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Analysis of CAMEL Components and Commercial Bank Performance: Panel Data Analysis

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Article Info	Abstract
	The banking industry, one of the crucial elements in economic development, circulate funds from the surplus to the deficits to create a healthy, developing, and sustainable economic condition. Besides, the primary indicator of the soundness of the financial system is the performance of banking. Therefore, the objective of the study is to analyze Capital Adequacy, Asset Quality, Management Efficiency, Earning Quality, and Liquidity (CAMEL) towards bank performance. This study employed a static panel data model and utilized data of nine developed countries from 2013-2017. **Findings.** The study showed that capital adequacy and earning quality had a positive impact on bank performance and conversely asset quality, management efficiency, and liquidity has a negative effect on bank performance. Holding a high liquidity asset will reduce income as liquid assets are associated with lower rates of return. It will expect that higher liquidity will negatively affect bank performance. Therefore, the researcher can conclude that the banking industry should pay attention to CAMEL components for the maintenance and supervision of bank performance, and determinant factors are essential for sustainable economic growth.

1. Introduction

The economic development of a country depends on real factors such as industrial development, agriculture, mining, manufacturing, water supply, contraction, accommodation and food services, transportation, information and communication, real estate, financial, and insurance activities. The importance of banking and monetary policy must be addressed through economic development as it allocates capital to the most productive activities and transfers funds from surplus to deficits. Therefore, banks and financial institutions play as vital roles in the main poles of commercial, investment, transaction, and trade.

One of the primary indicators of economic and financial development is the effectiveness of a commercial bank. A commercial bank is a financial institution that collecting money from depositors and investors and invest the money in form personal and corporate loan and investment instruments. Therefore, banks move their savings in the economy and facilitate the redistribution of these savings streams. Bank financial resources are surplus money from

households that are not used. The surplus money is the basis of the loan and is given to an organization, businessman, or another person who needs it for productive, investment, or personal use.

Commercial banking's performance indicates that the banking system's health plays a fundamental role in capital formation due to its primary function as a financial intermediary. Therefore, commercial banks must get more attention than any other type of economic agent in the economy. Flannery, et al (2013) point out that the bank's capabilities can influence financial turmoil and financial failure. For regulators, economic crisis and collapse are the main financial problems, and they have to plan a supervisory framework that enables them to maintain the strategic distance from institutional failures (Weber, 2014). The payment system, savings transformations, and monetary policy transmission are the primary financial functions to avoid business failure. Therefore, regulators must pay attention to CAMEL towards bank performance to identify the SWOT of the banking system.

Examples of banking problems affecting the world economy occurred in 2008. The financial crisis in 2008 took place because of the influence of the price bubble in the US housing market tied to the subprime mortgage market suddenly broke out. This phenomenon had triggered the failure of large financial institutions, such as banks, insurance companies, brokerage firms, and other businesses in the United States. The collapse of the United States economy quickly developed into a global crisis, which resulted in failures in some European banks, a decline in various stock indices, and significant reductions in the market value of equities (stocks), and commodities worldwide (Norris, 2008). In some studies, we can find that the lack of stress testing as a regulatory tool and CAMEL model will lead to the financial crisis. A concrete example was the Asian financial crisis in 1997 and 2008; the two crises occurred with a span of 10 years.

Thus, the stress test is critical to overcoming the imminent financial crisis that might occur in the future. The collapse of Lehman Brothers in 2008, triggering an economic crisis on the world market, influenced banks using the CAMEL model to gauge the timing and severity of the next financial crisis. When there is a question, "Does the role of primary variables, such as capital, asset, quality of management, earning, and liquidity, affect the bank's performance?" The answer to this question is fundamental because it relates to the bank's readiness to overcome hard periods when the financial crisis is likely to come? Many existing kinds of research have used a time series method to analyze the effect of CAMEL on bank performance in particular countries (Ikpefan, 2013). In this study, the researcher uses the panel data since it is more effective in analyzing the data than the time series data.

In terms of recuperation, management efficiency, asset quality, earnings quality, and internal control systems, CAMEL has improved from the initial banking regulatory framework to control risk levels and commercial banks' viability. Dang (2011) has studied the CAMEL system as a valuable and productive tool since 2008. Dang witness in the research, the collapse of the financial face by the United States government.

