Analysis of Credit Bank Distribution with Seemingly Unrelated Regression Method on Panel Data

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Abstract. One of the bank’s business activities that most impactful for economic growth is credit distribution that is affected by independent variables including Thirds Party Funds, bank’s performance (CAR and LDR), credit interest rates, NPL, and external variables such as BI Certificate, BI Rate, and exchange rates. Panel data regression is used to analyze the impact of those variables. The type of this research data is combined features of both cross-section and time-series obtained from SPI. The study is aimed to see variables that affect credit distributions at the commercial banks between January 2016 until December 2019. Among the common error structures, there are individual correlations known as contemporaneous correlations. This case can be resolved by seemingly unrelated regression analysis. The result showed that Third Party Funds and LDR have significantly impacted the credit distribution of all types of commercial banks with a goodness of fit measure is 99.909%. Moreover, all variables studied were impact the credit distribution of the Joint Venture Bank and the Regional Development Bank.

1. Introduction

One of the bank’s business activities that most impact by national financial is credit distribution. The increase in demand for credit will affect lifestyle and public finance, such as an increase in transactions, motivation to develop ventures, and investments. Rajan and Zingales (1998) said that the credit bank distribution effect on per capita income in both developed countries and developing countries. The credit bank distribution in Indonesia can control by the central bank that is Bank of Indonesia (BI), with reference rates policy, namely BI Rate. BI has lowered the reference rates four times, from 6% became 5% from July until October 2019. Credit bank distribution is also affected by internal and external variables. The variables include Thirds Party Funds, bank’s performances (Capital Adequacy Ratio and Loan to Deposit Ratio), non-performing loans, credit interest rates, BI certificates, and exchange rates. In statistics, to see the effect of variables on credit distribution common use regression analysis.

The structure of data is panel data that combine features of both cross-section and time-series data. The individual in cross-section is the type of commercial banks. The data consist of January 2016 until December 2019. According to Gujarati [6], in the panel data, commonly uses analysis of static panel data regression. There are three models of panel data regression, namely the pooled model, the fixed-effect model, and the random effect model. If the panel data regression model correlates with its individual errors known as contemporaneous correlation, then Seemingly Unrelated Regression (SUR) can be used in this case. The SUR method was developed by Arnold Zellner (1972). The SUR method estimates the parameter of all equations simultaneously. Hence, each equation takes the information
provided by the other equation Cadavez and Henningsen [4]. This method is suitable for data that has a relatively small number of individuals and a long period Baum [3].

2. Objectives
This study aimed to know variables that affect the credit distribution at the commercial banks between January 2016 until December 2019 using analysis of panel data regression.

3. Materials
This research examined the credit bank by the commercial banks in Indonesia and was obtained from Indonesia Banking Statistic provided by the Financial Services Authority and Bank of Indonesia. The commercial banks are State-Owned Banks, Foreign Exchange Commercial Banks, Non-Foreign Exchange Commercial Banks, Regional Development Banks, Joint Venture Banks, and Foreign-Owned Banks. The time-series data used the monthly period from January 2016 until December 2019. The variables are listed in Table 1.

| Code | Variables                        | Unit of measurement     |
|------|----------------------------------|-------------------------|
| Y    | Credit Distribution              | 10.000 Billion IDR       |
| X1   | Third-Party Funds                | 10.000 Billion IDR       |
| X2   | Capital Asset Ratio (CAR)        | %                       |
| X3   | Loan to Deposit Ratio (LDR)      | %                       |
| X4   | Net-Performing Loan (NPL)        | %                       |
| X5   | Credit Interest Rates            | %                       |
| X6   | BI Certificates                  | Thousands of IDR        |
| X7   | BI Rate                          | %                       |
| X8   | Exchange Rates                   | Thousands of IDR        |

