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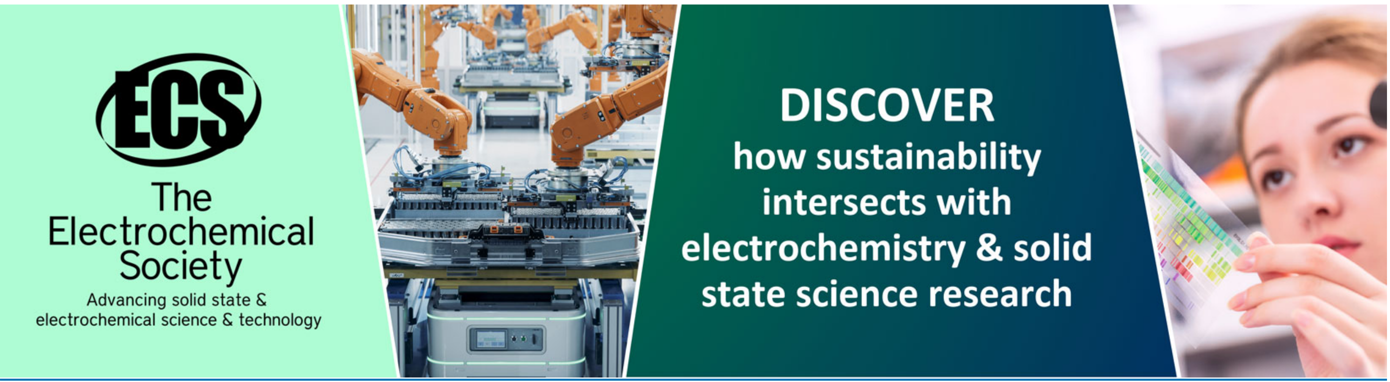

Quantitative Method For Analysis of Non-Performing Financing Return: A Case Study on Assets of PT. BSM

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Abstract. There are several ways to describe data mathematically. Likewise with the computing tool. As a computational aid, Mathematica® is designed to make it easier for users to carry out the calculation process symbolically or numerically. This article will discuss the use of Mathematica® to describe banking data through quantitative methods. A case study that discussed in this article is the results of the analysis of the influence of Non-Performing Financing (NPF) against the financial performance of PT. Bank Syariah Mandiri (BSM) through indicators of Return on Asset (ROA). Research conducted using a quantitative approach to the data of the financial statements of PT BSM. The sampling technique used was purposive sampling criteria the Public Sharia Banks publish annual financial statements in the period 2009-2018 with > 75 trillion rupiahs in assets. Based on quantitative method using Mathematica® programming, the research data has a normal distribution and no deviation from the rules of classical assumptions. In addition, the diversity of the data being used can explain the regression models constructed by the NPF variable towards the ROA variable, and the hypothesis testing results show that the variables of NPF have a significant, negative effect on ROA.

Keyword: NPF, ROA, BSM, Quantitative method.

1. Introduction

The Bank is one of the institutions with financial intermediation functions and a development agent. Companies can have a different risk than each product and tend to be more likely than conventional banks [1]. Such risks include payments caused by failures to meet payment obligations measured through the Non Performing Financing (NPF) indicator. The NPF indicator becomes important because the NPF ratio is equal to the bank's financing risk. In addition to NPF, another factor affecting corporate bank performance is size and CAR [2].

Assessment of corporate banking conditions can use some measuring tools or indicators, such as earnings or profitability aspects. In this respect, there is an important ratio called Return on Asset (ROA). Like the NPF, the ROA level compared to the profit level of a bank. As a result, on the asset side, the bank's position is getting better. That means ROA can be an asset-use efficiency indicator in gaining for a bank. Some research on factors that can influence the profitability of corporate banks has been conducted and has inconsistent results. Research on things that affect the profitability of corporate banks has been done with varying conclusions. For example, profitability influenced by the change in Financing to Deposit Ratio (FDR) and the accumulated Giro Mandatory Minimum (GWM) that does not affect ROA, while the change in Capital Adequacy Ratio (CAR) has a positive and significant impact. But for changes in Productive Active Quality (PDO), Operational Costs and Operational Procurement (BOPO) and Operational Efficiency Ratio (REO) have a negative and significant impact on ROA [3]. While research related to CAR, BOPO and size have a negative and significant impact on ROA as well as FDR and NPF relationships that have no impact on the ROA General Bank [4] [3].