The CAMEL rating of the bank can only be recognized directly by the bank's senior management and the corresponding supervisor. Even in the case of a significant lag, regulators have never announced the CAMEL rating. Although all test materials are hidden, public banks can conclude regulatory information in the bank's conditions based on subsequent bank actions or specific disclosures. In general, private regulatory information collected during bank inspections will not be reported to regulators; even research suggests that these measures filter the financial markets.

Besides, the development of the economy depends on the stage of the banking industry. To assess the banks' overall performance and ranking can be done by implementing the regulatory and supervisory framework. The regulators have increased bank supervision by monitoring through the CAMEL system, such as capital adequacy, asset quality, management quality, earnings, and liquidity. This paper aims to analyze the effect of capital adequacy, asset quality, management efficiency, earning quality, and liquidity on bank performance. This study's main contribution is to add evidence of the impact of CAMEL on bank performance in developed countries using static panel method analysis, and the researcher redefines the asset quality as non-performing loans of total assets.

The rest of the article will be organized as follows. Section two reviews the literature concerning the determinants of bank performance. Section three details the methodology that defines the sources of data, the research variables, and the research specification model. Section four presents and discusses the results, while section five concludes and provides implications of the study.

1.1   Stress Testing for Bank Performance

Banks have an essential role in economic development because they control the supply of currency, the primary stimulus for economic growth. Performance means implementationor accomplishment, or the achievement of certain activities, or the performance of an obligation. "Bank performance" can be defined as a reflection of how a bank's resources are used in a form that allows them to obtain their goals. Besides, the term bank performance refers to the application of a set of indicators that indicate the current state of the bank and its ability to achieve the intended objectives.

Stress testing as a monitoring tool for measuring bank performance has other ratios for calculating the bank's performance, namely, ROA and ROE. ROA is the ratio of profit, indicating the bank's profitability in total assets. ROA also shows the efficient use of assets by management to generate revenue. ROA is the net income ratio distribute to the commercial assets. Gul et al. (2011) show how to manage bank assets to generate revenue for every dollar of investment banking company's assets.

ROE represents the performance of the bank measured financial ratios. This measurement will take a balance sheet and income statement to the accounting ratio that is proportional to return over time and relative to peers. ROE illustrates how effectively the bank is making cash into a business, which creates profit and enormous growth for the banks and investors. The higher the return on equity is, the more competent the bank's operations are using these funds.

In this research paper, five CAMEL model ratio parameters, such as capital adequacy, asset quality, management quality, earnings, and liquidity, are applied to measure the bank's performance. Capital adequacy (CAR) is the first variable group that calculates the bank's capital position. The ratio is acquired by calculating the total capital to total assets, which identifies the bank's capability to incur a reasonable loss of operation.

Asset quality (LOA) represents the level of asset risk and the bank's financial strength. The LOA determines the type of advance payment by the bank to get interest income and the types of bank debtor. Given the highest risk of default on loans, the increase in non-performing loans reflects the deterioration in asset quality.

Management quality (IED) is a qualitative issue of top managerial staff and the board capacities that recognize, evaluate, and control the danger of organizational activities and guarantee compliance with laws and regulations (Uniform Financial Institutions Rating System 1997).

Earnings quality (IIA) is an essential parameter that determines the bank's future profitability. The earnings quality reflects the sustainability and growth of future bank income and bank efficiency to maintain these qualities and profits, known as the bank's profit indicator. The primary function of a bank is to increase profits and earn profit to shareholders.

Liquidity (LQD) of a bank can only be described as the ability to meet short-term debt and maintain solvency. The liquid assets to the total deposits amount reveal the liquidity level available depositors of the bank. Total deposits consist of savings deposits, long-term deposits, demand deposits, and deposits from banks or other financial institutions.

Gul et al. (2011) analyze the case in Pakistan, which takes the effects of bank and macroeconomic factors on profitability to evaluate bank performance. Gul et al. review on 15 commercial banks and use the Pooled Ordinary Least Squares method 2005 to 2009. From the research, they find significant relationships between internal and external factors and revenue. If equity capital is high, the growth in the economy increases and the bank's profit becomes large. Another research is proposed by Alabede (2012). He conducts a study in Nigeria and concludes that with the impact of global financial conditions, only asset quality and market concentration are critical determinants of Nigeria's performance. The study proposes to reduce non-performing assets and introduce policies to promote fair competition between banks.

