

Natural resources and economic growth: evidence from Brunei Darussalam

Natural resources and economic growth

Muhammad Tahir

Management Sciences, COMSATS University Islamabad, Abbottabad Campus, Abbottabad, Pakistan

Umar Burki

University of South-Eastern Norway, Kongsberg, Norway and Department of Economics and Administration, New Oslo University College, Oslo, Norway, and

Arshad Hayat

International Business, Metropolitan Univerzita Praha ops, Praha, Czech Republic

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Abstract

Purpose – This paper explores the relationship between natural resources and economic growth of Brunei Darussalam, an underresearched area in the available literature.

Design/methodology/approach – Annual data are sourced from reliable sources for the period 1989–2020. Appropriate cointegration techniques for time series data are employed to estimate the specified models and extract results.

Findings – The results provide evidence about the positive and significant role that natural resources have played in the economic growth of Brunei Darussalam. Similarly, trade openness and domestic investment have also positively and significantly impacted the long-run economic growth. On the other hand, the impacts of government expenditure and the growth of human capital on economic growth are although positive but insignificant statistically in the long run. The short-run results show that natural resources, government expenditures and domestic investment have influenced economic growth both positively and significantly. Moreover, the positive and significant impact of trade openness on economic growth, which was observed in the long run, turned negative and insignificant in the short run. Finally, the insignificant positive relationship between the growth of human capital and economic growth observed in the long run remained the same in the short run.

Originality/value – This paper studies the resource curse hypothesis for Brunei Darussalam for the first time, and therefore, the findings will be of significant interest for policymakers and researchers.

Keywords Natural resources, Economic growth, Brunei Darussalam, ARDL, Resource curse

Paper type Research paper

1. Introduction

Brunei Darussalam is a resource-rich economy in Southeast Asia, mainly surrounded by the South China Sea but also sharing a land border with Malaysia. According to the [Department of Statistics \(2020\)](#), the gross domestic product in current prices as of 2019 was Brunei Dollar (BND) 18,375m, while per capita GDP was BND 39,989.1. The economy of Brunei Darussalam has shown stability over the years, as is shown by the low inflation rate – a key indicator of macroeconomic stability – of 0.5%. Brunei Darussalam is hugely dependent on natural resources. According to the [IMF \(2019\)](#), in 2018, the oil and gas sector contributed 58% of GDP, 81% of total government revenue and 95% of exports. Youth unemployment is the major issue faced by policymakers, having increased to 28.9%, the highest of any nation in the ASEAN and Gulf region ([IMF, 2019](#)). Overall, the performance of the economy of Brunei Darussalam is satisfactory even though some problems persist.

Several different factors could explain the satisfactory growth of the economy of Brunei Darussalam over the years. For instance, [Anaman \(2004\)](#) empirically showed that exports



and the relative size of the government are the key drivers of economic growth. Brunei Darussalam is blessed with extensive natural resources and policies related to foreign trade are largely open and liberalized (Tahir and Hayat, 2020). Similarly, Mensah and Abekah-Koomson (2014) suggested that the economy of Brunei Darussalam has grown steadily and slowly for the last 50 years primarily because of its huge oil and gas reserves.

The relationship between natural resources and economic growth is not straightforward as the available empirical literature is largely inconclusive and ambiguous due to contradictory findings. The resource curse hypothesis – extensively debated and researched in the literature – proposes that nations with vast natural resources can still experience poor economic performance. Frankel (2012) proposed that poor economic performance is possible due to the undesirable impacts associated with a reliance on natural resources and dubbed the phenomenon “the natural resource curse.” Havranek (2016) highlighted the same point and documented that about 40% of articles that had studied the linkages between an abundance of natural resources and economic growth indicated a negative impact, 20% saw a positive impact and 40% no impact at all. Moshiri and Hayati (2017) found the relationship between natural resources and economic growth to be positive. They clarified their findings by stating that the impact of natural resources on economic growth is dependent on both the type of natural resource and the quality of national institutions. A recent study by Hayat and Tahir (2021) provides evidence about the positive impact of natural resources and economic growth for UAE, Saudi Arabia and Oman. On the contrary, Sachs and Warner (1995) showed that resource-rich economies have experienced relatively slow economic growth. Busse and Gröning (2013) pointed out that natural resource exports have increased corruption. Kwakwa *et al.* (2021) argued that natural resources generally promote economic growth. In contrast, Rahim *et al.* (2021) provided evidence in favor of resource curse hypothesis for the emerging Next Eleven (N-11) nations using data from 1990 to 2019. These contradictory findings indicate that the resource curse hypothesis is not universally accepted, and hence, while it may be relevant for some economies, it may have little impact on others.

Brunei Darussalam is a resource-rich economy, and therefore, an investigation of the resource curse hypothesis is necessary (Tahir and Hayat, 2020). Therefore, in this paper, we explore the relevance of the resource curse hypothesis to Brunei Darussalam. Secondly, we are also interested in providing empirical evidence for the potential determinants of economic growth in this underresearched country. The scant research that is available focuses on the impact of trade liberalization (Tahir and Hayat, 2020; Mensah and Abekah-Koomson, 2014). This lack of research in the context of Brunei Darussalam is another key motivation for the current study.

This paper contributes to the literature in three ways. Firstly, it focuses on the economy of Brunei Darussalam to investigate the rarely researched relationship between an abundance of natural resources and economic growth in that country. Secondly, by focusing on an individual economy, the paper resolves the problem of results generalization found in cross-sectional studies (Hayat and Tahir, 2021). Thirdly, the available empirical literature remains ambiguous on the relationship between natural resources and economic growth. For example, the studies by Haseeb *et al.* (2021) and Rahim *et al.* (2021) provided radically different (both positive and negative, respectively) findings on the association between natural resources and economic growth. Therefore, fresh empirical evidence is required to shed further light on the resource curse hypothesis and contribute to the literature on economic growth in Brunei Darussalam, while also providing new perspectives for policymakers.

The organization of the remaining article as follows. Section 2 provides some brief commentary on the theoretical and empirical literature; the third section presents the model design and estimation techniques; the fourth section discusses the results; and finally, we make some concluding remarks, including the implications of this work, its limitations and some potential avenues for future research.

2. Theoretical and empirical literature review

Natural resources and their potential impact on economic growth have been researched by many scholars. Both researchers and policymakers are keenly interested in the possible positive relationship between natural resources and economic growth. Many economists believe that having significant natural resources is essential for long-run economic growth (Haseeb *et al.*, 2021) as this is a key ingredient in production processes and accelerates the speed of development. The presence of natural resources ensures lower per unit costs for resource-rich economies, enabling them to earn significant foreign reserves through the production and export of surplus production. Hayat and Tahir (2021) support the notion that resource-rich economies see an increase in economic activities across different sectors of the economy in a mutually self-stimulating process that provides opportunities for economies of scale. Ibrahim (2017) pointed out that the existence of natural resources increases outputs but at the same time accelerates the depletion rate, illustrating that too much dependence on natural resources may not be a wise strategy. Epo and Faha (2020) argued that the growth and development of Australia, Scandinavia and the USA during the 19th century and early half of the 20th century could be explained by their abundant natural resources, but the positive contribution of natural resources to the process of economic growth largely disappeared in the second half of 20th century.

The relationship between natural resources and economic growth is a controversial issue even in empirical literature (Daniele, 2011). There are two major schools of thought about the relationship. The first school believes that natural resources are a hurdle for the economic growth of resource-rich countries, while the second group argues the diametric opposite: that natural resources are vital for economic growth.