One of the banks in Indonesia that applied the corporate principle is BSM. BSM's existence can be seen from its bank service offices spread throughout Indonesia. The BSM service office in Indonesia has 865 service offices and has 16,926 employees. In 2014, for example, BSM's relatively good asset growth is 5.1% of total assets of 66.96 trillion rupiah to 70.37 trillion rupiah in 2015 and has the total number of largest corporate bank assets in Indonesia in 2016 at 78.82 trillion rupiah. With its rapid development BSM indicates that BSM has good performance. It's known from a number of awards he won, both operational and financial. Based on earnings or profitability, the development of NPF and ROA BSM ratios can be seen in Table 1 [4].

Table 1. BSM Financial Ratio and Total Assets in 2009-2018
Source: Annual financial report of PT. BSM

Year	NPF (%)	ROA (%)
2009	1.34	2.23
2010	1.29	2.21
2011	0.94	1.95
2012	1.14	2.25
2013	2.29	1.53
2014	4.29	0.17
2015	4.05	0.56
2016	3.13	0.59
2017	2.71	0.59
2018	1.56	0.88

The NPF is a ratio measured by the corporate bank because there is unbalanced, unbalanced, slashed and doubtful funding [5][6]. The NPF function is to measure the amount of problem financing faced by banks [7]. The NPF ratio of total credit or repayment is calculated by comparing the total NPF to total credit. The NPF ratio can be measured by comparing problem funding to the total funding provided by the bank [8]. There is a link between credit risk and bank profitability. The relationship explains that the increase in credit risk increases the cost to the bank, thereby reducing its profitability [9]. Mathematically the NPF ratio is calculated using the formula [8]:

$$NPF=\frac{\text{Number of problematic financing}}{\text{Total Financing Distributed}}\times 100\% \qquad (1)$$

The NPF ratio is shown in the equation (1) provides information that if the total financing that is channeled is greater but the number of problematic financing is getting smaller then the bank's performance can be relatively very well categorized.
In table 1. The development of NPF in the period 2009-2018. In that period, the NPF ratio varies but is still at a number below 5%. The NPF is a concern to handle with caution as it can suppress the risk of financing.

In performance, banking is the result obtained by a bank that can be profit-oriented or non-profit oriented for a certain period [10]. In Sharia banking, financial performance is assessed and measured by Bank Indonesia Regulation number 9/1/PBI/2007 and SE No. 9/24/DPbS dated October 30, 2007. Explicitly in SE No. 9/24/DPbS It is stated that assessment of Sharia banking level includes capital, asset quality (Asset quality), and reliability (Earnings). One indicator that can be used in measuring the health of a bank through the earning factor is ROA. ROA has the function of measuring the company's effectiveness in terms of earnings by utilizing the assets owned [11]. It can be said that ROA is directly proportional to the bank's profit level, which results in asset usage rate. The information obtained from ROA is very important because it can determine the policy direction that needs to be done in order to maintain the current source of the bank capital. A bank is said to be healthy based on the earnings factor if it has ROA 1.5% (Bank Indonesia Provisions) which calculated the formula-based [7] [12];

$$\text{ROA}=\frac{\text{Profit before Tax}}{\text{Total Assets}}\times 100\% \tag{2}$$

Table 1. shows the development of ROA in the period 2009-2018. During this period, the ROA ratio owned by BSM showed a tendency to decrease. This tendency can be caused by internal and/or external conditions, for example, an increase in problem financing, an increase in business costs, and a declining national economic condition.
In this article the results of the research related to the profitability of PT. BSM based on bank performance in terms of ROA which is influenced by NPF based on annual report data for 2009-2018. The results of the research and discussion presented in this article consist of five parts. In the first part, Introduction, motivation and object of research are described. The second part presented a number of supporting theories related to the research conducted. In the third part, the Research Methodology, it is presented, among others, about the source of the data and the steps to handle it, as well as the research methods carried out. Whereas in the fourth section, Results and Discussion, the data analysis and discussion are presented quantitatively using the Mathematica® software.

