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**Article**

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# Empirical Evidence of Faulty Credit Scoring and Business Failure in P2P Lending

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A B S T R A C T

**Purpose:** This study attempts to identify the cause of the failure of a platform operator in a P2P lending market, from the perspective of the internal credit rating system.
**Design/methodology/approach:** Data from Moneyauction, the first P2P lending platform in Korea, which led the market for a while and then unexpectedly closed down, was analyzed using a series of binary logistic regression and relative weight analysis methods. The study concentrates on the effect and importance of the self-assessed credit score system used by Moneyauction with regard to investor funding decisions and the actual repayment performance outcomes of borrowers. The predictive power of this self-assessed credit score is also identified.
**Findings:** The findings show that while the internal credit score is considered the most important factor in an investor's funding decision, its importance with regard to a borrower's actual repayment performance is significantly lower compared to other factors. Specifically, the predictability when using a model with an internal credit score with regard to a borrower's repayment performance is inferior to a model without this factor. The findings therefore suggest that low-quality self-assessed credit rating systems may in fact contribute to the failure of individual platforms, even when the market is growing rapidly.
**Research limitations/implications:** A series of business failures in a P2P market in the early stages of growth could make it difficult for the market to grow as a promising means of alternative finance due to the mounting distrust of potential participants and the exodus of existing investors. Therefore, the results of this study may present important issues to be discussed in relation to healthy market growth. The findings of this study are from the special case of Moneyauction in Korea. Thus, there is a limit to generalizing the results in this study, and further research is needed on additional platforms in similar situations in different markets.
**Originality/value:** None of the previous studies on P2P lending markets has investigated individual platform failure cases. Existing studies mainly focus on the statistical significance of the effects of borrower characteristics on investors' decisions or borrowers' repayment performances. This study is also distinct in terms of its methodology in that it goes one step further and discusses the relative importance among all aspects of the borrowers' characteristics.

*Keywords: Relative importance, Credit score system, P2P lending, Business failure, Prediction*

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# I. Introduction

Peer-to-Peer ("P2P") lending is a new way of financing from a large number of individuals by connecting borrowers directly with lenders through online marketplace. Since a P2P lending market is operated entirely online, it can mediate financial transaction without the intermediation of conventional banks. These attributes enable P2P lending borrowers to source money at lower cost than banks. Lenders can also anticipate to make higher profits compared to bank savings. To this end, P2P lending is drawing attention as an alternative finance.

According to the general procedure in P2P lending, after borrowers post their loan applications, a platform operator verifies the information which borrowers posted. Then, lenders bid their money on the loan applications until the loan amount has been collected. In Korea, the limit that a lender can invest is limited to 5 million won per case and 20 million won per year.

Since the creation of Zopa in the U.K. in 2005, P2P lending markets have developed rapidly around the world (Turner 2017). Recently, however, the development patterns in different countries have started to diverge considerably. In the U.S. and the U.K., the oligopoly is becoming increasingly entrenched, with companies established in the early stages leading (Dixit 2018, Turner 2017). On the other hand, China, the world's largest P2P lending market, has seen a number of companies fall behind due to government regulations and market uncertainty[1]. However, the market position of the frontrunners is solid (Shih 2018). South Korea has a number of companies in fierce competition but without the oligopolies held by certain early companies that exist in the U.S. and U.K. Over time, some companies have been left behind due to worsening or negative business conditions[2].

Such differences in market structure may be partly related to control of existing banking markets. In other words, China and South Korea have relatively high bank influence in the private loan market compared to the United States and the United Kingdom[3]. This can act as a stumbling block to the growth of the P2P loan market as an alternative finance, and eventually lead to a fiercer competition between platforms within a limited market.

There is a particular difference in Korea's case, especially in comparison with the U.S., the U.K. and China, where some of the early entrants are still leading the market, as the country is in a special situation where early leading companies are declining and latecomers are competing for market leadership. Until recently, Moneyauction was the leader of the P2P lending market in Korea. As the first P2P lending platform, it was established in 2006 and had been the market leader until the early 2010s. The Asian Banker, one of the Asian region's leading consultancies in financial services research, introduced Moneyauction as the only major Korean P2P lender, along with LendingClub and Prosper of the U.S., Zopa of the U.K. and PPdai of China[4]. Since then, with several latecomers entering the market around 2014, Moneyauction began to lose market leadership gradually and was eventually expelled from the market in 2017 due to the poor performance resulting from its gradual insolvency[5]. Since then, a number of platforms have been culled from the market due to tighter regulations by financial authorities[6].

