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COMPLEX CORRELATION BETWEEN ECONOMIC GROWTHAND OIL EARNINGS: EMPIRICAL STUDY FROM BRUNEI DARUSSALAM USING AN ARDL – BOUND TEST APPROACH AND ECM

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ABSTRACT
The study examines the impact of oil rents on Brunei Darussalam's economic prosperity, official exchange rate and inflation between 1990 and 2017, with the help of Autoregressive Distributed Lag (ARDL), bound test approach as well as Error Correction Model (ECM). The bond test F- statistic value shows that the variables are long - term integrated. Empirical estimation of ECM indicates that the fuel revenue coefficient has a positive and significant

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effect on economic growth in the country. In contrast, the official exchange rate and inflation have inverse implications. It means that increasing oil export patterns will lead to positive economic growth. Official exchange rate instability and inflation have inverse repercussions. From the policy point of view, fuel industry growth, stable government exchange rates, and inflation have seemed to create a better ramp up in Gross Domestic Product. We, therefore, propose to increase investment in the petroleum sector and pursue the same policy concerning official exchange rates and inflation to benefit the national economy in the future

JEL Classification: C50, N15,C32,O40, Q00

1. INTRODUCTION

1.1. The instant world view fuel worth for economic growth:

Economists have taken a useful look at the fuel-economic growth relationship (Allegret et al., 2014;Sachs & Warner, 1999). However, the question remains, whether an abundance of natural raw materials in a country is a source of joy or an onus? While this has contributed to a considerable academic work of scholars, there remains a lack of comprehensive and compelling literature. Therefore, it was a controversial concern for researchers to align the abundance of natural resources and economic growth.

The origins of some literary works establish a definite positive link between natural resources abundance and economic efficiency (Chivvis & Martini, 2014; El-Sakka & Al-MutaINFRi, 2001; Esfahani et al., 2009; Gallup & Sachs, 1998; Hamdi & Sbia, 2013; Islam & Bahari, 2012; Lakuma, 2020; Metwally & Tamaschke, 1980; Raheem, 2016; Schrank, 2004; Stijns, 2005). This evidence is consistent with academic work (Ross, 2003), Ross goes further and indicates that correlation between abundant natural resources and weak economies can be falsifiable.

In comparison, a large number of empirical shreds of evidence, however, suggests that natural resource (oil) will not necessarily offer economies huge benefits. This confusing phenomenon is proved by (Badeeb et al., 2016; Bhattacharyya & Hodler, 2014; Bulmer-Thomas, 1994; Cockx & Francken, 2015; Doraisami, 2015; Kim & Lin, 2015; Lal & Myint, 1996; Mavrotas et al., 2011; Shao & Yang, 2014). The findings seem to confirm the detrimental correlation between oil revenue and economic welfare. Auty (1993, 2001) noted that the per capita income of capital - abundant countries increased by two to three times more than the resource-subject countries between 1960 and 1990. He acknowledges that crop-driven resource abundance should be less than its production equivalent. In contrast, mineral-driven countries were among the worst. Several economists were motivated to understand its roots by this so-called "resource curse." In the same vein, Sachs & Warner, (1997) also found that the exportation and the growth of a Group of 95 developing countries were straightaway negative, based on natural resources, agriculture, and minerals between 1970 and 1990. However, two notable examples were Mauritius and Malaysia, which have maintained an annual growth of 2% between 1970 and 1980. Furthermore, Rosser (2006) follows the same direction and states that literature on resource education provides strong evidence of the associations between excess natural resources and adverse effects on

growth.

Brunei Darussalam is South East Asia's fourth-largest petroleum producer and ninth-largest gas exporter in the world, Brunei Economic Development Board (BEDB, 2011). A nation can see itself as a rentier economy if its oil revenue represents a 40 percent minimum of the gross domestic product of the country (Beblawi, 1987). Thus Brunei Darussalam is also an oil-and gas-based rentier economy that contributes around 50% of GDP and 90% of trade revenue(Deutsche Bank Country Report, 2012).

In 2013 fall in oil production and its prices decreased Brunei's income and revenue by 17.3% and further reduced by 21.5% in the first three quarters of 2014(Asian Development Bank, 2015). Sales of Brunei hydrocarbons declined by $3,300 (37.4%) in 2009 compared to 2008, both due to a decrease in crude oil prices and government policies against the ceiling of production. At its maximum in 1979, the production of oil amounted to 240,000 barrels daily (bd), but production dropped to 132 000 bd by 2009. The policy of reducing demand was necessary to extend the current reserves ' life cycle, which currently scheduled to might expire by 25 years (Roberts, 2011). The consequences of over-reliance on oil profits would negatively impact a rentier economy on governments, markets, and societies. From an economic perspective a "Resource curse" or "Dutch Disease" will probably result in the growth of the enclaving oil sector, the role of most rentier states is therefore mainly limited to the provision of public goods revenues to the population(Beblawi, 1987; Mahdavy, 1970). Resource amortization seems to be a universal fact, as shown by (Hashim, 2010), Brunei's foodstuffs shopping accounts for 80% and virtually all of its importation of intake and machinery from abroad. To rectify the problem, BEDB (2011), considered that the country is becoming aware that its natural resources are being exhausted and that it must gradually diversify its reliance on offshore oil and gas output. Brunei Darussalam's proposals for raising the ability of workers, reducing unemployment, strengthening banks and tourism, and growing the economic base outside petroleum and gas formulated in Brunei's long-term vision 2035. Additionally, a short-run solution for the problem proposed, the National Development Plan for 2007-2012 supported the Brunei Vision by 2035, allocating roughly USD 6.6 billion (equivalent Brunei Dollars 9.5 billion) to 826 plan and ventures aimed at boosting and supporting the development of competitive marketplace, economic actors, social services and infrastructure The key industries suppose be called finance, tourism, farming and, halal products (Asia Pacific Energy Research Centre (APERC)., 2009).

