ANALYSIS OF BANKING CREDIT DISTRIBUTION USING THE VECTOR ERROR CORRECTION MODEL

Suyanto Suyanto *, Sri Lestari Prasilowati **, Julia Safitri ***, Jayadi Jayadi **

* *Corresponding author*, Management Department, IPWIJA University, Jakarta, Indonesia
Contact details: Management Department, IPWIJA University, Jl. H. Baping No. 17, RT. 10/RW.6, Susukan, Ciracas, East Jakarta City, Jakarta 13750, Indonesia
** Management Department, IPWIJA University, Jakarta, Indonesia
*** Faculty of Economics, Universitas Terbuka, South Tangerang, Indonesia

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Abstract

The business model and consequently, the bank's risk exposure significantly depends on the source of capital (Riabichenko et al., 2019). This research uses vector error correction model (VECM) data analysis to investigate the influence of capital adequacy ratio (*CAR*), non-performing loans (*NPL*), loan to deposit ratio (*LDR*) on the level of *credit distribution* at commercial banks in Indonesia. Using secondary data, research data was processed using the EViews 12 application with the research population being banking companies listed on the Indonesia Stock Exchange in 2019–2021. The research results show the variables *CAR*, *NPL*, and *LDR* have a significant effect on long-term *credit distribution*. In addition, the *NPL* variable significantly influences the *credit distribution* variable in the short term. The Granger causality test result shows that there is no two-directional causality relationship between the independent variables *CAR*, *NPL*, and *LDR* on the *credit distribution* variable. The results of this research are in accordance with financial intermediation theory, where the theory explains that savings and loans with high leverage can reduce the possibility of default (payment failure).

Keywords: Capital Adequacy Ratio (CAR), Third-Party Funds (TPF), Non-Performing Loans (NPL), Vector Error Correction Model (VECM)

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1. INTRODUCTION

Law concerning Banking No. 10 of 1988 states that a bank is an economic entity that accommodates funds from the public in the form of savings and distributes them to the public in the form of credit and/or other forms with the aim of improving the living standard of many people. In Indonesia, banking has a very important role in economic growth (Supriyono & Herdhayinta, 2019). The important role of banking is to move the wheels of the economy through lending so that the real sector can grow. The banking sector is growing rapidly in Indonesia, as evidenced by the growth rate of total assets which reached 63% in 2018 (Prabantarikso et al., 2022). More advanced

technology and advances in information technology, relatively stable movement of bank interest rates and inflation, and increasingly advanced infrastructure development, accompanied by increased creativity of economic actors, especially in Indonesia, illustrate the rapid development of the Indonesian economy (Wahyuni & Wimba, 2022). The capital market, where companies are incorporated in the banking sector, is one of many alternative sources of choice and a long-term perspective for an economic entity. This of course supports the bank's function as a financial intermediary, namely a financial intermediary institution between parties who have excess funds and parties who need funds (Falah & Septiarini, 2019).

According to John et al. (2023), risk management is a systematic process used to identify, measure, monitor, and control risks arising from all bank business activities. Credit risk is the risk that occurs due to the counterparty's failure to make payments. Credit risk comes from bank functional activities such as financing, treasury, or investment recorded in the bank's books. Banks make maximum efforts to minimize the risks posed by credit extended to the public which can affect credit distribution by banks (Yudaruddin, 2020). To minimize this, the bank conducts an analysis of credit risk so that the bank avoids losses due to the counterparty's failure to fulfill its obligations in making bank payments so in the end banks must be prudent in distributing credit to debtors. Banks have the authority to reduce the value of capital and increase risk provided that the bank has been registered with the Deposit Insurance Corporation (*Lembaga Penjamin Simpanan, LPS*) where indirectly LPS can benefit the bank in managing its risk and profitability (Lutfi et al., 2020).

Credit risk is influenced by internal and external factors (de Leon, 2020). Some examples of external factors include the inability to repay loans by debtors, domestic economic conditions such as inflation, gross domestic product (GDP) growth, etc. Meanwhile, internal factors include those measured by the amount of third-party funds (TPF), capital adequacy ratio (CAR), non-performing loans (NPL), return on assets (ROA), and loan to deposit ratio (LDR). Credit distribution needs to pay attention to these various factors (Harmayati & Rahayu, 2019). Good bank performance will be able to support economic growth because of the role of banks as providers of investment funds and business capital for business units so that they are able to move the economy (Romli & Alie, 2017).

Hermuningsih et al. (2020) examine internal factors that affect credit distribution using the variables of TPF, NPL, and profitability. This quantitative research using a purposive sampling technique shows that the profitability variable can be a moderating variable in the relationship between TPF and NPL in lending. The TPF variable has a positive effect on lending, while the NPL variable has a negative effect on credit distribution. This is similar to Prawitasari et al. (2020) in a study that analyzed the influence of internal factors (ROA, TPF, CAR variables) and external (economic growth and interest variables) on lending to banks listed on the Indonesia Stock Exchange in 2014–2017. This research uses a multiple linear regression model which shows that internal factors have a major influence on capital distribution. The highest effect is given by the ROA variable and the lowest is given by the TPF variable.

