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UNCOVERING THE RELATIONSHIP BETWEEN BROAD MONEY AND THE RESPECTIVE MACROECONOMIC VARIABLES: QUANTITATIVE RESEARCH IN MALAYSIAN PERSPECTIVE

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ABSTRACT

A market's broad money (BRM) can vary according to a country's monetary policy. Monetary policymakers always investigate the relationship between broad money and other macroeconomic variables to understand the economic insight of a country and then implement the best monetary policy that suits the country. Prior studies have identified a few macroeconomic variables, namely consumer price index (CPI), real interest rate (RIR), government final consumption (GFC), net foreign asset (NFA), and unemployment rate (UER), that can affect broad money circulation in a market. By utilizing time series data range from 1991 to 2019, this study has employed Multiple Linear Regression (MLR) Analysis, Augmented Dickey-Fuller unit root assessment, Johansen Cointegration test, Vector Error Correction Model, and Wald Test to evaluate the direction of impact, short-run and long-run causality effects between the variables. This study reveals that no macroeconomic variables have either short-run or long-run causality effects.

Keywords: Broad Money; Interest Rate; Consumer Price Index; Consumption

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1. INTRODUCTION

After Malaysia was announced to be an independent country on 31 August 1957, Malaysia underwent significant changes in social, cultural, political, as well as economic (Sundaram & Wee, 2013). Early in the 1960s, rubber and tin production and export drove the majority of economic growth in Malaysia (Ken, 1965). However, the Malaysian government has considered the long-term growth of Malaysia's economy. Thus, action to diversify Malaysia's economy is necessary to empower Malaysia's economic growth in the long term. Therefore, over the last few decades, Malaysia shifted its focus to the manufacturing industry (Sundaram & Wee, 2013). Money supply has assumed greater significance (Chaitip et al., 2015) as Malaysia's economy has shifted from an agricultural base to one based on services and manufacturing. Some forces propelling Malaysia's economic development can be better understood by examining how broad money interacts with other macroeconomic variables. Money is a commodity or tangible asset generally recognized and received by the public as a means of exchanging goods and services, and it is always ready to be used in payment transactions (Davies, 2010). Ultimately, there are two types of money: the money that central banks hold to settle transactions is known as narrow money, while the money that governments, companies, and households hold to settle transactions is known as broad money (Goodfriend, 2005). Hence, in general, in this research, broad money can be known as money that is broadly used and circulates quickly in the economy. In contrast, narrow money is reserved by the central bank, which does not circulate in the economy.

Malaysia has been experiencing an upward trend in inflation rates, recently reported by Talha et al. (2021), and an increase in the cost of living, reported by Aziz (2023a). Consequently, the central bank of Malaysia, Bank Negara Malaysia, is ready to increase the Overnight Policy Rate (OPR) to cope with the high inflation in Malaysia (Vasu, 2022). Hence, two problem statements could be used to investigate the impact of the Consumer Price Index (CPI) and Real Interest Rate (RIR) on Broad Money (BRM) in the country since we can know the causality effect of CPI and RIR on BRM. Besides that, the changes in monetary policy will also affect the T-bill or T-bond rates (CFI, 2022). In order to stabilize the demand for government bonds, the government will sell foreign assets and repurchase the bonds (Abdullah & Razali, 2017). Thus, net foreign assets (NFA) are valuable independent variables that can investigate the relationship between broad money. Moreover, the Malaysian government recently announced the largest fiscal package, RM 388.1 billion (Aziz, 2023b). Apparently, in recent years, the Malaysian government has kept increasing the size of its fiscal package (Tay, 2022). LAU & LEE (2021) reexamine the concept

of fiscal sustainability for Malaysia. According to their research, 40 of the 48 years in the sample period show that Malaysia's budget is unsustainable. Hence, to better prepare the government for future economic shocks, the authors recommend reducing the debt ratio and reallocating spending away from less efficient and more growth-enhancing areas. As a result, we are curious about how Government Final Consumption (GFC) can impact broad money. Therefore, we conduct a study to explore the role of Government Final Consumption (GFC) in monetary policy and its impact on Broad Money. The relationship between the monetary policy of money supply and unemployment is debated among economists. Some point of view holds that lower levels of money supply led to lower levels of inflation, leading to lower levels of unemployment (Selim & Hassan, 2019). However, some point of view holds that raising interest rates results from deflation and decreasing money supply, causing an inefficient economy and, ultimately, fewer jobs (Challe, 2020). Therefore, we are curious whether money supply and employment are related, causing these scenarios.