Nevertheless,petroleum sector contributions dropped significantly due to decreases in oil prices and a growing focus on diversification schemes in the mid-1980s. For example, the share of the petroleum industry in GDP decreased to almost 53,63% in 1990, from 71,36% in 1985. The oil sector witnessed negative growth in the years 1975 to 2004, with an average annual growth of around -2.3% (Elgar, 2007).

Table 1*The share of the oil and non - oil sector in GDP (1975–2004)*

Year	Oil Sector (%)	Non-oil sector (%)
1975	86.01	13.99
1980	90.29	9.71
1985	71.37	28.63
1990	53.63	46.37
1995	35.90	64.10
2000	36.90	63.10
2004	43.78	56.22

Source: Brunei Darussalam, National Development Plans

As it seems that fuel's contribution ratio to GDP was falling, thus, in its 2nd National Development Plan for Sustainable Economic Growth and Development (1962-1966), Brunei Darussalam tried to diversify the economy and became the main agenda since the development of 3rd National Development Plan. This diversification is based on reducing oil and gas dependency, providing more than 50 percent of GDP and public expenditure(Anaman & Al-Kharusi, 2003). Brunei government has, however, made some attempts to diversify, but few progresses in projects that are starting up or that are essential new growth engines have achieved. It must still employ by expanding economic opportunities through domestic and international investment in local industries and structures outside the specific energy sector, such as fuel and gas (Bhaskaran, 2007).

Furthermore, Obben (1998) addressed the problem and analyzed the vector autoregressive model of hierarchical interactions among GDP, Government revenues, and government spending in Brunei. Furthermore, oil rents have been an essential source of GDP volatility and contribute to the efficient use of public funds to boost economic growth. Long - term growth rates depend on the formation of labor, human and natural resources, and changes in technology. A vital issue to further study is the correlation between the economic growth rate and investment expenditure.

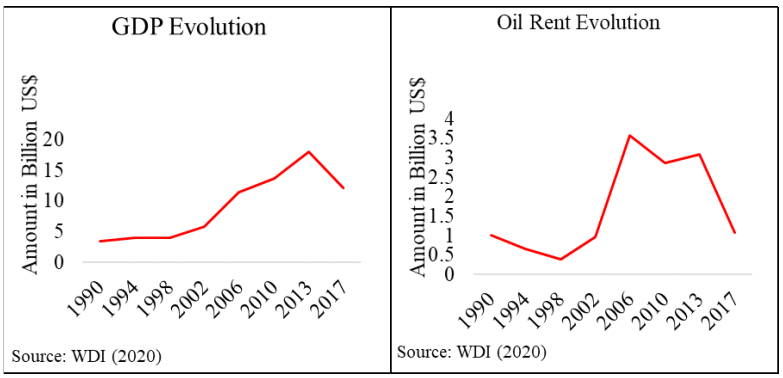
According to Gylfason (2001), several out of the 65 nations that are categorized as natural resource-rich, namely Indonesia, Botswana, Malaysia, and Thailand, managed to achieve, long - terms investing exceeding 25% of GDP. Besides, per capita GNP growth of more than 4% per year between 1970 and 1998, which is equal to that of several prosperous, raw material-free industrialized countries. However, some eastern Asian economies have done even more than the resource-rich nations with a small number of raw materials, Singapore, Hong Kong, South Korea, and Taiwan.

High technological economies' demand for fossil fuel increases prices. It makes fossil fuels tooexpensive to choose alternative and sluggish energy supplies in less advanced countries what a technologically advanced world is seeing sustainable growth and developing endogenously using fossil energy alone. In contrast, a less developed country prefers pre-industrial technology and does not rise endogenously in the region (Gars & Olovsson, 2015).

The evolution of macroeconomic data in Brunei Darussalam, comprised of 27 years, see Figure 1 and Figure 2. The figures show four macro-economic

variables, namely, GDP, fuel rent, official exchange rates, inflation rate, and horizontal. In short, the trend towards GDP and fuel exports is expanding, which denotes that fuel exports and GDP are slightly increasing over the period. On the contrary, the real exchange rate declined, suggesting Brunei's appreciation of the dollar, whereas inflation rates have fluctuated trend during the time. Consequently, macroeconomic indicators, such as GDP and OILR, are growing. OEXCHR denotes Brunei Dollar is appreciating, and finally, (INFR) fluctuates along the period.

