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Cointegration of Banking Performance on World Oil Prices

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Abstract

This study investigates the cointegration between banking performance and global oil prices from 2014 to 2021. Using the Augmented Dickey-Fuller (ADF) test for cointegration analysis, the research examines the relationships between global crude oil prices and banking performance indicators such as Return on Assets (ROA), Return on Equity (ROE), Price to Book Value (PBV), and Loan to Deposit Ratio (LDR). The findings reveal significant cointegration between global crude oil prices and the banking performance variables. Notably, an inverse correlation was observed in 2021, indicating a deviation from the established pattern.

Keywords: *Bank Performance, RoA, RoE, PBV, LDR and OIL Price, Cointegration.*

Introduction

Banking is the backbone or can be said to be the heart of a country's economy which plays a vital role in supporting economic growth and stability. However, like many other industries, the banking sector is faced with complex, risky and ever-changing challenges in the face of ever-evolving global economic dynamics. In facing this challenge, banks are expected to not only survive (resilience), but must also contribute to sustainable economic growth. To explore the challenges faced by the banking industry today and their impact on community welfare as well as efforts to contribute to sustainable economic growth (Abbas et al., 2020)

Khaer & Anwar (2018) conducted an in-depth analysis of the challenges faced by the banking industry today and will provide a solid foundation for identifying appropriate strategies and solutions in promoting sustainable economic growth. In this context, sustainable economic growth is the central point in this research, with efforts to bridge the gap between the need for economic growth and environmental and social protection of society. One of the challenges faced by all industries in the business world nowadays is how to manage ecosystems and the industrial environment, as well as reducing the negative impact on natural resources and the impact of global warming. Banking operational practices must pay attention to environmental impacts, such as implementing policies that emphasize effectiveness and efficiency, as well as reducing carbon emissions, to support the future prosperity of society (Sarwat et al., 2021; Iqbal et al., 2020)

Banking financial performance is the main factor and is important for assessing overall banking performance and has a significant impact on the economic system. In the last 5 years, bank performance has fluctuated greatly due to very competitive banking competition due to changes in conventional service systems to digital system services (digitization). In addition, government policies towards banking both in terms of external and internal factors, as well as various other factors (such as geopolitics, geoeconomics and climate change) greatly influence bank performance. Therefore, researchers want to see what factors make bank performance fluctuate because they have an impact on bank share prices (issuers) on the stock exchange. The contribution of the banking sector in Indonesia is very significant in supporting economic growth, increasing development in order to maintain national economic stability. As can be seen from the strategic contribution of banking to the economy as an intermediary institution whose main function is to collect and channel public funds to help finance, especially real sector activities, to strengthen economic resilience (resilience) (Khan et al., 2019; Abbas et al., 2024).

In this research, banking performance is measured by Return on Assets (ROA), Return on Assets (ROE), Price Book to Value (PBV) which is mediated by the Loan to Deposit Ratio (LDR). ROA is a ratio that shows the

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comparison between returns and total assets owned to see the extent of the company's (bank) ability to generate income (Asikin, et al., 2020). Banking ROA fluctuates from 1.59% to 3.11%. Generally, this ROA is below 3% which was shown at 2.86% in 2010 with the exception of 2011 which was 3.03%; in 2012 it was 3.11% and in 2013 it was 3.08%.

In 2014, ROA decreased from 2.85% to 2.47% in 2019 and fell in 2020 to 1.59% then in September 2021 it rose to 1.91%. These figures explain that the company's ROA is experiencing fluctuations and declines, so it is necessary to study why this is happening. ROA is a measure of bank performance, because banks are often measured by the size of the bank, known as total assets. According to Bank Indonesia No. 13/24/DPNP The ROA value is considered good if ROA > 1.21%. Banks with higher ROA tend to be more effective & efficient in generating profits from the total assets owned by the bank. There are three measurement metrics that can be used for this research as banking performance. ROA (Return on Assets) measures the extent to which a bank can generate net profits from the total assets it owns.

ROE (Return on Equity) is a ratio used to measure how efficient a company is in generating profits from the equity capital it owns. The higher the ROE, the better the company's performance in generating profits for its shareholders. Banking ROE also fluctuated from 7.26% to 18.69% where ROE in 2010 was 16.93%. This ROE increased to 18.21% in 2011, increased again to 18.69% in 2012 and is the highest ROE. Then the bank's ROE decreased and fluctuated to 7.26% in September 2021. The company's RoE also decreased due to fluctuating net profit, so it is necessary to investigate why this happened. These results also need to be investigated, especially in relation to external banking factors.