2. LITERATURE REVIEW

To investigate the relationships between broad money and other respective macroeconomic variables in Malaysia, we have identified one dependent variable and five independent variables based on theoretical and empirical considerations. In the subsequent section, we will review the existing literature to understand the relationships and interactions between these variables.

2.1 Broad Money (BRM)

BRM is defined as the total amount of money circulating outside the banks. This includes demand deposits, savings, time, foreign currency deposits, certificates of deposit, and commercial paper (*Broad Money (Current LCU) - Malaysia | Data*, 2023). Researchers Maboudian and Ehsani (2020) analyze the impact of significant macroeconomic shock variables on Iran's GDP growth rate. Their research found that the money supply influences the expansion rate of GDP. They suggest that if the money supply expands, consumers will have more purchasing power, businesses will have more capital to invest, and the economy will grow faster. Therefore, the total amount of liquid assets available in an economy significantly impacts economic activity and GDP growth rates, so understanding what influences broad money in the short and long run is crucial. Besides that, Habibullah (1998) investigates the empirical relationship between money supply and stock prices in the Kuala Lumpur Stock Exchange (KLSE). The result suggests that stock prices and money supply are related in a bidirectional manner. Thus, the study on the factors that impact broad money will be crucial since if these factors cause the broad money to reduce, the stock prices will also reduce, which may cause Malaysia's stock market to become

weak. Investigating the factors that can affect BRM also can give policymakers a clear indication of how to improve stock market performance.

2.2 Consumer Price Index (CPI)

Inflation means the cost of living of the population in a country where CPI is a unit percentage indicator to measure the average cost of the consumer to get a basket of goods and services that may be constant or changed at a specific time frame (*Inflation, Consumer Prices (Annual %) - Malaysia | Data*, 2023). Doan Van (2020) uses the economic theories of Marx, Fisher, and Friedman to analyze the relationship between the money supply and inflation. The author discovered that a continuous increase in money supply causes long-term inflation but does not cause short-term inflation, with correlations between Vietnam and China's research data being extremely close at 99%. Eventually, the author suggests that governments need effective policies to curb inflation while fostering economic expansion. Moreover, Dinh (2019) analyzes the correlation between Vietnam's expanding money supply and price increases using Ordinary Least Squares (OLS) regression and interviewing specialists. Their results provide evidence of a robust relationship between changes in the money supply and the ensuing changes in inflationary pressures within the Vietnamese economy. Smauel et al. (2019) explore the missing connection between Nigeria's money supply and inflation rate. This research shows that inflation is not caused by an increase in the money supply but rather by non-monetary factors like political instability, corruption, and inadequate basic infrastructure. As shown by the results of the causality tests, there is a unidirectional flow between the money supply and inflation, and the disequilibrium can be converted back to equilibrium within a year, according to the Vector Error Correction Model (VECM). Rather than focusing on increasing the money supply, as the Quantity Theory of Money predicts the increase in money supply would cause inflation to rise, policymakers should instead pay attention to these non-monetary factors to keep inflation in the single digits.

Smauel et al. (2019) contend that non-monetary factors have a more significant impact on inflation, even though Doan Van (2020) and Dinh (2019) find a positive relationship between the two variables. The connection between the money supply and inflation is nuanced and may be affected by external factors. These studies' findings have substantial policy ramifications. Policymakers require efficient measures to control inflation while encouraging economic growth if the relationship between money supply and inflation is positive, as found by Doan Van (2020) and Dinh (2019). Policymakers should address non-monetary factors that affect inflation if the relationship is insignificant, as Smauel et al. (2019) found.

2.3 Government Final Consumption (GFC)

Government Final Consumption (GFC) includes all kinds of expenses for buying goods and services (*General Government Final Consumption Expenditure (Current LCU) - Malaysia | Data*, 2023). Kandil (2006) demonstrates that variations in real output growth, price inflation, wage inflation

and real wage growth vary concerning anticipated and unanticipated shifts to the money supply, government spending, and energy prices. Furthermore, price flexibility is critical for differentiating the impact of expansionary and contractionary policies. Anjande et al. (2022) found that foreign direct investment and government spending negatively affected poverty reduction in the region, but the expansion of the money supply had the opposite effect. There is a call for a refocus on improving financial systems so that monetary policy can be effective again and to foster an enabling environment that encourages foreign direct investment (FDI) into Africa. The paper by Mehrara and Sujoudi (2015) indicated that inflation was significantly affected by the money growth rate but not by GDP growth, exchange rates, or government spending. Inflation can be contained by slowing the expansion of the money supply and keeping the energy cost down.