Meanwhile, Pujiati et al. (2020) examine the influence of CAR, profit and loss sharing (PLS), and TPF on bank profitability with liquidity as an intervention variable using path analysis techniques. Research shows that CAR has a positive effect on liquidity while PLS and TPF have a negative effect on bank liquidity. From these results, the study concludes that PLS and TPF have a positive effect on profitability, while the CAR variable has a negative effect on bank profitability. Research by Priyadi et al. (2021) analyzes the influence of internal and external factors on credit risk as shown through the non-performing financing (NPF) variable in Sharia banks in Indonesia. Internal factor variables used are CAR, financing to deposit ratio (FDR), ROA, operating expense ratio (OER), financing to value (FTV), and PLS while external factor variables used are inflation, economic growth, and interest rates. Using the autoregressive distributed lag (ARDL) method, research shows that in the short term, the NPF, inflation, CAR, and PLS variables have a lag. In the long term, CAR and ROA have a positive effect on NPF, while inflation and PLS have a negative effect. Broadly speaking, internal variables have a greater influence on NPF.

Permataningayu and Mahdaria (2019) analyzed the effect of NPF and FDR on Sharia bank financing in Indonesia. In this study, the TPF variable was used as a mediating variable. By using the mediation regression analysis technique, it shows that NPF and FDR have no effect on Sharia bank financing, NPF and FDR have no effect on TPF, TPF has a positive effect on Sharia bank financing, and TPF perfectly mediates FDR on the financing volume in Indonesian Sharia banks. The current global economic condition, which has changed greatly as a result of the COVID-19 pandemic, has become a research gap in this study. Global economic changes have also caused the banking world to make adjustments to current conditions. This study used data range in the period January 2019–December 2021 so that the data are factual data that can explain the influence of the dependent and independent variables on current conditions.

This study aims to see and analyze the effect of independent variables (*TPF*, *CAR*, *NPL*, and *LDR*) on the dependent variable (*credit distribution*) in Indonesia. This research uses the vector error correction model (VECM) analysis model where the model is expected to provide information on the influence between dependent variable and independent variable in the long and short term. The choice of the VECM model is also intended to forecast the condition of commercial bank lending in the future so that it can be used as information on phenomena that occur.

This research paper consists of 6 sections. Section 1 presents an introduction containing background, phenomena, research gaps, problem formulation, and objectives. Section 2 contains theory and literature which is the basis for building hypotheses. Section 3 provides the methods used to complete the research. Section 4 includes statistical descriptions. Section 5 explains the results of data processing and compares them with the results of previous research. Section 6 offers conclusions from the research along with research limitations and recommendations from the research and managerial implications.

2. LITERATURE REVIEW AND HYPOTHESES

2.1. Financial intermediation

Financial intermediation is key to understanding the benefits of a position that gives you the authority to oversee every financial function and savers are never in that position (Diamond, 1984). Financial intermediation enables entities in transactions to produce the best contracts and the highest allocations. Enabling financial transactions is the most important role played by financial intermediation. Generally, savings and loan activities with high leverage can reduce the possibility of payment failure. Financial models that delegate supervision and diversify savings and loan activities can keep defaults lower. The financial intermediation theory of moral hazard was developed by Diamond (1984). This theory says that the bank acts as a monitoring delegation and this position can reduce the supervision costs that must be incurred by the customer (investor) in supervising the borrower (debtor).

2.2. Bank risk management

Theoretically, risk management in banking institutions is defined as the logical construction and implementation of plans to deal with potential losses. The practical focus of risk management in the banking industry is to manage institutional exposure to losses or risks and also to protect asset values (Tursoy, 2018). The banking industry has considered risk management as a necessary way to control exposure to four risks, namely credit risk, interest rate risk, foreign currency risk, and liquidity risk (Pyle, 1999). Bank risk management is a process where managers must carry out several activities, such as identifying salient risks, taking steps to ensure that operational risks can be consistently understood, choosing which risks and how risks can be reduced and increased, and determining procedures to monitor the risk position (Ratnovski, 2013).

2.3. Credit distribution

According to the Banking Law No. 10 of 1996, credit is the delivery of money or debt equivalent to it, based on a loan agreement or agreement between a bank and another party, which requires the borrower to repay the debt after a certain period of time with interest. Credit distribution is the largest asset owned by banks. More than 70% of the assets owned by banks are in the form of lending so lending has a high risk (Al-Eitan & Bani-Khalid, 2019). Credit risk does not always have a positive effect on increasing the value of lending, with good technology and service, credit risk can be suppressed even though credit distribution is high.

2.4. Third-party funds (TPF)

Third-party funds are sources of funds or total funds collected by banks from the public (Hermuningsih et al., 2020). Generally, loans provided by banks based on funds collected by the community are used to finance the real sector. In other words, the higher the TPF, the more funds are distributed (Harmayati & Rahayu, 2019). Deposits are the largest source of bank operations, where the funds collected in the bank will be used for operations, one of which is credit (Riabichenko et al., 2019).

