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Oil Price and Economic Growth Relationship in Malaysia: An Autoregressive Distributive Lag (ARDL) Approach

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ABSTRACT

This study aimed to determine the impact of oil prices, inflation and exchange rates on Malaysia's economic growth. This study employed the autoregressive distributive lag (ARDL) method to observe the long-run and short-run relationships between the explanatory variables of oil price (Poil) as the focused variable, the inflation (INF) and exchange rate (ER) as the controlled explanatory variables, with Malaysia's gross domestic product (GDP) as the dependent variable. The tests conducted are in the following order; the Unit Root Test, F-bound test, Error Correction test, diagnostic tests and the stability test. Annual type of time series data from 1990 to 2022 are used. The unit root tests provide evidence all data are stationary at first difference level. The finding of the F-bound test reveals the presence of long run relationship among the variables, and results generated from error correction model (ECM) show the presence of short-run relationship between the variables. Here we may conclude changes in oil price, inflation and exchange rates have significant impact on GDP. Given the significant results of these factors on GDP; other than oil price, policymakers are recommended to incorporate also the expected change in the inflation and exchange rate when implementing the stabilization policy. The multiple target variables in policy implementation not only helps trigger higher economic growth but also achieving a more sustain economy.

Keywords: economic growth, inflation, exchange rates, ARDL method, F-bound test

INTRODUCTION

Economic growth is often referred to changes in gross domestic product (GDP) in the economy. In order to raise living standards and end poverty, the economy must grow. The leaders of rising countries initiate action through changes in the factors that determine economic growth such as capital goods, human capital, technology, and labour force. It's a well-accepted fact that oil is one of the most important macroeconomic drivers in the global economy, and country economic performance is highly associated with oil prices (Jalil et al., 2019; Team 2023; Rambeli et al., 2018; Razak, 2019; Elhassan, 2021; and Olujobi, 2022). At global level, oil have a significant role despite ongoing effort to lessen its use and discover other green energy sources. Oil price fluctuations have an impact on both established and emerging economies, either negatively or positively.

Problem Statement

It cannot be denied that the issue of the increase in market oil prices is a phenomenon that always shaken economic performance of many countries including Malaysia. This is because, in majority of cases, change in oil prices has direct impact on the inflation rate and this in return may affect country's economic growth. Earlier studies of Mork (1989), Garratt et al. (2003), Jimenez-Rodriguez and Sanchez (2005), and Narayan et al. (2014) have all established that fluctuations in oil prices exert considerable negative effects on oil-importing nations. Conversely, some research indicates that elevated oil prices can have a beneficial impact on the real economic

activities of certain countries, such as Norway, while adversely affecting others, like the United Kingdom (refer to Jimenez-Rodriguez and Sanchez [2005]). The detrimental effects may stem from phenomena such as the Dutch disease associated with oil resources (Bjornland, 1998).

As a commodity-exporting nation, Malaysian economy is significantly influenced by changes in oil prices. In 2016, mineral fuels constituted 13.9 percent of Malaysia's total exports, a decrease from 15.8 percent in 2010. Additionally, petroleum-related revenues represented nearly 15.0 percent of government revenues in 2016, down from over 35.0 percent in 2010. Therefore, it is crucial to comprehend the implications of oil price fluctuations on Malaysia's economy. Other than that, the mixed findings obtained from previous studies opens this topic for further research. In relation to this, a study on the same theme is conducted but pays specific attention on the following objectives; to detect the existence of long-run relationship between the GDP GROWTH and the selected macroeconomic variables namely, Oil Price (Poil), Inflation (INF) and Exchange Rates (ER), and to determine the existence of short-run relationship between the GDP and the selected macroeconomic variables namely; Poil, INF and ER.

LITERATURE REVIEW

Throughout time the study on Poil-GDP growth has extended in many directions. This section overview past researches that focused on economic growth. The focused factor is oil price while the others; inflation and exchange rates are the controlled variables. Inflation and exchange rates are included as part of the variable in the existing study because literatures had provide evidences on the significance of these variables with the GDP growth. The earlier discussion of the following paragraph focuses on studies of the inflation-gdp growth relationship followed by the exchange rate-gdp growth relationship.