Khalid (2012) examines the effect of asset quality on profits of private financial institutions in India, using ROA as profit variables from 2006-2011. This study uses various regression models to analyze the connection between bank asset quality and operational performance. The research finds that there is a lousy courting that exists among the performance of banking operations after effect on control functional scale and bad asset ratio, idle fund ratio, and traditional banking business.

Kamau (2013) concludes that the total management quality leads to the introduction of efficient production processes, new products produce, rate of sales increase, and a cause of the extension of market studies, especially in financial sectors. Kipkelion (2013) concludes in his research in Kenya that economic performance is determined mainly by the quality management practice of 75.5%. From the analysis, specific quality management has been noted to impact the entity's operational performance. These alleged failures have been observed by the Government of Kenya, which has been at the forefront of enforcing performance and service contracts effectively and efficiently. Therefore, Kenya's commercial banks have no choice but to embrace total quality management practices that effectively and efficiently deliver services. The result is that now the bank can be competitive within the banking niche of the country.

Oloo(2009) also conducts another research in Kenya. He examines the relationship between operational efficiencies and growing commercial banks in Kenya. This research aims to explore whether the structural efficiency hypothesis applies to Kenya's commercial banks. The research is concentrated on the performance of commercial banks in Kenya from 1998-2007. The study involves 42 commercial banks operating in Kenya, under licensed by the Central Bank of Kenya. Finding in this research shows that there is a significantly positive correlation between the efficiency and growth of banks in Kenya.

Shen, et al (2010) state that liquidity hazard will decrease financial institution profitability, which estimated by return on average assets and returns on average equities. Liquidity risk has a weak correlation with banks' performance in the market-based financial system, and it has no impact on banks' performance in the banking-based financial system.

2. Research Method

2.1 Model Specification

In this study, the researcher uses panel data analysis to determine the relationship between return on asset and CAMEL. Therefore, the model will be formed depending on the literature review from the previous chapter. The researcher finds that the determinants of capital adequacy, asset quality, management quality, earnings, and liquidity (independent variables) will affect the return on assets (dependent variables).

The CAMEL ratio is a bank-specific factor that is always used in measuring bank performance. This study focuses on selected developed countries for five years, and thus, the static panel data analysis will be utilized in this specification model. The form of the specification model is:

$$ROA_{it} = \alpha + \beta_1 CAR_{it} + \beta_2 LOA_{it} + \beta_3 IED_{it} + \beta_4 IIA_{it} + \beta_5 LQD_{it} + \varepsilon_{it} \tag{1}$$

Where; ROA_{it} is return on asset, CAR_{it} is capital adequacy ratio, LOA_{it} is asset quality ratio, IED_{it} ismanagement capability ratio; IIA_{it} is Earningsratio, LQD_{it} is Liquidityratio, α is intercept, $\beta_1 - \beta_5$ is coefficient of each independent variable, ε_{it} is error terms, and $_i$ is of cross-section, and $_t$ is the period.

2.2 Pooled Ordinary Least Squares (OLS) Regression Model

The pooled OLS assumes that the number of observation countries is the same, so the researcher combines all the data across the countries. The researcher also estimates that there is no heterogeneity problem in this model. The estimation of pooled OLS allows combining all the data that the researcher will ignore the nature of time series and cross-section data. Thus, this action ignores the economic changes among all countries. The equations of OLS is:

$$ROA_{it} = \alpha + \beta_1 CAR_{it} + \beta_2 LOA_{it} + \beta_3 IED_{it} + \beta_4 IIA_{it} + \beta_5 LQD_{it} + \varepsilon_{it} \tag{2}$$

