

LOGISTIC REGRESSION OF LOAN FULFILLMENT MODEL ON ONLINE PEER-TO-PEER LENDING

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Abstract

Loan fulfillment model is used to refine loan assessment of borrower which done by lenders based on historical lending of lenders. This model is a prediction about what loans will be funded by lenders. This paper used logistic regression to develop loan fulfillment model for online peer-to-peer lending. Seven dimensions or variables have been considered: loan duration; loan interest; current ratio; debt to equity ratio; debt service coverage ratio; net profit margin; and sales growth. This study used the secondary data from loan listing that have been assessed and available from one of online peer-to-peer lending website in Indonesia. A sample size of 300 data point was selected between July and September 2018. The results showed that all variables have positively relationship with loan fulfillment, except debt to equity ratio and net profit margin has negatively relationship. Accuracy of the model for training is 85% and testing is 83%. Loan fulfillment significantly has affected by loan duration and sales growth positively, and also debt to equity ratio negatively. This study provided some insights to attract lender to lend their fund into borrower's loans.

Keywords: Logistic Regression, Loan Fulfillment, Online Peer-to-peer Lending, Online Investment, Loan Predictive Model

INTRODUCTION

Online peer-to-peer lending transform the old idea of personal credits into internet and eliminate mediation of financial institutions from common credit application process (Herzenstein et al., 2008; Galloway, 2009). The decision process of loan origination is given into private lenders and borrowers. Intermediary only offer them a platform to engage with each other. Borrowers enable to describe the purpose of loan requests and provide financial information to ensure lender to lend their fund into borrower's loan. Lenders will get benefit from borrowers which is interest rate based on results of an assessment conducted by intermediary. it can be seen as an investment model where the investment risk is coupled to the credit rating of the funded loans (Galloway, 2009). On online P2P lending platforms, lenders and borrowers are not able to communicate face-to-face and funds trading is conducted online. There is a high level of information asymmetry between borrowers and lenders (Lin et al., 2009).

The problem of lenders is they do not know which loan criteria are often funded by each lender. The decision of lenders is only taken based on their own analysis and knowledge. Lenders can not check other portfolios in order to see another perspective analysis from other lenders. They do not know what financial information must be examined and analyzed to assess whether this loan is feasible or not. There is a lack of confidence in the decisions they make themselves and no comparison between their decision and other decision to ensure the decision is right according to most predictions in general. Based on the problem, intermediary need a predictive model to inform lenders whether the loan is finally funded or not.

Although online P2P lending is a relatively young field of research an increasing amount of scientific contributions has been published in recent years (Iyer et al., 2009; Pope & Sydnor, 2008; Ravina, 2007). This topic has attracted researchers from the fields of economics, information technology and social sciences to investigate the relationships between lenders and borrowers in online P2P lending platforms. Investigation of this study is analyze loan fulfillment which have been done by lenders to borrowers. In our approach, it is used seven variables to creating predictive model for loan fulfillment model. These variables are taken from the borrower's financial information provided on the platform. This study is consists of three stages. First, review related literature and theories and provide concepts and hypotheses. Second, describe design and results, include data collection and validation. Third, discuss and analyze the results and present conclusion from the results.

TRUST IN OTHER LENDER

Online peer-to-peer lending is high risk, because it is vital to identify credible borrowers. Trust must be established in order to running the this business model successfully. trust is defined as

the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of their ability to monitor or control the other party (Mayer et al., 1995). Trust is conceptualized as general trust beliefs lead to behavioral intention (Mayer et al., 1995; McKnight et al., 1998; Gefen, 2000). In online peer-to-peer lending context, general trust beliefs is described as trust in intermediary, borrower and other lender. Trust in other lender is used in this study to analyze what variables are used to predict the lending behavior of lenders.

Trust in other lender is conceptualized as a belief that other lender behavior will support the lender's decisions by comparing the behavior of lenders in general (McKnight & Chervany, 2002). This trust is additional assessment to help lenders determine which loan priorities will be funded by lenders. The other lenders' behavior is compared based on what parameters are used to assess loans. By looking at the lender's behavior, it can predict whether the loan was successfully funded or not (Lin et al., 2013). So this can prevent lenders from failing to fund loans, because of the reduced nominal loan funded. the small amount of funds or uncompleted loans obtained through lenders illustrates the loan criteria and the characteristics of borrowers that can attract lenders' attention (Julsrud & Bakke, 2008; Lewis & Weigert 1985).

The intermediary usually provide borrower information into 4 sections. There are loan detail, individual, business detail, and financial information. These information is summarized in a loan submission report, making it easier for lenders to analyze the loans. Loan detail is assessment information carried out by intermediaries, including the duration of loan, interest, type of loan, and others. Individual information is consists of background information and characteristics of the borrower. Business detail information is described a background and history of the business conducted by the borrower. Financial information is described as financial performance and condition of borrower business. In this study will use loan detail and financial information as data to make predictive model.