Theoretically, inflationary pressures raise overall living expenses, production, and borrowing. These situations would diminish expenditure level in the economy and create expectation of lower economic activity and total economic development. The theory tend to be in alignment with the findings of Adeosun et al. (2020) who observed a negative impact of inflation on economic growth. The study by Belloumi et al. (2023) take a step backward by studying the impact of changes in oil price to inflation. The study which is conducted by using Saudi Arabia’s time series data documents a positive relationship between oil price and the inflation rates. In other words, high oil prices lead to higher inflation, while lower prices lead to lower inflation.

Exchange rates, alongside inflation, have demonstrated to have significant influence to the economy (Zhao, 2020). This claim is corroborated by Shabsigh (1999) who found that misalignment of the real exchange rate had a notable effect on the overall economic growth of Egypt, Jordan, Morocco, and Tunisia. According to Han (2019) this is due to dual mechanisms identity at which the exchange rates affect economic growth. Specifically, a depreciation of the local currency increases the cost of imports, reduces demand for imported goods, promotes the consumption of domestic products, and lowers the foreign price of exports. These factors enhance the competitiveness of a country's exports, stimulate investment and export activities, and ultimately contribute to economic growth. Conversely, an appreciation of the local currency can result in decreased exports, increased capital flight, and a deteriorating trade balance, all of which can hinder stability and economic development. Notably, Han's research indicates that fluctuations in exchange rates exert a more pronounced impact on economic growth through foreign direct investment channels compared to foreign trade channels.

Focusing on oil price and economic growth relationship, many studies reveal statistically significant relationship between the two variables, implying that oil prices have a positive impact on economic growth. One of the studies is Solaymani (2020) which examines the relationship between oil prices and the economy of the Asian nations. The findings provide indication of positive impact of oil price on the economic. Dinh (2021) has depicted the same type of relationship between the two variables and concluded the positive relationship is due to the fact that oil is an input material in many economic sectors, therefore a fall in oil prices reduces manufacturing costs which then improves the economy's competitiveness and economic growth. Focusing on the same theme of the study, Majuca (2020) who assess the impact of oil prices on the Malaysian economy through the GARCH model has also documented a positive relationship between the two factors. Other studies

who recorded the same type of relationship are Monjazeb, Souri and Shahabi (2013). The study by Brucal and Roberts (2018) however has documented a negative relationship between the variables.

Tillaguango et al. (2024) put focus on the same relationship and tested the variables by using the Cointegration and causality methods. They figured the existence of long-run type of relationship between the two variables, and observed a significant result only in the non-linear type of model. Alekhina & Yoshino (2018) who study the Impact of World Oil Prices on Energy Exporting Economies had observed significant results of the Oil price and the economy relationship.

Finally, the study by Karunanithi (2019) who conducted test on oil price and the economy using both linear and non-linear models has come to the conclusion that, there are insignificant results from the linear model, but Asymmnetric results in the non linear model. other studies who figured asymmetric results are Akinsola & Odhiambo (2020) and Chen et al. (2019).

Based on the review of literatures, we may conclude there are mixed results obtained from these studies and this situation leaves the topic wide open for further investigation. With regards to that, the current study is fascinated to put focus on the same theme of the study, but put specific focus on the oil price – economic growth relationship by using ARDL approach, and is tested on Malaysian case. The outcome of the study provide guidance to policy makers in policy development and implications in counteract the impact of oil price fluctuations on the economy.

METHODOLOGY

The empirical investigation focuses on the model specification, conceptualized as:

GDP = f (Poil, INF, ER) (1)

Where,

GDP GROWTH = Gross Domestic Product

Poil = Oil Prices

INF = Inflation

ER = Exchange Rates

The GDP function outlined in equation 1 is derived from the production function. This equation indicates that GDP is influenced by oil prices, inflation, and exchange rates. Consequently, we can articulate the empirical model (1) as follows:

$$\gamma_{t=} a_0 + a_1 POIL_1 + a_2 INF_2 + a_3 ER_3 + \mu_t \quad (2)$$

Where,

Y = Gross Domestic Product

Poil = Oil Prices

INF = Inflation

ER = Exchange Rates

α = the parameter for the explanatory variables

t = time series

μ = error terms

This empirical model aims to unravel the intricate relationship between GDP and its key determinants, allowing for a nuanced understanding of their impact on economic growth. The data considers the time period from year 1990 to the year 2022. This study uses yearly data which are obtained from various sources namely World Bank Data and FRED Economic Data websites. The data for GDP and oil prices are taken from the World Bank Data website, while the data for inflation rates (measured by Consumer Price Index CPI)) and exchange rates are obtained from FRED Economic Data website. The GDP, Poil, and ER data are in log values while inflation is percent value.