Price to Book Value (PBV) is a financial ratio used to assess the share price of a company relative to the book value of its equity per share. PBV is calculated by dividing the company's share price by the book value of equity per share. In general, PBV gives an idea of how expensive or cheap a company's share price is compared to the value of its assets. If PBV is more than 1, it indicates that the company's share price is higher than the book value of its equity (overpriced), which could indicate that the shares are priced at a premium. Conversely, if PBV is less than 1, it indicates that the company's share price is lower than the book value of its equity (underpriced), which could indicate that the shares are priced at a discount. PBV is one of the indicators used by investors to evaluate whether a stock is trading at a fair price or not, as well as to look for potential investment opportunities. However, PBV should be used in conjunction with other analysis because it does not provide a complete picture of a company's performance or value. Price to book value (PBV) is a ratio that compares the share price with the book value per share of a company. PBV influences share prices on the stock exchange in several ways. First, PBV gives an idea of how cheap or expensive a stock is compared to its book value. A low PBV can indicate a cheap share price and be a buy signal, while a high PBV can be a sell signal. Second, PBV also influences investor sentiment. Low PBV tends to attract investors because prices are considered cheap, while high PBV can cause caution. Third, PBV also reflects risk perception; stocks with low PBV tend to be considered safer, while stocks with high PBV are considered riskier. Finally, PBV can also reflect growth expectations; A high PBV may indicate high growth expectations in the future. However, PBV is only one of many factors that influence stock prices, and investors also consider other factors before making an investment decision.

Based on regulations from the Financial Services Agency (Otoritas Jasa Keuangan, OJK) in Indonesia, the maximum Loan to Deposit Ratio (LDR) limit for commercial banks is 92%. This means that commercial banks in Indonesia are required not to exceed a percentage of 92% of the total funds they receive from customers in the form of loans to other parties. If a commercial bank's LDR exceeds this limit, the bank may be subject to sanctions or corrective action from the OJK. Meanwhile, Bank Indonesia (BI) has issued an LDR limit which can be used as a benchmark for measuring the health of a banking business through Bank Indonesia Regulation no. 178 of 2015, namely with a minimum LDR limit according to BI of 78%.

In this research, LDR is used as an intermediary or intervening variable as a bank criterion. The LDR ratio is the ratio of credit provided to third party funds received by the bank concerned. The size of the LDR will affect profits through lending to customers. A high LDR identifies the existence of credit distribution from third party funds collected by the community through third party funds. Large credit will increase profits. Liquidity growth is in the opposite direction to profit growth, that is, if liquidity growth shows an increase in idle money, it can cause profits to decrease in the next year (Ulfa, 2020). If LDR is not managed well, there is the potential for banks to experience

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financial distress which could trigger a bank run and the collapse of the banking financial system which could give rise to systemic risks to the economy. External banking factors vary greatly, especially the policies of local governments, foreign governments and also oil price factors. Oil prices are a very important discussion because they have an impact on the company. Fluctuations in oil prices greatly affect the economy of a country, especially Indonesia. An increase in oil prices can make businesses outside of banking volatile. Oil price is the price of crude oil on the world market. There are several oil prices that are used as benchmarks for oil producers in the world. This research only

uses oil prices as a reference for trading, namely West Texas Intermediate (WTI). Many researchers use this price as a reference because this oil price is considered the price of quality oil (Ardana, 2016). Corporate turmoil due to oil prices will also have an impact on banking because banks provide credit to companies. The existence of this phenomenon makes researchers want to see the relationship between oil prices and banking performance such as RoA, RoE, Loan to Deposit Ratio and bank performance as seen from book prices and prices on the stock market.

Based on above explanation, there is a cointegration between Banking Performance on Macroeconomics Variable. Macroeconomics variable is only Oil Price in this Paper. Kwon and Shin (1999) explored Cointegration and causality between macroeconomic variables and stock market returns. Maysami et.al (2004) studied Relationship between Macroeconomic Variables and Stock Market Indices using Cointegration method for Evidence from Stock Exchange of Singapore's All-S Sector Indices. Brahmasrene and Jiranyakul (2007) investigated Cointegration and Causality between stock index and Macroeconomic Variables in An Emerging Market. Bouri et.al (2017) explored Cointegration and nonlinear causality amongst gold, oil, and the Indian stock market: Evidence from implied volatility indices. Hasan et.al (2020) investigated cointegration Bank performance and Macroeconomics Variabeles. Yadav et.al (2022) studied Empirical Relationship between Macroeconomic Variables and Stock Market for India Stock Market. Research of The Cointegration of Bank Performance on Macroeconomic Variables is limited especially for Indonesia' case.