Sachs and Warner (1995) demonstrated that economies with significant natural resources have experienced relatively slow economic growth. Auty (1998) mentioned the same point and agreed that resource-rich nations have not performed well economically since 1960. There could be multiple factors responsible for such outcomes. For instance, Busse and Gröning (2013) documented that natural resources are one of the main causes of increased corruption in host countries. It is an undeniable fact that corruption hampers economic growth. Basedau (2005) came to more nuanced conclusions and suggested that the resource curse is dependent on contextual variables such as country-specific and resource-specific conditions. Godwin and Chuka (2014) found that natural resources have had a negative impact on economic growth in the resource-rich country of Nigeria. Ibrahim (2017) opined that natural resources play a vital role in production processes and, as a result, enhance economic growth.

Natural resources clearly have important implications, especially in developing countries. They determine the wealth of such economies and can play an important role in enhancing fiscal revenue, incomes and the reduction of poverty (OECD, 2011). Mohamed (2020) highlighted such outcomes and empirically demonstrated a positive impact of natural resources on the economic growth of Sudan for the period 1970–2015. Moreover, Alexeev and Conrad (2009) found that natural resources had a positive impact on long-run economic growth. Finally, the recent study by Hayat and Tahir (2021) also provided evidence about the absence of the resource curse hypothesis in the UAE, Oman and Saudi Arabia by conducting a time series analysis.

Brunei Darussalam is blessed with abundant natural resources. According to the ASEAN business guide report (KMPG, 2018), the hydrocarbon industry is contributing significantly to the country's wealth. However, empirical literature is scant on the impact of natural resources on economic growth for Brunei Darussalam. Two recent studies on Brunei Darussalam investigated the driving forces of economic growth in the country with a principle focus on trade liberalization (Tahir and Hayat, 2020; Mensah and Abekah-Koomson, 2014). We have attempted to estimate the potential relationship between natural resources and economic growth in the country and then consider the policy implications in this paper.

This brief review has highlighted the fact that literature has ignored the Brunei Darussalam, which is resource-rich country. In other words, there is a gap in the literature as far as the resource-rich economy of Brunei is concerned. The prime motivation for focusing on Brunei Darussalam is the lack of empirical evidence on the potential impact of natural resources on economic growth, even though it has abundant natural resources. We expect that the policymakers of Brunei Darussalam will consider the results of this study when formulating appropriate policies related to the natural resource sector and economic growth.

3. Modeling and methodology

3.1 Specification of the model

Natural resources comprise the main independent variable while economic growth is the dependent variable. However, the previous literature has made it clear that economic growth is a complex process and depends on multiple factors. Therefore, we have tried to include all the relevant determinants of economic growth in our model to provide robust and comprehensive evidence about the determinants of economic growth in Brunei Darussalam with the main focus on natural resources. Human capital and physical capital are both key drivers of economic growth, and hence, they must be included in any growth-accounting framework (Barro, 2003; Marquez-Ramos and Mourelle, 2019). Moreover, open trade policies are also important for economic growth (Sachs and Warner, 1995; Edwards, 1998), as no economy in the world is self-sufficient. Finally, the role of government is also necessary to consider as it influences overall economic activities through different projects and channels. Dudzevičiūtė *et al.* (2018) showed that government expenditures are positively associated with economic growth. Based on these factors, the research hypotheses of the study are now presented:

- H1. Natural resources are positively linked with economic growth.
- H2. Human capital is positively linked with economic growth.
- H3. Domestic investment is positively linked with economic growth.
- H4. Trade openness is positively linked with economic growth.
- H5. Government expenditure is positively related to economic growth.

Economic growth could also be impacted by various other factors; however, these are not considered due to the limited time dimension of the study. The following model is specified for the empirical analysis.

$$EGR_t = \beta_0 + \beta_1 LNNR_t + \beta_2 GEDU_t + \beta_3 LNINV_t + \beta_4 LNOPEN_t + \beta_5 LNGEX_t + U_t \quad (1)$$

In equation (1), economic growth is measured by the growth rate of GDP per capita (constant prices). Total natural resources rent as a percentage of GDP is used for measuring natural resources, which is consistent with literature (Mohamed, 2020; Tahir and Hayat, 2020). Natural resources rent is basically calculated as the sum of oil rents, gas rents, coal rents, mineral rents and forest rents (Ben-Salha *et al.*, 2018). Gross fixed capital formation is used for measuring domestic investment, also in line with the previous literature (Tahir and Azid, 2015). General government final consumption expenditures (% of GDP) are utilized as a proxy for government expenditures (Chobanov and Mladenova, 2009). Similarly, again following previous literature (Tahir *et al.*, 2019), trade as a ratio of GDP is taken as a measure of trade openness. Finally, human capital is measured by the indicator "School enrollment, secondary (% gross)." Information on data sources and variables construction is provided in Appendix.

3.2 Estimation methods

The data collected from the World Development Indicators for the estimation of model 1 is a time series, as it varies over time. Time series data are usually nonstationary, and therefore, the problem of unit root exists. The very first step in dealing with time series data modeling is to explore whether the variables under consideration are stationary or not. It has been already acknowledged by the researchers that the statistical properties of ordinary least squares (OLS) are only valid when variables are stationary. If the underlined data are nonstationary, then the OLS estimator is not recommended for the estimation as the obtained results would be spurious (Tahir, 2020; Tahir and Hayat, 2020). The OLS estimator requires the variables to be stationary, which is rare in time series models. Using the OLS estimator with nonstationary data would not produce results that could be useful for policymaking due to its unreliability.

The recommended procedure for dealing with nonstationary time series data is to utilize the cointegration approach. There are several procedures of cointegration that are available for handling nonstationary variables. Granger (1988) proposed a cointegration procedure that works well in situations where an investigation of a relationship between two nonstationary variables is required. The Johansen (1988) is another multivariate approach of cointegration that is suitable for handling more than two nonstationary variables. Both the Granger and Johansen approaches require the chosen variables to have a unit root problem at level and no unit root problem at first difference. Some situations arise where the order of the integration of variables differs. In such an eventuality, both the Granger (1988) and Johansen (1988) approaches cannot be utilized, as both require the variables to be nonstationary at level and stationary at first difference. Recently, Pesaran *et al.* (2001) proposed an alternative testing procedure for cointegration, known as the Autoregressive Distributed Lagged Model (ARDL) that can be used in situations where the order of integration of the variables is not the same.

