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Analysis of Islamic Banking Growth in Indonesia Using Fuzzy Logic

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Abstract:- The paper presents the analysis of Islamic banking growth in Indonesia. The method used in this paper is fuzzy logic that implemented by using Matlab software verses 7.1. The research result shows that by following the partial variable of total asset gives negative effect to dependent variable (Islamic banking growth). The growth has average error of 0.00153104 (asset growth*).*

Keywords – *Islamic banking, assets, fuzzy logic*

I. INTRODUCTION

Indonesia has the biggest Moslem compared on the others religion. It indicates that Indonesia is suitable as pioneer and standard of Islamic banking development in the world. It can be reality because Indonesia has potential of global player in the biggest Islamic banking, such as: (i) It has the biggest Moslem that it can to be costumer of Islamic banking industry; (ii) It has a good prospect, it is reflected from the relative high economical growth (about 6.0% - 6.5%) that it cut by the solid economical fundamental; (iii) It increase the sovereign credit rating in Indonesia that it to be the investment grade and it will increase the number of investor to invest in domestic banking sector, including the Islamic economical industry; and (vi) It has a big natural resources that it can be become as transaction of Islamic banking. Indonesia is in the 9th biggest Islamic banking in the world that it has total asset of $35.63 millions or it is equivalent to Rp 420.43 trillion. Based on the report of Islamic banking in 2014, the total asset is only 2.1% of the total asset of Islamic financial in the world that it is recorded up to $1.66 trillion. The asset of Islamic banking in Indonesia is $19.7 millions, the first level is owned by Malaysia that it has Islamic financial asset of $423.28 million or it is 25.5% of the total asset of Islamic global. Nowadays, the Islamic financial system has been used as a business model in Indonesia. It is due to the system gives a stable Islamic financial and it can increase the development of national economic. The total asset of Islamic banking industry is Rp 273.494 trillion. The financial agency authority states that on June 2015, the Islamic banking industry has the total asset of Rp 273.494 trillion with index of 4.61% that it is consist of 12 general Islamic banking, 22 units of Islamic entrepreneurship. The total asset gross, defrayal and the third fund in Jakarta are Rp 201.379 trillion, Rp 85.410 trillion and Rp 110.509 trillion, respectively.The Islamic banking and financial industry are very important to do public education socialization, thus the products and the difference and competitive Islamic services can be introduced and used to the assessment of huge community. It is hoped that it can be give real and optimal contribution in the national economical growth. For this reason, this paper is presented to analyzed the Islamic banking growth in Indonesia using fuzzy logic.

II. METHODOLOGY

2.1 Research Scope

This research is focused on the depended variable, they are total asset, the third fund, budget, current year benefit. This research is qualitative analysis, it is due to the research objective is to study the analysis of effect of two variable, exactly the independent variable (total asset) and dependent variable (Islamic banking growth) using fuzzy logic. This research uses the operational data of time series. The data is recorded from Bank Indonesia started in 2004 to December 2015.

2.1 Data Collection

The method of data collection can be stated as below:

1. Field research
   The data is secondary data, it is data collected by a data collection agency and it is published to the community who uses the data. The data is referred from Bank Indonesia (BI).

2. Library research

The data used in this research is data based on the book, article, journal that related to the aspect of research as a requirement to fulfill a valid data.

3. Internet research

Reference or literature borrowed from library is some time not up to date. It is due to the knowledge is always growth. Thus, an internet access is very important to obtain the latest data information related to this research. The obtained data should be suitable to the research objective.

2.3 Data Analysis Method

This research uses the method of quantitative data, it is data used in this research numeric term. The fuzzy logic is applied to test the hypothesis and prove the effect of independent variables on the dependent variable. The testing result should has minimum deviation or error and it is more than the independent variable. Some calculations are related using Matlab program verse 7.1. A estimation method using fuzzy logic is applied to estimate the regression population of function of simple regression. Fig. 1 shows the flow chart of research methodology.