4. Methods
The analysis for this research using R.4.0.1 software. The data analysis procedures are shown in Figure 1 and are described as follows:
1. Performing the data exploration to see the connection of explanatory variables and response variables. The exploration also is used to identify the cross-sectional effect and time series effect in data.
2. Going to panel data regression analysis with the following step:
   a. Estimate parameter for the pooled model and the fixed-effect model,
   b. Select the best model of both with the Chow test. The null hypothesis for this test is that the pooled model is preferred. At the same time, the alternative hypothesis is the fixed-effect model to be selected.
   \[ F_{stat} = \frac{(SSE_{pooled} - SSE_{fixed})/(N - 1)}{SSE_{fixed}/(NT - N - K)} \]
   The test is compared to the Fisher distribution table \(F_{(N-1),(N(T-1)-K,a)}\). N is the number of individuals, T is the number of time periods, and K is the number of explanatory variables.
   c. Estimate parameter for random effect model
   d. Select the best model between fixed-effect and random effect with the Hausman test. The null hypothesis is the random effect model is desired than the fixed-effect model.
   \[ \chi^2_{stat} = (\beta_{random} - \beta_{fixed})' \text{Var}(\beta_{random} - \beta_{fixed})^{-1} (\beta_{random} - \beta_{fixed}) \]
3. Testing the heteroscedasticity on model errors structure for the selected panel data regression model
   a. Heteroscedasticity is tested by using the modified Wald test. The null hypothesis is no heteroskedasticity ($\sigma_i^2 = \sigma^2$, i = 1, 2, .. N). If reject the null hypothesis, then heteroskedasticity is present.
   
   $$ W = \sum_{i=1}^{n} \frac{(\hat{\sigma}_i^2 - \sigma^2)^2}{\bar{T}_i(T_i - 1)} $$

   b. If there is heteroskedasticity, then test the phenomenon of contemporaous correlation. The hypothesis is as follows:
   
   $H_0: E(\varepsilon_{it}, \varepsilon_{jt}) = 0$ (the error terms are not correlated across units)
   $H_1: E(\varepsilon_{it}, \varepsilon_{jt}) \neq 0$ (the error terms are correlated across units)

   Statistic’s test is using Breusch-Pagan Lagrange Multiplier Halunga et al [7]:
   
   $$ \text{BP}^{LM} = \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \frac{1}{\sqrt{T_i T_j}} \hat{\varepsilon}_{it} \hat{\varepsilon}_{jt} $$

   The criteria rejection the null hypothesis if the value of $\text{BP}^{LM}$ greater than the value of the chi-square distribution table with a degree of freedom is $\frac{1}{2} N(N - 1)$. It means the contemporaous correlation is existence. So, simple panel data regression can not be used in that case. The alternative method is using the Seemingly Unrelated Regression (SUR) method.

4. Doing the analysis of SUR to resolve the contemporaous correlation. The estimated SUR developed from Feasible Generalized Linear Square (FGLS) estimator can solve the correlation in disturbance Baltagi [2], FGLS developed from the GLS estimator, which the covariance ($\Sigma$) of residuals is unknown and was estimated by Ordinary Least Square (OLS) to gain the covariance. The following steps by Anggana [1]:
   a. Estimate parameter $\hat{\beta}^{OLS}$ for each N regression equation
   b. Determine the residuals vector $\hat{\varepsilon}_i^{OLS} = Y_i - X_i^{'}\hat{\beta}^{OLS}$ (i= 1, 2, 3, …, N)
   c. Estimate covariance matrix $\hat{\Sigma} = E(\varepsilon_i \varepsilon_j ^{'}) = \sigma_{ij} I_T$, which $\hat{\sigma}_{ij} = \frac{\hat{\varepsilon}_i \hat{\varepsilon}_j }{T}$.
   d. Compute $\hat{\Omega} = \hat{\Sigma} \otimes I_N$, $I_N$ is matrix identity, $\otimes$ Kronecker product (for each matrix $A_{kxl}$, $B_{mxn}$, $A \otimes B = C_{lmxkn}$)
   e. Compute estimate parameter $\hat{\beta}^{SUR}$
   
   $$ \hat{\beta}^{SUR} = [X^{'}\Omega^{-1}X]^{-1} [X^{'}\Omega^{-1}Y] $$

   f. Re-compute $\hat{\Omega}$ by using the estimated value in step (e) until the estimation coefficient is convergent. This step is also called iterative SUR.

5. Evaluating the goodness of model
   The goodness-of-fit measure for every single equation using coefficient determination (R-square). And for the overall best model using McElroy’s R-square (McElroy 1977)
   
   $$ R^2_{ME} = 1 - \frac{\hat{\varepsilon}^{'}\hat{\Omega}^{-1}\hat{\varepsilon}}{y^{'}\hat{\Omega}^{-1}y} $$

6. Testing linear restrictions for the SUR model
   Linear restrictions are tested for regression fit. The hypothesis is as follows:
   $H_0 : \beta_1 = \beta_2 = \cdots = \beta_N = \beta$ (all regression coefficient vectors for all individual are equal)
H$_1$ : at least there one $\beta_i \neq \beta$ (at least there 1 regression coefficient vectors are not equal)
Statisc’s test by using Ratio Likelihood test:
\[
LR = T. (\log |\Sigma_r| - \log |\Sigma_u|)
\]
$\Sigma_r$ is the covariance matrix of the restricted model, and $\Sigma_u$ is the covariance matrix of the unrestricted model. Statistic’s test LR follows the chi-square distribution with the degree of freedom is N.