3.3 The ARDL modeling

The ARDL modeling proposed by Pesaran *et al.* (2001) has been used extensively owing to its benefits. The ARDL model is generally effective when the time dimension is not very long and can also handle variables that have a diverse order of integration. Equation (1) is converted into the ARDL framework as follows in the light of the previous literature (Ahmad *et al.*, 2019; Tahir, 2020).

$$\begin{aligned} \Delta EGR_t = & \beta_0 + \sum_{i=1}^{n1} \beta_{1i} \Delta EGR_{t-i} + \sum_{i=0}^{n2} \beta_{2i} \Delta LNNR_{t-i} + \sum_{i=0}^{n3} \beta_{3i} \Delta GEDU_{t-i} \\ & + \sum_{i=0}^{n4} \beta_{4i} \Delta LINV_{t-i} + \sum_{i=0}^{n5} \beta_{5i} \Delta LNOPEN_{t-i} + \sum_{i=0}^{n6} \beta_{6i} \Delta LNGEX_{t-i} \\ & + \gamma_1 EGR_{t-1} + \gamma_2 LNNR_{t-1} + \gamma_3 GEDU_{t-1} + \gamma_4 LNINV_{t-1} + \gamma_5 LNOPEN_{t-1} \\ & + \gamma_6 LNGEX_{t-1} + \varepsilon_t \end{aligned} \quad (2)$$

$$\begin{aligned} \Delta LNNR_t = & \beta_0 + \sum_{i=1}^{n1} \beta_{1i} \Delta LNNR_{t-i} + \sum_{i=0}^{n2} \beta_{2i} \Delta EGR_{t-i} + \sum_{i=0}^{n3} \beta_{3i} \Delta GEDU_{t-i} \\ & + \sum_{i=0}^{n4} \beta_{4i} \Delta LINV_{t-i} + \sum_{i=0}^{n5} \beta_{5i} \Delta LNOPEN_{t-i} + \sum_{i=0}^{n6} \beta_{6i} \Delta LNGEX_{t-i} \\ & + \gamma_1 EGR_{t-1} + \gamma_2 LNNR_{t-1} + \gamma_3 GEDU_{t-1} + \gamma_4 LNINV_{t-1} + \gamma_5 LNOPEN_{t-1} \\ & + \gamma_6 LNGEX_{t-1} + \varepsilon_t \end{aligned} \quad (3)$$

$$\begin{aligned} \Delta GEDU_t = & \beta_0 + \sum_{i=1}^{n1} \beta_{1i} \Delta GEDU_{t-i} + \sum_{i=0}^{n2} \beta_{2i} \Delta LNNR_{t-i} + \sum_{i=0}^{n3} \beta_{3i} \Delta EGR_{t-i} \\ & + \sum_{i=0}^{n4} \beta_{4i} \Delta LINV_{t-i} + \sum_{i=0}^{n5} \beta_{5i} \Delta LNOPEN_{t-i} + \sum_{i=0}^{n6} \beta_{6i} \Delta LNGEX_{t-i} \\ & + \gamma_1 EGR_{t-1} + \gamma_2 LNNR_{t-1} + \gamma_3 GEDU_{t-1} + \gamma_4 LINV_{t-1} + \gamma_5 LNOPEN_{t-1} \\ & + \gamma_6 LNGEX_{t-1} + \varepsilon_t \end{aligned} \tag{4}$$

$$\begin{aligned} \Delta LNINV_t = & \beta_0 + \sum_{i=1}^{n1} \beta_{1i} \Delta LNINV_{t-i} + \sum_{i=0}^{n2} \beta_{2i} \Delta LNNR_{t-i} + \sum_{i=0}^{n3} \beta_{3i} \Delta GEDU_{t-i} \\ & + \sum_{i=0}^{n4} \beta_{4i} \Delta EGR_{t-i} + \sum_{i=0}^{n5} \beta_{5i} \Delta LNOPEN_{t-i} + \sum_{i=0}^{n6} \beta_{6i} \Delta LNGEX_{t-i} \\ & + \gamma_1 EGR_{t-1} + \gamma_2 LNNR_{t-1} + \gamma_3 GEDU_{t-1} + \gamma_4 LNINV_{t-1} + \gamma_5 LNOPEN_{t-1} \\ & + \gamma_6 LNGEX_{t-1} + \varepsilon_t \end{aligned} \tag{5}$$

$$\begin{aligned} \Delta LNOPEN_t = & \beta_0 + \sum_{i=1}^{n1} \beta_{1i} \Delta LNOPEN_{t-i} + \sum_{i=0}^{n2} \beta_{2i} \Delta LNNR_{t-i} + \sum_{i=0}^{n3} \beta_{3i} \Delta GEDU_{t-i} \\ & + \sum_{i=0}^{n4} \beta_{4i} \Delta LINV_{t-i} + \sum_{i=0}^{n5} \beta_{5i} \Delta EGR_{t-i} + \sum_{i=0}^{n6} \beta_{6i} \Delta LNGEX_{t-i} \\ & + \gamma_1 EGR_{t-1} + \gamma_2 LNNR_{t-1} + \gamma_3 GEDU_{t-1} + \gamma_4 LNINV_{t-1} + \gamma_5 LNOPEN_{t-1} \\ & + \gamma_6 LNGEX_{t-1} + \varepsilon_t \end{aligned} \tag{6}$$

$$\begin{aligned} \Delta LNGEX_t = & \beta_0 + \sum_{i=1}^{n1} \beta_{1i} \Delta LNGEX_{t-i} + \sum_{i=0}^{n2} \beta_{2i} \Delta LNNR_{t-i} + \sum_{i=0}^{n3} \beta_{3i} \Delta GEDU_{t-i} \\ & + \sum_{i=0}^{n4} \beta_{4i} \Delta LINV_{t-i} + \sum_{i=0}^{n5} \beta_{5i} \Delta LNOPEN_{t-i} + \sum_{i=0}^{n6} \beta_{6i} \Delta EGR_{t-i} \\ & + \gamma_1 EGR_{t-1} + \gamma_2 LNNR_{t-1} + \gamma_3 GEDU_{t-1} + \gamma_4 LNINV_{t-1} + \gamma_5 LNOPEN_{t-1} \\ & + \gamma_6 LNEGR_{t-1} + \varepsilon_t \end{aligned} \tag{7}$$

In equations (2–7), the parameters linked with the difference operators ($\beta_1 - \beta_6$) represent short-run relationships. Similarly, the parameters connected to the lagged terms ($\gamma_1 - \gamma_6$) stand for long-run relationships. After the estimation of equations (2-7), the following hypothesis will be tested to explore the long-run cointegrating relationship among the variables included in model 1.

$$H_0: \gamma_1 = \gamma_2 = \gamma_3 = \gamma_4 = \gamma_5 = \gamma_6 = 0 \tag{a}$$

$$H_1: \gamma_1 = \gamma_2 \neq \gamma_3 \neq \gamma_4 \neq \gamma_5 \neq \gamma_6 \neq 0 \tag{b}$$

In the ARDL modeling, the null hypothesis that rejects the presence of a long-run relationship will be tested against the alternative hypothesis that accepts the presence of long-run relationships. The ARDL testing is based on the *F*-test. The value of the *F*-test will be compared with the critical values proposed by Narayan (2004). The null hypothesis will be rejected if the *F*-test value is found to be greater than the critical value. Conversely, if the value

of the F -test does not exceed the critical value at lower bound, the null hypothesis will be accepted and the possibility of a cointegrating relationship will be rejected. Finally, there will be inconclusive evidence about cointegration if the value of the F -test lies between the upper and lower bound values.

4. Results and analysis

4.1 Descriptive statistics

In the first step of the analysis, descriptive statistics are depicted in [Table 1](#). The mean value of natural resources rent is 23.533% of the GDP while its standard deviation is 5.460. The maximum value of natural resources rent is 35.273% observed for the year 2006 while the minimum value of 12.758% was recorded for the year 1998. Similarly, the average value of economic growth is -0.575% , while the standard deviation is 2.109. The mean value of economic growth is negative, which indicates that the economy of Brunei Darussalam has witnessed consistent ups and downs over the years in economic activities. The maximum value of economic growth was 2.945% for the year 2006 while the minimum value of economic growth was -3.848% in 1989. The economy of Brunei Darussalam has also done well during the period being studied, as the trade openness index is more than 100% of the GDP on average. Domestic investment on average is 25.750% of GDP with a standard deviation of 10.124, which is reasonable. The highest and lowest values of domestic investment as a proportion of GDP are 41.314 and 10.465% respectively. Government expenditure averages 23.811% of GDP with maximum and minimum values of 29.867 and 17.140%. The observed statistics on government expenditure reflect the active role of the government in the economy. Finally, in terms of human capital, the economy of Brunei fares well with a remarkable gross enrollment rate at secondary school level of 87.847. The maximum and minimum values for the human capital indicator are 106.264 and 62.375, respectively.