LOAN INFORMATION

There are seven dimensions or variables are used in this study based on loan detail and financial information that provided by intermediary. Interest rate and loan duration are founded on loan detail information. Current ratio, debt to equity ratio, debt service coverage ratio, non profit margin, and sales growth are founded on financial information. Interest rate is the proportion of a loan that is charged as interest to the borrower, typically expressed as an annual percentage of the loan outstanding (Abbas & Honghui, 2016). Loan is a monetary loan that is repaid in regular payments over a set period of time. The set term of payment is referred to as loan duration. Current ratio shows the relationship between the size of the current assets and

current liabilities. This ratio is considered to be more indicative of short term debt paying ability than the working capital. It measures the overall liquidity position (Gibson, 2013).

The debt to equity ratio measures the riskiness of the firm's capital structure in terms of the relationship between the funds supplied by creditors and investors (Fraser & Ormiston, 2004). Debt service coverage is the firm's ability of covering current obligations of fixed charge such as interest, dividend and other fixed charges payable currently. The components of debt service coverage are liquidity, profitability, leverage, efficiency and firm size discounted by fixed charges (Brealey et al., 2000). Net profit margin is equal to net income or profits divided by total revenue and represents how much profit each dollar of sales generates. This is the ratio of net profits or net income to revenues for a company. Sales growth is the increase in a company's sales over a particular period of time, usually given as a percentage.

HYPOTHESES

For studying the predictive model of loan fulfillment in online peer-to-peer lending, we select the following hypothesis:

H1: loan duration is a significant predictor of loan fulfillment and how this variable relates to loan fulfillment.

H2: interest rate is a significant predictor of loan fulfillment and how this variable relates to loan fulfillment.

H3: current ratio is a significant predictor of loan fulfillment and how this variable relates to loan fulfillment

H4: debt to equity ratio is a significant predictor of loan fulfillment and how this variable relates to loan fulfillment.

H5: debt service coverage ratio is a significant predictor of loan fulfillment and how this variable relates to loan fulfillment.

H6: net profit margin is a significant predictor of loan fulfillment and how this variable relates to loan fulfillment.

H7: sales growth is a significant predictor of loan fulfillment and how this variable relates to loan fulfillment

RESEARCH METHOD

This research is using secondary data which is loan information is provided on platform website. We select one of online peer-to-peer platform in Indonesia to get dataset by crawling loan listing that posted on the website. This model only use seven variables as predictors and one variable as target predictor.

This model is illustrated through this below equation:

$$\log \left[\frac{P(Y = 1|X_1, X_2, \dots, X_7)}{1 - P(Y = 1|X_1, X_2, \dots, X_7)} \right] = \alpha + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_7 X_7$$

Where;

Y: loan funded status; X1: loan duration; X2: interest rate; X3: current ratio; X4: debt to equity ratio; X5: debt service coverage ratio; X6: net profit margin; X7: sales growth

Data were collected from website are loans and submitted on July to September 2018. This model use logistic regression that runs on statistics application (Rattle). We categorize predictor variables as following categories:

Table 1: Category of predictor variables

Variable	Category	Description	Variable	Category	Description
Loan Duration	6	6 month	Debt Service Coverage Ratio	Very Low	0% - 40%
	12	12 month		Low	40% - 80%
	15	15 month		Medium	80% - 120%
	18	18 month		High	120% - 160%
Interest Rate	24	24 month	Net Profit Margin	Very High	160% - 200%
	Very Low	14% - 16%		Very Low	0% - 20%
	Low	16% - 19%		Low	20% - 40%
	Medium	19% - 22%		Medium	40% - 60%
	High	22% - 25%		High	60% - 80%
Current Ratio	Very High	25% - 27%	Sales Growth	Very High	80% - 100%
	Very Low	0% - 60%		Very Low	0% - 10%
	Low	60% - 120%		Low	10% - 20%
	Medium	120% - 180%		Medium	20% - 30%
	High	180% - 240%		High	30% - 40%
Debt to Equity Ratio	Very High	240% - 300%		Very High	40% - 50%
	Very Low	0% - 50%			
	Low	50% - 100%			
	Medium	100% - 150%			
	High	150% - 200%			
	Very High	200% - 250%			

Total sample data of loan information that taken on July to September 2018 is 300 data. Before data is used in predictive model, the data is transformed from numerical data into categorical data according to the categories that have been set.