This study demonstrates the importance of oil resources to fund the needs of public institutions and improve Brunei's well-being because of Brunei Darussalam 's petroleum strength. The objective is to investigate the complicated relationship between Brunei Darussalam's revenues from fossil fuel exports (OILR), official exchange rate (OEXCHR), inflation rate (INFR), and its economic growth. In our best understanding, literature did not address in recent studies, in light of the importance of oil as a competitive financer for the economies of oil dependency countries in Brunei Darussalam. This article is thus a first in the literature to examine short - term and long-term ties among economic growth in the case of an oil-dependent economy called Brunei Darussalam. To achieve this significant goal, we use Auto-regressive Distributed Lag (ARDL) econometric model based on the Bound Test Approachfor a long-term series of data covering the timeframe between1990-2017.



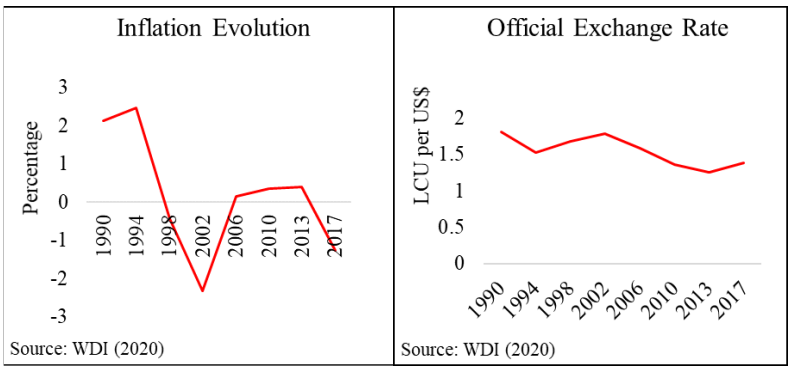


Figure 1 *Macroeconomic trend of inflation and exchange rate in Brunei Darussalam (1990-2017)*

2. LITERATURE REVIEW

The scope of oil has increased to the point that all key manufacturing mechanism which enables more than domestic economic activities will immediately disintegrate and the global economy collapses beyond the oil (Hathaway, 2009).

Brunei's Darussalamfuel and LNG gas production and export are becoming essential aspects of the economy's expansion. Figures from 1986 through 2012 show that in 2012, the tremendous revenues and exchanges generated from LNG and oil accounted for 93% of government revenues. These large sales are mainly creating indications of the so-called Dutch disease for Brunei(Odano & Islam, 2013).

The useful trade between exporting goods has, therefore, become an essential instrument for economic growth. Countries converge on exports to generate foreign exchange revenues to allow business activities to operate efficiently. Export sales are expected to lead to short - term economic healing and long - term economic development. The growth rate and positive development of a developing country depend not only on the nature and success of an export industry but also on the use of export income (Adedokun, 2012a; Bloch et al., 2015; Douglass, 1990; El-Sakka & Al-MutaINFRi, 2001;Grossman & Helpman, 1991; Helpman & Krugman, 1985; Jung & Marshall, 1985; Krueger, 1980; Michaely, 1979; North, 1990). Specific literature on resource-rich nations usually focuses on short - term effects, and indeed the depletion nature of raw materials makes revenues temporary (Van der Ploeg & Venables, 2009). Likewise, studies have found that there is a short - term connection among both oil income and economic growth(Ologunla et al., 2014; Stevens, 2008; Yuan et al., 2008).

On one side of the coin, oil revenues were blessed by some countries. Saudi Arabia is one of the most significant as well as rapidly growing countries of the middle east and Northern Africa (MENA). Saudi Arabia remains primarily a petroleum economy, despite continued efforts to diversify the economy. Oil accounts for about 90% of total government revenues, around 88% of export profits, and nearly 35% of the total GDP(Sultan & Haque, 2018). Similarly, the analysis shows that the development of total fixed capital is highly sensitive to oil export rise in all the countries examined, excluding Libya as well as Kuwait (Metwally & Tamaschke, 1980). While also observing Iranian economics, oil exports have a long-term contribution to the economic outcomes through their effect on capital accumulation (Esfahani et al., 2009). In line with the Atukeren (2003), in recent years, Nigeria's oil exports at high prices–enabled Nigeria to post-trade in commodities and current account surpluses. Nigeria's energy revenues, reportedly, flow into the state for 80%, operating costs for 16% and investors for the remaining 4%. Finally, Brunnschweilera and Bulte (2008) also reported different results regarding the impact of resources on economic growth, the so-called resource curse is not contradicting, and resource abundancy leads to better growth. However, it is still ambiguous that natural resources are a blessing or a mystery among scholars.