Where; $_i$ = number of cross-section and tis the period

2.3 Fixed Effects Model (FEM)

FEM allows the researchers to analyze the effects of variables from time to time. This model is used to control the influence of cross-country variables, that each cross-sectional have their characteristics by using their intercept values. Therefore, FEM will use the net effect of the return on asset (dependent variable) on capital adequacy, asset quality, management capability, earnings, and liquidity (independent variables), which has removed the existence of time-invariant in the model. The following binary variable will explain in this model:

$$ROA_{it} = \beta_0 + \beta_1 CAR_{1,it} + \cdots + \beta_k CAR_{k,it} + \beta_1 LOA_{1,it} + \cdots + \beta_k LOA_{k,it} +$$
$$\beta_1 IED_{1,it} + \cdots + \beta_k IED_{k,it} + \beta_1 IIA_{1,it} + \cdots + \beta_k IIA_{k,it} + \beta_1 LQD_{1,it} +$$
$$\cdots + \beta_k LQD_{k,it} + \gamma_2 E_2 + \gamma_n E_n + \varepsilon_{it} \tag{3}$$

Where; β_k is coefficient for the independent variables; γ_n is coefficient for the binary country; E_n

is dummies for the countries n; ε_{it} is error term for cross-sectional, $_i$ and time, $_t$.

2.4   Random Effect Models (REM)

REM is different from the FEM, where various considerations in different countries will affect the dependent variable. REM assumes the random variable is the individual effect(θ_i). The random effect models equationis:

$$ROA_{it} = \theta_0 + \beta_1 CAR_{it} + \beta_2 LOA_{it} + \beta_3 IED_{it} + \beta_4 IIA_{it} + \beta_5 LQD_{it} + \varepsilon_{it} + w_{it} \qquad (4)$$

Where: ε_{it} is within the countries error term, and w_{it} is between the countries error term

The selection of the model conducted is as follows: the FEM is assumed by using the OLS method. Therefore, the researcher can test the fixed-effects model's appropriateness by applying a restricted F-test (Gujarati, 1999). In the Restricted F-test, the null hypothesis is that the dummy parameter is similar to each other. While the alternative hypothesis is that at least one dummy parameters are different from each other. This hypothesis is tested by an F-test, which is based on the loss of goodness-of-fit. This test compares Least Square Dummy Variables (LSDV), which is the robust model with the pooled OLS, which is an efficient model and examines the extent that the sum of the goodness-of-fit measure of squares error or R squares (SSE or R^2) changes. The decision rule is when the restricted F-test statistic is higher than F-test critical. The researcher needs to reject the null hypothesis and conclude that there may be a considerable fixed-effect or will increase in goodness-of-fit in the FEM. Therefore, the fixed-effect model is the best compared to the pooled OLS because each cross-sectional units have their intercept. According to Gujarati (1999), Hausman Test is useful to decide the efficiency of the FEM and REM. The Hausman test is a specification test to identify the Best Linear Biased Estimate (BLUE) when the REM and FEM are both consistent and uncorrelated. The null hypothesis means that random effects are consistent and efficient, and there is no correlation betweenw_{it} and independent variable. While the alternative hypothesis shows that random results are inconsistent, and composite error term (w_{it})correlates with the independent variables..The decision rule is when the computed value ofχ^2 is more than χ^2 critical, so the researcher rejected the null hypothesis, which REM is consistent with and accepts the FEM estimator.

Robustness tests explore the dependence of parameter estimation for reasonable changes in the model specification (Neumayer and Plumper, 2016). The 'natural' definition of robustness and hence, the most reasonable criteria to make a conclusion based on robustness tests will be some measure of effect stability. Path dependence ensures that researchers will not relinquish significance despite all known weaknesses of null hypothesis significance testing. Heteroscedasticity assumes that all the variance of the disturbance terms is constant across observation. The present of heteroscedasticity is to oppose the underlying assumption made in the OLS model, which isv (εj) = σ^2 for all j or the constant in the variance of the error term. Thus, heteroscedasticity means the model does not have a constant variation of the error term. This study uses ARCH heteroscedasticity to test for the presence of heteroscedasticity. If the p-value is more significant than the level of significance, the null hypothesis does not reject, and the researcher concludes that it is homoscedasticity. There is enough evidence to prove that the model is suffering from the heteroscedasticity problem. Multicollinearity occurs when two or more independent variables are highly related. Multicollinearity can identify with the Variance

Inflation Factor (VIF). If the VIF is less than 0.2 or 0.1 does not problematic. However, if the number of VIF is more than 10, there is multicollinearity.