4.2 Correlation analysis

The correlation among the variables is shown in [Table 2](#). Results of the correlation analysis indicate that all variables are moderately correlated with each other. The highest correlation of -0.698 is observed between government expenditure and natural resources. The lowest

Statistics	EGR _t	NR _t	GEX _t	INV _t	OPEN _t	EDU _t
Mean	-0.575	23.533	23.811	25.750	103.082	87.847
Maximum	2.945	35.273	29.867	41.314	120.574	106.264
Minimum	-3.848	12.758	17.140	10.465	85.176	62.375
Std. Dev.	2.109	5.460	3.336	10.124	8.087	11.663
Observations	32	32	32	32	32	32

Source(s): Authors own calculation from the data of the World Development Indicators (WDI)

Table 1.
Descriptive statistics

Variables	EGR _t	NR _t	INV _t	OPEN _t	GEX _t	GEDU _t
EGR _t	1	0.278	-0.486	0.478	-0.157	0.371
LNNR _t	0.278	1	-0.654	-0.094	-0.698	-0.018
LNINV _t	-0.486	-0.654	1	0.137	0.362	-0.208
LNOPE _t	0.478	-0.094	0.137	1	0.122	0.218
LNGEX _t	-0.157	-0.698	0.362	0.122	1	-0.052
GEDU _t	0.371	-0.018	-0.208	0.218	-0.052	1

Table 2.
Correlation analysis

correlation of -0.018 is witnessed between natural resources rent and the growth of human capital. All other variables are moderately correlated with each other. The highest correlation of 0.698 has motivated us to run the variance inflation factor (VIF) test to examine the potential multicollinearity problem. The results of the VIF test presented in [Table A3](#) (Appendix section) show that the multicollinearity problem is absent as the values of VIF are less than 5.

4.3 Stationarity check

In this section, we have attempted to examine whether the variables included in model 1 are stationary or nonstationary. For this purpose, we have employed the ADF test, used in the previous literature to explore the unit root problem. The results of the unit root are included in [Table 3](#).

The unit root results extracted with the help of the ADF test provide evidence about the mixed order of integration. The majority of the variables are stationary at first difference while trade openness and human capital are stationary at level. This mixed order of the selected variables justifies the use of the ARDL modeling approach rather than the Johansen approach.

4.4 The bound testing

The unit root results indicated that the ARDL cointegrating approach is suitable for the estimation of model 1. Appropriate lag selection is very important in ARDL framework. The lag length criteria mentioned in [Appendix Table A2](#) suggest using two lags for the ARDL estimation. Similarly, [Pesaran and Shin \(1999\)](#) and [Duasa \(2007\)](#) proposed that a maximum of two lags should be used for annual data. Following the results of aforementioned studies and the results provided in [Table A2](#) (see, [Appendix](#)), the current study uses two lags. The results of the ARDL cointegration test are shown in [Table 4](#). For the equation where economic

Variables	Level	F.D	Decision
EGR_t	-2.579	-4.219^{***}	I(1)
$GEDU_t$	-4.437^{***}	-4.807^{***}	I(0)
$LNINV_t$	-1.240	-4.621^{**}	I(1)
$LNGEX_t$	-2.391	-7.046^{***}	I(1)
$LNNR_t$	-2.921	-6.562^{***}	I(1)
$LNOPEN_t$	-4.980^{***}	-4.716^{***}	I(0)

Table 3.

Unit root results

Note(s): The asterisks (***) and (**) stand for 1 and 5% significance level

Dependent Variables	F-state	Decision
$(EGR_t/LNNR_t, GEDU_t, LNINV_t, LNOPEN_t, LNGEX_t)$	4.955	Cointegrated
$(LNNR_t/EGR_t, GEDU_t, LNINV_t, LNOPEN_t, LNGEX_t)$	13.276	Cointegrated
$(GEDU_t/LNNR_t, EGR_t, LNINV_t, LNOPEN_t, LNGEX_t)$	3.759	Cointegrated
$(LNINV_t/LNNR_t, GEDU_t, EGR_t, LNOPEN_t, LNGEX_t)$	1.279	Not Cointegrated
$(LNOPEN_t/LNNR_t, GEDU_t, LNINV_t, EGR_t, LNGEX_t)$	1.777	Not Cointegrated
$(LNGEX_t/LNNR_t, GEDU_t, LNINV_t, LNOPEN_t, EGR_t)$	1.488	Not Cointegrated
Critical Values	Lower Bound	Upper Bound
1%	3.50	4.63
5%	2.81	3.76
10%	2.49	3.38

Table 4.

Cointegration results

growth is used as the dependent variable, the F -test value is higher than the critical values at a 1% significance level. Similarly, the presence of cointegration is also accepted for the equations where natural resources and the growth of human capital are used as dependent variables. On the other hand, we conclude that there is an absence of a cointegrating relationship for the models where trade openness, investment and government expenditure stand as dependent variables. In summary, there are three cointegrating equations out of the six estimated equations.

After establishing a long-run relationship, we have specified the error correction models to explore not only the short-run relationships but also identify the speed of adjustment. The error correction models are specified in the following manner.

$$\begin{aligned} \Delta EGR_t = & \beta_0 + \sum_{i=1}^{n1} \beta_{1i} \Delta EGR_{t-i} + \sum_{i=0}^{n2} \beta_{2i} \Delta LNNR_{t-i} + \sum_{i=0}^{n3} \beta_{3i} \Delta GEDU_{t-i} \\ & + \sum_{i=0}^{n4} \beta_{4i} \Delta LINV_{t-i} + \sum_{i=0}^{n5} \beta_{5i} \Delta LNOPEN_{t-i} + \sum_{i=0}^{n6} \beta_{6i} \Delta LNGEX_{t-i} \\ & + \gamma_1 ECT_{t-1} + \varepsilon_t \end{aligned} \quad (8)$$

$$\begin{aligned} \Delta LNNR_t = & \beta_0 + \sum_{i=1}^{n1} \beta_{1i} \Delta LNNR_{t-i} + \sum_{i=0}^{n2} \beta_{2i} \Delta EGR_{t-i} + \sum_{i=0}^{n3} \beta_{3i} \Delta GEDU_{t-i} \\ & + \sum_{i=0}^{n4} \beta_{4i} \Delta LINV_{t-i} + \sum_{i=0}^{n5} \beta_{5i} \Delta LNOPEN_{t-i} + \sum_{i=0}^{n6} \beta_{6i} \Delta LNGEX_{t-i} \\ & + \gamma_2 ECT_{t-1} + \varepsilon_t \end{aligned} \quad (9)$$

$$\begin{aligned} \Delta GEDU_t = & \beta_0 + \sum_{i=1}^{n1} \beta_{1i} \Delta GEDU_{t-i} + \sum_{i=0}^{n2} \beta_{2i} \Delta LNNR_{t-i} + \sum_{i=0}^{n3} \beta_{3i} \Delta EGR_{t-i} \\ & + \sum_{i=0}^{n4} \beta_{4i} \Delta LINV_{t-i} + \sum_{i=0}^{n5} \beta_{5i} \Delta LNOPEN_{t-i} + \sum_{i=0}^{n6} \beta_{6i} \Delta LNGEX_{t-i} \\ & + \gamma_3 ECT_{t-1} + \varepsilon_t \end{aligned} \quad (10)$$

