Predicting Re-loan Success based on Friendship Network Characteristics in the Online Micro-loan Marketplace

Abstract

Online micro-loan marketplaces cannot accurately and effectively approve loan applications due to the uncertain opportunistic behavior of loan applicants and the possibility of loan defaults by loan applicants. To address this challenge, in this study we integrate signaling theory, the social structure of competition, and the concept of homophily to develop a research model to predict a loan applicant’s re-loaning success by examining his/her financial status, friendship network characteristics, and friendship network centrality. Data of 683 anonymous and distinct loan applicants at a major online micro-loan marketplace in China largely support our hypotheses, highlighting the three key signals of a successful re-loan approval, a loan applicant’s credit card default, the number and the percentage of his/her friends with re-loan approvals in the focal micro-loan marketplace. Research and practical implications are discussed.

Keywords

Micro-loan marketplace, signaling theory, social structure of competition, homophily, friendship network.

Introduction

As a salient application of information technology (IT) and Web 2.0, online micro-loan marketplaces have been growing rapidly and gaining popularity for the last few years. Some marketplaces follow the leader, such as Kiva.com in the USA, aims to provide small loans for people in poverty, while other commercial websites target both needy entrepreneurs and individuals who search for small financial solutions to their liquidity problems. Such examples of micro-loan marketplaces include the most protruding lending platform in the USA, Prosper.com that has issued over US$10 billion in funded loans for profit1. Simultaneously, the turnover of Chinese online peer-to-peer (P2P) marketplaces reached over US$290 billion in the first half of 20172. These online micro-loan marketplaces function as the intermediation that

utilizes the detailed information from borrowers and investors. To some extent, such intermediation service mitigates the problems of information asymmetry in the online market. However, the inherent hazard with the emerging micro loans may lead to market failure due to its uncertainty and sometimes anonymity (Grabner-kräuter and Kaluschka 2008). YingHao Li, the Chief Risk Officer of Rong360.com, one of the most popular Chinese online micro-loan marketplaces, highlights that “the online loans appear to be characterized with micro amounts and high frequencies compared to offline ones. Over 70% of the applicants have two or more loans”. This suggests how to effectively and strategically grant a borrower with re-loans (i.e., the second loan or afterword) is of utmost interest to online micro-loan platforms.

In fact, researchers have pointed out that useful information to determine whether to grant a loan includes hard information and soft information on the applicants (Godilloncamus and Godlewski 2005). Wherein hard quantitative information can be objectively confirmed, such as financial status (Puro et al. 2010), as well as the demographic information (Barasinska and Schaefer 2010; Emekter et al. 2015). On the other hand, soft information refers to the content which cannot be directly verified, like photos (Duarte et al. 2012), the accuracy of personal loan statements (Larrimore et al. 2011) and social networks (Lin et al. 2013; Liu et al. 2015). A virtual friendship network is created where applicants (i.e., network nodes) are connected with friends (i.e., network links) through unknown mechanisms (Figure 1). Conventional micro-loan marketplaces usually evaluate lending risks and grant borrowers loan funds without considering (1) the degree that the borrowers interact in their friendship networks; (2) the loan approval of borrowers' friends in the associated social networks. Previous research provides rich insights on social networks and herding behavior in micro-loan marketplaces by focusing on investors' bidding choices (Freedman and Jin 2008; Herzenstein et al. 2011; Lin et al. 2013; Liu et al. 2015; Zhang and Liu 2012). To our best knowledge, there is no conceptual and empirical studies yet considering borrowers' (loan applicants') friendship networks and their homophily behaviors in determining loan approvals. This is what we seek to examine in this study.

![Figure 1. A Virtual Friendship Network of Borrowers in an Online Micro-Loan Platform](image)

Notes: The loan applicant labelled with “?” is the focal borrower in the figure. She has four direct friends in total as connected in the virtual friendship network in an online micro-loan platform. Two of her friends have been granted with loans (labelled with “Yes”), while the loan applications of her other two were rejected (labelled with “No”). Whether the re-loan application of this focal applicant should be granted may be implicitly influenced by her friendship network through unknown mechanisms.