Based on this description and the research conducted is still very limited, this research tries to analyze the relationship between banking performance and oil prices will move together in both the short term and long term.

Theoretical Review

Bank is an intermediary institution from surplus units to deficit units that is managed by some professionals to get profit for its operations. As a bank, they collect funds or money from the surplus unit or household and distribute it to deficit units or company, and the bank gets margin as a return to operate the bank. Banks have four tasks to transform which are value, time, risk and liquidity (Manurung, 2017). Banks need the high capital to operate as required by the banking regulator or central bank of a nation. The Capital of the Bank will grow as much as profit that the bank gets.

Then, the capital of bank could be arranged as follows:

$$E_1 = E_0 + \pi_1$$
$$E_2 = E_1 + \pi_2 = E_0 + \{\pi_1 + \pi_2\}$$
$$E_n = E_0 + \{\pi_1 + \pi_2 + \ldots + \pi_n\}$$

E1 is bank capital on year – 1 and grows from on year – 0 by profit (π1) then it grows again by profit on year – 2 (π2), so total capital becomes E2 as mentioned in equation (1). Banks could increase their capital through profit (π1, π2, ….., π□) and issue shares to other people or public (Svitek, 2001), and also issue long term debt is known Subordinate Debts (Kleff and Weber, 2008). Profit of the bank could be calculated as follows:

$$\pi = (1-T)*(r * L - i*D) \qquad (2)$$

T = tax
L = Loan

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D = Deposits

r = rate of Loan
i = rate of deposits

If L = (1 – α)*D + E, which is α as reserve requirement by central bank that it isprovided by bank (Jiang, 2010). Then, equation (2) could be rewritten (Manurung et.al,2017) as follows:

$$(\pi/E) = (1 - T)*[r + \{(1 - \alpha)*r - i\}*(D/E)] \quad (3)$$

(□ /E) is known as Return on Equity (RoE). If we want to make equation (3) to become(□ /A), is known as return on assets (RoA), Equation 3 could be rewritten as follows: $(\pi/A) = (1 - T)*[r*(E/A) + \{(1 - \alpha)*r - i\}*(D/A)]$ (4)

If E = A – D, so Equation (4) could be rewritten as follows:

$$(\pi/A) = (1 - T)*[r + \{(-\alpha)*r - i\}*(D/A)] \quad (5)$$

Equation (3) and (5) are first indicators to see bank of financial performance for practitioners, academicians and regulators. If we want to maximize for each RoA and RoE, then we could derive first order for equation (3) with (D/E) and equation (5) with (D/A).

Corporate Performance Theory

Corporate performance theory is concerned with the ways in which companies can achieve and maintain optimal performance. Company performance can be measured by various indicators, including financial, operational, and customer satisfaction.

By understanding and applying these theories, companies can formulate effective strategies and practices to improve their overall performance. Corporate growth theory explains how companies develop and expand their operations over time. The theory put forward by Richard Cyert and James March, known as the "Behavioral Theory of the Firm", is one of the important approaches in understanding how companies operate and make decisions. This theory was introduced in a book entitled "A Behavioral Theory of the Firm" which was published in 1963. This concept (Cyert & March 1963) clearly states that companies are founded to obtain maximum profits. Sunder (1997) states that when viewed from an accounting perspective, the company is a collection of contracts (nexus of contracts). The contract is the basis for activities carried out by the company to other parties, even to the company's employees. This recording is also through a contract where the contract includes a purchase guarantee for the products offered by the company. As a result, a company can be seen from several approaches according to (Becerra, 2009; Jensen & Meckling, 1979; Penrose,

1959) and Walker (2017), while measures of company performance are often used, the ratio Return to Assets (RoA), Return to Equity (RoE) and also the stock market value to its book value (PBV).