H1: TPF has a positive effect on lending.

2.5. Capital adequacy ratio (CAR)

Bank capital adequacy is measured using the CAR. This ratio is a capital or solvency ratio that describes the bank's ability to provide business development financing and calculates the potential risk of loss due to bank activities (Widyakto & Wahyudi, 2021). According to Bank Indonesia rules, the CAR amount that must be achieved by a bank is at least 8%. This figure is an adjustment to the provisions that apply internationally based on the standards of the Bank for International Settlement (BIS). The high CAR value in a bank shows good performance in management and operations so it has a positive impact on bank profitability (Usman & Lestari, 2019).

H2: CAR has a positive effect on lending.

2.6. Non-performing loan (NPL)

According to Hermuningsih et al. (2020), NPL is a unit of measurement used to determine the ability of the debtor to pay the credit given. A high NPL value can be interpreted as a high level of debtor's inability to pay bank debt and interest. At the beginning of the transition that occurred in the banking system, the NPL number was high, this was due to the unpreparedness of the system used (Mazreku et al., 2018). The NPL value is one of the bank's considerations in determining the value of credit distribution in addition to various external factors that can influence it (Jessica & Chalid, 2021). Mohamed Metwally et al. (2019) explain that risk management must be managed properly, according to existing policies and rules.

H3: NPL has a positive effect on lending.

2.7. Loan to deposit ratio (LDR)

According to Kasmir (2014), LDR is the ratio used to measure the composition of the amount of credit given compared to the amount of public funds and own capital used. The ratio stated by LDR can be used as an illustration of deposits such as demand deposits, time deposits, and others which can then fulfill loan requests by customers (Widyakto & Wahyudi, 2021). LDR is a measure of a bank's ability to provide loans relative to the total deposits owned by the bank as an institution that functions to collect public funds (Arintoko, 2021). LDR and liquidity have a negative relationship, if there is an increase in the LDR value, the liquidity value of a bank is low, and vice versa (Supriyono & Herdhayinta, 2019).

H4: LDR has a positive effect on credit distribution.

3. METHODS

This study uses a quantitative approach. Data used in this study are secondary data obtained from the website of the Financial Services Authority (OJK). The dependent variable used in this study is *credit*

distribution, while the independent variables are *TPF*, *CAR*, *NPL*, and *LDR*. The data analysis used is the VECM. This model can explain changes in the relationship between dependent and independent variables in both the short and long term (Ashraf et al., 2019). The VECM model equation can be written as:

$$Y_1 = C + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon \quad (1)$$

where,

- Y = credit distribution;
- X_1 = third-party funds (TPF);
- X_2 = capital adequacy ratio (CAR);
- X_3 = non-performing loan (NPL);
- X_4 = loan to deposit ratio (LDR);
- C = constant;
- B = independent variable coefficient;
- ε = error term.

There are several steps that need to be done in conducting a VECM analysis, which are presented below.

3.1. Stationarity test

To test the long-term relationship between variables, we must test the stationary of the series using the augmented Dickey-Fuller (ADF) unit root test procedure (Ashraf et al., 2019).

3.2. Determination of optimal lag

Determination of the optimal lag in the model is to determine the lag interval. The larger the lag interval, the more fully it can reflect the dynamic nature of the model. There are several criteria to determine the optimal lag length including Akaike information criterion (AIC), Schwarz information criterion (SIC), and Hannan-Quinn criterion (HQC) (Zou, 2018).

3.3. Stability test

The stability of the vector autoregression (VAR) must be tested before further analysis is carried out because if the estimation results of the VAR combined with the error correction model are unstable, the impulse response function (IRF) and variance decomposition (VDC) will be invalid (Zou, 2018).

3.4. Johansen cointegration test

Johansen cointegration test was conducted to test whether the long-term equilibrium exists or not. Johansen proposes two different likelihood ratio tests of the significance of this correlation which can be demonstrated through the trace and maximum Eigenvalue test (Ashraf et al., 2019).

3.5. VECM models

To explain changes in independent variables, short-term and long-term relationships are estimated using the VECM, which explains changes in independent variables as well as deviations from long-term relationships between variables (Ashraf et al., 2019).

3.6. Granger causality test

The cointegration test shows a long-term equilibrium relationship between the two variables, but in the case of a causal relationship, further testing needs to be done. If variable *A* helps in predicting *B*, that is, *B*'s regression is based on *B*'s past values, and *A*'s past values are added, this can greatly improve the explanatory ability of the regression. If the p-value is smaller than the 5% significant level, it means that there is a Granger causality relationship (Zou, 2018).

3.7. Impulse response function (IRF) analysis

In order to identify structural shocks and their dynamic effects, innovative accounting techniques have been adopted, consisting of IRF. IRF examines the relative effect of each variable on other variables and displays the response of each relevant variable in a linear system to the shock of the system variable (Ashraf et al., 2019).