2.4 Net Foreign Asset (NFA)

Net foreign Assets (NFA) are all foreign assets held by monetary authorities and financial institutions after deducting foreign liabilities (Net Foreign Assets (Current LCU)—Malaysia | Data, 2023). Minimal research investigates the relationship of net foreign assets to broad money. Hence, our study will fill this gap by contributing to this literature. Eventually, the only related study we can find is the study of Chowdhury et al. (2014).

The study of Chowdhury et al. (2014) aims to analyze the determinants of foreign exchange reserves in Bangladesh. Since net foreign assets include all assets, including cash, this research investigating the foreign exchange reserve is considering a form of foreign assets, which is also helpful to review before we conduct our study. This study suggests a correlation between broad money and foreign exchange reserves and the exchange rate, remittances, domestic interest rate, exports, imports, GDP per capita, and UPI. However, the relationship between foreign exchange reserves and broad money is negatively significant. We will temporarily generalize the relationship between net foreign assets and broad money as a negative sign.

2.5 Real Interest Rate (RIR)

The GDP deflator measures the real Interest Rate (RIR), and it is referred to as the lending interest rate after the adjustment of inflation (*Real Interest Rate (%) - Malaysia | Data*, 2023). Cornell and French (1986) found that announcements about the money supply had a negligible effect on short-term real interest rates (between one and three months). However, the real interest rate over the following six and twelve months positively correlates with monetary shocks. Longer-term investments (those with a maturity of six months or more) can benefit from a “money shock” that increases the total amount of currency in circulation and, in theory, leads to higher returns for investors.

Another research by Cornell (1983) examines the money supply announcements puzzle phenomenon, which is when stock prices tend to increase after an announcement of changes in the money supply. They suggest several possible explanations for why the money supply announcements puzzle occurs, including expectations about future economic activity due to increased liquidity, higher returns from investors anticipating more available funds, and a "flight to quality" effect caused by investors seeking safety during times when there are significant increases or decreases in the money supply. The study also suggests that changes in the money supply can affect accurate interest rates. Specifically, a large increase or decrease in the money supply can lead to higher or lower real interest rates due to increased liquidity and investor demand for safety. Furthermore, Litterman and Weiss (1983) examine the relationships between money, real interest rates, prices, and output using Keynesian and equilibrium monetary theory of output. Both monthly and quarterly data show that the author's hypothesis of an exogenous real interest rate cannot be rejected. According to the prevalent monetary theories of output, the money supply in circulation affects the real interest rate at which people are willing to lend and borrow money and, thus, economic activity more generally (output). Besides that, inflation innovation was found to harm future output. Current monetary theories of output that attribute causality to the growth of the money supply have been called into question due to these findings.

2.6 Unemployment Rate (UER)

Unemployment Rate (UER) is meant by the unit percentage of active job seekers that are without work (*Unemployment, Male (% of Male Labor Force) (Modeled ILO Estimate) - Malaysia | Data*, 2023). Rush (1986) conducted empirical research on the rational expectations hypothesis, which states that actual variables like the unemployment rate are only affected by sudden shifts in the money supply. The author concludes that the base money supply is an improved monetary aggregate metric over M1. Changes that were widely anticipated failed to affect the unemployment rate. Umar's (2020) research sought to measure how a hike in Nigeria's minimum wage affected the country's unemployment rate. Moreover, the secondary objective was to examine the relationship between the national employment rate and key macroeconomic variables like inflation, the CPI, and the money supply. The study found that increasing the minimum wage nationally would increase unemployment, hurting the economy. It was also discovered that while the consumer price index and money supply were positively related to unemployment, inflation had a negative relationship with the unemployment rate. Based on our literature review, we conclude our research hypotheses as follows:

There is a positive relationship between CPI and BRM.
There is a positive relationship between GFC and BRM.
There is a negative relationship between NFA and BRM.
There is a positive relationship between RIR and BRM.
There is a positive relationship between UER and BRM.

3. DATA AND METHODOLOGY

This section will clarify the datasets we used, the theoretical framework employed, and the research method used.

3.1 Datasets

The dataset used in this study has 29-year data from 1991 to 2019 that was retrieved from the "World Bank Database", which excluded the data during the COVID-19 pandemic period from 2020 to 2022. This is because, during the COVID-19 pandemic period, several studies such as Aribisala & Oluwadamilare Olufolarin (2020), Chronopoulos et al. (2020), and Ozili (2021) have proven to have significant changes or structural breaks in the economy that were not present in the earlier period. From the evidence, we infer that these changes could have affected the relationship between the dependent and independent variables. Therefore, the purpose of this research is to investigate the relationships between broad money and other macroeconomic variables, so we only include 29 observations in this study, excluding the data that is in the COVID-19 period. The measurement units of BRM, GFC, IMP, and NFA are all in the current LCU, while CPI, RIR, and UER are in percentage (%). The measurement unit "LCU" means Local Currency Unit, whereas the word "current" indicates that the value of the variables is adjusted for price inflation (The World Bank, 2023). Multiple linear regression (MLR) is an inferential analysis method used to probe the connection between a single dependent variable and many potential independent variables, as described by Hair et al. (2006). Three important research questions are aided by multiple linear regression (Hair et al., 2007). The first question that MLR can answer is whether or not there is a statistically significant connection between the independent and dependent variables. Besides that, how strongly the independent variables predict the dependent variable is the second question that MLR can answer. As a third point, the direction of the relationship between the independent and dependent variables is either positive or negative and can be determined using MLR. Thus, we construct the following equation as our theoretical framework:

$$BRM = C + \beta_1 CPI + \beta_2 GFC + \beta_3 IMP + \beta_4 NFA + \beta_5 RIR + \beta_6 UER + \varepsilon$$

Where BRM is Broad Money (in current LCU), CPI is Consumer Price Index (unit of percentage), GFC is Government Final Consumption (in current LCU), IMP is Import (in current LCU), NFA is Net Foreign Asset (in current LCU), RIR is Real Interest Rate (unit of percentage), and UER is Unemployment Rate (unit of percentage).

3.2 Cointegration Test: Johansen Cointegration Test

We often use the Johansen cointegration test to determine if multiple time series variables are cointegrated. Cointegration refers to the statistical property of a set of variables where the time series of a linear combination of those variables is stationary. In econometrics, cointegration is helpful because it

enables the modelling of long-run relationships between variables that might not be immediately apparent from looking at short-term data alone (Asteriou & Hall, 2011). Johansen Cointegration test describes the dynamic relationships between multiple time series variables that form the basis of the test, specifically, the Vector Autoregression (VAR) model (Johansen, 1992). The null hypothesis of no cointegration is rejected. At least one cointegrating relationship among the variables is inferred if the trace statistic or the maximum eigenvalue statistic is larger than a predetermined threshold. The test also reveals the number of cointegrating relationships.

3.3 Causality Test: Vector Error Correction Model (VECM) and Wald Test

The Vector Error Correction Model (VECM) is a statistical model for describing the long-term dynamic relationships between multiple time series variables, and it is an extension of the standard Vector Autoregressive (VAR) model (Maitra, 2023). VECM is based on the assumption that the levels of the variables being studied are not stationary but that the differences, I(1) and I(2), are stationary over time (Shahid et al., 2018; Asteriou & Hall, 2011). The long-run equilibrium relationship and the short-run dynamics are separated into two distinct but interconnected parts in VECM. A system of linear equations describing the long-run equilibrium relationship between the variables is provided. In the short run, the dynamics are captured by error correction equations that describe how the variables correct for shifts away from their long-term equilibrium (Maitra, 2023; Asteriou & Hall, 2011). On the other hand, if we want to evaluate the short-term causality effect, we need to use the Wald test. The Wald test determines whether a set of explanatory variables in a regression model is statistically significant. Using the Wald test, the null hypothesis is that the parameters in a regression model all equal zero, while the alternate hypothesis is converse. We need to reject the null hypothesis as if the coefficients of the independent variables are equal to zero. Then, it indicates no short-run causality effect between the dependent and independent variables.

4. RESULTS AND DISCUSSION

Table 1 shows the variable results with BRM (-1) and LAG1RESIDUAL added into the basic equation. From the result, we can find that CPI (p-value=0.9902), GFC (p-value=0.2051), RIR (p-value=0.6210), and UER (p-value=0.5451) are not significant due to their p-values being more than 0.05. On the other hand, NFA (p-value=0.0225) is the only significant variable because its p-value is less than 0.05. From the results of the coefficient of the significant variable, for instance, we know that NFA has a coefficient of 0.0296, which indicates that when NFA increased by 1%, BRM also increased by 0.0296%. From the results, we can also note that the adjusted R-square value of this model is 0.9711, meaning that 97.11% of the variation in BRM is due to NFA only. Besides that, the probability F-statistic (0.0000) is shown to be significant because it has a value less than 0.05, indicating that this model is fit. After interpreting the results of this multiple regression model, we need to diagnose the coefficients and

residuals and ensure they satisfy the four assumptions: no multicollinearity, free from serial correlation, normally distributed, and homoscedasticity.