Research Methodology

As mentioned previously, this research wants to explore the cointegration of Bank Performance with Oil Price. Bank Performance is measured by Return on Assets (ROA), Return on Equity (ROE) and Price to Book Value (PBV). The Methodology for research objectives will use two methods which are simple methods using Graph analysis and statistical analysis method. Graph analysis is a technique for arranging data for both variables put together. If the graph shows both variables together in the short time and until long term, it means both variables to indicate cointegration. The Cointegration introduced by Granger (1981). Understanding Cointegration is stated as follows:

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Consider two integrated series of order one, Yt and Xt, and suppose that a linear relationship exists between them. This is reflected in the proposition that there exists some value β such that Yt – βXt is I(0), although Yt and Xt are both I(1). In such case it is said that Yt and Xtare are cointegrated and that they share a common trend (Verbeek, 2008, p. 328).

Cointegration also use to investigate the equilibrium of the two variables in short and long run (Engle and Granger, 1987). There are seven methods to test Cointegration (Engle and Granger, 1987). The Significance level and DW-Statistic and Dickey Fuller Test which are tools to test Cointegration as follows:

Table 1: Critical Values for Testing for Cointegration

Levels of Significance.	DW-Statistics	Augmented DF t-Statistics
1%	0.511	3.77
5%	0.386	3.17
10%	0.322	2.84

DATA

Data for this research was collected from the company that they published to the public in newspaper or their website as mandatory requirement from government and Indonesia Stock

Exchange, but macroeconomics data was obtained from Central Bank of Indonesia. The data is annually data that was collected for the period from 2014 to 2021, that only thirty-six companies have financial statements for the period. Then, Return on Assets (RoA), Return on Equity (RoE), Price to Book Value (PBV) and Oil Price (OILP) are calculated that is based on data collection. OIL Price data are transformed to natural logarithm.

Discussion Result

In accordance with the title of this paper about Cointegration of Banking Performance and Oil Prices, the discussion of this paper discusses descriptive statistics and Cointegration of Banking Performance and Oil Prices. The analysis begins with descriptive statistics and continues with the Cointegration of Banking Performance and Oil Prices.

Descriptive Statistics

As explained previously, this paper analysis will discuss descriptive statistics and cointegration of banking performance and oil prices. This sub-section discusses Descriptive statistics.

	ROA	ROE	PBV	LDR	OIL Price
Minimum	-0.1475	-0.9544	0.21	0.1235	37.04
Maximum	0.0473	0.3119	18.9	1.9756	75.21
Average	0.008861	0.037265	1.662917	0.849293	54.35625
Stdev	0.024527	0.183659	1.730967	0.191238	11.55477
Skewnes	-2.71534	-2.85849	5.911176	1.10784	0.433031
Kurtosis	10.89509	9.757644	50.95072	6.830097	0.680879

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Jarque Bera	642.4638	575.2327	16898.16	107.6132	84.9916

Return on Assets (ROA) has the lowest value of -14.75%, the highest value is 4.73% and the average is 0.89% and the standard deviation is 2.45%. The standard deviation value for ROA is quite small, which means that the ROA values are very close, even though there are highs and lows. If there is a negative ROA value, then a bank experienced losses during the research period. This NPL variable has a normal distribution shown by Skewness, Kurtosis and Jarque Bera.

Return on Equity (ROE) has the lowest value of -95.44%, the highest value is 31.19% and the average is 3.73% and the standard deviation is 18.37%. The standard deviation value for ROE is quite small which means thatThe ROA values are very close, although there are the highest and the lowest. If there is a negative ROA value, then a bank experienced losses during the research period. This NPL variable has a normal distribution shown by Skewness, Kurtosis and Jarque Bera.

Price to Book Value (PBV) has the lowest value of 0.21x, the highest value is 18.9x and the average is 1.66x and the standard deviation is 173.1%. The standard deviation value for PBV is quite high, which means that the PBV value has a very large difference, which is indicated by the PBV value itself. If there is a sufficient PBV value, it indicates that the share price is very cheap. This PBV variable has a normal distribution

Loan to Deposits Ratio (LDR) has the lowest value of US$ 37.04, the highest value is 197.56% and the average is 84.93% and the standard deviation is 19.12%. The standard deviation value for LDR is quite small, which means that the LDR value is around the average LDR value and the LDR figure is almost in line with bank supervisors' expectations because of the minimum statutory reserves and reserves that must be kept at Bank Indonesia. This LDR variable has a normal distribution shown by Skewness, Kurtosis and Jarque Bera.