3.8. Variance decomposition (VDC) analysis

The VDC can be applied to analyze the effect of updating each variable on other variables, which shows a relative effect (Zou, 2018).

An alternative to the method suggested in this study is using the error correction model (ECM) method, which is a technique for correcting short-term imbalances toward long-term balance and can explain the relationship between dependent variables and independent variables in the present and past. VECM is a multivariate form of ECM. The ECM method itself is used to explain whether or not there is a relationship between the independent variable and the dependent variable in the long and short term.

4. RESULTS AND DISCUSSION

4.1. Results

4.1.1. Stationarity test

The initial step before carrying out the VECM test is the stationarity test of the data for each dependent and independent variable to obtain a VECM estimate. The stationarity of the data is necessary because it can affect the results of the VECM estimation test.

The stationary test results in Table 1 show that the *TPF*, *CAR*, *NPL*, *LDR*, and *credit distribution* data are stationary at the first difference, with all $p < 0.05$. So, the test continues to the stage of determining the optimal lag.

Table 1. Stationarity test

Variable	*Probability*	
	Level	*1st diff.*
TPF	0.9991	0.0122
CAR	0.0632	0.0000
NPL	0.5524	0.0000
LDR	0.9834	0.0001
Credit distribution	0.2297	0.3699

4.1.2. Optimal lag determination

VECM estimation is very sensitive to the lag length of data used. The lag length shows the influence of time required by each variable on its past variable. The determination of the lag length is based on the highest value of the sequentially modified likelihood ratio (LR) test statistic.

The results of data processing in Table 2 show that the lag used is the 1st lag.

Table 2. Optimal lag determination

Lag	*LogL*	*LR*	*Final prediction error (FPE)*	*AIC*	*SIC*	*HQC*
0	-960.0130	NA	3.09e+18	56.76547	56.98994	56.84202
1	-805.8302	253.9482	1.58e+15	49.16648	50.51327	49.62577
2	-790.6717	20.50852	3.12E+15	49.74539	52.21451	50.58743

4.1.3. Stability test

Model stability testing is the next step that must be carried out before using VECM estimation. The model stability test aims to test the validity of IRF and VDC.

Table 3. Stability test

Root	*Modulus*
0.960662	0.960662
0.909419 – 0.112367i	0.916335
0.909419 + 0.112367i	0.916335
0.327493	0.327493
0.258365	0.258365

The VAR model is said to be stable if the modulus value is at radius < 1, and unstable if the modulus value is > 1. Based on the results of the stability test in the table above, it is known that the model is stable and has passed the stability test because the modulus value is < 1.

4.1.4. Johansen cointegration test

The cointegration test is a method to see how far the relationship between economic variables is in the long run. This test is carried out after the stationarity test and has integrated to the same degree. The cointegration test is carried out to see the long-term relationship between the independent variable and the dependent variable. This test is carried out after the stationary test. The main purpose of this test is to determine whether the cointegrated residue is stationary or not. If the independent variable and dependent variable are cointegrated, it shows that there is a stable relationship in the long term. On the other hand, if there is no cointegration between variables, it indicates there is no long-term relationship.

Table 4. Johansen cointegration test

Number of cointegrating vectors	*Eigenvalue*	*Trace statistic*	*0.05 critical value*	*Prob.*
None	0.821425	112.0895	69.81889	0.0000
At most 1	0.650845	55.23886	47.85613	0.0087
At most 2	0.325777	20.51493	29.79707	0.3886
At most 3	0.202945	7.506524	15.49471	0.5196
At most 4	0.000638	0.021073	3.841465	0.8845

The results of the cointegration test in Table 4 show that the probability values in the *None* and *At most 1* rows are 0.0000 and 0.0087 < 0.05, respectively. This means that the results of the cointegration test show the movements of the independent variable and dependent variable have a relationship of stability/balance and similar movements in the long term or in this case it is called cointegrated. So, the estimate that will be used is VECM.

4.1.5. VECM model

The VECM estimation model became an option after seeing the test results through pre-estimation stages consisting of data stationarity test, determining lag length, cointegration test, and VECM stability as well as the fact that there are three cointegration rankings at the 0.05 (5%) test level in this study. This VECM estimate supports solving the problem in this research to identify short-term and long-term relationships between the influence of the independent variable on the dependent variable.

Table 5. VECM models

Cointegrating equation	*t-count*
Credit distribution(-1)	1.000000
TPF(-1)	-13.5036
CAR(-1)	3.51098
NPL(-1)	0.55145
LDR(-1)	6.11853
Error correction:	
CointEq1	-2.44995
D(Credit distribution(-1))	-0.56210
D(TPF(-1))	0.70620
D(CAR(-1))	0.68154
D(NPL(-1))	2.22110
D(LDR(-1))	0.16221
R-squared	0.313154
Adj. R-squared	0.160521
Sum sq. resides	8.72E + 10
S.E. equation	56822.15
F-statistic	2.051683
Log likelihood	-416.5462
AIC	24.91448
SIC	25.22873
Mean dependent	15899.79
S.D. dependent	62017.28

Table 5 shows a long-term relationship between the dependent and independent variables. Meanwhile, the bottom of the table shows the interpretation of the short-term relationship between the three variables. The results of the VECM model in the table above can be interpreted as presented below.