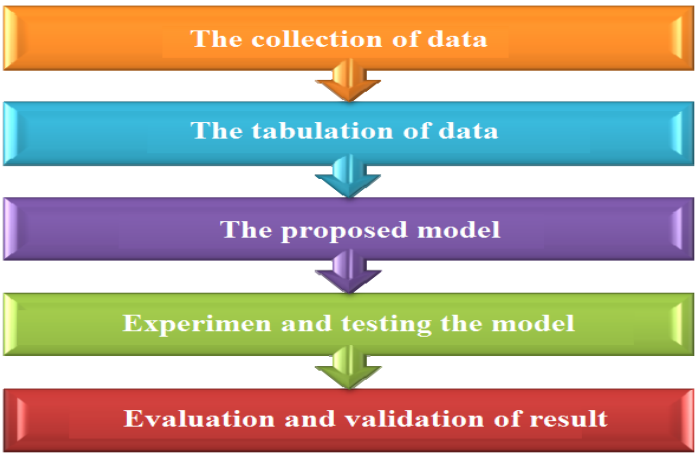

Figure 1: Research methodology

The growth of Islamic banking can be observed from networking of Islamic banking offices. Based on the data of Bank Indonesia on October 2003 that Indonesia has only 225 units of Islamic banking office, but in 2008 (based on the data of Bank Indonesia on October 2008) showed that the number has been increased to be 1440 units of Islamic banking office. The growth of Islamic banking office shows a significant increasing from year to year. The Islamic banking office has reached the community in 33 provinces in Indonesia, exactly they are in district area or city. But the number of Islamic banking office is still lower compared to the conventional banking office. Based on the bank information research agency that the number of networking banking office on December 2003 was 12917 units.

III. RESULT AND DISCUSSION

The analysis of total asset growth is based on the time series on Islamic banking in Indonesia using fuzzy logic. Fig. 2 shows the total asset of actual Islamic banking throughout the year of 2004 to 2015. It shows that the total asset is always increased. The total asset increase started in 2004 to 2013 and increase back in 2014 and it has significant increasing in 2015.

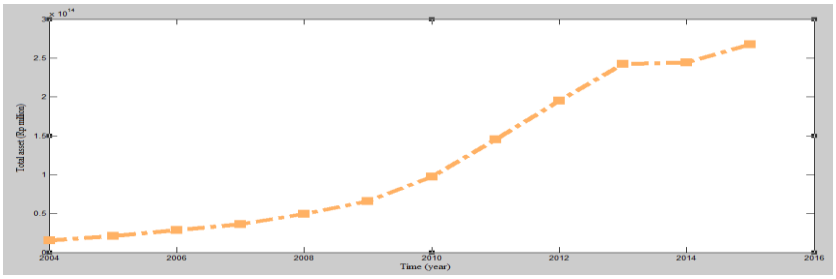

Figure 2: Total asset of actual Islamic banking throughout the year of 2004 to 2015

The input system is the data of time series total asset, whereas the output system is the asset growth that creates a matrix with dimension of 12 rows and 3 columns. The data is clustered following Table 1 and it is sued as training data and checking data. It is very important to be applied in fuzzy logic and has well function when it is in validation time and creates network architecture system. It arranges the number of rules to obtain the optimum value or root means square error (RMSE). It can be achieved by testing the type of required and the best membership function, thus its performance is fulfilled.

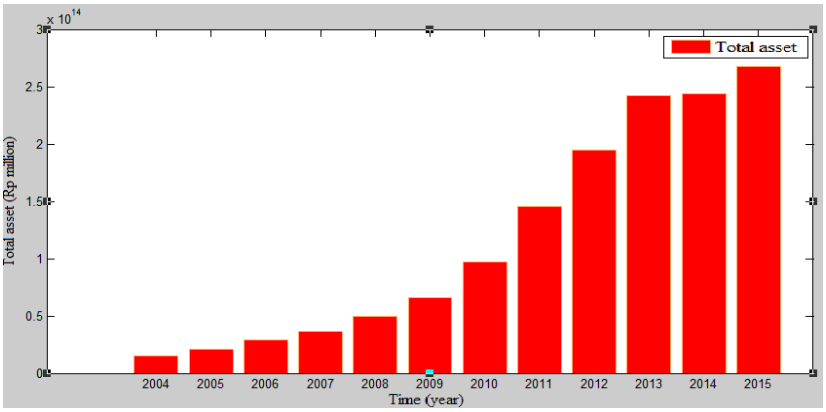

Figure 3: Actual total asset of Islamic banking throughout the year of 2004 to 2015 in bar graph