Table 2: Percentage of Loan Funded

Variable	Category	% Loan Funded	Variable	Category	% Loan Funded
Loan Duration	6	83.33%	Debt Service Coverage Ratio	Very Low	0.00%
	12	71.96%		Low	16.67%
	15	0.00%		Medium	43.37%
	18	33.33%		High	81.75%
	24	19.23%		Very High	96.88%
Interest Rate	Very Low	100.00%	Net Profit Margin	Very Low	0.00%
	Low	87.50%		Low	19.51%
	Medium	65.83%		Medium	68.42%
	High	13.51%		High	86.84%
	Very High	0.00%		Very High	100.00%
Current Ratio	Very Low	0.00%	Sales Growth	Very Low	0.00%
	Low	16.67%		Low	10.34%
	Medium	68.53%		Medium	61.84%
	High	87.88%		High	84.21%
	Very High	100.00%		Very High	95.45%
Debt to Equity Ratio	Very Low	0.00%			
	Low	15.38%			
	Medium	65.63%			
	High	86.67%			
	Very High	100.00%			

According to descriptive analysis on loan duration, the 6 month category has the largest percentage of 83.33%. the very low category (14% - 16%) on interest rates has the largest percentage of 100%. The very high category (240% - 300%) on current ratio has the largest percentage of 100%. The very high category (200% - 250%) on debt to equity ratio has the largest percentage of 100%. The very high category (160% - 200%) on debt service coverage ratio has the largest percentage of 96.88%. the very high category (80% - 100%) on net profit margin has the largest percentage of 100%. The very high category (40% - 50%) on sales growth has the largest percentage of 95.45%.

RESULTS

The dataset is divided into 2 parts, there are data for training and testing. Portion of data for training is 80% and testing is 20%. The number of samples is 299 divided into 240 for training and 59 for testing. Sample size used to run logistic analysis is satisfactory. Recommended sample size for logistic regression analysis not to be less than 100 otherwise the result will be misleading (Pampel, 2000; Long, 1997). A minimum of 50 cases per independent variable is recommended (Wright, 1995). In all cases sample size used fulfil the requirement.

Table 2: Percentage of Loan Funded

Variable	Estimate	Std. Error	Z Value	Pr(> z)
Intercept	-28.977	24.661	-1.175	0.2400
Duration	0.136	0.061	2.219	0.0265*
Interest	0.849	0.781	1.086	0.2774
Current ratio	0.059	0.071	0.829	0.4069
Debt to equity ratio	-0.292	0.165	-1.769	0.0769
Debt service coverage ratio	0.104	0.089	1.167	0.2431
Net profit margin	-0.338	0.334	-1.011	0.3120
Sales growth	1.503	0.664	2.262	0.0237*

Significance. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

The results show that there are several variables that significantly affect loan funding. The predictors are loan duration, debt to equity ratio, and sales growth. These variables has a significant value less than 0.1 compared to other variables. Only debt to equity ratio has negative relationship to loan fulfillment with coefficient is -0.292, while debt to equity ratio and sales growth has positive relationship with coefficient are 0.136 and 1.503. This can mean that the largest coefficient is obtained from sales growth.

Lending behavior of lenders described through this model, explained that most lenders choose loans that want to be funded based on these 3 variables. The biggest influence is on sales growth. The biggest influence is on sales growth, it means that lenders do an assessment of the sales ratio for each period. Sales growth signifies that the business being run is growing rapidly. The effect of the loan duration illustrates that the shorter the duration of the loan, the less the risk of the borrower not paying the installments. Debt to equity ratio is assessed by lenders as the ratio of the ratio between capital and debt. in this case lenders tend to choose fewer ratios, because the amount of debt borrowers other than on this platform is fewer then compared to their capital.