7. Checking the assumption of model errors structure in the SUR model.
a. Test the multivariate normality on residuals
b. Test the heteroskedasticity on residuals
c. Test the autocorrelation on residuals
d. Compute the contemporaneous correlation

5. Result and Discussion

5.1. Data Description

The graphic below shows the credit distribution in 6 commercial banks from 2016 to 2019. It can be seen that some commercial banks had a similar characteristic. State-Owned and Foreign Exchange Commercial banks were the highest credit distribution and had a similar characteristic pattern. For four years the number of credit distribution of both was rose gradually. State-Owned banks are State-Owned Enterprises, which the bank customers are more dominated by the public, while Foreign Exchange Commercial banks are privately owned but have the same role as State-Owned banks. The lowest number of credit distribution in Indonesia in 4 years is Non-Foreign Exchange banks caused by some factors, including geographic services coverage and availability of the number of banks.
From 2017 to 2018, the number of credit distribution in Foreign-Owned and Joint Venture banks is almost similar, shown on coincide lines in Figure 2. The similarity between Foreign-Owned and Joint Venture banks is both are owned by foreigners. Join Venture banks were partly foreign-owned and domestic privately owned. The number of credit distribution of these two banks is in the second-lowest position. It is caused by the public more trusting national banks than banks are owned by foreigners.

Regional Development banks were in the third-highest of the number of credit distribution in Indonesia in 4 years. The number of credit distribution in Regional Development banks was increasing in 4 years. Regional Development banks have location advantages than other banks and already operating. These advantages are the bank’s potential to improve the economy in micro, small, and medium enterprises in regional, and to increase the number of credit distribution in productive economic sectors. Overall, Figure 2 proves that there were individual effects (between commercial banks) and time effect during these years in credit distribution from 2016 to 2019.

5.2. Panel Data Regression Analysis
Regression is analyzed to see the effect of exogenous variables on the response variable. In common, regression analysis was implemented in cross-sectional data, but in this research focus on panel data to know the effect of variables in credit distribution in commercial banks on period time from January 2016 to December 2019. The combination of data called panel data and the analysis used panel data regression.

Panel data regression has three approach estimation models, the pooled model, the fixed-effect model, and the random effect model. First, estimate pooled and fixed-effect model, and then going to the specification model used the Chow test. The parameter estimation of the pooled model is the Ordinary Least Square (OLS). The pooled model disregards the unit and time-specific. The estimates
pooled model assumes that each unit or individual and time has the same intercept value, which is also called the linear regression model. Whereas the fixed-effect model makes individual or time-specific as intercept with the dummy variables Gujarati [6]. The pooled and fixed-effect model estimations are shown in Table 2.

Table 2. The result of the pooled and fixed-effect model estimation

| Coefficient | Pooled model | Fixed-effect model |
|-------------|--------------|--------------------|
| Intercept   | -38.4186     | -52.6398           |
|             | 0.0000       | 0.0000             |
| X1          | 0.9150       | 1.0647             |
|             | 0.0000       | 0.0000             |
| X2          | 0.0359       | 0.1252             |
|             | 0.2202       | 0.2338             |
| X3          | 0.4129       | 0.3106             |
|             | 0.0002       | 0.0000             |
| X4          | 0.8186       | 0.3749             |
|             | 0.1575       | 0.3360             |
| X5          | -0.4878      | 0.0495             |
|             | 0.0000       | 0.7419             |
| X6          | -0.0383      | 0.0693             |
|             | 0.1003       | 0.0000             |
| X7          | -0.2150      | -0.1587            |
|             | 0.7287       | 0.7158             |
| X8          | 1.0827       | 0.0000             |
|             | 0.9715       | 0.0000             |

R² 99.787% 97.551%
F 16374.3 1364.47
Pr(>|t|) 0.0000 a 0.0000 a

*significant at α = 0.05

Chow test is used to specify both models, pooled and fixed-effect models. The value of the statistic’s test was 109.65 and \((F\text{table})=2.132\). It means that statistic’s test more significant than the score \(F\text{table}\), so the fixed-effect model is to be temporarily selected. After that, estimate the random effect model and going to the Hausman test to specific between random effect and fixed-effect model. The Hausman value of the test was 5.7272, and the p-value 0.6778. The p-value of the Hausman test was more than α = 0.05, so the null hypothesis was accepted. It could be concluded that the random effect model is preferred over the fixed-effect model. The result of the random effect model estimation is shown in Table 3.