In the short term, changes in *NPL* during the past 1 month have a significant effect on *LDR* in the current month, with t-statistic value |2.22110| > t-table value of 2.042. If the current *NPL* 1 month ago increased by 1%, it will cause changes in *credit distribution* at this time to decrease by -0.364928. In the long term, *TPF*, *CAR*, and *LDR* have a significant effect on *credit distribution*, with the t-statistic value of each variable |-13.5036|, |3.51098|, |6.11853| > t-table value of 2.042. F-statistic value of 2.05 < F-table of 4.02 means that all independent variables have no effect on dependent variable simultaneously or together.

4.1.6. Granger causality test

The Granger causality test is carried out to find the causal relationship between each independent variable and dependent variable. The test level in this test is at a confidence level of 0.05 (5%) and the lag length is up to lag 2 according to the optimum lag length test that has been carried out. Granger causality results are shown in the table below.

Table 6. Pairwise Granger causality test

Null hypothesis	*Obs.*	*F-Statistic*	*Prob.*
TPF does not Granger cause *credit distribution*. *Credit distribution* does not Granger cause *TPF*.	35	0.25041 0.14718	0.6202 0.7038
CAR does not Granger cause *credit distribution*. *Credit distribution* does not Granger cause *CAR*.	35	0.69156 1.81824	0.4118 0.1870
NPL does not Granger cause *credit distribution*. *Credit distribution* does not Granger Cause *NPL*.	35	0.29362 1.92414	0.5917 0.1750
LDR does not Granger cause *credit distribution*. *Credit distribution* does not Granger cause *LDR*.	35	0.06187 6.31707	0.8052 0.0172
CAR does not Granger cause *TPF*. *TPF* does not Granger cause *CAR*.	35	0.31668 7.21155	0.5775 0.0114
NPL does not Granger cause *TPF*. *TPF* does not Granger cause *NPL*.	35	6.94561 0.06580	0.0128 0.7992
LDR does not Granger cause *TPF*. *TPF* does not Granger cause *LDR*.	35	0.08397 2.92769	0.7739 0.0968
NPL does not Granger cause *CAR*. *CAR* does not Granger cause *NPL*.	35	3.96137 1.03325	0.0552 0.3170
LDR does not Granger cause *CAR*. *CAR* does not Granger cause *CAR*.	35	7.70076 3.03150	0.0091 0.3170
LDR does not Granger cause *CAR*. *NPL* does not Granger cause *LDR*.	35	0.00162 14.6140	0.9681 0.0006

Note: Date: July 6, 2022. Time: 00:27. Sample: 2019M01–2021M12. Lags: 1.

The results of the Granger causality test in the table above show that *TPF* doesn't significantly affect *credit distribution* with a probability value of 0.6202 ≥ 0.05 and *credit distribution* doesn't significantly affect *TPF* with a probability value of 0.7038 ≥ 0.05. So, there is no two-way causality between *TPF* and *credit distribution*. *CAR* doesn't significantly affect *credit distribution*, with a probability value of 0.4118 ≥ 0.05, and *credit distribution* does not significantly affect *CAR*, with a probability value of 0.1870 ≥ 0.05. So, there is no two-way causality between *CAR* and *credit distribution*. *NPL* doesn't significantly affect *credit distribution*, with a probability value of 0.5917 ≥ 0.05, and *credit distribution* doesn't significantly affect *NPL*, with a probability value of 0.1750 ≥ 0.05. The results of data processing show that there is no two-way causal relationship between *NPL* and *credit distribution*.

LDR does not significantly affect *credit distribution* with a probability value of 0.8052 ≥ 0.05, but *credit distribution* has a significant effect on *LDR* with a probability value of 0.0172 ≤ 0.05. So, there is a one-way causality between *LDR* and *credit distribution*. *CAR* does not significantly affect *TPF* with a probability value of 0.5775 ≥ 0.05, but *TPF* significantly affects *CAR* with a probability value of 0.0114 ≤ 0.05. So, there is a one-way causality between *CAR* and *TPF*. *NPL* significantly affects *TPF* with a probability value of 0.0128 ≤ 0.05, but *TPF* does not significantly affect *NPL* with a probability value of 0.7992 ≥ 0.05. So, there is a one-way causality between *NPL* and *TPF*. *LDR* does not significantly affect *TPF* with a probability value of 0.7739 ≥ 0.05, and *TPF* doesn't significantly affect *LDR* with a probability value of 0.0968 ≥ 0.05. This fact shows that there is no two-way causality between *LDR* and *TPF*.