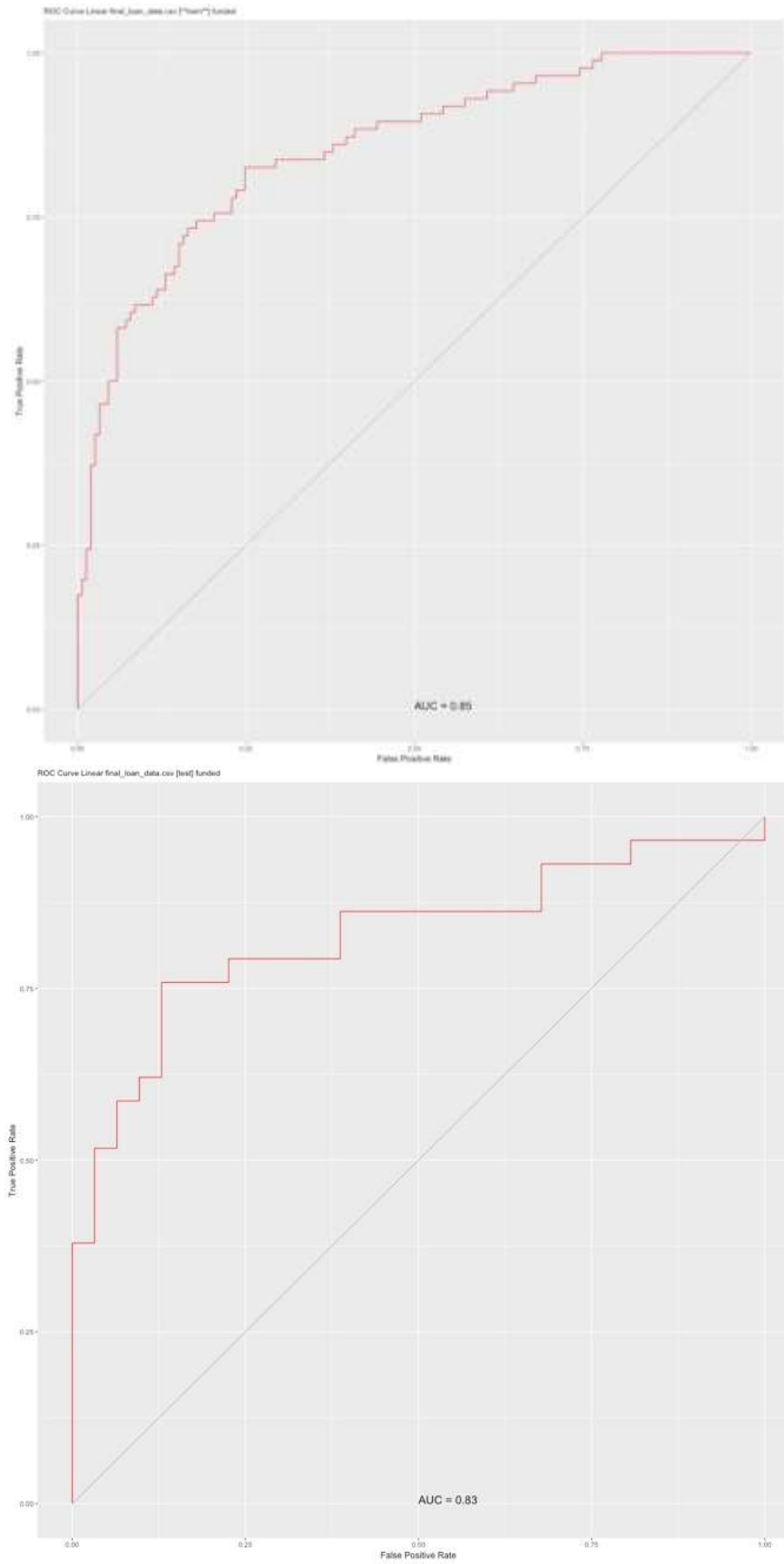


Figure 1: ROC Curve for Training and Testing

The performance of this model is shown in the picture above with ROC Curve. The accuracy of this model is divided 2 part in order to check consistency of model performance. For training accuracy is 85% and testing accuracy is 83%. this means that the performance model is consistent for the seven variables chosen and only decreases by 2%.

SUMMARY AND CONCLUDING REMARKS

This study proposed a model of loan fulfillment in online peer-to-peer lending. Loan fulfillment was reviewed by seven factors, namely loan duration, interest rate, current ratio, debt to equity ratio, debt service coverage ratio, net profit margin, and sales growth. This model was tested with 299 sample data of loan information which gathered on the website platform. The main findings summarized in the analysis of research results are as follows.

Firstly, loan duration has negative relationship to loan fulfillment. This means that the loan duration is significantly considered by other lenders, which tends to choose loans that has a shorter duration compared to other loans. Because the shorter the loan duration, the less the borrower's risk is not to repay the loan.

Secondly, debt to equity ratio has negative relationship to loan fulfillment. This means that debt to equity ratio is significantly considered by other lenders, which tends to choose loans that has a fewer debt to equity ratio compared to other loans. Because the fewer the debt to equity ratio, the less borrower's debt to other third party compared with their capital.

Thirdly, sales growth has positive relationship to loan fulfillment. This means that sales growth is significantly considered by other lenders, which tends to choose loans that has a greater sales growth compared to other loans. Because the greater sales growth, then the business run by the borrower may develop in each period, so that it can pay the installments on time.

LIMITATIONS AND FUTURE RESEARCH

This study covers only seven variables that can be predictors to loan fulfillment model, namely loan duration, interest rate, current ratio, debt to equity ratio, debt service coverage ratio, net profit margin, and sales growth. There are many variables that can be predictors besides the seven variables. Other variables include borrowers character, personality data, and business reputation. The addition of the variables is not done due to limited time and cost.

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