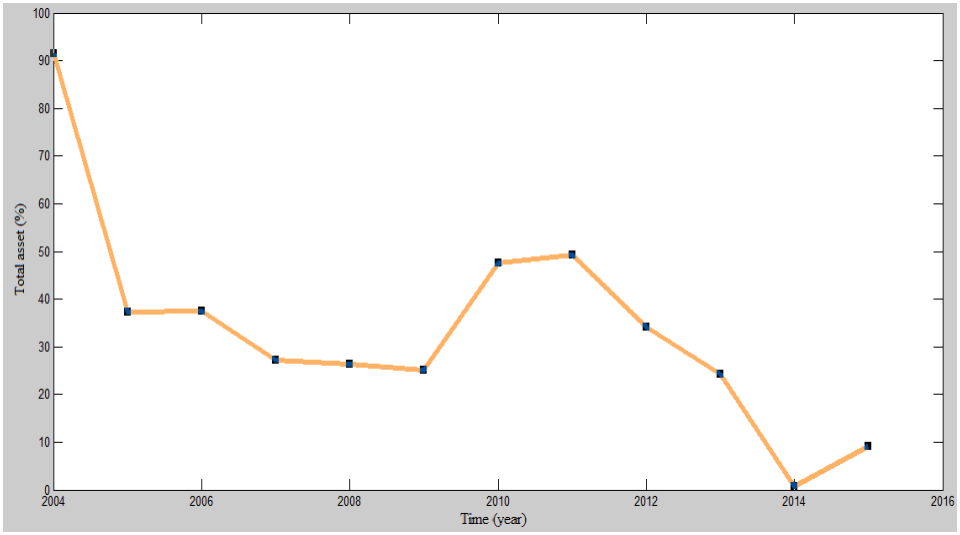

Figure 4: Growth of total asset of actual Islamic banking throughout the year of 2004 to 2015 in line graph

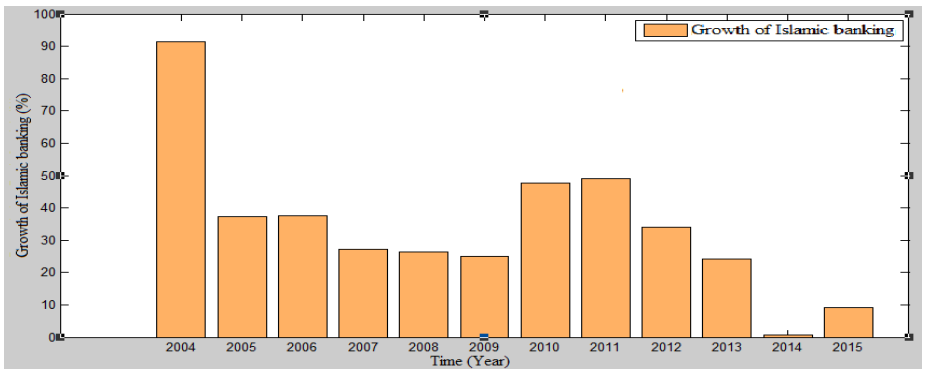

Figure 5: Growth of total asset of Islamic banking throughout the year of 2004 to 2015 in bar graph

Fig. 3 and Fig. 5 show that the total asset of Islamic banking has significant increasing throughout the year of 2004 to 2015. It is recorded in growth of Islamic financial on May 2014. The total asset of Islamic banking has reached in Rp 250.55 trillion and insurance asset has reached Rp 19.26 trillion, the asset of Islamic defrayal has reached in Rp 23.49 trillion in Jun 2014. In 2014 to 2015, the asset increasing is rather slow and in June 2015 , the Islamic banking increase back and has total asset of Rp 273.494 trillion with index of 4.61%. It consists of 12 general banks, 22 units of Islamic business owned by general conventional bank. Based on Fig. 4 that the growth of Islamic banking in 2004 increased significantly in 91.44% of total banking, but in 2014 to 2015 it decrease around 0.79%. Thus the rank of asset growth in 2004 to 2015 is 0.79% (it is lower than asset growth) and also lower than 91.44%. In 2009 to 2013 shows a average asset growth of Islamic banking of 43%. It indicates that the human resources and technology are still important to be improved.