NPL does not significantly affect *CAR* with a probability value of 0.0552 ≥ 0.05, and *CAR* doesn't significantly affect *NPL* with a probability value of 0.3170 ≥ 0.05. So, there isn't bidirectional causality between *NPL* and *CAR*. *LDR* significantly affects *CAR* with a probability value of 0.0091 ≤ 0.05, but *CAR* doesn't significantly affect *LDR* with a probability value of 0.0913 ≥ 0.05. So, there is a one-way causality between *LDR* and *CAR*. *LDR* doesn't significantly affect the *NPL* with a probability value of 0.9681 ≥ 0.05, but the *NPL* significantly affects the *LDR* with a probability value of 0.0006 ≤ 0.05. So, there is a one-way causality between *LDR* and *NPL*.

4.2. Impulse response function (IRF) analysis

Impulse response function analysis is used to analyze the impact of shocks to one variable on other variables, both short-term and long-term. This analysis can capture long-term responses if a variable experiences a shock. This analysis is also used to see how long this effect lasts.

Figure 1. Impulse response function (IRF) analysis results

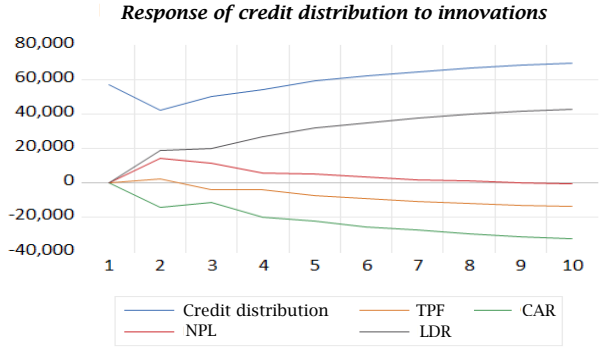

Figure 1 shows that when a shock occurs in the *credit distribution* variable, it will be responded positively by the variable itself. When a shock occurs in the *TPF* variable, it will be responded positively by the *credit distribution* variable in periods one and two, then responded negatively from the third period onwards. When a shock occurs in the *CAR* variable, it will be responded negatively from periods one to ten by the *credit distribution* variable. When a shock occurs in the *NPL* variable, *credit distribution* will be responded positively from periods one to ten, but it begins to decline in the second period and approaches the negative line. When there is a shock to the *LDR* variable, it will be responded optimistically by the *credit distribution* variable from periods one to ten.

4.3. Variance decomposition (VDC) analysis

Variance decomposition analysis is used to measure the composition value or contribution of the independent variable to the dependent variable. In this study, the VDC analysis was focused on looking at the effect of independent variables on dependent variable.

Table 7. Variance decomposition (VDC) analysis of credit distribution

Period	*S.E.*	*Credit distribution*	*TPF*	*CAR*	*NPL*	*LDR*
1	56822.15	100.0000	0.000000	0.000000	0.000000	0.000000
2	76104.62	86.84665	0.088034	3.579468	3.433454	6.052390
3	94765.35	83.87838	0.215977	3.783898	3.654985	8.466759
4	114357.7	80.09492	0.259702	5.529798	2.774609	11.34097
5	134896.2	76.95677	0.483364	6.642079	2.141256	13.77653
6	154779.0	74.41803	0.716132	7.721078	1.680554	15.46420
7	174404.5	72.33945	0.938481	8.563716	1.336457	16.82190
8	193534.7	70.62905	1.143132	9.269305	1.087746	17.87077
9	212048.7	69.21738	1.326469	9.845627	0.906130	18.70440
10	229930.5	68.04546	1.486826	10.32334	0.771330	19.37305

The output in the table above shows that in the first period, the variable amount of *credit distribution* was only influenced by itself without any shock contribution from other variables. Meanwhile, for the second period, *LDR* is the more dominant variable contributing to the shock in the variable amount of lending compared to the *TPF*, *CAR*, and *NPL* variables. The dominance of the *LDR* variable continues until period ten.

4.4. Discussion

The results of research on the determinants of bank lending in Indonesia for the 201–2021 period using the VECM method using the Eviews 12 software show that the *TPF*, *CAR*, and *LDR* variables affect the *credit distribution* variable significantly in the long term. In addition, *NPL* significantly affects the lending variable in the short term. Granger causality test results show that there is no two-way causality relationship between *TPF*, *CAR*, and *NPL* variables on *credit distribution*. However, there is a one-way causality relationship between *LDR* and *credit distribution* variables. The results of IRF analysis of *credit distribution* due to the *TPF*, *CAR*, *NPL*, and *LDR* variables are as follows. *TPF* has a positive response to the *credit distribution* variable in periods one and two, then responds negatively from the third period onwards. *CAR* has a negative response from periods one to ten to the *credit distribution* variable. *NPL* has a positive effect on *credit distribution* from period one to ten but begins to decline in the second period and approaches the negative line. *LDR* has a positive response to the *credit distribution* variable from periods one to ten. Variance decomposition test results show against conventional banks, it can be seen that *LDR* has the largest shock contribution to credit distribution, while those that provide the smallest contributions are *TPF*, *NPL*, and *CAR*.