Table 1: Results of Multiple Linear Regression Analysis

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.09E+09	5.44E+09	0.752127	0.4612
CPI	-5594040	4.50E+08	-0.012432	0.9902
GFC	0.007478	0.005699	1.312194	0.2051
NFA	0.029547	0.011893	2.484327	0.0225
RIR	-84903960	1.69E+08	-0.502659	0.6210
UER	-9.56E+08	1.55E+09	-0.616217	0.5451
LAG1RESIDUAL	0.525183	0.258354	2.032804	0.0563
BRM(-1)	0.604889	0.169060	3.577964	0.0020

R-squared = 0.978849	Mean dependent var = 2.39E+10
Adjusted R-squared = 0.971057	S.D. dependent var = 1.41E+10
S.E. of regression = 2.40E+09	Akaike info criterion = 46.27298
Sum squared resid = 1.09E+20	Schwarz criterion = 46.65693
Log likelihood = -616.6852	Hannan-Quinn criter = 46.38714
F-statistic = 125.6161	Durbin-Watson Stat = 2.201095
Prob(F-statistic) = 0.0000	

Table 2: Results of Variation Inflation Factor Test

Variable	Coefficient Variance	Uncentered VIF	Centred VIF
C	2.96E+19	139.0761	NA
CPI	2.02E+17	7.564691	1.503732
GFC	3.25E-05	41.88259	13.24937
NFA	0.000141	39.05166	8.441551
RIR	2.85E+16	3.078149	1.685720
UER	2.41E+18	123.9064	1.282497
LAG1RESIDUAL	0.066747	1.585293	1.585228
BRM(-1)	0.028581	93.97822	25.03724

Table 3: Results of Pearson Correlation Coefficients Test

	CPI	GFC	NFA	RIR	UER	LAG1R	BRM(-1)
CPI	1.0000	-	-	-	-	-	-
GFC	-0.3070	1.0000	-	-	-	-	-
NFA	-0.2613	0.8362	1.0000	-	-	-	-
RIR	-0.2873	-0.1505	-0.3206	1.0000	-	-	-
UER	-0.1160	-0.0847	-0.0062	0.0427	1.0000	-	-
LAG1R	-0.1042	0.0176	0.0026	0.0916	-0.2181	1.0000	-
BRM(-1)	-0.2545	0.940*	0.8846	-0.1332	-0.1746	0.1742	1.0000

** denotes a high Pearson correlation coefficient*

Table 2 shows that almost all independent variables have no multicollinearity with dependent variables since their centred VIFs all fall in the normal range of 1 to 10. However, the centred VIF value of GFC (13.2494) is abnormal. Table 3 shows that GFC is highly correlated with the lagged dependent variable "BRM (-1)" with a correlation value 0.9404. Since GFC is not highly correlated with other independent variables (CPI, NFA, RIR, and UER), we can confirm that this model has no multicollinearity issue. Therefore, we can proceed to the next step, diagnosing this model's normality.

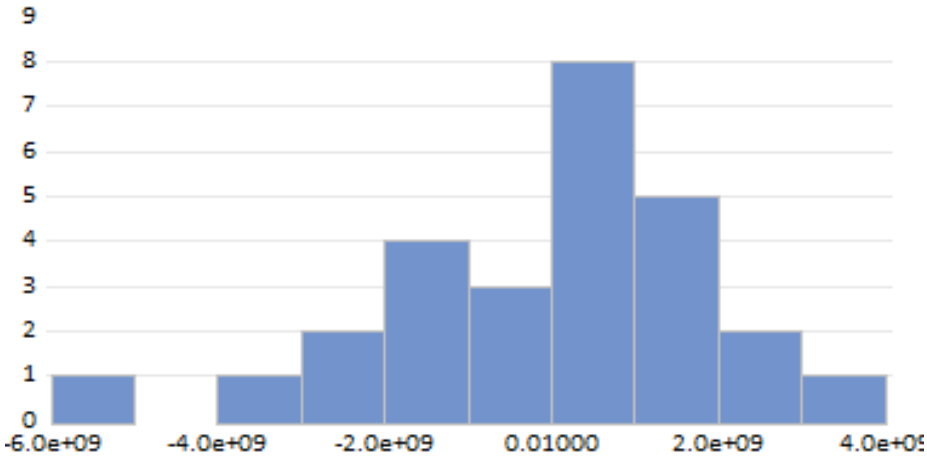

Figure 4.1: Graph of Jarque-Bera Test

Table 4: Results of the Jarque-Bera Test

Particulars	Figure
Mean	1.30E-06
Median	3.16E+08
Maximum	3.58E+09
Minimum	-5.53E+09
Std. Dev.	2.05E+09
Skewness	-0.706598
Kurtosis	3.425475
Jarque-Bera	2.450423
Probability	0.293696

In the Jarque-Bera test, there are two hypotheses:

H_0: *The residuals are normally distributed.* ($Reject\ if\ p - value < 0.05$)

H_1: *The residuals are not normally distributed.* ($Reject\ if\ p - value > 0.05$)

From the Jarque-Bera test results of Table 4, we can see that the residuals of this model have a Jarque-Bera value of 2.4504 and a p-value of 0.2937 (>0.05), meaning that we can infer that the residuals of this model are normally distributed since the null hypothesis is being accepted.