In order to bridge the research gaps and address the above-mentioned practical problems, in this study we examine whether and how the characteristics of friendship networks in online micro-loan marketplaces influence the success of re-loan applications. We draw upon signaling theory (Akerlof 1970; Spence 1973), the social structure of competition (Burt 1992) and the concept of homophily (McPherson et al. 2001) to develop our research model. Specifically, we integrate three sets of quality signals to determine the re-loan success, viz., the conventional financial data such as credit card information, as well as the characteristics of online friendship network as generated in the focal micro-loan platform and the associated network centrality of borrowers (loan applicants).

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3 In this research, we are interested in the approval of online re-loan applications. As a result, we use the terms of borrower and applicant interchangeably.

In the following sections, we first review the related theory and the relevant literature. We then proceed the theoretical development and hypotheses, as well as describe the research context a major online micro-loan marketplace, pseudonymous as “OnlineLoan.com”, from which we collect the actual field data. We discuss the results of data analysis and conclude the papers with implications and future research.

**Theoretical Foundation and Development**

**Signaling Theory**

Financial intermediation service is considered to serve to mitigate the problems of information asymmetry between borrowers and investors (Leland and Pyle 1977). In online micro-loans, platforms and investors possess insufficient information and therefore unable to distinguish credible borrowers from risky borrowers for making accurate loan decisions. Due to such a nature of uncertainty in online micro-loans, the adverse selection problem as described by Akerlof (Akerlof 1970) can occur. In order to deal with this problem, Spence (Spence 1973) proposes that quality signals could serve as the mitigation mechanism. *Signaling theory* (Spence 1973) took roots in economics and examines indices that represent the existence of latent quality. Applying signaling theory in our research context, we argue that borrowers can make use of quality signals, such as financial records, to demonstrate their reliability and trustworthiness when applying for mortgages and loans. Prior studies find that a borrower's delinquencies situation and debt-income ratio could be a salient negative signal for an investor's decision in funding (Iyer et al. 2009; Puro et al. 2010). Credit grade, debt-to-income ratio, and FICO mortgage score were also identified as effective information cues for loan defaults (Emekter et al. 2015).

**The Concept of Homophily**

Related to social networks, the concept of *homophily* describes that similarity raises connections, resulting in personal networks homogeneous across sociodemographic, behavioral, and interpersonal characteristics or some other unknown mechanisms (McPherson et al. 2001). Hence, homophily denotes the presence of others who are similar (Monge and Contractor 2003) or contact between similar people occurs at a higher rate than among dissimilar people (McPherson et al. 2001). This concept is equivalent to the proverb that “birds of a feather flock together.” The concept of homophily has been utilized in a variety of contexts to explain network and group dynamics.

Indeed, online social networks are shaped into groups, and a social network could transmit valuable signals in various aspects. Online social networks appear having the potential to significantly reduce information asymmetry in lending markets, enhance borrowers' reputation and improve credit ratings (Chen et al. 2014; Collier and Hampshire 2010; Everett 2010).

Practically speaking, such borrowers' friendship networks with specific bidding and lending roles are available to be operated for some economic goals (e.g., loan success). Conceptually, we argue that homophily can be used to describe borrowers' network characteristics and behavior. However, extant studies on social network and lending markets merely focus on the aggregated effect of friends who could be borrowers, bidders, and lenders, but they ignore the ties of between borrowers and their friends at the individual level for considering loan/re-loan application approvals or borrowers' loan default. Whether the likelihood of successfully re-loans is influenced by the loan approval performance of friendship networks prevail us to fill the research gap.

**The Social Structure of Competition**

The structure of social networks can create a competitive advantage to reflect the social capital of nodes (Burt 1992). This means the individuals with whom a person interacts readily impact attitude and personal behaviors, affected by the structurally-equivalent nodes within the network. Indicators of centrality identify interaction of those nodes in social structure, we use three centrality measures to quantify social influence. *Indegree* is for the popularity while *outdegree* is considered as gregariousness of a node(Diestel 2007). Besides, the *eigenvector* centrality shows the reputation social influence as the “total effects centrality” (Faust 1997; Friedkin 1991). High degree and eigenvector centrality is found to be associated with superb information quality in online peer community (Kane and Ransbotham 2016). In
the context of the online micro-loan marketplace, centrality which express user’s interaction enables trust and improves funding performance (Agreste et al. 2015).