$$\begin{aligned} \Delta LNINV_t = & \beta_0 + \sum_{i=1}^{n1} \beta_{1i} \Delta LNINV_{t-i} + \sum_{i=0}^{n2} \beta_{2i} \Delta LNNR_{t-i} + \sum_{i=0}^{n3} \beta_{3i} \Delta GEDU_{t-i} \\ & + \sum_{i=0}^{n4} \beta_{4i} \Delta EGR_{t-i} + \sum_{i=0}^{n5} \beta_{5i} \Delta LNOPEN_{t-i} + \sum_{i=0}^{n6} \beta_{6i} \Delta LNGEX_{t-i} \\ & + \gamma_4 ECT_{t-1} + \varepsilon_t \end{aligned} \quad (11)$$

$$\begin{aligned} \Delta LNOPEN_t = & \beta_0 + \sum_{i=1}^{n1} \beta_{1i} \Delta LNOPEN_{t-i} + \sum_{i=0}^{n2} \beta_{2i} \Delta LNNR_{t-i} + \sum_{i=0}^{n3} \beta_{3i} \Delta GEDU_{t-i} \\ & + \sum_{i=0}^{n4} \beta_{4i} \Delta LINV_{t-i} + \sum_{i=0}^{n5} \beta_{5i} \Delta EGR_{t-i} + \sum_{i=0}^{n6} \beta_{6i} \Delta LNGEX_{t-i} \\ & + \gamma_5 ECT_{t-1} + \varepsilon_t \end{aligned} \quad (12)$$

$$\begin{aligned} \Delta LNGEX_t = & \beta_0 + \sum_{i=1}^{n1} \beta_{1i} \Delta LNGEX_{t-i} + \sum_{i=0}^{n2} \beta_{2i} \Delta LNNR_{t-i} + \sum_{i=0}^{n3} \beta_{3i} \Delta GEDU_{t-i} \\ & + \sum_{i=0}^{n4} \beta_{4i} \Delta LINV_{t-i} + \sum_{i=0}^{n5} \beta_{5i} \Delta LNOPEN_{t-i} + \sum_{i=0}^{n6} \beta_{6i} \Delta EGR_{t-i} \\ & + \gamma_6 ECT_{t-1} + \varepsilon_t \end{aligned} \quad (13)$$

Equations (8-13) are the error correction models. The last terms in equations (8–13) are the error correction terms measuring the speed of adjustment from the disequilibrium in the short run toward equilibrium in the long run. The error correction term is expected to enter the estimated models both negatively and significantly.

4.5 Discussion on the long-run and short-run results

Results are shown in Table 5 both the long and short run. The results prove that the growth performance of Brunei Darussalam is significantly dependent on the presence of natural resources. The sign of coefficient of natural resources is positive and statistically different from zero, which is in line with our prior expectations. Ibrahim (2017) rightly endorsed the idea that economic growth can be influenced positively by natural resources, as they are the key input of production. The results indicate that the resource curse hypothesis is not relevant for Brunei Darussalam. The evidence obtained in this study to disprove the resource curse hypothesis is consistent with the recent study by Hayat and Tahir (2021), who empirically rejected the presence of the resource curse hypothesis for selected countries in the Gulf Cooperation Council (GCC). On the other hand, the obtained findings are in contrast with the recent study by Rahim *et al.* (2021), who provided evidence in favor of resource curse hypothesis for the N-11 economies. The contradictory findings reported in these studies reflect the fact that the positive relationship between natural resources and economic growth is not universal. However, it is also a fact that natural resources deplete very rapidly, and the economy of Brunei Darussalam is not an exception. Therefore, it is suggested that policymakers should take some steps to reduce the dependence on natural resources and gear up a necessary process of economic diversification.

The trade liberalization policies adopted by Brunei Darussalam over the years have improved economic growth. In the estimated equation, the coefficient of trade openness is not only positive but also statistically significant, which supports previous literature (Dollar, 1992; Frankel and Romer, 1999; Tahir and Hayat, 2020). Trade openness influences economic growth by improving productivity, especially in the manufacturing sector, allows access to advanced technologies and further promotes healthy competition between companies (Tahir and Hayat, 2020). Mohamed Sghaier (2021) opined that the impact of trade openness on economic growth is more visible with advanced financial development. This implies that an advanced financial system is needed to secure the full benefits of trade openness. Policymakers in Brunei Darussalam should therefore be encouraged to speed up the trade liberalization process and also pay attention to improving the financial system in order to enhance economic growth and consequently improve the quality of life.

The results also highlight that in the long run, human capital has played an expected positive role in accelerating the growth of Brunei Darussalam. However, this relationship is

ss	Coefficients	Standard Errors	T-test
<i>Long Run</i>			
$GEDU_t$	0.038	0.184	0.209
$LNINV_t$	0.053**	0.022	2.392
$LNGEX_t$	0.140	0.090	1.555
$LNNR_t$	0.332***	0.094	3.526
$LNOPEN_t$	0.184*	0.092	2.00
Constant	5.999	1.903	3.152
<i>Short Run</i>			
$GEDU_t$	0.028	0.136	0.209
$LNINV_t$	0.039**	0.014	2.782
$LNGEX_t$	0.104*	0.051	2.025
$LNNR_t$	0.126***	0.023	5.494
$LNOPEN_t$	-0.005	0.061	-0.092
ECT_{t-1}	-0.743***	0.111	-6.674

Note(s): The asterisks (***), (**) and (*) stands for 1, 5 and 10% level of significance

Table 5.
Long-run and short-run results

not statistically significant. This insignificant but positive impact of human capital raises some concerns for policymakers. There is consensus in the literature about the positive and significant relationship between human capital and economic growth. [Bye and Faehn \(2021\)](#) highlighted the role of human capital and argued that it enhances innovative capacity through R&D expenditure and further accelerates the absorptive capacity of sectors of the economy. Both innovative and absorptive capacities are key ingredients of higher economic growth. Therefore, the positive and insignificant influence of human capital on growth in this study may be due to the presence of some nonlinearities, implying that the current high engagement with education in Brunei Darussalam may be important for economic growth in future ([Tahir and Azid, 2015](#)). Another explanation may be that the current human capital in the country is low skilled and therefore playing a less significant role in economic growth. Therefore, we recommend that policymakers introduce structural reforms in the education system to improve the skills of human capital using advanced trainings and technologies. Highly skilled human capital will accelerate the economic growth of Brunei Darussalam.

Government expenditure appeared to be positively but insignificantly linked to economic growth. The positive but insignificant impact of government expenditure on economic growth calls for a more active role for government in boosting the economy. The literature does not come to a concrete conclusion on the impact of government expenditure on economic growth, but the available evidence points to a positive impact ([Nyasha and Odhiambo, 2019](#)). It is certainly true that the role of government is important in growing the economy if it monitors all economic activities efficiently and makes policy choices to accelerate the overall growth process.

Finally, the results also show that investment significantly impacted economic growth of Brunei Darussalam. The coefficient of the investment variable is positive and statistically significant. Previous research has also supported the significant positive impact of investment on economic growth ([Adams, 2009](#); [Ullah et al., 2014](#)). Similarly, the role of investment may also be dependent on other complementary policies such as having good infrastructure, a business-friendly environment, the availability of a skilled labor force and a strong institutional framework. We suggest that policymakers take some visible steps to encourage domestic investment by fostering a business-friendly environment and through the introduction of investment incentives. Such policy changes would increase domestic investment in the economy. Consequently, economic growth would be enhanced.