2. Result and Discussion

2.1. State of The Art

Several previous studies related to the capital adequacy ratio (CAR), the problem financing ratio (NPF), and the size of the Bank's financial performance have been carried out. For example, research carried out on 72 samples of six Syrian General Banks in Indonesia concerning a CAR change that has a positive and significant impact on ROA is concluded that if there is an increase in CAR then the ROA also goes up [3]. Meanwhile, research carried out using sample 19 banks registered at the EIB has shown that size and CAR have a positive and significant impact on the profitability of go public banks [13]. While studies carried out by Wardana and Widiyarti in 2015 with a sample of five general corporate banks by BI group that NPF did not significantly influence and coefficient positive regression [14]. Other studies that have been carried out against ROA with data of 59 banks consisting of 4 private banks, 27 private national foreign exchange banks, and 28 private non-foreign national banks show that CAR and LDR have a positive and significant relationship with ROA. While NPL and DER show positive and insignificant results for ROA [15]. In the meantime, concerning sample 10 Shariah General Banks, it appears that changes in funding risk measured by NPF indicators show a negative and significant impact on profitability [8]. Based on the results of previous research, the research that we did was different in terms of data and data analysis computing tools. The research we're doing is using the data of the PT annual financial report. The 2009-2018 BSM period resulted in a strong increase in the results of previous research, particularly on NPF and ROA variables. While the analytical tool that we use is software Mathematica® version 9 with output programs equipped with confidence level. Software Mathematica® can specifically discuss descriptive statistics with functions that work with numbers and symbols [16][17].

2.2. Hypothesis Formulation

ROA and NPF ratios are two important ratios in Islamic banking that have a functional relationship to measure the financial performance of banks. Specially the ROA is a major factor in evaluating bank earning/profitability aspects. While the NPF indicator measures the level of financing risk faced by banks as a result of defaults made by customers. The framework in the research conducted is related to the functional relationship of ROA and NPF which can be seen as a linear function which means that NPF can influence ROA. The assumption is NPF has a negative influence on ROA. In the form of a diagram of this functional relationship shown in Figure 1.

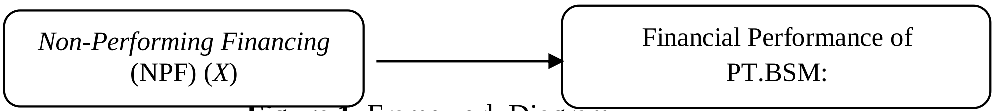

Figure 1. Framework Diagram

Based on the framework diagram, the hypothesis in the research is
Ho: NPF has a negative and significant impact on financial performance (ROA) on PT.BSM.
H1: NPF does not affect financial performance (ROA) on PT. BSM.

2.3. Type of Research

According to its type, research conducted is a quantitative study of numerical data of financial statements prepared based on a statistical analysis of hypotheses created using Mathematica® computing tools, while based on their nature, this research is associative research (the linkage between a free-to-non-free encyclopedia and analyzing the functional relationships that occur). More specifically, this study analyzes the functional relationship between the NPF (financial ratio) with ROA (financial performance) at PT. BSM based on financial report data period 2009-2018. The type of data used in the research conducted is quantitative data sourced from PT. BSM is in the form of annual financial statements for the period 2009-2018. The data collection is done through a documentation approach with documents used in the form of information published through the official website of PT. BSM.

2.3.1. Data space. Until early 2019, in Indonesia, there were only 13 (thirteen) Sharia Commercial Banks registered at BI and this became the population of the data used. From this population a sample (Sharia Bank) was used purposively based on judgment (judgment) of fulfilling the following criteria:

- Banks that are audited quarterly and publish financial reports online;
- The Bank publishes reports regularly from 2009-2018;
- Banks that have assets/assets of more than 75 trillion Rupiah. Based on these criteria, the study focused on PT. BSM to see the effect of NPF on profitability ratios based on ROA.