Theoretical Development

In this study we draw on signaling theory (Akerlof 1970; Spence 2001), the social structure of competition (Burt 1992), and the concept of homophily (McPherson et al. 2001) to develop our research model and the associated hypotheses in the research model (Figure 2), as explained below. Definitions of the principal constructs in the research model and control variables are summarized in Table 1.

![Figure 2. The Proposed Research Model]

Financial Characteristics

Loan and mortgage are often determined by a borrower's financial situation because such information plays as effective cues for loan defaults (Emekter et al. 2015). Specifically, a borrower’s delinquencies situation and debt-income ratio have been considered as salient negative signals for an investor to lending decision (Iyer et al. 2009; Puro et al. 2010). We argue that a borrower’s credit card information, including whether a borrower has a credit card default and the percentage of credit card default (i.e. the number of a borrower holding credit card defaults divided by the times of credit card consumption), can be referred as signaling indexes. Applying signaling theory (Spence 1973) in this online micro-lending context, the cost of holding low even no credit card defaults is different and strictly higher for risky borrowers who may be reluctant to pay back than it is for credible borrowers. We thus hypothesize:

Hypothesis 1a: A borrower’s credit card default negatively influences his/her re-loan success.

Hypothesis 1b: The percentage of credit card defaults negatively influences a borrower’s re-loan success.

Friendship Network Characteristics

Although no conceptual or empirical research exists to describe loan/mortgage approval by considering borrowers' friendship network, we integrate the concept of homophily (McPherson et al. 2001) to argue that a borrower's friendship network can characterize a borrower's loan behavior and performance. Specifically, we propose that a borrower’s friendship network can serve as an effective signaling mechanism to demonstrate a borrower’s credibility and partially mitigate the risk of information asymmetry in online micro-loan marketplaces. Social networks in various forms are found to provide explicit information and implicit implications about a borrowers’ loan bidding behavior and performance (Collier and Hampshire 2010; Everett 2010; Herzenstein et al. 2011; Lin et al. 2013). Another kind of the term, friendship network, is examined to act as a pipe, prism, and herding signal in investors’ decisions (Liu et al. 2015). Online relationships are easier to form and are more visible to others (Kane et al. 2014). Nonetheless, we expect the flocking signal to exist in between borrowers and their friends with successful re-loans. The concept of homophily denotes that similarity breeds connections and indicates the presence
of others in a group who are similar or contact between similar people occurs at a higher rate than among dissimilar people. In the same vein, if a borrower’s friendship network has more connections that have successfully obtained the re-loans, it is likely that a flocking signal exists whereby s/he might also share a similar possibility to obtain successful re-loans in a homophonous group. We thus hypothesize:

Hypothesis 2a: A borrower is more likely to be granted with successful re-loans if s/he has more friends with successful re-loans.

Hypothesis 2b: A borrower is more likely to be granted with successful re-loans if the percentage of his/her friends with successful re-loans increases.

Friendship Network Centrality

The structure of social networks creates a competitive advantage (Burt 1992). Degree centrality is an intuitive and vital measure of structural centrality in social networks (Brodka et al. 2009; Freeman 1978). Especially, we used the direction approach in which indegree refers to the number of other applicants adjacent to a particular loan applicant in the friendship network graph and outdegree is the number of links in which the specific applicant directs to others (Wasserman and Faust 1995). In general, indegree is often interpreted as a form of popularity, and outdegree is considered as gregariousness (Diestel 2007). The eigenvector centrality in such a friendships network measures the influence depth to the networks where the focal applicants are available to the other peer nodes directly and indirectly As a result, it reflects the reputation of highly influential nodes as “total effects centrality” (Faust 1997; Friedkin 1991). Because a person’s central status suggests broader competition advantage, high popularity, gregarious, and reputation we argue that the three indictors of centrality within a micro-loan platform can influence, though implicitly, a borrower’s re-loan performance. We thus hypothesize:

Hypothesis 3a: The indegree centrality of a borrower contributes to his/her re-loan success.