Quite the opposite, oil products cannot stimulate growth, nor do oil rents lead to development in democratic regimes and institutions, mainly because most African oil exporters are missing. The substantial drastic cause of adverse economic growth is the reality that the weak rule of law, egregious bureaucracy, and inequality in African oil-rich developing countries. These countries still focus on a network of privilege and disorganize a political, democratic, and transparent system. The long-term effect is a stunted economy, in the face of rising revenue from crude oil exports. Therefore, African oil exporters should ensure that the rule of law is enforced and that corruption and profitable activities are eliminated in order to take advantage of fuel rents for economic growth and need different production facilities to encourage manufacturing and industrial action(Akanni, 2007).

In line with this, Gars & Olovsson (2015) used an endogenous static growth model, founding that technologically advanced countries buy and produce final products using fossil fuel to have more stable growth. While the levels of initial technologies with incoherent growth in fossil fuel extractive countries sufficiently differ, resulting in low economic growth. Similarly, Dutch diseases, renting and sponsorship, non-implementation, and unproductive government expenditure in the form of capital and social projects are facing sub - Saharan oil-rich countries. In particular, in different dimensions and faces, these challenges were evident in nations, regions, and populations. The relationship between natural resources and economic growth, therefore, has to be explained by looking at the dynamic nature of factors like resource rents and sales of natural resources dependency (Onyejiuwa, 2016). Thus, to efficiently utilize resources, authors suggest, energy security is characterized for an economy's capacity to ensure sustainable and timely supply of energy resources at a cost that will not negatively affect economic performance (APERC, 2007). This energy security partitioned into four main elements, which include availability, affordability, and acceptability. Features of availability concern the geological existence of energy resources, aspects of accessibility-related to geopolitical factors, aspects of affordability relate to the economic issues of energy resources. In contrast, elements of acceptability relate to the environmental impacts of the life cycle of energy resources (Winzer, 2012). Similarly, in some cases, the resources dependency inefficient the situation of raising wages, schooling, standards for productivity, promotion of human resource growth in other production areas by the relatively low yields in the fields of natural resource (Gylfason, 2000; Gylfason et al., 1999).

2.1. Oil exporting countries: diversification, oil prices, the Dutch disease, and exchange rates:

Because of the Dutch disease, raising the marginal energy product for the current job in manufacturing and the non - tradable industries. Oil exports are thus a higher share GDP (gross domestic product) fo Brunei Darussalam, and the boom of the energy sector will have a partial impact on other trade and non-tradeable production (Anaman & Mahmod, 2003; Corden & Neary, 1982).Similarly, Isdell (2005) claimed that, is Brunei essential to diversify and expand its private sector to sustain its revenue to be the final "major "question raised? This diversification may not be sufficient for Brunei's economic survival because of proper investment and accrued rental revenue and its return on its investment funds.

Diversification (a larger private sector) may, however, give Brunei a higher income. A further question is whether it is desirable, for reasons of economic development and transformation, to' forced' tap into Brunei's petroleum production, as part of government policy.

Oil price shock generally will favor oil exporters, but only by a single oil seller will the oil price rise have a damaging effect on foreign revenues. Sachs (1981) also confirmed that the oil prices high during (1973–1974) in OPEC countries explained to produce a significant surplus, contributing to both the developed and developing countries ' troubling deficits. Similarly**,** it is, therefore, believed that oil price instability, instead of abundance per location, is the engine of the resource curse paradox in Algeria, because of its adverse growth effects of oil price fluctuations (Elhannani & Farah, 2013). Further, changing oil prices decide the rate of inflation of the economy and its unemployment, affecting economic growth and contributing to welfare cuts by the government in Saudi Arabia. (Al-sasi et al., 2017). Nonetheless, the interaction between economic growth and fuel exports decreases over the long term because of the industrial diversification. El Hag & El Shazly (2012) said that the implementation of a comprehensive reform plan focused on minimizing the risk of volatile oil income to improves the diversification and expansion of export structures from low-to-high productivity productsin the United Arab Emirates.

In overview, after 1970, the analysis provides strong support for the Dutch disease idea. The research has been carried out to explore the risk of Dutch disease in the oil-producing countries and examined the interaction between real petroleum prices and currency exchange rates in 13 oil-producing countries using threshold and momentum threshold autoregressive models. Only three states have a significant long - term impact of oil prices and exchange rates in Bolivia, Mexico, and Norway. Recently, the countries operating under the currency exchange regime by a creeping bolt or an independent float. In these countries, high oil prices result in real, long-term currency appreciation. The other ten nations were operating under either free - float conditions like Algeria, Colombia, Gabon, Indonesia, and Nigeria, or under a system of fixed-pegs like Kuwait, Russia, Saudi Arabia, Venezuela, and Angola. Therefore the prevalence of Dutch diseases in countries with more favorable exchange rates is more vulnerable (Mohammadi & Jahan-Parvar, 2012). However, these results provide a more inferior evaluation than those published on the impact of petroleum prices on exchange rates and the potential Dutch diseases. The low cost of oil, the real relationship between the foreign exchange markets in most countries implies that the majority of oil exporters are able, through the development of investment funds. To effectively separate their national economies, by assigning directly to imports the resulting exchange earnings and investment from overseas.

