0.978***	0.068	14.246
Shor run			
$\Delta lnopenk_t$	0.206	0.209	0.987
$\Delta lnedu_t$	-13.361***	3.626	-3.684

$\Delta linv_t$	0.022	0.056	0.398
$\Delta lnnr_t$	0.723***	0.071	10.065
ECT (-1)	-1.250***	0.170	-7.318

D.W Test: 2.011

Adj R2: 0.981

Note: The asterisk (***) stands for 1 percent significance level.

Results show that trade openness has positively impacted economic growth in the long run. In other words, trade openness has influenced positively the growth of Brunei Darussalam. The positive trade-growth relationship observed is in line with previous studies (Frankel and Romer, 1999, Tahir and Azid, 2015). Therefore, it is suggested that policymakers of Brunei Darussalam shall focus on outward-oriented policies to gear up the growth process. The coefficient value of trade openness indicated that its contribution towards the economy of Brunei Darussalam is second highest after natural resources.

The results also highlighted that natural resources have accelerated economic growth. Natural resources are crucial from the perspective of economic growth as they can be used domestically and can also be exported to other countries to increase foreign reserves. In terms of magnitude, the results revealed that the impact of natural resources on growth is highest as compared to all other determinants. The positive effect of natural resources on growth is an indication of the presence of a resource-blessing hypothesis in Brunei Darussalam. However, in the long-run, economic diversification needs to be promoted as single resource-dependent countries are very vulnerable to external shocks.

Domestic investment has a significant positive coefficient. The findings are in line with the findings of (Barro, 2003). Domestic investment is the main determinant of growth; therefore, policymakers are suggested to encourage it further by introducing various incentives for investors. Increased investment will also help the policymakers to diversify the economy.

Moreover, the findings indicated a negative impact running from human capital to growth. Human capital has influenced growth negatively and significantly according to results. There is ample evidence about the positive role of human capital from the growth perspective. Therefore, it is hard to find an explanation for the observed relationship between human capital and growth. However, it is possible that the quality of education may not be sufficient to produce the essential skills required for improving economic growth (Altinok, 2007). Further, the impact of human capital on growth may be non-linear (Tahir and Azid, 2015). It implies that current human capital stock may improve economic growth in the future. Therefore, in such circumstances, the impact of human capital on growth may be negative. Pelinescu (2015) also reported a

negative relationship between human capital and economic growth for 28 economies for the period 2002-2012. Moreover, Hanushek and Woessmann (2010) endorsed that cognitive skills instead of only school attainment are important from growth perspective. Further, they argued that quality education matters for the long run growth but at the same time it needs patience.

The short-run findings demonstrated in the bottom portion of Table 4. According to findings, natural resources have positively impacted economic growth while human capital has influenced economic growth negatively like the long-run results. Moreover, trade openness and domestic investment have lost their significance in the short run, while the signs of their coefficients remain the same. It implies that both trade openness and domestic investment flourish growth in the long run. Hence in the short-run, their impacts may be marginal.

The coefficient of the error correction term is negative and significant, which is desirable. Usually, the coefficient of error correction term ranges from 0 to 1. However, in our case, the coefficient value of error correction exceeds one, which means that it is not converging monotonically. Narayan and Smyth (2006) have also found the error correction term more than unity and documented that it fluctuates in a dampening manner instead of monotonical convergence.

4.5 Diagnostics testing

In this section, we have focused our attention to carry out some diagnostic testing. For this purpose, serial correlation, heteroscedasticity, normality, and the functional form of the model are examined using appropriate tests. Table 5 includes results.

Table 4 Diagnostic checking

Diagnostics	Null Hypothesis	F-Statistic	Conclusion
LM Test	H_0: No Serial Correlation	0.007 (0.992)	Don't reject H_0
ARCH	H_0: Homoskedasticity	0.280 (0.601)	Don't reject H_0
White Test	H_0: Homoskedasticity	1.383 (0.278)	Don't reject H_0
Normality	H_0: Residuals are normally distributed	1.289 (0.524)	Don't reject H_0
Ramsey Test	H_0: Functional form is correct	0.0009 (0.976)	Don't reject H_0

Diagnostic tests presented in Table 5 confirmed the validity of the estimated models. Serial correlation and heteroscedasticity are absent from the estimated models as the corresponding LM and White test are

statistically insignificant. Moreover, the data used is as shown by the Jarque-Bera test and its associated probability. Finally, the functional form is correct as the Ramsey test is not significant statistically.