Hypothesis 3b: The outdegree centrality of a borrower contributes to his/her re-loan success.

Hypothesis 3c: The eigenvector centrality of a borrower contributes to his/her re-loan success.

Control Variables

Besides our hypothesized variables, we also control other potential factors in the research model (Table 1). OnlineLoan.com applies masking to some fields of data in order to protect commercially sensitive data. We collected masked data including gender, education, marital status, job occupation, the type of living house and the type of working company. Education and marital status often have great impacts on the investors’ willingness to grant funds (Liu et al. 2015), thus both variables are controlled. Since different investors cater to different borrower demographics, we also control for the borrowers’ age, gender, salary, job occupation, the type of living house, and the type of working company in our statistical model.

We also collected data related to the number of loan requests and average loan request amount. The literature finds investors use existing loan amounts requested as herding signals in predicting loan performance (Zhang and Liu 2012). Hence, we take the average amount and the number of loan requests of a borrower as the other sets of control variables in predicting his/her re-loan success.

Methodology

The Research Context: OnlineLoan.com (pseudonym)

To examine the above proposed research model, we collaborated with OnlineLoan.com for data collection. OnlineLoan.com is a Chinese popular online micro-loan commercial marketplace. It enables borrowers to search and compare loan products from various banks and lending agencies as well as allows borrowers to make direct contact with banking business personnel in a way similar to Prosper.com.

Different from the extant literature about traditional offline social networks or online social connection such as at Facebook, OnlineLoan.com provides the discussion forum that any user with a valid ID can invite his/her friends to register at OnlineLoan.com. Meanwhile, users can also interact with each other in the discussion forum by posting comments, following some other users and replying to other users’
comments about loans experience and financial knowledge in a way similar to the bulletin board. In this study, the friendship network refers to the contacts and connections at OnlineLoan.com by inviting friends in the registration at OnlineLoan.com or the interactions in the discussion forum at OnlineLoan.com. These features (friendship connections) can be found in some popular P2P lending platforms such as Ppdai.com in China, Fundingsocieties.com in Singapore, and Propers.com in US, there are official blogs where users can login with community accounts, then comment and make a connection.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Definitions (and Operationalization)</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Principal Variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Re-loan Success</td>
<td>If the borrower’s re-loan fund is granted: yes=1, no=0</td>
<td>0</td>
<td>1</td>
<td>.50</td>
<td>.500</td>
</tr>
<tr>
<td>Percentage of Credit Card Defaults</td>