The higher oil price–exchange rate ties–has several political consequences for the remaining three countries, Secondly, to be temporary in the event of high oil prices and exchange gains, an appropriate policy requires the support of fragile industries. Nevertheless, if the trade opportunity continues positively, the competitive system will require significant

structural changes that encourage the allocation of resources from traditional exports to non-tradable and diversify the export sector so that it will become less exposed to extreme fluctuations (Issa et al., 2008; Koranchelian, 2005).

Since international crude oil demand is hugely insensitive to short-and long-term price fluctuations, as reported in 23 countries (Cooper, 2003). This continuous and dramatic change in fossil fuel prices, both upward and downward, can have a significant impact on manufacturing companies, economies, and international geopolitics. Oil price rises may, for example, interrupt economic activity, and a sudden drop in price can devastate profit-strapped oil companies. The oil price coaster has blown holes in national budgets, immediate retail structural progress, or changes over time in the geopolitical priorities(Greenberg, 2016; Kriskkumar & Naseem, 2019; Zamani, 2004). Russia is the most significant petroleum producer in the world, accounted for 12.5% of the world's oil production. Since Saudi Arabia is cutting its output to meet the OPEC quota criteria in 2009, Russia expanded its oil export network and an eventual oil export destination using aggressive diplomacy with its strategic gains (Vatansever, 2010).

Along with (Smith, 1982) as illustrated in Table 2 for the USA, throughout the 1970s, the amount of net income received by U.S. petroleum companies had significantly increased. 1973 was a milestone for a dramatic rise in net income, with rates that far surpassed those of the early 1970s.

Table 2*Net income, with no repeat gain or loss for the United States of 24 Oil companies (Dollar trillions from 1971-80)*

Year	**1971**	**1972**	**1973**	**1974**	**1975**	**1976**	**1977**	**1978**	**1979**	**1980**
Income	6.4	6.2	9.0	11.4	7.9	8.8	8.7	9.1	13.8	16.3

Source: (Smith, 1982)

This empirical analysis, using an error correction model, shows that Nigeria's short and long - term economic recovery from 1975 to 2009 has a strong positive influence on oil sales(Adedokun, 2012b). Uganda also earns considerably significant amounts of oil sector profits(Lakuma, 2018). The projections, based on the actual volume of oil output, reserves as a resource endowment proxy. Shows that oil abundanceprovides a blessed and not a malicious boost a long-term positive connection between the actual revenue, the investment rate,and the real oil value pushes the actual size of total output (Cavalcanti et al., 2011).

Authors argued that in economic success, low-income equilibrium pitfalls are essential to encourage development, and natural resource bubbles may, therefore, be potentially real key ingredients and social development. Natural export revenue in Bolivia increased from 11% of GDP in the nine years from 1975 to 23% in GDP, an increase of 12% in GDP. In Latin America, this was a practical example. Leading export sales in Ecuador rose by 19 percent of GDP in just two years from 1972 to 1974. In Mexico, oil revenues increased by 6 percent of GDP between 1978 and 1983, for this is the clarification. Whether a significant public spending program, foreign aid, the breakthrough of minerals, or even a boost in the world natural price

resort will do anything which stimulates demand, this is the rationale. Also, the possibility of a discovery or an exogenous worldwide rise in the price of global aggregate demand appears, according to an informal numerical analysis, to rival that of the average public. Set of Expenses(Murphy et al., 1989; Rosenstein -Rodan., 1961; Rosenstein-Rodan, 1943).

Examples exist of countries which have broken the oil curse and of others which have entirely prevented it. The latter group comprises mainly states which were democracies long before the arrival of oil. These countries developed strong institutions for years and centuries to protect themselves against corruption, employers, and self-enlargement. The USA, the U.K., Norway, and Canada are among these countries. Nevertheless, another party succeeded in switching from the oil that damaged oil. These include the emirate of Dubai, Indonesia, and Mexico. Over the last ten years, the economy of Dubai has multiplied. Since the mid-1990s, it is oil income has been used for world-class holdings of more than $15 billion, including funds and companies(Schubert, 2006).

Nevertheless,Gylfason (1999) approved that relatively sizeable public sector connectomes only with both slow patterns in economic diversification and growth in small-scale oil-rich countries such as Brunei has been clarified at times due to a "rentier state" problem. A rentier state receives significant revenue, such as oil, from mining fixed natural resources. This state described itself as embarking on social and economic projects, often tax - free.Moreover, this type of country is confronted with the "Dutch Disease" usually leading to the stagnant growth in other manufacturing industries rather than in the energy industry.

3 METHODOLOGY AND EMPIRICAL ANALYSIS

3.1. Data Source and Methodology

Data has been taken from the Development Index of the World Bank from 1990 to 2017.(World Bank., 2020). The World Bank takes a more comprehensive view of the variables of our interests:

GDP (at current united states dollars) - Brunei Darussalam: The figures are currently in U.S. dollars. Exchange from Brunei's domestic currencies official one-year dollar exchange rates for GDP are exchanged. In several countries where the official currency does not represent a sufficient rate for real exchange transactions, another converting factor is used. GDP is a total added value, including all commodity taxes and fewer subsidies at the buyer 's price. That is not included in the products ' cost, by all resident producers in the economy, measured without deducting the depreciation of manufacturing assets as well as depletion or deterioration of natural resources.