4.6 Residual stability

After confirming the validity of estimated models through various diagnostic tests, we have also examined the stability of the residuals with the CUSUM and the square of CUSUM tests. Their graphical representation is given below in Figure 1 and 2, respectively.
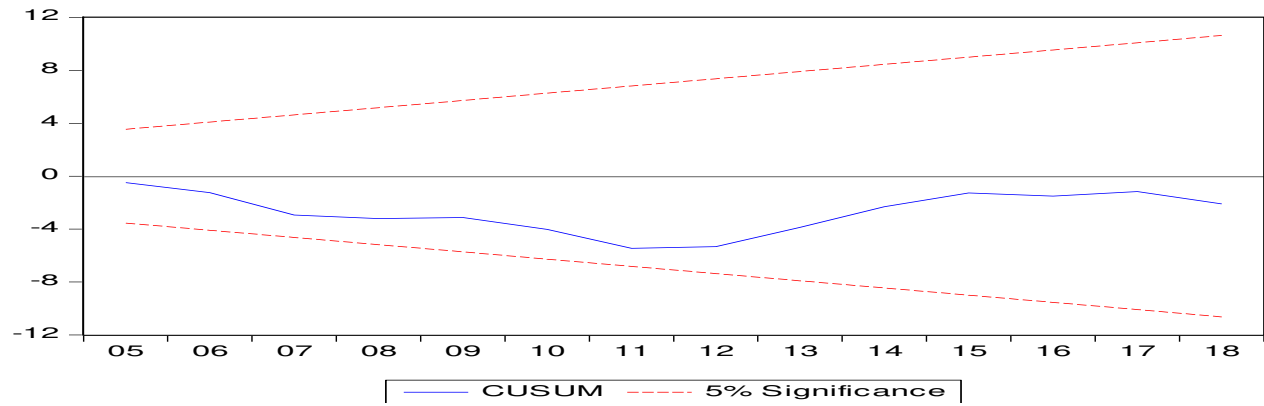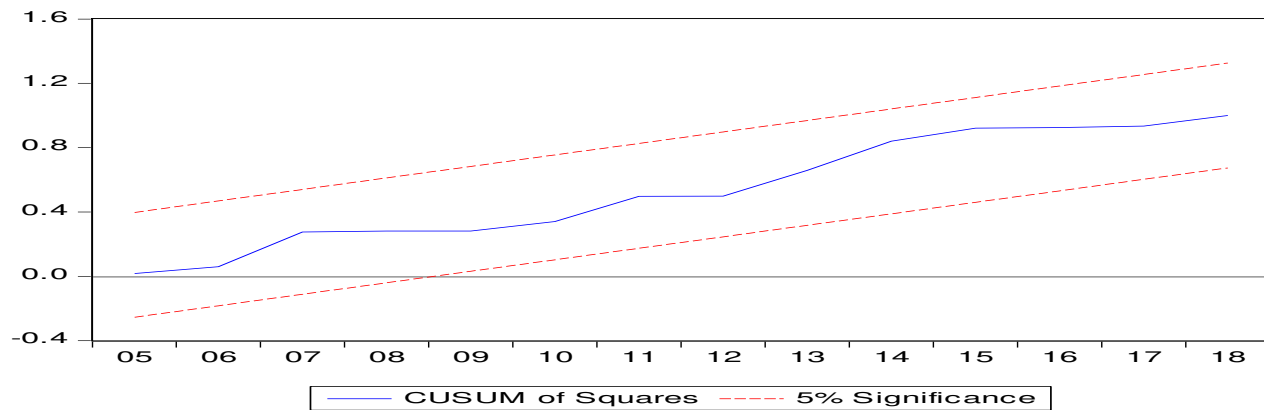
Figure 1: CUSUM Test

Figure 2 Square of CUSUM Test

The CUSUM and square of CUSUM tests reported in Figure 1 and 2 indicated that the residuals of the estimated models are stable. The blue lines in both figures are lying within the critical lines. Therefore, we conclude that the residuals of estimated models are stable.

5. Conclusion and Implications

5.1 Conclusion

This paper tried to explore the impact that trade openness has on economic growth for the Brunei Darussalam. Time-series observations from 1989 to 2018 are collected from internationally reliable

sources. The ARDL modeling framework is employed to examine the long-run influence of trade openness on economic growth.

The results show that trade openness has positively and significantly influenced the economic growth of Brunei Darussalam. Policymakers, therefore, are required to speed up the process of trade liberalization from the perspective of long-run economic growth. Increased trade liberalization will push the economy of Brunei on the desired path of growth. Similarly, natural resources have also impacted economic growth positively. Domestic investment which has been considered as the driver of growth in the previous literature has also flourished the growth of Brunei Darussalam both positively. The significant role of investment in the growth process is the indication that economic diversification has been the priority of policymakers.

Further, we found that education has a negative on growth of Brunei Darussalam. In the short run, results indicated that openness and domestic investment have lost their significance level, confirming that they are the long-run drivers of growth. Finally, in the short run, natural resources and human capital have maintained their impacts with growth.

5.2 Recommendations

Based on results obtained through comprehensive analysis, we suggest the following points to policymakers for consideration.

1) Trade openness appeared as the main factor of growth. It is the indication that policymakers have formulated and exercised open trade policies over the years. Based on our findings, we suggest policymakers to gear up the trade liberalization. Increased trade liberalization would help the Bruneian economy in terms of economic growth remarkably.

2) Domestic investment has flourished economic growth as indicated by findings. Therefore, Bruneian policymakers are suggested to encourage domestic investment in the economy by giving investors some attractive incentives. Increased investment in the economy will flourish the growth process of the Bruneian economy.

3) The results provided sound evidence about the positive influence that natural resources have on growth. However, it is also a fact that economic diversification is the way forward for resource-rich economies. Bruneian policymakers are, therefore, suggested to take some steps for the economic diversification.

4) Human capital has impacted economic growth negatively which implies that policymakers need to re-think their existing policies. In the long run, only educational quality instead of school attainment

matters from a growth perspective. Consequently, efforts should be made to improve the essentials skills through increased investment in education so that to enhance growth.

5.3 Limitations

The first limitation of the current study is that the time dimension is not very long. Secondly, the estimated model only includes four determinants of economic while it is a fact that economic growth is dependent on several factors. Moreover, the results of the study are only valid for the economy of Brunei Darussalam and hence generalization of results may not be possible.

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