The short-run results are presented in the lower half of [Table 5](#). Again, we found a positive and statistically significant impact that natural resources have on economic growth. The fact that there is a positive relationship between natural resources and economic growth in both the short and long run is a clear reflection of the absence of the resource curse hypothesis in Brunei Darussalam. In the short run, trade openness loses both its significance and sign of the coefficient indicating that trade openness is a long-run driver of economic growth. Policymakers should keep this fact in mind when formulating policies regarding foreign trade. The significant benefits associated with trade openness will only be realized in the long run.

The positive but insignificant long-run relationship between government expenditure and economic growth became significant in the short run. This implies that government expenditures are growth-enhancing in the short run and suggests the need for a more active government role in the economy. Moreover, in the short run, the relationship between investment and economic growth is significant and positive, in line with findings in the previous literature. Finally, the insignificant but positive impact of human capital on economic growth observed in the long run remained unchanged in the short run.

The error correction term included in the estimated model is both negative and significant. The coefficient of the error correction term is -0.74 , which shows that the speed of adjustment of the estimate model is 74%. The disequilibrium from the short run converts to the long-run equilibrium at the speed of 74%, which is remarkable.

4.6 Diagnostic tests

In this section, we consider the validity of the estimated models by conducting a range of different tests. The literature has highlighted a number of diagnostic tests in the ARDL framework to validate estimated models (Tahir and Hayat, 2020). Both serial correlation and heteroscedasticity are not present as both the LM test and White tests are insignificant as shown in Table 6. The normality is confirmed by the Jarque–Bera test and its probability. Lastly, the Ramsey test validated the correct functional.

4.7 Residual stability

In this section, we have employed the CUSUM and the square of CUSUM tests to assess the stability of residuals in line with standard practice in the literature. Both Figures 1 and 2 prove the stability of residuals as the estimated lines lie inside the critical values.

Table 6. Diagnostic checking

Tests	Null Hypothesis	F-Test	Decision
Serial Correlation (LM)	$H_0 =$ No Serial Correlation	1.376 (0.240)	H_0 Accepted
Heteroscedasticity (White Test)	$H_0 =$ No Heteroscedasticity	0.982 (0.507)	H_0 Accepted
Normality (Jarque-Bera)	$H_0 =$ Residuals are distributed normally	1.184 (0.553)	H_0 Accepted
Functional Form (Ramsey Test)	$H_0 =$ Functional Form is Correct	0.259 (0.618)	H_0 Accepted

Figure 1. CUSUM test

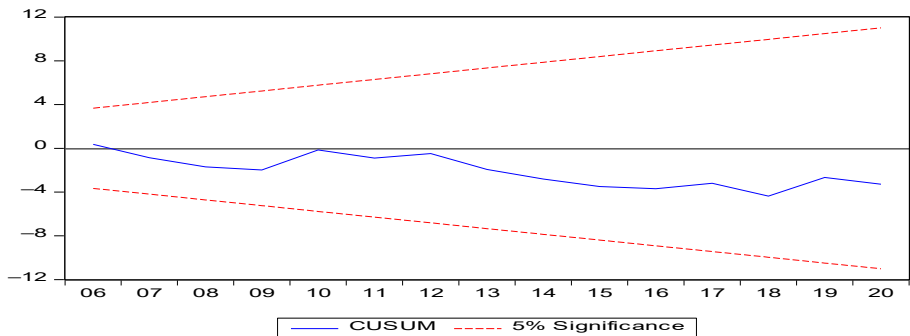
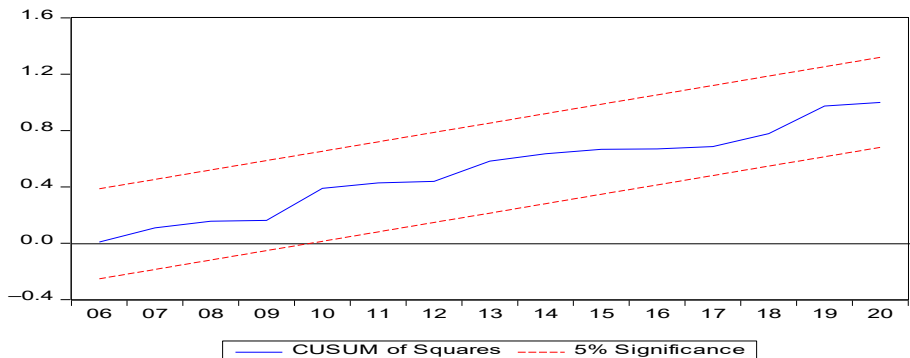


Figure 2. Square of CUSUM test



5. Conclusion

This paper has aimed to quantify the impact of natural resources on economic growth for Brunei Darussalam, a relatively unexplored economy in the literature. Data obtained from the WDI for the period 1989–2020 are analyzed with the help of the ARDL modeling approach in order to quantify both the long- and short-run impacts of natural resources on economic growth.

The findings show that natural resources have played a dominant role in the growth process of the economy of Brunei Darussalam over the years in both the short and long run. The positive relationship between natural resources and economic growth in the short and long run confirms the absence of the resource curse hypothesis in the context of the economy of Brunei Darussalam. Trade openness and domestic investment have also played positive and significant roles in improving long-run economic growth. Both human capital and government expenditure have had a positive but insignificant impact on long-run economic growth. In the short run, natural resources, domestic investment and government expenditure are the main driving forces behind the economic growth of Brunei Darussalam. In the short run, trade openness loses its significance and sign of the coefficient, illustrating that trade openness is a long-run determinant of economic growth. Moreover, the insignificant impact of human capital on economic growth was surprisingly evident in both the long and short run. The results of the study will be useful for policymakers to design and implement appropriate policies to improve long-run economic growth in Brunei Darussalam.

5.1 Implications

Based on the findings of this paper, we now highlight some of the implications for policymakers in Brunei Darussalam.

- (1) Natural resources have improved the economic growth of Brunei Darussalam significantly. However, as natural resources deplete very rapidly, placing too much dependence on them is not a rational choice. Therefore, as is the case in all resource-rich economies, policymakers should take visible steps toward economic diversification.
- (2) Investment is required in human capital as its relationship with economic growth is positive but statistically insignificant. Policymakers should focus on improving and revamping the educational system by incorporating the necessary structural changes. Improvement to the existing education system through constructive reforms to foster a more highly skilled workforce would help the economy of Brunei Darussalam to accelerate long-run economic growth.
- (3) Trade openness has influenced economic growth positively as is indicated by results. It is also a fact that Brunei Darussalam has adopted relatively open trade policies in the years under study. The country should continue along this path through the reduction of both tariff and nontariff barriers to further improve economic performance.
- (4) We also suggest that the government of Brunei Darussalam should continue to play an active role in the economy, as its expenditure is positively associated with economic growth.
- (5) Finally, policymakers should encourage domestic investment by providing incentives to investors to further boost the speed of economic growth.

5.2 Limitations

There are some unavoidable limitations to this research that should be highlighted. Firstly, the time dimension of the study is not very extensive as data for some of the variables were

not available prior to 1989. Secondly, due to this short time dimension, other potential determinants of economic growth such as research and development (R&D) expenditures and energy consumption were not included in the model. Thirdly, due to the uniqueness of the economy of Brunei Darussalam in terms of its population, size and political regime, the results generalization may not be possible.