Table 3. The result of the random effect model estimation

| Coefficient | Estimate | Pr(>|t|) | VIF |
|-------------|----------|---------|-----|
| Intercept   | -54.3836 | 0.0000 a|     |
| X1          | 1.0598   | 0.0000 a| 1.3147 |
| X2          | 0.1400   | 0.1719  | 1.3881 |
| X3          | 0.3125   | 0.0000 a| 1.4676 |
| X4          | 0.3590   | 0.3553  | 1.5295 |
| X5          | 0.0783   | 0.5932  | 2.5824 |
| X6          | 0.0685   | 0.0000 a| 1.1493 |
| X7          | -0.0716  | 0.8687  | 2.8471 |
| X8          | 0.9577   | 0.0000 a| 1.5968 |

R² 97.545%
Chi-sq 11084.5
Pr(>|t|) 0.0000 a

*a significant at α = 0.05

By using multiple linear regression, multicollinearity checking of the explanatory variables must be considered. Multicollinearity is a condition that across between explanatory variables is linearly strongly related. Multicollinearity is detected by VIF (Variance Inflation Factor). The value of VIF more than 10
indicate the multicollinearity. Based on Table 3, the random effect model gives the VIF of explanatory variables that is less than 10, so there is no multicollinearity.

The normality on residuals in panel data can be tested by using the Jarque-Bera test. The null hypothesis for the Jarque-Bera test is the normally-distributed residuals Gujarati[6]. The result of the test for the random effect model was 2.4041 and the p-value 0.3006. The p-value of the Jarque-Bera test was more than $\alpha = 0.05$, so the null hypothesis was accepted, the residuals were normally distributed.

The assumption of serial correlation (autocorrelation) in residuals can be tested by using the Durbin Watson (DW) test. The value of DW in residuals of the random effect model was 0.5669 and the p-value was less than $\alpha = 0.05$, so the null hypothesis was rejected. It means that the serial correlation present in the residuals or across the residuals were not independently.

The cross-sectional heteroscedasticity often occurs in the panel dataset. It means the variance of residuals is heteroskedasticity across individuals, while the standard assumption of residuals in model regression is the same for all individuals. Heteroskedasticity is tested by using the modified Wald test Greene [5]. The test result was 91.511, and the p-value was less than 0.05, it means the phenomenon of heteroskedasticity was present. The violation of these residuals assumptions except the normal distribution leads the random effect model can not to be used.

5.3. *Contemporaneous Correlation*
Because the simple panel regression is not fit to use, the alternative analysis must be required to get the research objectives. Based on the assumption of homoscedasticity violated, then a further test must be carried out, namely, contemporaneous correlation. Contemporaneous correlation is an anomaly in data modeling, which is when the residuals model has correlated across individuals or units. It’s also called cross-sectional dependence in the residuals.

The test for contemporaneous correlation uses the Breusch-Pagan LM test. The result of the test value was 90.354, and the p-value was less than 0.05, so the null hypothesis was rejected, it means the residuals correlated across individuals (cross-sectional correlation). The present of contemporaneous correlation in panel data can be resolved by using the Seemingly Unrelated Regression method.