Official exchange rate (period average per United States Dollars) - Brunei Darussalam: Official exchange rates refer to the officially accepted regional or fixed exchange rate. The year-on-year Value of the U.S. dollar is expressed according to the monthly averages for local currency units.

Inflation, consumer prices indexing (per annum percent) - Brunei Darussalam: Inflation is the annual percentage change in the cost to purchase the average package of goods in defined periods, as measured

from the consumer price index by using Laspeyres, for example, for the year.

Oil Rent (united states dollars) - Brunei Darussalam: Oil rent demonstrates the difference between the global price of crude oil production and the actual production costs.

Table 3 *Variable identification (GDP, OILR, OEXCHR, INFR)*

Variable	Description	Sources
GDP	Gross domestic product	World Bank development indicator 2020
OILR	Oil rent	World Bank development indicator 2020
OEXCHR	Official exchange rate	World Bank development indicator 2020
INFR	Inflation rate	World Bank development indicator 2020

3.1.2 Methodology

The methodological analyzes preceded multiple econometric measures and steps to determine if oil rent has long-and short - term economic growth (GDP) implications. Firstly, descriptive statistics depict that variables fulfilled symmetry and standard distribution requirements (Jarque & Bera, 1980; Thadewald & Büning, 2007), as shown in Table 4. Secondly, the Augmented Dickey-Fuller (F-ADF) (F-ADF) result confirmed the unit root properties and variables ' stationary properties. Finally, to investigate the cointegration link among GDP, OILR, OEXCHR, and INFR. As shown in equation (1), we find GDP as a dependent variable while the rest are independent; The analytical Value (GDP) and the analytic Value (OILR) are in the form of natural logarithms displayed in equation (2). The autoregressive distributed lag (ARDL) bounds testing approachand error correction model (ECM) is implemented (Pesaran et al., 2001). For the analysis, we use the econometric software of the Eviews 10 +. Several econometric studies are aligned with this research (Alkhathlan, 2013; Bildirici & Bakirtas, 2014; Fuinhas & Marques, 2012; Yusma et al., 2013).

$$GDP = f(OILR, OEXCHR, INFR) \quad \ldots\ldots(1)$$

Where:

$GDP = Gross\ Domestic\ Product$
$OILR = Oil\ Rent$
$OEXCHR = Official\ Exchange\ Rate$
$INFR = Inflation\ Rate$

Also, since two variables are identified in logarithmic form, thus, the equation appears as follow:

$$ln(GDP) = \beta_0 + \beta_1 lnOILR + \beta_2 OEXCHR + \beta_3 INFR + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots(2)$$

Where:

$\beta_0 = Intercept,$
$\beta_{1,2,3\ldots n} = Coefficients,$
$\varepsilon_t = Erorro\ term$

Table 4: *Variables and their Descriptive characteristics*

	LNGDP	LNOILR	INFR	OEXCHR
Jarque-Bera	2.574535	2.224398	10.41356	1.994726
Probability	0.276024	0.328835	0.005479	0.368851
Sum	638.0018	588.9356	25.75900	42.89200
Sum Sq. Dev.	8.647548	13.29124	71.19421	0.894239

3.2 Empirical Analysis

3.2.1. Unit Root Tests

This work used the Dickey-Fuller (Dickey and Fuller, 1979)unit root test to determine the non - stationary proprieties of the data series. The logarithm represents two variables, such as GDP and OILR. Whereas, OEXCHR is on average and INFR in percentage form. The result is shown in Table 5. Test statistics are statistically significant for GDP (LnGDP), oil revenues (LnOILR), the official exchange rate (OEXCHR), and inflation rate (INFR). If the first difference between the two variables is applied in unit root tests. For each variable, we reject the 5% null hypothesis. The root tests for units thus indicate that all variables, except for inflation, are included in the order I (1).

Table 5*Unit Root test Result*

	T-test	Prob. Value (*)	Critical Value at 5%	Result
LnGDP (**)	-4.434693	0.0084	-3.595026	
Ln OILR (**)	-4.409178	0.0093	-3.603202	I (1)
OEXCHR (***)	-3.090660	0.0398	-3.595026	
INFR (****)	-3.785462	0.0333	-3.587527	I (0)

* Depicts significance level for McKinnon critical value, **Regression in first order with the trend and intercept, *** Regression in first order with intercept, ****Regression in level with the trend and intercept.