2.5   Research Data

This study employs the quantitative research design and the panel data from 2013-2017, representing ten countries that present 21 banks in developed countries, collected from Thomson Reuters Datastream. The data in this study are total assets, total deposits, total equity, non-performing loans, interest expense, interest income, net income, and liquid assets presented by RM million. Research variables are return on asset (ROA), namely net income/ or total assets. Capital adequacy (CAR) is the equity capital of total assets and calculated by equity capital or total assets. Asset quality (LOA) is non-performing loans of total assets, and the proxy is non-performing loans or total assets. Management quality (IED) is the interest expense of total deposits and peroxided by interest expense or deposits. Earnings (IIA) is the net-interest income of total assets and presented by Interest income or assets. Liquidity (LQD) is the total liquid assets of total assets and calculate by liquidity assets.

3. Results And Discussions

Table 1 shows the impact of capital adequacy, asset quality, management capability, earnings, and liquidity on bank's performance. There are several diagnostic tests for selecting the model (the pool OLS Model, FEM, and the REM). First, the determinants of coefficient (R-squared) test. Based on Adjusted $R2$, the Pool OLS Model, FEM, and REM are 0.5888, 0,8946, and 0.4798. Then, the researcher can conclude that all independent variables, capital adequacy ratio, asset quality ratio, management capability ratio, earnings ratio, and liquidity ratio, can explain for 58.88% variation independent variables. The independent variation variables are the return on assets ratio in Pool OLS Model, 89.46% in FEM, and 47.98% in REM.

The restricted F-test is used to identify the best model between the fixed effects and the pooled OLS model. The first step of the Restricted F-test needs to form a test hypothesis, where the null hypothesis has developed as a pooled regression model is more appropriate. In contrast, the alternative hypothesis states that the fixed effect is the best model. Based on the result, Restricted F-test has a probability of 0.0000. This means that the null hypothesis should be rejected and the alternative hypothesis is accepted, and the conclusion is that the fixed effect is the best model.

Since the pools model has been rejected and the FEM is accepted. Thus, the researcher continues to use the Hausman Test to identify the best model in the FEM and REM. The null hypothesis has developed as the random effect model is more appropriate, and the alternative hypothesis states that the fixed effect model is appropriate. Based on the result, the Hausman test has a probability of 0.0001. This means that the null hypothesis should be rejected and concluded that the fixed effect model is more appropriate since the researcher accepts the alternative hypothesis.

The empirical result shows that the FEM is the best model to evaluate the effect of CAMEL variable on the bank's performance. The CAR has a positive impact on the bank's performance at a significant level of 1 percent. In other words, the higher the level capital adequacy ratio is, the more profitable banks directly affect bank performance and expect the stability of the bank growth. The LOA has an inverse effect on bank performance at a significant level of 5 percent. This finding implies that asset quality presented by non-performance loans of the total asset has the highest default risk. The increase in the number of non-performing loans

indicates a disintegration of asset quality. It is because low-quality assets can incite a financial institution rating to downsize, yet the bank will become hard to get depositors' trust. In this case, the bank will promote a higher deposit rate to acquire deposits.

Table 1. The Impact of CAMEL on The Bank's Performance

	Pooled OLS	Fixed Effect	Random Effect
Constant	- 0.4450**	-0.8718***	-0.4287*
	(-2.0310)	(-2.7255)	(-1.8211)
CAR	0.0333**	0.1697***	0.0904***
	(1.9945)	(6.1659)	(4.6348)
LOA	-0.0356***	-0.0288**	-0.0294**
	(-2.7796)	(-2.0612)	(-2.3653)
IED	-0.2540***	-0.2336***	-0.2284***
	(-7.1264)	(-6.0263)	(-6.5820)
IIA	0.3384***	0.2917***	0.2745***
	(8.7224)	(6.0148)	(7.0452)
LQD	0.0134***	-0.0087*	0.0014
	(3.0765)	(-1.7524)	(0.3259)
R-Adjusted squared	0.5888	0.8946	0.4798
Restricted F-test	11.470936***		_
	(0.0000)		
Hausman Test	_	27.293021***	
		(0.0001)	
Heteroskedasticity	_	134.4601***	_
		(0.0000)	
Multicollinearity	_	4.52	_
Observation	105	105	105

Note: *, ** and *** indicate significance at 10%, 5% and 1% levels respectively.