2.3.2. Notation and definition of variables. This study involved two variables, each an independent variable and an independent variable. Notifications and definitions of the intended variables are:

- Non-independent variables are denoted by the symbol Y associated with ROA.
- The free variable is denoted by the symbol X associated with the NPF.

2.3.3. Data analysis technique. The data analysis approach uses the concept of descriptive statistics (quantitative). For ease in analyzing available data, tools in the form of Mathematica® software version 9.0 are used. Analysis of the data referred to includes:

- Classical Assumption Test. The classic assumption test is performed by selecting a value of α = 5% against the data normality test.
- Linear Model Assumptions. The assumptions of the linear model analyzed in the research conducted are:

$$Y = a + bX + e \tag{3}$$

  with:

  Y : ROA a : constant X: NPF
  b : coefficient of regression e : error

- Coefficient of determination (*Adjusted-R^2*). To know the total diversity of NPF-ROA data that can be described by regression models is determined by *Adjusted-R^2*. If the value *Adjusted-R^2* = s %, then there is a (100 – s)% diversity of data that is still not explained by the regression model.
- Hypothesis Test. By selecting α = 5%, the existence of the parameters accompanying the free-transform (NPF) model assumed to be tested with hypothesis testing. The following hypothesized provisions:

  H_0 : $b = 0$ accepted when the *p-value* > α.

  H_1 : $b \neq 0$ accepted when the *p-value* < α

2.4. Mathematica® Programming for NPF-ROA Data Analysis

2.4.1. Data source condition. The representation of the data obtained from the annual financial report of PT. BSM period 2009-2018, NPF change has a minimum value of 0.94% (year 2011) and has a maximum value of 4.29% (year 2014). Meanwhile, the variable of ROA has a minimum value of 0.17% (2014) and has a maximum value of 2.25% (year 2012). More general information about the observed data is given in Table 2.

Table 2. The general condition of data based on descriptive statistics (normal distribution) *Source: Mathematica® output.*

Variable	N	Mean (μ)	Variance (σ)	Minimum	Maximum
NPF	10	2.274	1.227	0,94	4,29
ROA	10	1.296	0.822	0,17	2,25

Some information in Table 2 can be obtained from Mathematica® with the following scripts:

```
dataNPF={1.34,1.29,0.94,1.14,2.29,4.29,4.05,3.13,2.71,1.56};
dataROA={2.23,2.21,1.95,2.25,1.53,0.17,0.56,0.59,0.59,0.88};
{Min[dataNPF],Max[dataNPF]}
{Min[dataROA],Max[dataROA]}
{Mean[dataNPF],Mean[dataROA]}
{StandardDeviation[dataNPF],StandardDeviation[dataROA]}
```

From Table 2. For the average value and standard deviation, information is obtained that the NPF and ROA variables can be said that there is no relatively large gap between the two variables.

2.4.2. Classical Assumption Test (*Data Normality Test*). The results of the normality test for the observed data (Table 1.), for α = 5%, are given in Table 3.

Table 3. Normality Test Result for NPF and ROA
Source: Mathematica® output.

NPF			ROA		
Stat Test Type	Stat Value	*p*-Value	Stat Test Type	Stat Value	*p*-Value
Anderson-Darling	0.514538	0.18854	Anderson-Darling	0.701581	0.0632865
Cramér-von Mises	0.0785219	0.21792	Cramér-von Mises	0.113945	0.0720433
Jarque-Bera ALM	1.53542	0.33183	Jarque-Bera ALM	2.23904	0.195538
Mardia Combined	1.53542	0.331833	Mardia Combined	2.23904	0.195538
Mardia Kurtosis	-0.748812	0.45397	Mardia Kurtosis	-1.08066	0.279847
Mardia Skewness	0.487985	0.484827	Mardia Skewness	0.00139238	0.970234
Pearson χ^2	3.2	0.361805	Pearson χ^2	6.8	0.0785532
Shapiro-Wilk	0.888722	0.161694	Shapiro-Wilk	0.857278	0.0689436