5.3 Future research avenues

This study could be extended in three ways. Firstly, potential researchers could use alternative proxies for natural resources such as natural resource exports instead of natural resource rents to provide further robust evidence of how they influence economic growth. Secondly, future studies could also control for institutional factors while exploring the impact of natural resources on growth for Brunei Darussalam. Thirdly, the specified model could also be tested on other resource-rich economies with similar characteristics.

References

- Adams, S. (2009), "Foreign direct investment, domestic investment, and economic growth in Sub-Saharan Africa", *Journal of Policy Modeling*, Vol. 31 No. 6, pp. 939-949.
- Ahmad, N., Du, L., Tian, X.L. and Wang, J. (2019), "Chinese growth and dilemmas: modelling energy consumption, CO₂ emissions and growth in China", *Quality and Quantity*, Vol. 53 No. 1, pp. 315-338.
- Alexeev, M. and Conrad, R. (2009), "The elusive curse of oil", *The Review of Economics and Statistics*, Vol. 91 No. 3, pp. 586-598.
- Anaman, K.A. (2004), "Determinants of economic growth in Brunei Darussalam", *Journal of Asian Economics*, Vol. 15 No. 4, pp. 777-796.
- Auty, R.M. (1998), *Resource Abundance and Economic Development Improving the Performance of Resource-Rich Countries*, UNU/WIDER, Helsinki.
- Barro, R.J. (2003), "Determinants of economic growth in a panel of countries", *Annals of Economics and Finance*, Vol. 4, pp. 231-274.
- Basedau, M. (2005), "Context matters-rethinking the resource curse in sub-Saharan Africa", GIGA Working Paper No. 1, Global and Area Studies German Overseas Institute, Hamburg.
- Ben-Salha, O., Dachraoui, H. and Sebri, M. (2018), "Natural resource rents and economic growth in the top resource-abundant countries: a PMG estimation", *Resources Policy*, Vol. 74, pp. 1-8, 101229.
- Busse, M. and Gröning, S. (2013), "The resource curse revisited: governance and natural resources", *Public Choice*, Vol. 154 Nos 1-2, pp. 1-20.
- Bye, B. and Faehn, T. (2021), "The role of human capital in structural change and growth in an open economy: innovative and absorptive capacity effects", *World Economy*, pp. 1-29, doi: [10.1111/twec.13184](https://doi.org/10.1111/twec.13184).
- Chobanov, D. and Mladenova, A. (2009), *What is the Optimum Size of Government*, Institute for Market Economics, Bulgaria, pp. 1-47.
- Daniele, V. (2011), "Natural resources and economic growth: a curse or a blessing?", *Rivista italiana degli economisti*, Vol. 16 No. 3, pp. 507-528.
- Department of Statistics (2020), "Gross Domestic Product, Second Quarter Report", available at: <http://www.deps.gov.bn/SitePages/National%20Accounts.aspx> (accessed 28 March 2021).
- Dollar, D. (1992), "Outward-oriented developing economies really do grow more rapidly: evidence from 95 LDCs, 1976-1985", *Economic Development and Cultural Change*, Vol. 40 No. 3, pp. 523-544.
- Duasa, J. (2007), "Determinants of Malaysian trade balance: an ARDL bound testing approach", *Global Economic Review*, Vol. 36 No. 1, pp. 89-102.

- Dudzevičiūtė, G., Šimelytė, A. and Liučvaitienė, A. (2018), "Government expenditure and economic growth in the European Union countries", *International Journal of Social Economics*, Vol. 45 No. 2, pp. 372-386, doi: [10.1108/IJSE-12-2016-0365](https://doi.org/10.1108/IJSE-12-2016-0365).
- Edwards, S. (1998), "Openness, productivity and growth: what do we really know?", *The Economic Journal*, Vol. 108 No. 447, pp. 383-398.
- Epo, B.N. and Faha, D.R.N. (2020), "Natural resources, institutional quality, and economic growth: an African tale", *The European Journal of Development Research*, Vol. 32 No. 1, pp. 99-128.
- Frankel, J.A. (2012), "The natural resource curse: a survey of diagnoses and some prescriptions", *Commodity Price Volatility and Inclusive Growth in Low-Income Countries*, pp. 7-34.
- Godwin, E.A. and Chuka, C. (2014), "Natural resources, human capital and economic development in Nigeria: tracing the linkages", *Journal of Economics and Sustainable Development*, Vol. 5, pp. 35-52.
- Granger, C.W. (1988), "Some recent development in a concept of causality", *Journal of Econometrics*, Vol. 39 Nos 1-2, pp. 199-211.
- Haseeb, M., Kot, S., Hussain, H.I. and Kamarudin, F. (2021), "The natural resources curse-economic growth hypotheses: quantile-on-Quantile evidence from top Asian economies", *Journal of Cleaner Production*, Vol. 279, 123596.
- Havranek, T., Horvath, R. and Zeynalov, A. (2016), "Natural resources and economic growth: a meta-analysis", *World Development*, Vol. 88, pp. 134-151.
- Hayat, A. and Tahir, M. (2021), "Natural resources volatility and economic growth: evidence from the resource-rich region", *Journal of Risk and Financial Management*, Vol. 14 No. 2, p. 84.
- Ibrahim, M.J. (2017), "Introductory chapter: economics, natural resources and sustainable development", in *Emerging Issues in Economics and Development*, pp. 1-4, doi: [10.5772/intechopen.70399](https://doi.org/10.5772/intechopen.70399).
- International Monetary Fund (2019), "Brunei Darussalam, Brunei Darussalam 2019 Article IV Consultation", Press Release and Staff Report, IMF Country Report No. 19/310, Washington.
- Johansen, S. (1988), "Statistical analysis of cointegration vectors", *Journal of Economic Dynamics and Control*, Vol. 12 Nos 2/3, pp. 231-254.
- KMPG (2018), "Brunei Darussalam, ASEAN business guide", available at: <https://assets.kpmg/content/dam/kpmg/sg/pdf/2018/07/ASEAN-GUIDE-Brunei.pdf>.
- Kwakwa, P.A., Adzawla, W., Alhassan, H. and Achaamah, A. (2021), "Natural resources and economic growth: does political regime matter for Tunisia?", *Journal of Public Affairs*, e2707, doi: [10.1002/pa.2707](https://doi.org/10.1002/pa.2707).
- Marquez-Ramos, L. and Mourelle, E. (2019), "Education and economic growth: an empirical analysis of nonlinearities", *Applied Economic Analysis*, Vol. 27 No. 79, pp. 21-45, doi: [10.1108/AEA-06-2019-0005](https://doi.org/10.1108/AEA-06-2019-0005).
- Mensah, O.J. and Abekah-Koomson, I. (2014), "Trade openness and economic growth of Brunei Darussalam", *CSPS Strategy and Policy Journal*, Vol. 5, pp. 13-30.
- Mohamed, E.S.E. (2020), "Resource rents, human development and economic growth in Sudan", *Economics*, Vol. 8 No. 4, p. 99.
- Mohamed Sghaier, I. (2021), "Trade openness, financial development and economic growth in North African countries", *International Journal of Finance and Economics*, pp. 1-12, doi: [10.1002/ijfe.2503](https://doi.org/10.1002/ijfe.2503).
- Moshiri, S. and Hayati, S. (2017), "Natural resources, institutions quality, and economic growth; A cross-country analysis", *Iranian Economic Review*, Vol. 21 No. 3, pp. 661-693.
- Narayan, P.K. (2004), "Fiji's tourism demand: the ARDL approach to cointegration", *Tourism Economics*, Vol. 10 No. 2, pp. 193-206.