3.2.1. Cointegration- ARDL Bound Test

This research is aimed mainly at investigating the long - term effect of oil income, official exchange rate, and inflation on economic growth. We search the cointegration relationship using an ARDL-bound testing approach and ECM. The first step to this goal is to calculate GDP (Y) as a dependent variable for error correction term, as long as the following ECM models have been developed.

$$\Delta GDP_t = a_0 + \sum_{i=1}^{n} \beta_1 \Delta GDP_{t-i} + \sum_{i=0}^{n} \beta_2 \Delta OILR_{t-i} + \sum_{i=0}^{n} \beta_3 \Delta\, OEXCHR_{t-i} + \sum_{i=4}^{n} \beta_2 \Delta INFR_{t-i} + p_1 GDP_{t-1} + p_1 OILR_{t-1} + p_1 OEXCHR_{t-1} + p_1 INFR_{t-1} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 4$$

The second stage shows if the variables have a long-term link in the F-bound test analysis. The null hypotheses, H_0, thus represent a cointegration between variables in equation 4, while alternative, H_1represent. There is no cointegration among variables.

$$H_0 = p_1 = p_2 = p_3 = p_4 = 0$$
$$H_1 \neq p_1 \neq p_2 \neq p_3 \neq p_4 \neq 0$$

In Table 7,The optimal model lag length is four, according to Akaike Info Criterion (AIC). The long - term effects of relationship respond to the model's lag(Bahmani-Oskooee & Bohl, 2000). According to Pesaran et al. (2001), the following analysis shows that the lower and the limited upper figures with a lag order of four at 95 percent connotation level are 2.79 and 3.67, respectively. They are indicating that F-statistic's calculated Value (12.01785**)** is more extensive than F-statistic's upper bound Value, which allows us to reject the null hypothesis of no long-term relationships, illustrated in Table 6. We thus conclude the long - term relationship among variables, indicating that the country's GDP has long been positively affected by oil rents, the official exchange rate, and inflation.

Table 6*F-statistic Bounds Test cointegration Result*

	Value	**Signif.**	**I (0)**	**I(1)**
F-statistic	**12.01785**	10%	2.37	3.2
		5%	**2.79**	**3.67**
		2.5%	3.15	4.08
		1%	3.65	4.66

Table 7*VAR Optimal Lag-length Selection*

Lag	**LogL**	**AIC**	**SC**	**HQ**
0	-46.50368	4.208640	4.404982	4.260729
1	44.02505	-2.002088	-1.020376*	-1.741639
2	61.63728	-2.136440	-0.369359	-1.667633
3	84.88204	-2.740170	-0.187720	-2.063005
4	119.5932	**-4.299434***	-0.961615	-3.413909*

AIC: Akaike information criterion, **SC:** Schwarz information criterion, **H.Q.:** Hannan-Quinn criterion

Table 8 shows the long-term cointegration between variables, which proves that Brunei Darussalam's oil revenue is the main factor in economic growth.At 5 percent confidence and 0,0002 probability, the impact continues to be significant. It was indicating that a 1 percent increase over crude oil revenues is indicated by the oil rental coefficient, with GDP increasing by 0.379,696% over the long term. However, the inflation rate (INFR) is another vital element of GDP growth. At five percent confidence, the impact of prices on GDP is estimated to be negative. In the long term, a 1 % increase in general price levels would decrease GDP by–0.235738 percent. Similarly, the coefficient of the official exchange rate (OXCHR) also shows that it has a significant negative relationship with GDP in the same period.

Several authors, namely, Hamdi & Sbia (2013) and Ogbonna & Ebimobowei (2012),support that oil sales are still the leading source of economic growth in Bahrain and Nigeria. Besides, the findings in the following literature show a clear correlation between the wealth of natural resources (oil) and significant economic growth, also in line with this study.(Chivvis & Martini, 2014; El-Sakka & Al-Mutairi, 2001; Esfahani et al., 2009; Gallup & Sachs, 1998; Hamdi &Sbia, 2013; Islam & Bahari, 2012; Lakuma, 2020; Metwally & Tamaschke, 1980; Raheem, 2016; Ross, 2003; Schrank, 2004; Stijns, 2005).

Table 8*ARDL Coefficients in Long-Run_ Dependent Variable ln (GDP)*

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNOILR	0.379696	0.029493	12.87415	0.0002
OEXCHR	-1.384939	0.085646	-16.17048	0.0001
INFR	-0.235738	0.016903	-13.94623	0.0002
C	17.36268	0.740368	23.45141	0.0000

EC = LNGDP - (0.3797*LNOILR -1.3849*OEXCHR -0.2357*INFR +17.3627)

3.2.2. Error Correction Model (ECM)

The calculated error correction model (ECM) is shown in the following calculation:

$$\Delta GDP_t = a_0 + \sum_{i=1}^{n} \beta_1 \Delta GDP_{t-i} + \sum_{i=0}^{n} \beta_2 \Delta OILR_{t-i} + \sum_{i=0}^{n} \beta_3 \Delta\, OEXCHR_{t-i} + \sum_{i=0}^{n} \beta_4 \Delta INFR_{t-i} + p_1 GDP_{t-1} + p_1 OILR_{t-1} + p_1 OEXCHR_{t-1} + p_1 INFR_{t-1} + \omega ECT_{t-1} + \varepsilon_t \dots\dots\dots\dots 5$$

We examined the long - term effects of oil earnings, official exchange rates, and inflation on economic growth for Brunei Darussalam, after confirming long - term relationships between selected variables. The analysis in Table 9 indicates that the negative ECT (-1), e.g., –0.063 means model is fit and statically significant for long-term cointegration between GDP, oil income, the official exchange rate, and inflation. It somehow means that we dismiss the long - term null hypothesis that variables do not coincide.