Table 1: Result of testing of the total growth asset based on fuzzy logic and error value

Year	Asset growth (%)	Result of fuzzy logic (%)	Error (%)
2004	91.44	46.12	45.32
2005	37.28	46.12	-8.84
2006	37.55	46.12	-8.57
2007	27.21	46.12	-18.91
2008	26.27	46.12	-19.85
2009	25.02	46.12	-21.10
2010	47.55	46.12	1.43
2011	49.17	46.12	3.05
2012	34.06	46.12	-12.06
2013	24.23	46.12	-21.89
2014	0.79	46.12	-45.33
2015	9.06	46.12	-37.06

The value of asset growth reach maximum growth of 91.44% in 2004 as shown in Fig. 6 and in 2005 to 2009 the asset growth decrease around 32.31%, however in 2010 to 2011 it reach 47.81%, in 2012 it reach 25.82% and decrease back around 1.08% in 2014. It occur through the year of 2015 around -4.05%. The testing is done using fuzzy logic training with combination of some training parameters, they are five numbers of membership function, type of trapezium membership function, number 05 50 epochs, 0 error goal. It shows that the average asset growth is 46.12%.There is no change in step size 1 to 9 as shown in Fig. 7, it indicates that the system stable, but in epoch 10 shows that the step size decrease to 0.036. Then epoch 18 shows that the step size decrease to 0.0324 until epoch 42 goes to optimum value.

Figure 6: Result of fuzzy logic verses output data of asset growth and error value

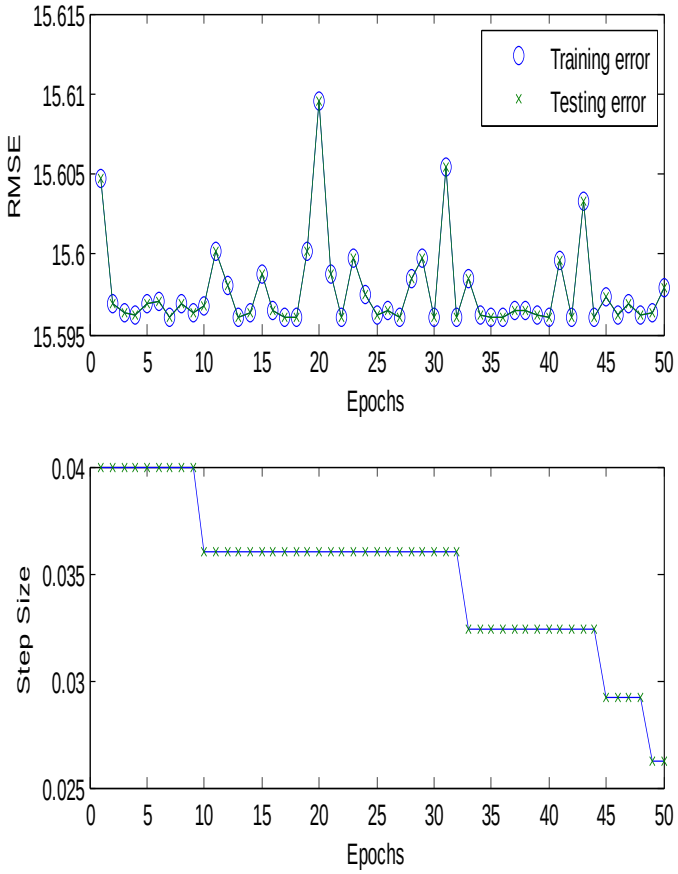

Figure 7: Step size of trapezium fuzzy logic

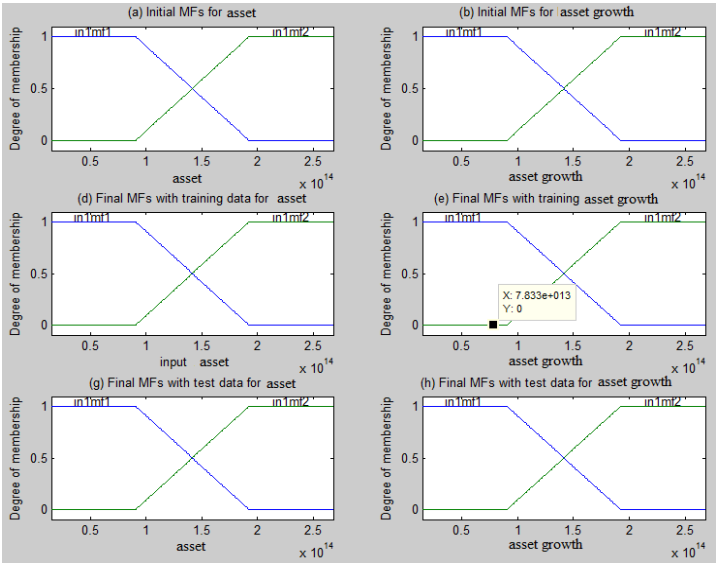

Figure 8: Function value of trapezium membership function

Fig. 8 represents the value of asset growth in membership function. It means that the asset variable use trapezium curve for the decreasing and increasing compilation.