5. CONCLUSION

This research aims to see and analyze the influence of *TPF*, *CAR*, *LDR*, and *NPL* on *credit distribution* with the research population being banking companies listed on the Indonesia Stock Exchange for the period of 2019–2021. Results of the study found that *TPF*, *CAR*, and *LDR* variables have significantly affected the lending variable in the long term. In addition, the *NPL* variable significantly affects the *LDR* variable in the short term. Based on the

Granger causality test results, there isn't a two-way causality relationship between *TPF*, *CAR*, and *NPL* variables on *credit distribution*. However, there is a one-way causality relationship between the *LDR* variable and *credit distribution*. From the theory of bank risk management, theoretically, risk management in banking institutions is defined as the logical construction and implementation of plans to deal with potential losses. The results of this research show that capital adequacy and liquidity greatly influence credit distribution.

The managerial implications of this research are that the application of risk management can increase shareholder value, explain possible future losses to bank managers, and help improve systematic decision-making methods and processes based on available information. This research is only limited to the influencing variables using VECM as a model. The next research suggestion is to apply risk management which includes 10 risks, namely credit risk, market risk, liquidity risk, operational risk, legal risk, reputation risk, strategic risk, compliance risk, rate of return risk, and investment risk.

REFERENCES

Al-Eitan, G. N., & Bani-Khalid, T. O. (2019). Credit risk and financial performance of the Jordanian commercial banks: A panel data analysis. *Academy of Accounting and Financial Studies Journal, 23*(5), 1–13. https://www.abacademies.org/articles/Credit-Risk-and-Financial-Performance-of-the-Jordanian-Commercial-Banks-1528-2635-23-5-467.pdf

Arintoko, A. (2021). Internal factors affecting commercial bank lending: Symmetric and asymmetric effects of macro-level data evidence. *Jurnal Keuangan dan Perbankan, 25*(3), 717–733. https://doi.org/10.26905/jkdp.v25i3.5760

Ashraf, I., Yong, S., Afzal, R. M., & Kun, G. (2019). Empirical analysis of foreign direct investment and economic growth in Pakistan using VECM model. *African Journal of Business Management, 13*(16), 544–556. https://doi.org/10.5897/ajbm2019.8857

de Leon, M. V. (2020). The impact of credit risk and macroeconomic factors on profitability: The case of the ASEAN banks. *Banks and Bank Systems, 15*(1), 21–29. https://doi.org/10.21511/bbs.15(1).2020.03

Diamond, D. W. (1984). Financial intermediation and delegated monitoring. *The Review of Economic Studies, 51*(3), 393–414. https://doi.org/10.2307/2297430

Diamond, D. W., & Dybvig, P. H. (1983). Bank runs, deposit insurance, and liquidity. *Journal of Political Economy, 91*(3), 401–419. https://doi.org/10.1086/261155

Falah, N. S., & Septiarini, D. F. (2019). Analisis perbandingan kinerja pembiayaan bank umum Syariah dan bank umum konvensional di Indonesia periode 2014–2017. *Jurnal Ekonomi Syariah Teori dan Terapan, 6*(6), 1166–1177. https://doi.org/10.20473/vol6iss20196pp1166-1177

Harmayati, W. R., & Rahayu, D. (2019). Faktor-faktor yang mempengaruhi penyaluran kredit pada bank umum yang go publik di Bursa Efek Indonesia. *Jurnal Ekonomi Manajemen Akuntansi, 26*(46), 119–131. https://ejurnal.stiedharmaputra-smg.ac.id/index.php/JEMA/article/view/345/334

Hermuningsih, S., Sari, P. P., & Rahmawati, A. D. (2020). The influence of third-party funds, non-performing loans (NPL) on credit distribution with profitability as intervening variable in commercial banks. *International Journal of Economics, Business and Accounting Research, 4*(2), 40–50. https://doi.org/10.29040/ijebar.v4i02.988

Jessica, T., & Chalid, D. A. (2021). Determinants of bank loans in Indonesia. In *Proceedings of the Asia-Pacific Research in Social Sciences and Humanities Universitas Indonesia Conference (APRISH 2019)* (pp. 505–512). Atlantis Press. https://doi.org/10.2991/assehr.k.210531.064

John, J. A., Diotay, D. C., Sankar, J. P., & Alawi, S. H. Y. (2023). The mediating role of innovation and change in the relationship between organizational learning and the sustainability of banks [Special issue]. *Corporate Governance and Organizational Behavior Review, 7*(2), 399–408. https://doi.org/10.22495/cgobrv7i2sip18

Kasmir. (2014). *Bank dan lembaga kuangan lainnya.* PT Raja Grafindo Persada Jakarta.