5.4. *Seemingly Unrelated Regression*
The SUR method gives equations for each individual, but the equations may be related through the residuals across individuals. In this research, estimate the SUR model by using iterative SUR method that convergent in 34th iteration. The advantage of the SUR method can handle some violated assumptions that can not be handle in the SUR method without iterative. The result SUR model estimation is shown in Table 4.

| Coefficient | State-Owned | Foreign Exchange | Non-Foreign Exchange | Regional Development |
|-------------|-------------|-----------------|----------------------|---------------------|
| Intercept   | 17.122      | 0.644           | -207.863             | -3.470              |
| X1          | 0.900       | 0.000$^a$       | 0.880                | 0.000$^a$           |
| X2          | -1.600      | 0.000$^a$       | 0.184                | -0.005              |
| X3          | 0.743       | 0.000$^a$       | 2.2156               | 0.042               |
| X4          | 11.510      | 0.000$^a$       | -0.124               | -0.041              |
| X5          | -6.069      | 0.000$^a$       | 0.486                | -0.048              |
| X6          | 0.0764      | 0.020$^a$       | 0.025                | 0.071               |
| X7          | -0.683      | 0.528           | 0.325                | 0.108               |

*Table 4.* The result of Seemingly Unrelated Regression estimation for each type of commercial banks
The SUR method is no longer has the same explanatory variables as in the standard regression model. The SUR method estimates all six credit distribution equation in commercial banks. Table 4 shows that all explanatory variables involved have a significant impact at a 5% level on credit distribution in Regional Development and Joint Venture banks. Furthermore, the explanatory variables that affect credit distribution for all six commercial banks were third party funds (X1) and Loan to Deposit Ratio (X3). Both have a significant positive effect on credit distribution. Third-party funds are the bank’s largest funding source in savings, deposit, and giro. The ability of banks to raise funds from the public will be very influential in funding allocation for credit distribution. In contrast, Loan to Deposit Ratio (LDR) is the ratio between total loans (volume of credit extended) and total deposits (volume of fund received).

Capital Adequacy Ratio (X2) is the ratio between the amount of capital and risk-weighted assets. CAR has a significant negative effect on credit distribution in State-Owned, Regional Development, and Joint Venture banks. NPL is a non-performing loan that means the amount of trouble credit by the total credit extended. NPL will increase the credit risk rate cause the more credit is not paid, the more funds are allocated to cover the losses.

The other explanatory variables, like credit interest rates, will increase the credit demand if the interest rates are low. Meanwhile, the BI certificate issued by the central bank has an effect on credit distribution for all commercial banks at a 5% significant level, except Foreign-Owned banks. Moreover, the reference rates also issued by the Bank of Indonesia only has no effect on credit distribution in State-Owned and Foreign Exchange Commercial banks. These two banks have the highest total of credit distribution. The exchange rate of IDR, which significantly affects national economic growth, only significantly affects credit distribution in Joint Venture, Foreign-Owned, and Regional Development Banks.

5.4.1. The Goodness-of-fit measure
The goodness-of-fit measure in SUR model estimation is shown in Table 5. The goodness-of-fit measure in each equation in the regression model uses the coefficient of determination, commonly called R-square adjusted. At the same time, McElroy’s R² is the overall goodness-of-fit measure in SUR model.
estimation. McElroy’s $R^2$ value reveals that the variation of credit bank distribution is explained by the independent variables in the SUR model is 99.909%.

| Table 5. $R^2$-adjusted and McElroy’s $R^2$ in the SUR model |
|--------------------------------------------------------------|
| Commercial Banks Equation | $R^2$-Adj  |
| Owned State             | 99.520%    |
| Foreign Exchange        | 99.951%    |
| Non-foreign Exchange    | 99.397%    |
| Regional Development    | 99.573%    |
| Joint Venture           | 99.438%    |
| Foreign-Owned           | 99.585%    |
| McElroy’s $R^2$         | 99.909%    |

5.4.2. **Linear Restrictions Test**

Ratio likelihood test in the one of linear restriction test that is inference statistic in the vector of regression coefficients. It is to test the vector of regression coefficients under homogeneity or different for each equation. If the vector of regression coefficients is homogeneity, then SUR is not fit to be used in that panel dataset. The result of ratio likelihood is shown in Table 6. It can be concluded that the p-value is less than 0.05, so the null hypothesis was rejected. It is mean the SUR model estimation is fit to use.

| Table 6. The result of the likelihood ratio test |
|-----------------------------------------------|
| Model                  | Log-Likelihood |
| Restricted             | -613.48        |
| Unrestricted           | 77.59          |
| Chi-square             | 1402.3         |
| Pr(>|t|)                | 0.000 $^a$     |
| $^a$significant at $\alpha = 0.05$           |

5.4.3. **Assumption Test**

In the regression model, the assumption of normal distribution in residuals must be required. Hence, in the SUR model, the assumption in residuals each equation is a multivariate normal distribution. The multivariate normality can be tested by using the Mardia test Korkmaz [8]. Under the null hypothesis, the residuals have a multivariate normal distribution. The Mardia test values are shown in Table 7. This leads to accepting the null hypothesis, so the residuals have the multivariate normal distribution.