To obtain information as in Table 3, the Mathematica® program listing can be written as follows:

```
HNPF = DistributionFitTest[dataNPF, Automatic, "HypothesisTestData"];
        HNPF["TestDataTable",All]
HROA = DistributionFitTest[dataROA,
        Automatic,"HypothesisTestData"];ROA["TestDataTable",All]
```

From the normal data test equipment shown in Table 3., Anderson-Darling for example, NPF and ROA data are normally distributed with the respective p-value values of 18.85% and 6.3% which are greater than the value = 5%. It is interesting to know that computing normality data using Mathematica® provides tests of data normality based on the tests it has without having to do it one by one the test equipment used. In the NPF data, there is 11 normality test equipment which states that the data is normally distributed and this is different from the ROA data. One data normality test tool that does not apply to ROA is a test tool commonly used by novice researchers namely the Kolmogorov-Sminov test tool. When conducted independently the Kolmogorov-Sminov test rejects the ROA data normally distributed but this is not the case for the Anderson-Darling and Cramér-von Mises methods, for example.

2.5. Mathematica® Programming for Linear Regression Model

From some results obtained in the previous section, the NPF-ROA data analysis process can be followed up to the process of building a linear regression model. The use of Mathematica® 9 software with the following program listing can help analysts do their work more efficiently and effectively.

```
dataNPFROA =
ReadList[Table[{dataNPF[[j]],dataROA[[j]]},{j,10}];
linmodfitNPFROA = LinearModelFit[dataNPFROA,x,x];
Normal[linmodfitNPFROA]
Show[{ListPlot[dataNPFROA],Plot[linmodfitNPFROA[x],{x,0,5}]}, Frame ->
True, Axes -> False,PlotRange -> {{0,5},{0,3}}]
```

The output from the above listing is a linear regression model that is equipped with a linear regression model curve as shown in Figure 2. To find out the data behavior and correlation that occurs between NPF and ROA can be used Pearson Correlation Matrix and Anova Table. The use of Mathematica® 9 with the following two program listings: each gives the output as shown in Table 4. and Table 5. From the Mathematica® listing output obtained above it can be explained that

- Pearson correlation measurement results between NPF and ROA variables show the close relationship between the two is 89.01% with a negative relationship value. This means that the NPF has a relatively large effect on ROA with a negative effect.
- NPF-ROA functional relationship in the form of linear functions can be expressed in the form:

$$Y = 2.6235 - 0.5838\, X \qquad (4)$$

- A constant value of 2.6235 means that if the NPF is zero then the average ROA is 2.6235.
- The NPF regression coefficient is -58.38%. This means that a change of 1% in the NPF can result in a decrease in the average value of ROA of 58.38%. The interpretation is that any decrease in profits derived from the financing channeled by Rp. 58,380,000 can be caused by problematic financing per Rp. 1,000,000.
- The total diversity of data (*Adjusted-*R^2) that can be explained by the linear model of equation (4) is 73%. The interpretation is the presumption that NPF factors can cause ROA to vary by 73%. Meanwhile, the assumption that apart from NPF variables (variables outside the model (4)) that can result in ROA varies is 27%.
- Because the p-value = 0.1% <5% for the NPF regression coefficient, the hypothesis Ho: is rejected. In other words, the effect of the NPF variable on ROA cannot be ignored.

Other information that needs to be known in linear regression is regarding the residual, the table of confidence intervals for the alleged single observation response, and the region of the level of confidence for the parameters involved. Listing the Mathematica® program below
The output from the above listing is a linear regression model that is equipped with a linear regression curve model as shown in Figure 2.