-
- Nyasha, S. and Odhiambo, N.M. (2019), "The impact of public expenditure on economic growth: a review of international literature", *Folia Oeconomica Stetinensia*, Vol. 19 No. 2, pp. 81-101.
- OECD (2011), "The economic significance of natural resources: key points for performers in Eastern Europe, caucasus, and central Asia", available at: http://www.oecd.org/env/outreach/2011_AB_Economic%20significance%20of%20NR%20in%20EECCA_ENG.pdf.
- Pesaran, H. and Shin, Y. (1999), "An autoregressive distributed lag modelling approach to cointegration", Chapter 11, in *Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium*.
- Pesaran, M.H., Shin, Y. and Smith, R.J. (2001), "Bounds testing approaches to the analysis of level relationships", *Journal of Applied Econometrics*, Vol. 16 No. 3, pp. 289-326.
- Rahim, S., Murshed, M., Umarbeyli, S., Kirikkaleli, D., Ahmad, M., Tufail, M. and Wahab, S. (2021), "Do natural resources abundance and human capital development promote economic growth? A study on the resource curse hypothesis in Next Eleven countries", *Resources, Environment and Sustainability*, Vol. 4, 100018.
- Sachs, J.D. and Warner, A. (1995), *Natural Resource Abundance and Economic Growth*, NBER, Cambridge.
- Tahir, M. (2020), "Trade and life expectancy in China: a cointegration analysis", *China Economic Journal*, Vol. 13 No. 3, pp. 322-338.
- Tahir, M. and Azid, T. (2015), "The relationship between international trade openness and economic growth in the developing economies: some new dimensions", *Journal of Chinese Economic and Foreign Trade Studies*, Vol. 8 No. 2, pp. 123-139, doi: [10.1108/JCEFTS-02-2015-0004](https://doi.org/10.1108/JCEFTS-02-2015-0004).
- Tahir, M., Estrada, M.A.R. and Afridi, M.A. (2019), "Foreign inflows and economic growth: an empirical study of the SAARC region", *Economic Systems*, Vol. 43 Nos 3-4, 100702.
- Tahir, M. and Hayat, A. (2020), "Does international trade promote economic growth? An evidence from Brunei Darussalam", *Journal of Chinese Economic and Foreign Trade Studies*, Vol. 13 No. 2, pp. 71-85, doi: [10.1108/JCEFTS-03-2020-0010](https://doi.org/10.1108/JCEFTS-03-2020-0010).
- Ullah, I., Shah, M. and Khan, F.U. (2014), "Domestic investment, foreign direct investment, and economic growth nexus: a case of Pakistan", *Economics Research International*, Vol. 2014, pp. 1-5, 592719, doi: [10.1155/2014/592719](https://doi.org/10.1155/2014/592719).

Further reading

- Engle, R.F. and Granger, C.W. (1987), "Co-integration and error correction: representation, estimation, and testing", *Econometrica: Journal of the Econometric Society*, Vol. 55 No. 2, pp. 251-276.
- Hayat, A. (2018), "FDI and economic growth: the role of natural resources?", *Journal of Economic Studies*, Vol. 45 No. 2, pp. 283-295, doi: [10.1108/JES-05-2015-0082](https://doi.org/10.1108/JES-05-2015-0082).
- Hayat, A. and Tahir, M. (2021), "Foreign direct investment, natural resources and economic growth: a threshold model approach", *Journal of Economic Studies*, Vol. 48 No. 5, pp. 929-944, doi: [10.1108/JES-03-2020-0127](https://doi.org/10.1108/JES-03-2020-0127).
- Narayan, P.K. and Smyth, R. (2006), "What determines migration flows from low-income to high-income countries? An empirical investigation of Fiji-US migration 1972-2001", *Contemporary Economic Policy*, Vol. 24 No. 2, pp. 332-342.
- Onifade, S.T., Çevik, S., Erdoğan, S., Asongu, S. and Bekun, F.V. (2020), "An empirical retrospect of the impacts of government expenditures on economic growth: new evidence from the Nigerian economy", *Journal of Economic Structures*, Vol. 9 No. 1, p. 6.
- World Development Indicators (2021), "The world bank", available at: <https://databank.worldbank.org/home.aspx> (accessed 15 February 2021).
- Young, A.O. (2018), "Impact of labour force dynamics on economic growth in Nigeria: an empirical analysis using ARDL bound testing approach", *Journal of Resources Development and Management*, Vol. 42, pp. 31-46.

Appendix

Natural resources and economic growth

Variables	Definition	Source
EGR_t	The growth rate of GDP per capita	WDI
$GEDU_t$	School enrolment, secondary (% gross)	WDI
$LNINV_t$	Gross fixed capital formation as % of GDP	WDI
$LNGEX_t$	General government final consumption expenditure (% of GDP)	WDI
$LNNR_t$	Total natural resources rent as % of GDP	WDI
$LNOPEX_t$	Trade as % of GDP	WDI

Table A1.
Variable description

Lag	LogL	LR	FPE	AIC	SC	HQ
0	173.7218	NA	3.82e-13	-11.56702	-11.28413	-11.47842
1	256.6728	125.8567	1.59e-14	-14.80502	-12.82480*	-14.18484
2	303.6618	51.84987*	1.06e-14*	-15.56288*	-11.88533	-14.41112*

Note(s): The asterisk (*) indicates the number of lags to be used based on different criteria

Table A2.
Lag length criteria

Variables	VIF
$LNNR_t$	3.084616
$LNINV_t$	1.980948
$LNOPEX_t$	1.088910
$LNGEX_t$	2.035764
$GEDU_t$	1.146118

Table A3.
Multicollinearity testing

About the authors

Dr. Muhammad Tahir is working in COMSATS University Islamabad, Abbottabad Campus as assistant professor of economics. His area of specialization is international trade, economic issues of developing countries, econometric modeling and terrorism. Dr Tahir has published in refereed international journals such as Asia Business Studies, Journal of Chinese Economic and Foreign Trade Studies, Contemporary Economics, Quality and Quantity, International Journal of Disaster Risk Reduction, Economic Systems, Applied Economics Letters, Applied Research in Quality of Life, African Development Review, Borsa Istanbul Review, China Economic Journal, International Journal of Social Economics, Journal of Economic Studies and International Journal of Emerging Markets recently. Muhammad Tahir is the corresponding author and can be contacted at: tahirm@cuiaatd.edu.pk

Umar Burki is an Associate Professor in Marketing and Supply Chain Management at the University of South-Eastern Norway. He is also an Adjunct Associate Professor at Bjorknes University College, Norway. His expertise and research areas mainly focus on B2B marketing, sustainability in interfirm relationships, supply chain management, consumer behavior and cross-cultural management. He has published in Journal of Macro Marketing, Australasian Marketing Journal, International Journal of Cleaner Production and a few book chapters. In 2021, Umar edited a book titled Foundations of a Sustainable Economy: Moral, Ethical and Religious Perspectives published by Routledge.

Arshad Hayat is a Macroeconomist with a research focus on economic growth, natural resources, institutional quality and foreign direct investment. Arshad Hayat is currently working as an Assistant

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Professor at Metropolitan University Prague, Czech Republic, where he teaches macroeconomics, international trade theory and policy. Arshad Hayat has published his work in refereed international journals such as the Journal of Economic Studies, The Journal of International Trade and Economic Development recently

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