Table 5: Results of Serial Correlation Test

F-statistic	1.372303	Prob. F(2,17)	0.2802
Obs*R-squared	3.753144	Prob. Chi-Square (2)	0.1531

There are two hypotheses in the Breusch-Godfrey Serial Correlation LM Test, which are:

H_0: *No serial correlation at up to two lags.* ($Reject\ if\ p - value < 0.05$)

H_1: *There is serial correlation at up to two lags.* ($Reject\ if\ p - value > 0.05$)

Table 5 shows the result of the Breusch-Godfrey Serial Correlation LM Test. By adding the natural logarithm transformation to BRM, we found that the observed R-squared value is 3.7531, and its respective p-value is 0.1531(>0.05). Now, the residuals are free from serial correlation issues since we have accepted the null hypothesis. This can be explained when we add the lagged residuals

(LAG1RESIDUAL) as a proxy for the potentially omitted variables that might cause the serial correlation issue. This also meant that we used the lagged values of the residuals as a predictor for the current value of the dependent variable. By doing so, we are essentially accounting for the information not included in the original model due to serial correlation. This can help improve our model's accuracy in capturing the relationship between broad money and other independent variables.

Moreover, we also include a lagged dependent variable [BRM (-1)] in our model. By doing so, we are effectively controlling for the influence of past values of the dependent variable on the current value, which can help to reduce serial correlation. We include information from previous periods in the model, which can help capture any systematic patterns or trends in the data that might contribute to serial correlation. In short, after adding an explanatory dummy variable (LAG1RESIDUAL) and a lagged dependent variable [BRM (-1)] into our model, the residuals in our model are now free from serial correlation.

Table 6: Results of Heteroskedasticity Test

F-statistic	0.376571	Prob. F(2,17)	0.9047
Obs*R-squared	3.289511	Prob. Chi-Square (7)	0.8570
Scaled Explained SS	1.975503	Prob. Chi-Square (7)	0.9612

There are two hypotheses in the Breusch-Pagan-Godfrey Test, which are:

$$H_0: Homoskedasticity\ is\ present. (Reject\ if\ p - value < 0.05)$$
$$H_1: Heteroskedasticity\ is\ present. (Reject\ if\ p - value > 0.05)$$

Table 6 shows the results of the Breusch-Pagan-Godfrey test. The observed R-squared value is 3.2895, and the respective p-value is 0.8570 (>0.05), indicating that the residuals in this model are free from heteroskedasticity since we accept the null hypothesis. In other words, the residuals of this model are homoskedastic, which makes the model fit. Table 7 shows all the results of the Augmented Dickey-Fuller (ADF) test at level, first difference, and second difference. Generally, the ADF test determines whether a unit root exists in a series (Shahid, 2019, 2022). There are two hypotheses in the ADF test:

$$H_0: The\ series\ has\ a\ unit\ root\ or\ it\ is\ not\ stationary. (Reject\ if\ p - value < 0.05)$$
$$H_1: The\ series\ does\ not\ have\ a\ unit\ root\ or\ it\ is\ stationary. (Reject\ if\ p - value > 0.05)$$

In the ADF test, we need to make sure our variable is not stationary at level [I(0)] while it is stationary at first difference [I(1)] or second difference [I(2)]. This means that the p-values in all trends, trends and intercepts, and none at the level must be greater than 0.05. On the other hand, the p-values must at

least have I(1) or I(2) in all trends, trends and intercepts, and none smaller than 0.05. In simple words, we accept the null hypothesis in level in all three cases while rejecting the null hypothesis at least in I(1) or I(2) in all three cases.