<td>The percentage of credit card defaults</td>
<td>0.00</td>
<td>1.00</td>
<td>0.039</td>
<td>0.149</td>
</tr>
<tr>
<td>Credit Card Default</td>
<td>If a borrower holds credit-card defaults, yes=1, no=0.</td>
<td>0</td>
<td>1</td>
<td>.12</td>
<td>.322</td>
</tr>
<tr>
<td>Number of Friends with Re-loan Approvals</td>
<td>The number of friends with successful re-loan approvals at OnlineLoan.com</td>
<td>0</td>
<td>8</td>
<td>.57</td>
<td>.642</td>
</tr>
<tr>
<td>The Percentage of Friends with Re-loan Approvals</td>
<td>The percentage of friends with successful re-loan approvals</td>
<td>0.00</td>
<td>0.071</td>
<td>0.003</td>
<td>0.006</td>
</tr>
<tr>
<td>Indegree Centrality</td>
<td>The number of ties directed to a borrower at OnlineLoan.com</td>
<td>0.00</td>
<td>2.00</td>
<td>0.91</td>
<td>0.337</td>
</tr>
<tr>
<td>Outdegree Centrality</td>
<td>The number of ties that a borrower directs to others at OnlineLoan.com</td>
<td>14</td>
<td>7649</td>
<td>370.44</td>
<td>629.572</td>
</tr>
<tr>
<td>Eigenvector Centrality</td>
<td>The measure of the influence of a borrower by calculating the relative scores of connections at OnlineLoan.com</td>
<td>0.00</td>
<td>0.415</td>
<td>0.002</td>
<td>0.027</td>
</tr>
<tr>
<td><strong>Control Variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td>19</td>
<td>52</td>
<td>28.26</td>
<td>4.970</td>
</tr>
<tr>
<td>Salary</td>
<td></td>
<td>0</td>
<td>60000</td>
<td>5403.84</td>
<td>5129.39</td>
</tr>
<tr>
<td>Number of Loan Requests</td>
<td>The number loan requests recorded at OnlineLoan.com</td>
<td>4</td>
<td>42</td>
<td>6.51</td>
<td>2.085</td>
</tr>
<tr>
<td>Average Loan Request Amount</td>
<td>The average amount of loan requests at OnlineLoan.com</td>
<td>1.00</td>
<td>100000</td>
<td>15135.44</td>
<td>15024.79</td>
</tr>
<tr>
<td>Number of Friends</td>
<td>The number of direct friends connected at OnlineLoan.com</td>
<td>14</td>
<td>7649</td>
<td>370.44</td>
<td>629.572</td>
</tr>
<tr>
<td><strong>Control Variables</strong></td>
<td>Frequency (Only categorical variables can be provided as the original data were masked)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender (masked)</td>
<td>Gender</td>
<td>1</td>
<td>578</td>
<td>84.6%</td>
<td>2(105, 15.4%)</td>
</tr>
<tr>
<td>Occupation (masked)</td>
<td>Job occupation</td>
<td>1(493, 72.2%), 2(61, 8.9%), 3(129, 18.9%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education (masked)</td>
<td>Education</td>
<td>1(1, 0.1%), 2(112, 16.4%), 3(329, 48.2%), 4(241, 35.3%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marital Status (masked)</td>
<td>Marital Status</td>
<td>1(341, 49.9%), 2(76, 11.1%), 3(240, 35.1%), 4(25, 3.7%), 5(1, 0.1%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Living Info (masked)</td>
<td>Type of living house</td>
<td>1(200, 29.3%), 2(80, 11.7%), 3(219, 32.1%), 4(138, 20.2%), 5(46, 6.7%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Company Type (masked)</td>
<td>Type of working company</td>
<td>0(150, 22%), 1(53, 7.8%), 2(33, 4.8%), 3(33, 4.8%), 4(62, 9.1%), 5(346, 50.6%), 6(6, 0.9%)</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Table 1. Descriptive Statistics of Variables
The Dataset