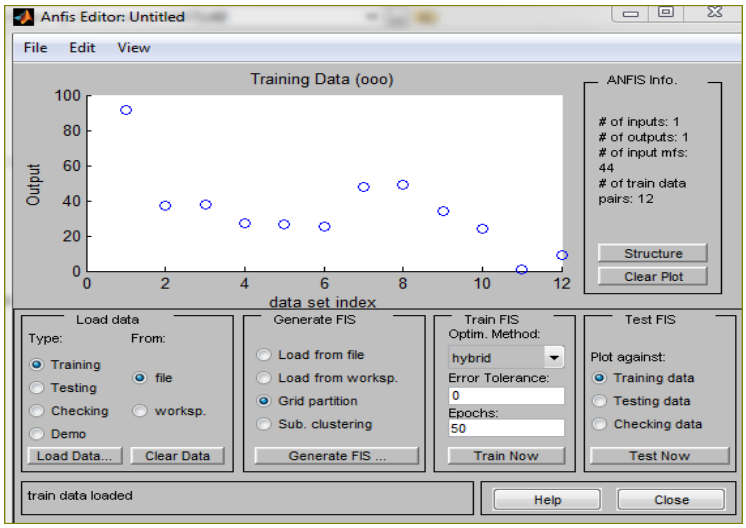

Figure 9: Data of asset growth before training

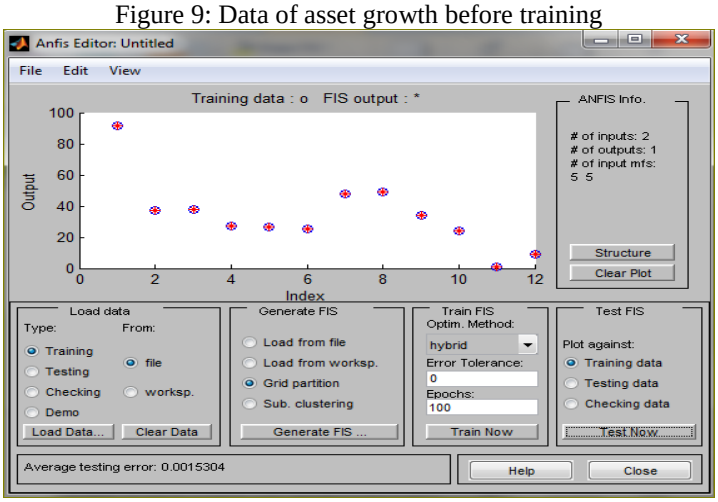

Figure 10: Data of asset growth after training for 2 inputs, 1 output and trapezium type

The system testing of fuzzy logic model is done to obtain a fuzzy inference system with the best performance. It is indicated by obtaining the value of RMSE in training process. The testing is done by training the combination of some training parameters; they are the number of membership function, type of membership function, number of epochs and error goal. The value of error tolerance is indicated as process success. The training will be stop if the training data error is in area of error tolerance.The required error is 0. The training process is decided until 50 epoch (iteration). Fig. 10 shows the training result and testing that related to the asset and asset growth. They affect one each other, it indicates that fuzzy logic can give the best performance and his value is very significant. From the performance of fuzzy logic, the two input network, three layers (one input with two inputs of membership function, eight rules and one output of membership function), then the value of outputs are normalized with error percentage of 0.00153104. The lines connected to the nodes show a suitable rule. The fuzzy architecture is shown in Fig. 11.