Table 9*Error Correction Term and the Selected ARDL Model*

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	0.008316	0.043651	0.190522	0.8508
D (LNGDP (-1))	0.437580	0.747746	0.585198	0.5650
D (LNOILR (-1))	0.238832	0.195866	1.219364	0.2369
D (OEXCHR (-1))	-0.887012	0.615605	-1.440877	0.1651
D (INFR (-1))	-0.021329	0.018626	-1.145148	0.2657
ECT (-1)	-1.328582	0.528070	-2.515921	0.0205

3.2.3. Diagnostic and Stability Tests to the ECM Model

Specific diagnostic and stability tests were performed on the ECM model to make the analytical analysis more reliable. The estimated probability value of the Breusch–Godfrey serial correlation L.M. test, for example, 0.7563, exceeds (5% significance interval) and shows that we acknowledge the model with no problem with serial correlation. Similarly, Prob. Values (0.7955) ofheteroskedasticity white tests denote there isno autoregressive conditional heteroskedasticity. Similarly, the probability value (0.2606) ofRamsey RESET tests reveals thatno misspecification has been seen in the model.

On the contrary, the probability value of a normal distribution test denotes that data is not normally distributed. The results, therefore, confirm that

each diagnostic test validates the reliability and significance of the model. The normal distribution test shows, however, that data is commonly not transmitted, see Table 11.

Table 10*Diagnostic Tests*

Test	F- statistics	Prob. Value	H_0	Decision
Serial Correlation LM	0.099134	0.7563	No serial correlation	Accept H_0
Heteroskedasticity: (White)	0.623131	0.7955	No heteroscedasticity	Accept H_0
Ramsey RESET	1.344818	0.2606	No specification errors	Accept H_0
Normal Distribution	0.179554	0.914135	No normal distribution	Accept H_0

The selected ARDL reliability was tested using the error correction method following the dependent variable stability test technique. (Brown et al., 1975; Tanizaki, 1995)Therefore, Figure 3 exhibits the reliability result of the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ). Since both plots are 5 percent essential within critical limits, we infer that it is a structurally stable model.

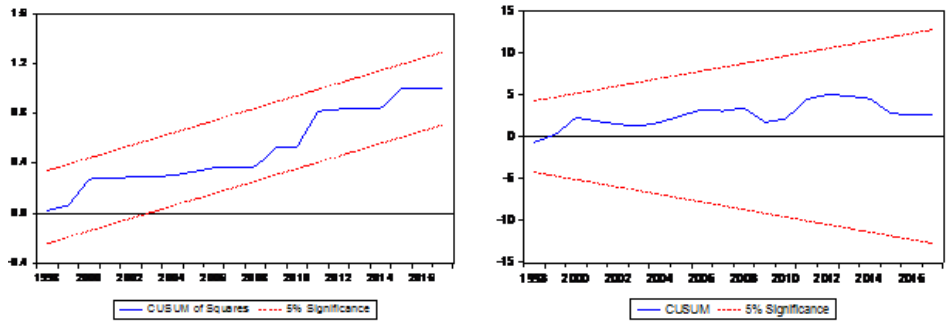


Figure 2*(CUSUM) and (CUSUMSQ) Reliability Exhibition.*

CONCLUSION

The importance of natural resources – more typically- crude oil has already extensively discussed in the economic literature as having uncertain effects on economic stability, sustainability, and long - term growth (Davis & Tilton, 2005; Eastwood & Venables, 2019). This is the case with Brunei Darussalam, as a small country with high per capita income due to attributable GDP oil rent allocations. It was the reason why this study was undertaken. In particular, we are examining the links between oil revenue, official exchange rates, inflation, and economic growth in Brunei. We used annual data from 1990 to 2017 to estimate the short and long-run results by adopting an econometric (ARDL)bound testing approach along with the error correction model. We calculated the time series diagnostic tests before the estimate and conducted the stability tests to validate the results ' robustness. The cointegration testing procedure has shown that the statistically significant association among oil income with economic expansion have a particular long - term relationship. The calculation at 5

percent of the oil rent coefficient is statistically significant, which means the long-term equilibrium of stability progresses rapidly sufficient. We are therefore showing the negative long - term relationship between national and official currency fluctuations and economic growth as Brunei Darussalam was its major oil-exporting country in Southeast Asia.

Oil exportation of fuel does not affect the quantity and price of fuel on the world oil market. The findings are found to be stable and may be useful to government leaders for different purposes. Results show that small countries are vulnerable to external events, face severe threats, and most are primarily attributed to global market conditions and have restricted diversification opportunities due to minor domestic market conditions. (World Bank., 2000). Brunei is a small and an oil-dependent economy which may profoundly influence by external oil shocks. To make Brunei's oil dependence stronger and boost the oil industry, whose influence remains vital to the gross domestic growth rates of this country. We suggest that the government could step up efforts to encourage progress in the oilsector by maintaining a suitable environment and appropriate policies. This would keep a stable long-run social well-being for the Brunei Darussalam economy.

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