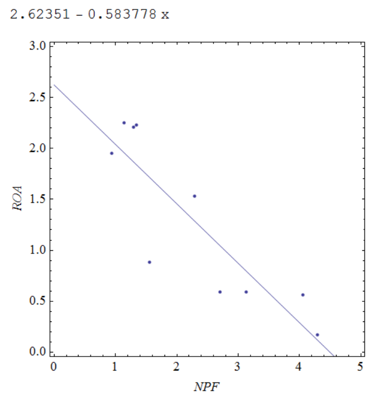

Figure 2.A linear regression equation and its curve for data in Table 1.
Source: Mathematica® output

To find out data behavior and correlation that occurs between NPF and ROA, Pearson Correlation matrix and Anova table can be used. Using the Mathematica® scripts below

Grid[{{" Pearson Correlation",(" ROA NPF ")},
{MatrixForm[{"ROA","NPF"}],
MatrixForm[linmodfitNPFROA["CorrelationMatrix"]]}}]

and

<<LinearRegression`
Regress[dataNPFROA,{1,x},x]

will be obtain information as shown in Table 4 and Table 5.

Table 4. Pearson's correlation values
Source: Mathematica® output.

	NPF	*ROA*
NPF	1	-0.890102
ROA	-0.890102	1

Table 5. Parameter's values
Source: Mathematica® output.

	Estimate	*SE*	*T-Stat*	*p-Value*
1	2.62351	0.29636	8.85245	0.0000209223
X	-0.583778	0.116003	-5.03245	0.00101108
	R^2 = 0.759944	*Adjusted*-R^2 = 0.729937	Est. Var. = 0.182438	

Another information that needs to be known in linear regression is related to the residual, the trust interval table for the alleged single observation response, and the trust level region for the parameters involved. The following *Mathematica®* listing program

```
modelregresi = Regress[dataNPFROA,{1,x},x, RegressionReport->
{FitResiduals,SinglePredictionCITable, ParameterConfidenceRegion}]
```

will provide the information needed about the residuals, the table of confidence intervals for the alleged single observation response, and the region of trust combined parameters (see Table 6 and Table 7 for the output of the scripts).

Table 6. ANOVA analysis results
Source: Mathematica® output

	DF	*Sum Of Sq*	*Mean Sq*	*F-Ratio*	*P-Value*
Model	1	4.62034	4.62034	25.3255	0.00101108
Error	8	1.4595	0.182438		
Total	9	6.07984			

Table 7. Residual Computing Results and Estimated Single Confidence Intervals
Source: Mathematica® output

Residual Computing			
{0.388751, 0.339562, -0.12476, 0.291995, 0.24334, 0.0508972, 0.30079, -0.206286, -0.451473, -0.832818}			
Estimated Single Confidence Intervals			
Observation Data	Estimated Data	Standard Error	Confidence Intervals
2.23	1.84125	0.460891	{0.778432, 2.90407}
2.21	1.87044	0.462289	{0.804398, 2.93648}
1.95	2.07476	0.473949	{0.981829, 3.16769}
2.25	1.95799	0.466799	{0.881354, 3.03466}
1.53	1.28666	0.447979	{0.253618, 2.31969}
0.17	0.11899	0.505344	{-1.046219, 1.284429}
0.56	0.25921	0.493078	{-0.877831, 1.39625}
0.59	0.79629	0.458848	{-0.261821, 1.85439}
0.59	1.04147	0.450821	{0.0018772, 2.08107}
0.88	1.71282	0.455568	{0.662277, 2.76336}
Elliptical Characteristics Region Level Trust Parameters			

Ellipsoid [{2.62351,-0.583778},{0.93867,0.14886},{{-0.941321,0.337513},{-0.337513,-0.941321}}]

With regard to the output shown in Table 6, it is geometrically easy to interpret the regression model that has been obtained previously. The following program listings will arrive at the intended geometrical illustration purpose.

- First, information about the residual list extracted from the previous output is obtained through the following listing
  errors = FitResiduals /. modelregresi;
- Secondly, it is also necessary to obtain extraction from the observed and predicted responses, the standard residue of the predicted responses, and their confidence intervals. For this need, the Mathematica® listing can be stated in the following form.
  {observed,predicted,se,ci} = Transpose[(SinglePredictionCITable /. modelregresi)[[1]]];
- Thirdly, it is necessary to know the predicted responses with the inclusion of the upper limit and the lower limit of the trust hose associated with the value X.
  (xval = dataNPFROA[[All,1]]; predicted = Transpose[{xval,predicted}];
  lowerCI = Transpose[{xval,First/@ci}]; upperCI = Transpose[{xval,Last/@ci}]);

By following the steps described above, we can display the distribution of data, the corresponding regression model curves, and the results of prediction responses with 95% confidence intervals to predict observations. The following is a list of Mathematica® programs accompanied by their output.