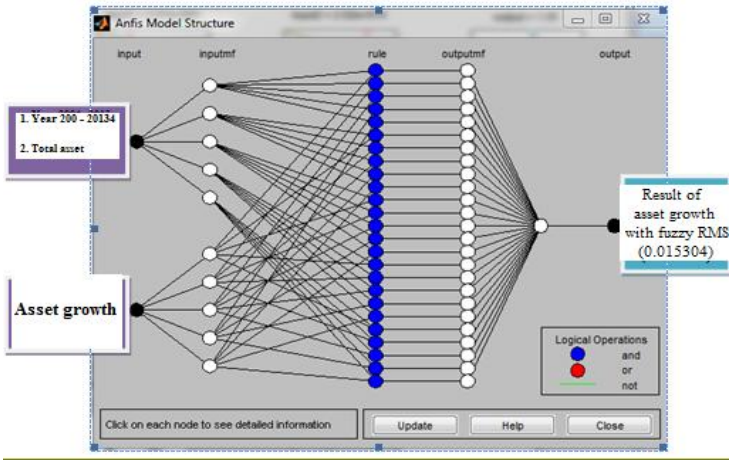

Figure 11: Fuzzy logic architecture for 2 inputs and 1 output with type of trapmf

After training the data input of total asset and asset growth based on the time series, thus the fuzzy arrangement will be created as shown in Fig. 12.

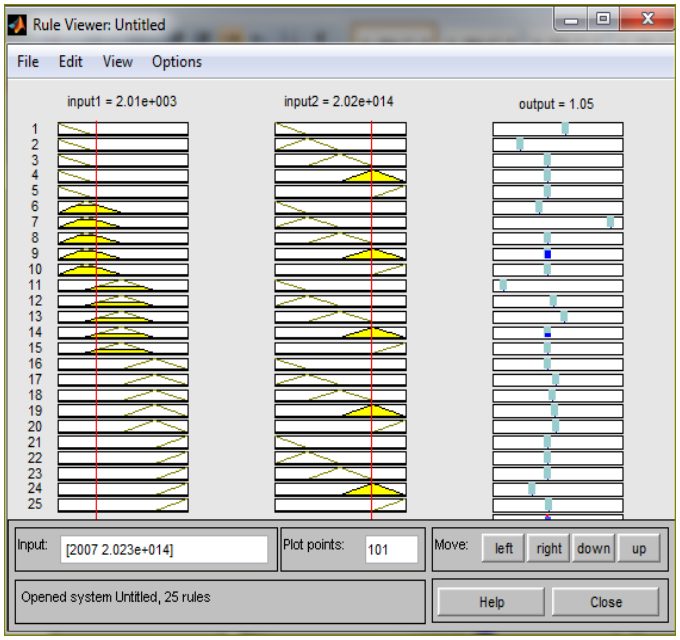

Figure 12: Fuzzy system with 25 rules

Fig. 12 shows the fuzzy arrangement, both of total input and asset growth that affect to the output.

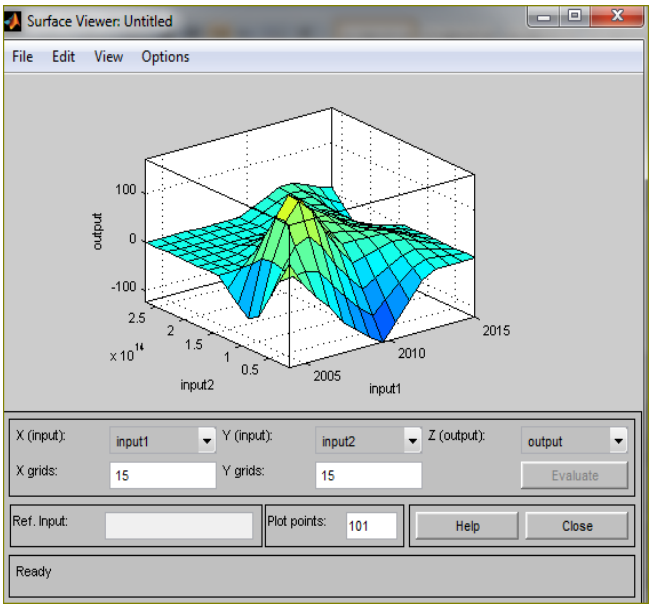

Figure 13: The total asset surface and growth for 2 inputs and 1 output with type of trapm

IV. CONCLUSION

Based on the research data analysis entitle " Analysis of Islamic Banking in Indonesia Using Fuzzy Logic" throughout the year of 2005 to 2015 can be concluded as stated below:

1. The variable of total asset gives negative effect and significant effect to independent variable. The Islamic banking in Indonesia has average error of 0.00153104 (asset growth) by finding the membership function with type of trapmf.
2. The type of membership function (trimf, bellmf, gaussmf, trapmf, pimf), number of epoch (iteration) and number of rule has significant effect for reaching the optimum value, thus this research needs try and error analysis.

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