We obtained a real dataset from OnlineLoan.com. Specifically, this dataset contains 683 anonymous and distinct borrowers’ information, including 4,443 loan requesting records, 22,591 credit card consumption entries and 233,817 unique friendship relations after removing some unusable data and missing values from the original dataset. This dataset allows us to analyze the key predictors of re-loan success in a much greater detail when compared to the extant literature. We summarize the borrowers’ general profile in Table 1. Based on the sample of 683 borrowers, the average likelihood to be granted a successful re-loan fund (namely re-loan Success) is 50%, meaning half of the borrowers successfully obtain a re-loan fund. The borrowers age varies from 19 to 52 with CNY ¥5403.84 as an average salary. On average, each borrower created 6.51 loan listings, expecting CNY ¥15135.44 for each loan. The average number of credit card defaults of each borrower is 3.96% (i.e., 3.96 times in every 100 times of borrower’s credit card consumption). Each borrower has about one online friend with successful loans among every 371 friends. The percentage of friends with re-loan successful approvals is ranging from 0 to 7.1%.

Data Analysis

The dependent variable re-loan success (whether a borrower granted are-loan fund) is a binary variable. We used a logistic regression model to test our hypotheses. Similar to this study, logistic regression was used to evaluate the likelihood of the loan default in bank loans and online loans service (Sohn and Hong 2007; Westgaard and Wijst 2001). Assuming the conditional probability of the event that a borrower i whom has been successfully granted a loan according to observations is:

$$Pr_i(\text{Re-loan Success} = 1| x) = \frac{1}{1 + e^{-g(x)}}$$

(1)

In Equation (1), the dependent variable Re-loan Success valued for i indicates the borrower i will successfully be granted with a loan fund again; otherwise for 0, meaning the borrower i failed to obtain the re-loan approval. Therefore, the odds of experiencing an event that a borrower i who has been successfully granted a loan is:

$$ \frac{Pr(\text{Re-loan Success} = 1|x)}{Pr(\text{Re-loan Success} = 0|x)} = \frac{p}{1-p} = e^{g(x)}$$

Let's take the logarithm of the odds:

$$\ln\left(\frac{p}{1-p}\right) = g(x) = -0 + -1X_1^i + -2X_2^i + -3X_3^i + -4X_4^i + \epsilon_i$$

(2)

In Equation (2), $X_1^i$ describes the demographic control variables; $X_2^i$ represents the available financial factors; $X_3^i$ represents friendship networks characteristics, and then $X_4^i$ stands for network structure centrality where $\epsilon_i$ refers to the random effect.

We apply the independent variables into the logistic regression model by the stepwise method to test our hypotheses. In order to examine the potential multicollinearity problem, we first made use of the SPSS collinearity-checking function. The results indicate all the VIF values of independent variables, including the percentage of friends with re-loan approvals and the absolute number of friends (two significantly correlated variables), were found smaller than 2.3, confirming no significant multicollinearity in this study. We then conduct the logistic regression. The results are summarized in Table 2 and Table 3.

The results of logistic regression in model 1 indicate the re-loan funding decisions of investors are sensitive to borrowers’ age and marital status. Among the financial information, credit card default in model 2 is found negatively significant ($\bar{\chi}^2 = 1:127, \text{waldstatistic} = 8.522, p = 0.004$), thus supporting H1a. However, H1b is rejected. H2 considers the causal relationship between Re-loan Success and Friendship Network Characteristics, as shown in model 3. The coefficients of the Number of Friends with Successful Re-loans ($\bar{\chi}^2 = 3.809, \text{waldstatistic} = 137.757, p = 0.000$), and the associated Percentage ($\bar{\chi}^2 = 77.538, \text{waldstatistic} = 39.339, p = 0.048$) are both positive and significant, thus supporting H2a and H2b. Results in model 4 reject H3a, H3b and H3c.

In order to test to what extent we can trust the results, we constructed the confusion matrix (also known as error matrix that allows the visualization of the performance of an algorithm) to capture the perdition performance based on the data of 683 borrowers. From the confusion matrix (available from the authors), we can conclude the overall precision performance of our model is 92.1%, suggesting we can trust our findings at the confidence level of 92.1%.
Predicting Re-loan Success in Online Micro-loan Market

<table>
<thead>
<tr>
<th>Dependent Variable: Re-loan Success</th>
<th>Logistic Regression Estimations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variables/Coefficient</td>
<td>Model 1</td>
</tr>
<tr>
<td>Age</td>
<td>-0.05**</td>
</tr>
<tr>
<td>Gender</td>
<td>-0.082</td>
</tr>
<tr>
<td>Occupation</td>
<td>-0.05</td>
</tr>
<tr>
<td>Education</td>
<td>-0.024</td>
</tr>
<tr>
<td>Marital Status</td>
<td>0.186*</td>
</tr>
<tr>
<td>Living Info</td>
<td>0.004</td>
</tr>
<tr>
<td>Company Type</td>
<td>-0.017</td>
</tr>
<tr>
<td>Salary</td>
<td>0.000</td>
</tr>
<tr>
<td>Credit Card Consumption</td>
<td>0.000</td>
</tr>
<tr>
<td>Percentage of Credit Card Defaults</td>
<td>0.989</td>
</tr>
<tr>
<td>Credit Card Default</td>
<td>-1.163**</td>
</tr>
<tr>
<td>Number of Loan Requests</td>
<td>0.021</td>
</tr>
<tr>
<td>Average Loan Request Amount</td>
<td>0.000</td>
</tr>
<tr>
<td>Number of Friends with Re-loan Approvals</td>
<td>3.809**</td>
</tr>
<tr>
<td>The Percentage of Friends with Re-loan Approvals</td>
<td>77.539*</td>
</tr>
<tr>
<td>Indegree</td>
<td>-0.402</td>
</tr>
<tr>
<td>Outdegree</td>
<td>0.000</td>
</tr>
<tr>
<td>Eigenvector</td>
<td>-148.365</td>
</tr>
<tr>
<td>-2Log likelihood</td>
<td>939.10</td>
</tr>
<tr>
<td>Cox&amp;Snell R square</td>
<td>0.01</td>
</tr>
<tr>
<td>Nagelkerke R square</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Table 2. Logistic Regression Estimations against Re-loan Success (* p < 0.05, **p < 0.01)