DATA ANALYSIS PROCEDURE

Data analyses are comprised of preliminary tests of the unit-root tests, followed by the ARDL F-Bound test and the error correction model (ECM). In this study, ARDL approach similar to the work of Poku et al. (2022) is applied.

The unit root test is conducted to confirm all variables achieve stationary. In this study, we use augmented Dickey-Fuller (ADF) and Phillip-Peron (PP) tests to evaluate the stationarity status of the variables. Stationary time series data are required for reliable t- and F-statistics. As a result, testing for unit root is a prerequisite before proceeding with additional econometric analysis.

Next, the Bound test is conducted to achieve the first objective. This test is used to check the existence of cointegration or long-run relationship between oil prices, inflation, and exchange rates and economic growth. The Bounds tests employ joint F-statistics to determine whether or not long run co-integration exists. If the computed F-statistic falls between the essential lower and higher thresholds in this scenario, the outcome is inconclusive.

The following test of the F-bound test is the ECM test. This test is to achieve the second objective. This test is to explore the short-term equilibrium relationship between variables, especially in the context of cointegration. It is particularly useful when examining relationships among variables that may exhibit both short-term deviations from and long-term tendencies toward equilibrium.

Diagnostic Tests

Diagnostic tests are mainly to determine the presence of any problems or issues from analyses conducted. In this study the tests include the serial correlation, heteroskedasticity, and the cumulative sum control chart (CUSUM) stability test. The serial correlation or autocorrelation problem is tested by using Breusch-Godfrey Serial Correlation Lagrange Multiplier (LM) Test. Next is testing for the heteroskedasticity problem. Heteroskedasticity is a systematic pattern in the error where the variances of the error are not. The modelling problem occurs when the variance of the error differ across observation. In this study, ARCH test is employed to detect the existence of heteroskedasticity problem in the regression model. The last test is the CUSUM stability test. The CUSUM test is used to determine whether or not the coefficient of regression changes systematically.

FINDINGS

The Unit Root Test (ADF)

The results summary of this test is displayed in Table 1. The null hypothesis established for this test is; H_0 Data is not stationary. The results provide indication at level form, only GDP is stationary (Pvalue < 0.01). The remaining variables (ER, INF, and Poil) are not stationary at level form. The results of the first difference analysis

(I (1)) reported significant results (Pvalue < 0.05).

Table 1. Results of Unit Root Test in Constant

Variables	Augmented Dickey-Fuller (ADF)	
	Level	1st Difference
GDP	-4.3646*** (0.0016)	-6.9008 *** (0.0000)
Poil	-1.3465 (0.5956)	-4.9726*** (0.0004)
INF	-0.0484 (0.9563)	-4.1731 *** (0.0029)
ER	-1.1229 (0.6944)	-4.6304 *** (0.0008)

Note:(*) Significant at the 10%; (**) Significantt the 5%; (***) Significant at the 1% and (no) Not Significant

F-bound Test

The F-bound Test is a test is to detect the existence of co-integration relationship between the variables (GDP, Poil, INF, and ER). The null hypothesis established for this test is; H_0 Cointegration relationship does not exist.

Table 2. F-bound Test Result

Model: GDPt = f (Poil, INF, ER)		
EC = GDP - (-0.6037*Poil + 0.0086*CPI + 0.1341*ER - 1.3707)		
Calculated F- Statistic	8.250134	
K	3	
Critical value for bound test: Restricted Constant and No Trend	Lower Bound I (0)	Upper Bound I (1)
1%	3.65	4.66
5%	2.79	3.67
10%	2.37	3.2

Based on the findings, the F-statistics appear to be higher than the critical value for the upper of I(1) and lower bound I(0). Here we may imply cointegration relationship exists among the GDP, Poil, CPI and ER exist. There fore we reject the null hypothesis.