Lutfi, L., Kristijadi, E., & Silvy, M. (2020). Simultaneous adjustment of bank capital and risk: Evidence from the Indonesian commercial banks. *Accounting, 6*(5), 637–648. https://doi.org/10.5267/j.ac.2020.6.021

Mazreku, I., Morina, F., Misiri, V., Spiteri, J. V., & Grima, S. (2018). Determinants of the level of non-performing loans in commercial banks of transition countries. *European Research Studies Journal, 21*(3), 3–13. https://doi.org/10.35808/ersj/1040

Mohamed Metwally, A. B., Ali, H. A. A., Diab, A. A., & Hussainey, K. (2019). The hype of risk-based management control: A phronetic approach. *Risk Governance and Control: Financial Markets and Institutions, 9*(2), 18–33. https://doi.org/10.22495/rgcv9i2p2

Permataningayu, G., & Mahdaria, S. (2019). The effect of non-performing financing and financing to deposit ratio on Islamic banks financing in Indonesia. *Asian Journal of Islamic Management, 1*(1), 28–37. https://doi.org/10.20885/ajim.vol1.iss1.art3

Prabantarikso, R. M., Abidin, Z., Fahmy, E., Tyastika, M., & Nabila, A. (2022). Determinant of net interest income of commercial banks in Indonesia. *Accounting, 8*(3), 259–268. https://doi.org/10.5267/j.ac.2022.1.002

Prawitasari, D., Kadarningsih, A., Machmuddah, Z., & Ud-Din, M. (2020). Internal company factors as determining variables for improving bank lending. *The Journal of Asian Finance, Economics and Business, 7*(8), 205–212. https://doi.org/10.13106/jafeb.2020.vol7.no8.205

Priyadi, U., Utami, K. D. S., Muhammad, R., & Nugraheni, P. (2021). Determinants of credit risk of Indonesian Shari'ah rural banks. *ISRA International Journal of Islamic Finance, 13*(3), 284–301. https://doi.org/10.1108/IJIF-09-2019-0134

Pujiati, P., Kisman, Z., & Bastaman, A. (2020). Analysis of capital adequacy ratio, prime lending rate, and third-party funds on profitability of commercial banks in Indonesia, with liquidity as intervening variable. *Journal of Economics and Business, 3*(1), 172–188. https://doi.org/10.31014/aior.1992.03.01.187

Pyle, D. H. (1999). Bank risk management: Theory. In D. Galai, D. Ruthenberg, M. Sarnat, & B. Z.Schreiber (Eds.), *Risk management and regulation in banking* (pp. 7–14). Springer. https://doi.org/10.1007/978-1-4615-5043-3_2

Ratnovski, L. (2013). Liquidity and transparency in bank risk management. *Journal of Financial Intermediation, 22*(3), 422–439. https://doi.org/10.1016/j.jfi.2013.01.002

Riabichenko, D., Oehmichen, M., Mozghovyi, Y., & Horsch, A. (2019). Ownership structure and risk profile of banks in emerging economies. *Risk Governance and Control: Financial Markets & Institutions, 9*(3), 46–65. https://doi.org/10.22495/rgcv9i3p4

Romli, H., & Alie, M. (2017). diterminan penyaluran kredit dan implikasinya terhadap kinerja profitabilitas bank yang terdaftar di Bursa Efek Indonesia periode 2010-2014. *Jurnal Manajemen dan Bisnis Sriwijaya, 15*(1), 62–76. https://www.neliti.com/publications/284056/diterminan-penyaluran-kredit-dan-implikasinya-terhadap-kinerja-profitabilitas-ba#cite

Supriyono, R. A., & Herdhayinta, H. (2019). Determinants of bank profitability: The case of the Regional Development Bank (BPD Bank) in Indonesia. *Journal of Indonesian Economy and Business, 34*(1), 1–17. https://doi.org/10.22146/jieb.17331

Tursoy, T. (2018). *Risk management process in banking industry* (MPRA Paper). Munich Personal RePEc Archive. https://mpra.ub.uni-muenchen.de/86427/

Usman, B., & Lestari, H. S. (2019). Determinants of bank performance in Indonesia. *Jurnal Minds: Manajemen Ide dan Inspirasi, 6*(2), 193–204. https://doi.org/10.24252/minds.v6i2.11282

Wahyuni, N. N. S., & Wimba, I. G. A. (2022). Analisis komparatif deskriptif kinerja bank umum Syariah dengan bank konvensional. *Widya Amrita: Jurnal Manajemen, Kewirausahaan dan Parwisata, 2*(1), 21–32. https://ejournal.unhi.ac.id/index.php/widyaamrita/article/view/1748

Widyakto, A., & Wahyudi, S. (2021). Analysis of factors affecting profitability of Sharia commercial banks: Evidence from Indonesia. *Diponegoro International Journal of Business, 4*(2), 95–104. https://doi.org/10.14710/dijb.4.2.2021.95-104

Yudaruddin, R. (2020). Determinants of micro-, small-and medium-sized enterprise loans by commercial banks in Indonesia. *The Journal of Asian Finance, Economics and Business, 7*(9), 19–30. https://doi.org/10.13106/jafeb.2020.vol7.no9.019

Zou, X. (2018). VECM model analysis of carbon emissions, GDP, and international crude oil prices. *Discrete Dynamics in Nature and Society*, Article 5350308. https://doi.org/10.1155/2018/5350308