Oil Prices (OIL) have the lowest value of 0.21times the highest value was US$ 75.21, and the average was US$ 54.36 and the standard deviation was 11.55%. The standard deviation value for oil prices is quite low, but various parties say that oil prices are already too high, some even say it will go above US$ 100 per barrel. The Oil Price variable has a normal distribution shown by Skewness, Kurtosis and Jarque Bera.

Graphical Cointegration

In this research, 3 banking performance variables were used, namely Return on Assets (ROA), Return on Equity (ROE) and Price to Book Value (PBV) which are linked to oil prices, known as Cointegration. Banking performance wants to be seen as co-integrated with oil prices and is a novelty of this research. According to Rao (2007), Cointegration is the correlation of one variable with other variables, both short and long term. The correlations that are often calculated are Spearman correlation and Pearson correlation, where the values appear when calculating regression. This second correlation does not explain the correlation period but cointegration is the correlation of one variable with another variable in the short term or long term.

Graph 1 shows a graph of Return on Assets (ROA) with oil prices from the period 2014 to 2021. The graph shows a positive correlation from 20124 to 2020. However, the graph or points in 2021 do not appear to be in the same direction but in the opposite direction. Seeing that this incident was influenced by the pandemic situation that occurred in Indonesia in 2020 (March) and 2021. The big influence occurred in 2021 so that the direction of the line from 2020 to 2021 was in a different direction between oil prices and ROA itself.

Graph 2 shows a graph of oil prices and Return on Equity for the period 2014 to 20121. The graph of these two variables is almost the same as the description of the oil price graph with ROA. This means that the conclusions given provide the same meaning as the previous results.

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Graph 3 shows a graph of oil prices and the Loan to Deposits Ratio in the period 2014 to 20121. The graphs of these two variables look somewhat different from the 2 previous graphs that have been described. Oil prices with ROA do not appear to have cointegration because they appear to be in opposite directions. This means that the conclusion given means that the two variables do not have the same direction so they are not cointegrated.

Graph 4 shows a graph of oil prices and PBV for the period 2014 to 20121. The graph of these two variables is almost the same as the description of the oil price graph with ROA. This means that the conclusions given provide the same meaning as the previous results, that oil prices are cointegrated with PBV (price to book value). In this graph at the end of the period they move together in the same direction, unlike oil prices towards ROA and ROE.

Cointegration with Mathematical Models

After testing cointegration using graphs as described in 5.4.1, then test cointegration using mathematics. Testing cointegration in mathematics is known as testing Augmented Dickey Fuller. What was tested was the error from the banking performance model with oil prices. The error is tested for stationary, so it is the same as testing Gujarati Cointegration and Porter (2008), Rao (2007) and Greene (2012). The results obtained for testing ROA and Oil Prices show that these two variables have cointegration, which means that ROA and oil prices are correlated in the short and long term, where the significance level is 1%.

Testing of the cointegration of the ROE variable and oil prices was also carried out using the same method. The results obtained show that ROE and oil prices are also cointegrated at a significance level of 5%.

Testing of the cointegration of the LDR variable and oil prices was also carried out using the same method. The results obtained show that LDR and oil prices are not cointegrated at the 5% significance level.

Cointegration testing between the Price to Book Value variable and Oil Prices was also carried out in this research. The results obtained show that oil prices are cointegrated with price to book value (PBV) both in the short and long term with a significance level of 5%.

Cointegration research is very limited, especially linking banking performance with oil prices. This research is one of the novelties of this research, namely the cointegration of bank performance, namely LDR, ROA and ROE with oil prices. Meanwhile, the cointegration of oil prices and PBV was only visible at the end of this research period. This research support previous research such as Kwon and Shin (1999), Maysami et.al (2004), Brahmasrene and Jiranyakul (2007), Bouri et.al (2017), Hasan et al (2020) and Yadav et.al (2022). The result will help bank management to decide bank planning.

Conclusions and Recommendations

- In accordance with the previous description, the research can conclude as follows:
- Banking RoA has an average of 0.89% per year and has a fairly small standard deviation
- Banking RoE has an average of 3.73% and a standard deviation of 18.17%
- Banking PBV has an average of 1.66% with a fairly high standard deviation
- Banking LDR is at 84.93% with a standard deviation of 19.72%
- Oil prices during the study had an average of US$ 54.36 and a small standard deviation
- This research finds that there is cointegration of bank performance, namely LDR, ROA and ROE with oil prices. Meanwhile, cointegration of oil prices and PBV was only visible at the end of this research period.

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