Table 7: Results of Augmented Dickey-Fuller (ADF) Test

		LBRM	CPI	GFC	NFA	RIR	UER
Level	Intercept	0.7788	0.0026*	1.0000	0.6029	0.0000*	0.0805
	Trend & Intercept	0.7976	0.0021*	0.9999	0.9545	0.0000*	0.2547
	None	0.9972	0.1459	1.0000	0.8856	0.1474	0.3618
First Difference	Intercept	0.0020*	0.0000*	0.9679	0.0003*	0.0000*	0.0010*
	Trend & Intercept	0.0109*	0.0001*	0.0083*	0.0012*	0.0000*	0.0034*
	None	0.0005*	0.0000*	0.9757	0.0000*	0.0000*	0.0000*
Second Difference	Intercept	0.0000*	0.0000*	0.0045*	0.0005*	0.0000*	0.0006*
	Trend & Intercept	0.0000*	0.0002*	0.0075*	0.0020*	0.0000*	0.0042*
	None	0.0000*	0.0000*	0.000*	0.0000*	0.0000*	0.0000*

*Note: * represents the level of significance at 5 percent. ADF is the abbreviation of the Augmented Dickey-Fuller test.*

The purpose of keeping variables non-stationary at the level and stationary at the first or second differencing is because performing the Vector Error Correction Model (VECM) will automatically transform it into stationary form at the first and second differencing. A notable adjustment that we have made in the ADF unit root test is that we have added a natural logarithm to the dependent variable (BRM); this can be annotated as LBRM. This is because BRM is not stationary in both the first and second differencing, so we cannot continue performing VECM. After adding LBRM, the dependent variable is not stationary at level but stationary at both first differencing and second differencing, which fulfil the requirement of doing VECM. Besides, according to the abovementioned conditions, we must reject CPI (p-value=0.0026) and RIR (p-value=0.0000) from the results. This is because their p-values are already less than 0.05 in the intercept at the level. Thus, we need to reject the null hypothesis and accept the alternate hypothesis, indicating that these two variables are stationary at level or do not have unit roots. Moreover, the CPI and RIR are also significant in "trend and intercept", in which CPI (p-value=0.0021) and RIR (p-value=0.0000) are at a level since their p-value is lesser than 0.05, which does not fulfil our requirement. Conversely, LBRM, GFC, NFA, and UER are all accepted. This is because their p-values at a level in all three cases

are all greater than 0.05, revealing that we need to reject the null hypothesis and accept alternative hypotheses in which LBRM, GFC, NFA, and UER do not have unit roots and are not stationary at a level in all three cases. Furthermore, GFC is not stationary in the first differencing since, in some cases, the p-values are more than 0.05. However, in the second differencing, it is proved to be stationary in all cases since we accept the null hypothesis and the p-values are less than 0.05. Besides that, LBRM, NFA, and UER are stationary at both first differencing and second differencing in all three cases. Hence, we only keep LBRM, GFC, NFA, and UER to perform our next step, selecting the best lags.

Table 8: Results of Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5% Critical Value	Prob.**
None*	0.811902	78.98362	47.85613	0.0000
At Most 1*	0.571450	33.87225	29.79707	0.0161
At Most 2	0.285144	10.99384	15.49471	0.2119
At Most 3	0.069009	1.930642	3.841465	0.1647

*Trace test indicates two cointegration equation(s) at the 5% significance level. * denotes rejection of the hypothesis at the 5% significance level while ** denotes MacKinnon-Haug-Michelis (1999) p-values*

Table 9: Results of Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5% Critical Value	Prob.**
None*	0.811902	45.11137	27.58434	0.0001
At Most 1*	0.571450	22.87841	21.13162	0.0281
At Most 2	0.285144	9.063200	14.26460	0.2809
At Most 3	0.069009	1.930642	3.841465	0.1647

*The trace test indicates two cointegration equation(s) at the 5% significance level. * denotes rejection of the hypothesis at the 5% significance level, while ** denotes MacKinnon-Haug-Michelis (1999) p-values.*

Once we have selected the best number of lags, we need to perform the Johansen Cointegration Test again with the two hypotheses:

$$H_0: The\ statement\ is\ accepted.\ (Reject\ if\ p-value < 0.05)$$
$$H_1: The\ statement\ is\ not\ accepted.\ (Reject\ if\ p-value > 0.05)$$

From the Johansen Cointegration test summary results, as shown in Table 8 and Table 9, we need to use either the Trace Test Statistic or Max-Eigen Test Statistic to determine the number of cointegrated independent variables with LBRM. For instance, from our Trace Test Statistic results, we can see at most 1 cointegration has a p-value (0.0000) lesser than 0.05; thus, we can conclude that there is more than one cointegration between the independent variables and LBRM. On the other hand, the Max-Eigen Test Statistic also suggests that "at most 1 cointegration" has a p-value (0.0000) lesser than 0.05. Therefore, we can conclude that there is more than one cointegration between the independent variables and LBRM. We conclude in both the Trace Test and the Max-Eigen Test because we have accepted the alternate hypothesis in which the statement of, at most, 1 cointegration is not accepted. Simply put, it means that the statement of at most 1 cointegration is wrong, which implies we have more than one cointegration.