| Table 7. The result of the Mardia test for multivariate normal |
|---------------------------------------------------------------|
| Value             | Pr(>|t|) |
| Skewness          | 60.706  | 0.310 |
| Kurtosis          | 0.037   | 0.971 |

The homoscedasticity test for the SUR model uses modified Wald. It is testing the single equation residuals in the SUR model. Table 8 is shown that the variance of each equation was homogeneous. The serial correlation in the single equation SUR model can be tested by Breusch-Pagan Godfrey. BP Godfrey is a strongly serial correlation test than the Durbin Watson test. Table 8 is shown that there was no serial correlation significant art 0.01.
Table 8. The result of homoscedasticity and serial correlation test

| Commercial Banks Equation | Modified Wald | BP-Godfrey |
|---------------------------|---------------|------------|
|                           | Value | Pr>|t| | Value | Pr>|t| |
| Owned State               | 9.617 | 0.293 | 0.199 | 0.655 |
| Foreign Exchange          | 15.199 | 0.055 | 4.964 | 0.026 |
| Non-Foreign Exchange      | 6.967 | 0.540 | 0.058 | 0.809 |
| Regional Development      | 8.731 | 0.366 | 2.236 | 0.135 |
| Joint Venture             | 14.905 | 0.061 | 2.609 | 0.106 |
| Foreign Owned             | 11.545 | 0.173 | 3.943 | 0.047 |

*a significant at α = 0.05

The characteristic of SUR is to handle the phenomenon of contemporaneous correlation was not became a violation. The efficiency of the SUR estimation compared to the OLS estimation in the single equation so that the residuals of the SUR model increase the correlation covariates. Table 9 and Table 10 are shown the OLS and SUR residuals correlation. It can be concluded that the correlation of residuals in the SUR model was higher than the regression model by using OLS estimation.

Table 9. Residual correlation in the regression model by using an ordinary least square

| Model          | Owned State | Foreign Exchange | Non-Foreign Exchange | Regional Development | Joint Venture | Foreign-Owned |
|----------------|-------------|------------------|----------------------|----------------------|--------------|---------------|
| Owned State    | 1.000       |                  |                      |                      |              |               |
| Foreign Exchange | 0.150      | 1.00             |                      |                      |              |               |
| Non-Foreign Exchange | -0.047  | 0.113            | 1.00                 |                      |              |               |
| Regional Development | 0.211   | -0.080           | 0.049                | 1.00                 |              |               |
| Joint Venture  | -0.284      | -0.394           | -0.153               | 0.289                | 1.00         |               |
| Foreign Owned  | 0.063       | -0.043           | 0.163                | -0.187               | -0.074       | 1.00          |

Table 10. Residual correlation in the seemingly unrelated regression method

| Model          | Owned State | Foreign Exchange | Non-Foreign Exchange | Regional Development | Joint Venture | Foreign-Owned |
|----------------|-------------|------------------|----------------------|----------------------|--------------|---------------|
| Owned State    | 1.000       |                  |                      |                      |              |               |
| Foreign Exchange | 0.228      | 1.00             |                      |                      |              |               |
| Non-Foreign Exchange | -0.024  | 0.116            | 1.00                 |                      |              |               |
| Regional Development | 0.238   | -0.075           | -0.068               | 1.00                 |              |               |
| Joint Venture  | -0.386      | -0.524           | -0.206               | 0.359                | 1.00         |               |
| Foreign Owned  | 0.102       | -0.115           | 0.183                | -0.326               | -0.140       | 1.00          |
6. Conclusion
This paper uses a seemingly unrelated regression method in the panel dataset. The selection of this analysis is to consider the violation of assumption in common regression called contemporaneous correlation. It can be sure that the credit distribution between commercial banks was correlated. The SUR analysis gives information that the explanatory variables has the significant positive effect on credit distribution in all type of commercial banks in 2016 until 2019 were third party funds and Loan to Deposit Ratio (LDR). By using SUR analysis, it is obtained a goodness-of-fit measure is 90.909%. The credit distribution in Joint Venture and Regional Development Banks in 2016 until 2019 was affected by all variables involved in this research. In this case, SUR is an efficient method and fit to be used in panel data, which has several individuals less than several period time.

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