The management capability ratio harms bank performance at a significant level of 1 percent. It means that the interest expenses of the total deposit increase will lower the bank performance. Operating expenses, divided by net operating income ratio, indicate that the percentage of bank's revenue is used to pay operating costs. Besides, the earnings ratio has a strong positive effect on bank performance at a significant level of 1 percent. The higher the level in earnings is, the higher the return on asset is. When earnings for a bank are higher or appreciated, it may illustrate that the higher bank performance as presented by return on asset. On the other hand, the liquidity ratio negatively affects bank performance at a significant level of 10 percent. In other words, the increase of commercial bank's liquidity will reduce productive assets, and a decrease in the bank's expected return will reduce bank performance.

Moreover, the robustness test of the FEM is a heteroscedasticity test. Based on the result showed that the heteroscedasticity test has a probability of 0.0000. It means that the null hypothesis should be rejected and accept the alternative hypothesis where the model presents the problem of heteroscedasticity in data of 60 observations. So, the researcher continues to do the cross-section weights in a heteroscedasticity test, based on the p-value result of all variables is significance. After that, the researcher proceeds to do the SUR cross-section weight, but it does not result because the sample, in this case, is not T > N. the researcher can conclude that there are problems of heteroscedasticity from 105 observation data. The last is the multicollinearity

test; first, the researcher runs the model then applies the Variance Inflation Factor (VIF) test. Based on the result shows that the multicollinearity test has a mean VIF of 4.52. It means, if mean VIF is greater than 10, then there is a problem of multicollinearity. In this case, mean VIF is smaller than 10, so there is no multicollinearity in 105 observation data.

Also, the researcher can conclude that management capability ratio has a negative effect on bank performance. In other words, operating costs for net operating income ratio shows the percentage of a bank's income that is being used to pay the operating costs. The results show a negative correlation between regulations and supervisions to the banks' profitability; this finding is supported by Sufian research in Malaysia (2010). In Sufian's research, the higher the regulation and supervision of the Malaysian banking system are, the lower the bank's operational profitability is. The results of Sufian's study are in line with Said and Tumin (2011). They use some of the internal factors to analyze the relationship between commercial banks' performance and financial ratios in Malaysia and China. The results show that credit risk and operating expenses negatively impact banks' performance in both countries in terms of ROA.

Besides, the researcher can conclude that earnings ratio has a positive relationship on bank performance. In other words, the higher the level in earnings is, the higher the asset's return is. It happens when earnings for a bank are higher or appreciate; it may illustrate that the higher bank performance is presented by return on asset. The findings obtained are the same as the findings acquired by Lee et al. (2013). Their result shows that the amount of managed earnings has a positive association with bank performance and economic growth.

However, the liquidity ratio has a negative effect on bank performance. In other words, the liquidity of a commercial bank is negatively significant in determining bank performance. Shen, Chen, Kao, and Yeh (2010) support this finding, where liquidity risk may lower the bank profitability, which measured using the ROA and ROE. Liquidity risk is negatively related to bank performance in the market-based financial system. At the same time, it does not affect bank performance in the bank-based financial system, which has a greater reliance on bank finance.

4. Conclusions

The banking industry, one of the crucial elements in economic development, circulates funds from the surplus to the deficits to create a healthy, developing, and sustainable financial condition.The objectives of this research paper are to examine the effect of capital adequacy, asset quality, management quality, earnings, and liquidity on bank performance in selected developed countries.

The results show that asset quality, management quality, and liquidity ratio has a negative effect on bank performance. In other words, when non-performing loans of total assets, interest expense of total deposits, and total liquid assets of total assets increase then the performance of bank decrease. Liquidity risk is negatively related to bank performance in the market-based financial system, while it does not affect bank performance in the bank-based financial system, which has a greater reliance on bank finance. In contrast, the capital and earnings ratio has a positive effect on the bank's performance. Higher capital and earnings are greater than the return on an asset when a capital increase can improve the loan and earnings for a bank. It shows the condition is higher or appreciated. It may illustrate that the higher bank performance is presented by return on asset.

The implication of these findings shows that CAMEL is a crucial factor in bank management to ensure bank performance and enable it to compete with other banks. The

suggestions for future research are to add more banks or to extend the duration of the study in developed countries, developing countries, and undeveloped countries.

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