Error Correction Model (ECM) Test

Table 3 reveals the result of the ECM Test which lists the coefficients and importance of the variables in the error correction model in order to show the short-run and long-run dynamics interactions between the variables. The null hypothesis established for this test is; H_0 Short-run relationship does not exist.

Table 3. Error Correction Model

Variables	Coefficient	Prob.
D(Poil)	-2.573787	0.0011
D(CPI)	0.119810	0.0001
D(ER)	-0.880135	0.0033
D (ER (-1))	-0.346540	0.0427
D (ER (-2))	0.271215	0.1620
D (ER (-3))	-0.404852	0.0138
CoinEq (-1)	-1.245886	0.0000

The error correction term within the model is denoted by the EC-equation, with particular emphasis placed on the ect term of CoinEq(-1). The findings pointed that, the ECT term by character is negative and significant, suggesting a tendency towards equilibrium in the long term; and with coefficient value exceeding 1. These findings imply the existence of a long-term relationship between the variables. Regarding the ect term's value, Narayan and Smyth (2006) made an assertion, the range for the error correction coefficient spans from 0 to just below 2 (with a negative sign and significance). A value below 1 indicates that equilibrium will adjust monotonically, while a value greater than 1 but less than 2 (with a negative sign and significant) suggests that equilibrium will be adjusted in a dampening manner. In the current scenario, the observed ect term falls within the range of -1 < ect > -2, indicating that equilibrium will be adjusted in a dampening manner. In other words, the error correction process oscillates around the long-term value.

Diagnostic Tests

The study had passed the Serial Correlation LM test (p-value (0.2701), Heteroskedasticity ARCH test (p-value=0.839), and the stability tests of the CUSUM test (See figure 1).

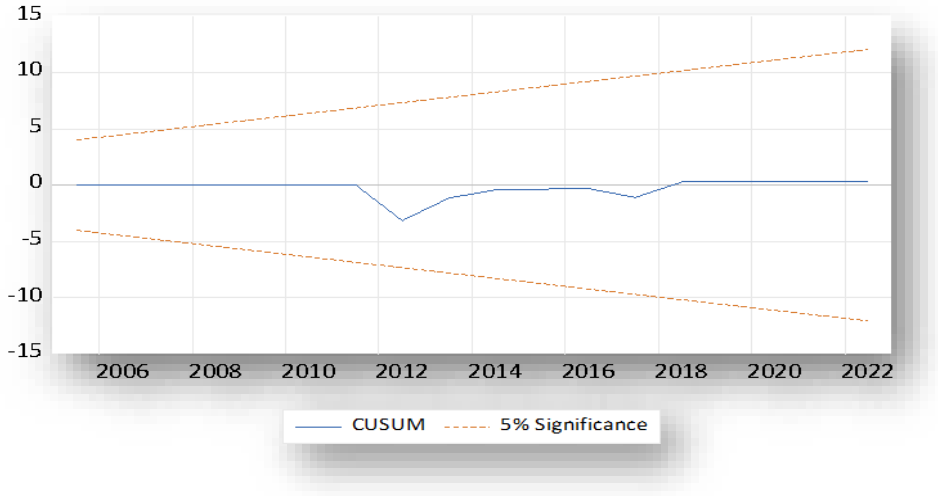

Figure 1: CUSUM Test

CONCLUSION

The objectives of this study is to investigate the impact of oil price on the Malaysian economy. The dependent

variable is the GDP, while the focused independent variable is the Poil, and the controlled independent variables are INF and ER. The empirical result of the F-bound test reveals evidence supporting the presence of a long run relationship among Poil, INF, ER with the GDP. Meanwhile, the ECM test results elucidate short-run dynamics among the variables. In specific it shows the existence of short-run relationship among the variables, but by character it has an oscillatory type of adjustment process where equilibrium is adjusted in a diminishing manner. In other words, the error correction process fluctuates around the long-run value. Overall conclusion of the findings is, changes in oil price, inflation and exchange rates do have significant impact on GDP. Given the significant results of these factors on GDP, policymakers are recommended to incorporate an expected changes in the inflation and exchange rate into their consideration when implementing the stabilization policy to ensure the economy achieve sustainable economic growth and development.

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