Besides that, we can also see that at no cointegration, both p-values of the Trace Test Statistic (p-value=0.0000) and Max-Eigen Test Statistic (p-value=0.0001) are smaller than 0.05, meaning the statement of no cointegration is false. Hence, our independent variables cannot be cointegrated with LBRM. Furthermore, the Trace Test Statistic (p-value=0.0542) and Max-Eigen Test Statistic (p-value=0.1546) both suggested that "at most 2 cointegrations" have p-values that are both more than 0.05, meaning that we are accepting the null hypotheses. In other words, the statement of "at most 2 cointegration" is accepted or correct, also meaning that we have at most 2 cointegrated independent variables with LBRM. Interestingly, "Trace Test Statistic" (p-value=0.0388) and "Max-Eigen Test Statistic" (p-value=0.0388) both also suggested "at most 3 cointegration" have p-values that are both less than 0.05, meaning that we can confirm the statement of "at most 3 cointegration" is false, revealing that there must not be three independent variables that are cointegrated with LBRM.

In conclusion, due to the statements of "at none", "at most 1 cointegration", and "at most 3 cointegration" being identified as false statements, then we can confirm that two of our independent variables are cointegrated with LBRM. Therefore, the Vector Error Correction Model (VECM) can be constructed now. The equation of the Vector Error Correction Model (VECM) is as follows, with 3 lags intervals for endogenous variables and 2 cointegrating:
D(LBRM)=C(1)*[LBRM(-1) - 4.28E-12 NFA(-1) + 0.33 UER(-1)-23.87] + C(2)*[GFC(-1) + 0.38 NFA(-1) - 21805332654 UER(-1) - 430936796532] + C(3)*D(LBRM(-1)) + C(4)*D(LBRM(-2)) + C(5)*D(LBRM(-3)) + C(6)*D(GFC(-1)) + C(7)*D(GFC(-2)) + C(8)*D(GFC(-3)) + C(9)*D(NFA(-1)) + C(10)*D(NFA(-2)) + C(11)*D(NFA(-3)) + C(12)*D(UER(-1)) + C(13)*D(UER(-2)) + C(14)*D(UER(-3)) + C(15)

Table 10: Results of Vector Error Correction Model

Constant	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.0664	0.6325	-0.1050	0.9169

By examining the positive and negative values of the coefficient, C (1), along with the p-value, we can identify four situations that indicate the presence of a long-term connection between the variables:

$(1): If C(1) < 0, p - value < 0.05, then\ the\ long - run\ causality\ effect\ is\ observed.$

$(2): If\ C(1) > 0, p - value > 0.05, then\ no\ long - run\ causality\ effect\ is\ observed.$

$(3): If\ C(1) < 0, p - value > 0.05, then\ not\ enough\ evidence\ to\ detect\ long - run\ causality.$

$(4): If\ C(1) > 0, p - value < 0.05, then\ not\ enough\ evidence\ to\ detect\ long - run\ causality.$

From the equation, we found that the estimated least square equation has a negative C (1) coefficient but a p-value of more than 0.05. Therefore, this scenario fulfils situation (2) as mentioned above, meaning that LBRM has no long-run relationship with any independent variables (GFC, NFA, and UER). Finally, we can only use the Wald test to determine if there is any short-run relationship between LBRM and other independent variables.

5. CONCLUSION

Based on our analysis, we have met the nine objectives that we proposed earlier. First, we have identified the relationship and tested the hypotheses about the relationship between BRM and independent variables using multiple regression analysis. In the multiple regression analysis, we found that only NFA has a significant relationship (p-value less than 5%) with BRM. Moreover, NFA has a coefficient of 0.0296, which indicates that when NFA increased by 1%, BRM also increased by 0.0296%. Furthermore, NFA can also explain the 97.11 % variation of BRM since 97.11% of data are fitted to the regression line. Second, we have found that the stationary variables at the level are CPI and RIR, while the non-stationary variables at the level are LBRM, GFC, NFA, and UER. We also note that at the first difference, only GFC is not stationary; the other variables are all stationary. Last but not least, all variables are stationary at the second differencing. Third, we found that two independent variables are cointegrated with LBRM. Then, after we used the information of two cointegrations to perform VECM, we found no evidence of either a long-term (VECM) or short-term causality effect (Wald Test) between the variables in our

model when LBRM was the dependent variable and GFC, NFA, and UER were the independent variables.

It is critical, however, to note that our study had some limitations, such as a small sample size and the possibility of omitted variable bias. As a result, more investigation is required to pinpoint the causes for the lack of correlation between these variables. The model specification used in this study could be updated in future research, or additional variables could be added for a more in-depth examination. Despite these caveats, our study adds to the existing literature on the relationship between the variables in our model and highlights the need for further investigation in this area.

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