H1a: A borrower’s credit card default negatively influences his/her re-loan success.  
H1b: The percentage of credit card defaults negatively influences a borrower’s re-loan success.  
H2a: A borrower is more likely to be granted with successful re-loans if s/he has more friends with successful re-loans.  
H2b: A borrower is more likely to be granted with successful re-loans if the percentage of his/her friends with successful re-loans increases.  
H3a: The indegree centrality of a borrower contributes to his/her re-loan success.  
H3b: The outdegree centrality of a borrower contributes to his/her re-loan success.  
H3c: The eigenvector centrality of a borrower contributes to his/her re-loan success.  

Table 3. Result Summary

Key Findings, Implications and Conclusion

This paper examines the role of borrowers’ financial status, friendship network characteristics and network centrality structure in predicting re-loan success in an online micro-loan marketplace. Following the common knowledge, our data demonstrate that the credit card default of a borrower is an important negative signaling indicator for micro-loan intermediation and investors to assess the borrower’s re-loan application. It is worth to highlight that the additional explanation power of the social network data was 48% for Cox&Snell R square and 64% for the Nagelkerke R square (comparing model 3 and model 2 in table 2). Therefore, the contribution of the social network factors are not trivial. A borrower’s online friendship network does provide significant insights in determining his/her re-loan success, in terms of the number and also the percentage of friends with successful re-loan are good signals for a borrower’s
success in the re-loan applications. A flocking signal is built in the process where borrowers interact with those friends with re-loan approvals experience, denoting the information quality from a group of similar people. This finding implies the social network characteristics, i.e., the re-loan approvals of friends, actually affect the related borrowers re-loan success as their interaction reveals latent homophily behaviors in the particular micro-loan lending community. It also recognizes that homophily is shaped when the experienced and creditable loan applicants interact and form groups in the online micro-loan marketplace. Future studies can further explore this signal to investigate in online funding performance.

Social structure of competition quantified by several centrality measures, including the indegree, outdegree, and eigenvector centrality, in social networks is found to make no difference in predicting borrowers' re-loan success. That means a borrower's popularity, gregariousness and reputation do not assert any influence on the success of his/her re-loan applications. These insignificant results may be associated with the lack of large social network data or since a large number of friends without re-loan approvals exists in friendship networks.

This research contributes to theory in several aspects. First, the integration of signaling theory, the social structure of competition, and the concept of homophily provides a novel conceptual foundation to research to investigate online micro-loan marketplaces. Second, a borrower's credit card default and friendship characteristics are identified as the two sets of effective signaling mechanisms for investors and loan decision-makers to reduce the information asymmetry in the online micro-loan marketplaces. Third, the homophily concept used in this study provides a thought-provoking conceptual rational to evaluate a borrower's credibility by investigating his/her personal friendship network. The flocking effect is an interesting and new phenomenon that deserves further theoretical investigations.

In practice, online micro-loan marketplaces can quickly response to loan listings by assessing the above signals to approve or reject online loan applications in order to increase revenue. Most P2P lending platforms do not provide the features to make friends, follow others, post comments on the forums, etc. Therefore, this study exactly demonstrates that adding such features can better depict the loan success and to avoid load default by analyzing such data. We hope to include the other factors such as load amount, interest and term length in the paper. However, these data were not available to us. We encourage future research can explore these factors when the data are available. Moreover, the findings from this study can be utilized by online marketplaces in order to build healthy and successful micro-loan platforms in the current sharing economy. We envisage more research and practice in this domain.

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