ListPlot[{dataNPFROA,predicted,lowerCI,upperCI}, Joined -> {False,True,True,True}, PlotStyle -> {Automatic,Automatic, {Dashed,Red},{Dashed,Blue}}, Frame-> True, Axes -> False, PlotRange -> Automatic]

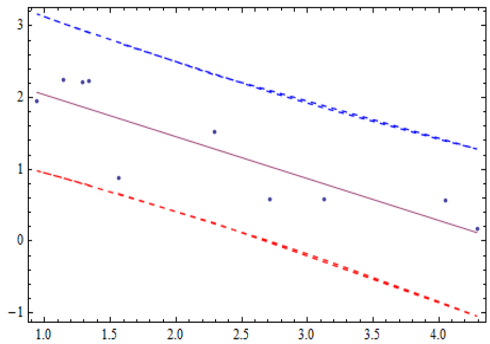

Figure 3. Predicted linear regression curves (middle), regression curves for the upper limit of the confidence interval (top) and the regression curve for the lower limit of the confidence interval (bottom).
Source: Mathematica® output

If it is desired to display an object that explains the region of the confidence interval for a regression parameter of 95%, it can be done with Mathematica® via the following listing.

Graphics[ParameterConfidenceRegion /. modelregresi, Axes -> True,AxesLabel -> {"constant","x"}, AspectRatio ->1, Frame-> False, PlotRange->{{1.5,4},{-1,-0.2}}]

The output of the Mathematica® program listing is an elliptical curve as shown in Figure 4. The areas covered by the ellipse (black) curve describe the region/area of 95% confidence level for the parameters of the regression model discussed. Object interpretation is that all forms of equations constructed by coordinates (*x*-constant) can represent a regression given previously with a confidence level of 95%.

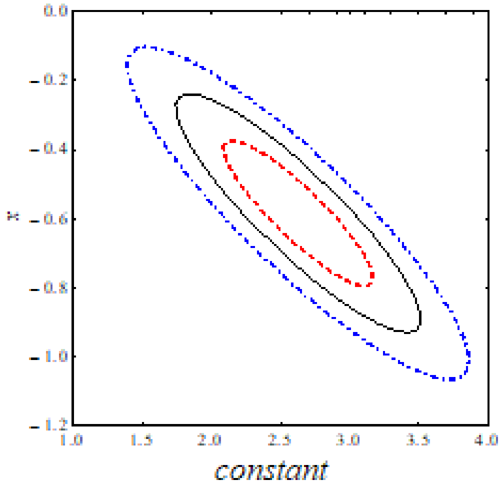

Figure 4. Elliptical curves describing areas for confidence level 75% (red), 95% (black), and 99% (blue) against linear regression model parameters.
Source: Mathematica® output

3. Conclusion

By using Mathematica® programming, it can be described in detail the NPF-ROA relationship in PT. BSM based on the 2009-2018 financial report data. In addition, the output in the form of descriptive statistical analysis provided by Mathematica® programming can also be easily converted into geometry (confidence interval ellipsoids). From the results of research and discussion, in terms of quantitatively based on data from PT. BSM 2009-2018 period in terms of the NPF-ROA variable can be concluded that the NPF has a significant and negative relationship to the financial performance of PT. BSM when viewed from the ROA indicator. In other words, if the NPF problematic financing level increases, it can reduce PT. BSM directly. From the results of this study can be followed up with regard to the level of the NPF ratio needs to be addressed with caution by the management of PT. BSM especially in terms of increased monitoring of the financing provided. Besides, to obtain research results that better explain the state of the performance of PT. BSM in terms of ROA, other variables need to be involved, for example, BOPO, FDR, and Size associated with optimizing the performance of PT. BSM. This is reasonable because there are still 27% of other variables that affect ROA that has not been discussed in this study.

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