It is not that there were no cases in which a leader in an online platform market has fallen behind in competition with latecomers. There are the typical cases of Yahoo in the U.S. and Cyworld in Korea. Yahoo accounted for half of the global internet search market share in the early 2000s, but later went downhill,

1) https://www.scmp.com/economy/china-economy/article/3006170/chinas-p2p-lending-market-could-be-decimated-year-amid (Visited on February 17, 2020)

2) https://shindonga.donga.com/3/all/13/1433735/1 (in Korean, Visited on February 17, 2020)

3) https://data.worldbank.org/indicator/FD.AST.PRVT.GD.ZS (Visited on May 14, 2021)

4) http://www.theasianbanker.com/publication/p2p-lending-companies (Visited on February 17, 2020)

5) http://vip.mk.co.kr/news/2017/183070.html (in Korean, Visited on February 17, 2020)

6) https://biz.chosun.com/site/data/html_dir/2019/04/16/2019041601843.html (in Korean, Visited on May 14, 2021).

losing ground to Google with regard to search engine performance[7]. Cyworld, which appeared in 2000, was also an undisputed No. 1 player in the SNS service market in Korea with 35 million users in 2006, but it was gradually pushed back by Facebook and Instagram, which eventually led to the discontinuance of its service in 2019[8]. Yet it is uncommon in the online platform market, especially in the early days of market development, for a leader to helplessly exit with the emergence of latecomers, despite its advantage as a first-mover. Compared to Yahoo and Cyworld, examples of market leaders competing with latecomers who emerged in the market growth phase beyond the initial stage, Moneyauction on the other hand represents a case of lost leadership almost immediately with the emergence of latecomers in the early stages of market formation.

The Korean P2P lending market is developing as rapidly as those in other countries. However, compared to the U.S., the U.K. and China, where P2P lending is growing as a promising means of alternative finance that can compete with traditional financers such as banks, the P2P lending market is still in its infancy in Korea. At this time, a market leader's business failure may increase investment losses of market participants, aggravating distrust in the market itself and preventing it from acting as an alternative means of finance. Therefore, from a practical perspective, it is an important matter to analyze the causes of a business failure at the individual platform level. As the academic focus is also rather on the rapid growth of the P2P lending market, there is little research on cases of platform business failures. Moreover, Moneyauction's failure may reflect certain special circumstances of the Korean P2P lending market. Therefore, the results of this study are also academically meaningful.

One of the important roles of the platform operator in a P2P lending market is to enhance its market transparency by minimizing the information asymmetry problem between borrowers and investors who participate in the market. Like other types of financial markets, the P2P lending market can maintain sustainable growth only if both the demand for loans and the supply of funds increase simultaneously in a balanced manner. In other words, the borrower group who needs the funds and the investor group who provides the funds should both expand simultaneously. However, the credit quality of the borrowers is much poorer than that of traditional finance in the Korean P2P lending market (Kim, Maeng, and Cho 2020). Moreover, ordinary individuals, the main investor group in the P2P lending market, have less expertise with regard to credit assessment than institutions such as banks, which are in charge of investments in traditional financial markets. Therefore, the information asymmetry issue between borrowers and investors in the P2P lending market is bound to be more serious than that in the traditional finance market (Lee and Lee 2012). Given that the P2P borrower inevitably has an advantage over the investor in information, in order to mitigate such information asymmetry, the platform operator has to provide investors with the borrower's information faithfully and accurately.

The platform operator simply transfers the information provided by the borrower, but also provides the borrower's creditworthiness information as evaluated with its own method to investors. Moneyauction also posted a self-assessed borrower's credit score, in addition to simply delivering the information offered by the borrower, such as gender, age, occupation, loan application amount, interest rate, duration and other data. This self-assessed credit score may be one of the key factors determining the ability of Moneyauction as a platform operator. If this self-assessed credit score is not accurate enough, Moneyauction, as a platform operator, is providing investors with incorrect information. This, in contrast to the intention of mitigating the information asymmetry problem by providing its own credit score information, could unintentionally even worsen the problem. If such inaccurate evaluations persist, investors will inevitably suffer from poor investment performance in the end

7) https://news.joins.com/article/20399413 (in Korean, Visited on February 17, 2020)

8) https://thecrimson.tistory.com/16 (in Korean, Visited on February 17, 2020)

and will be more likely to leave the market with distrust of the borrower as well as the platform operator.

In this respect, this study seeks to analyze the business failure of the P2P lending platform Moneyauction. In particular, latecomers, forced to be inferior in competition compared to Moneyauction, have survived despite the fact that the market is small and highly competitive. Thus, why Moneyauction failed may be more related to the operator rather than the market given that the business, in control of the market long since its establishment, went bankrupt. Accordingly, this study focuses on the platform level to identify the reason for this business failure.

The hypotheses in this study are as follows.

**H1.** The internal credit score will have a significant effect on investors' funding decisions.

**H2.** The internal credit score will not have a significant effect on borrowers' repayment performance.

**H3.** Investors' funding decisions will predict borrowers' repayment performances worse when considering the internal credit score than when not considering it.

To verify these hypotheses, first, a dichotomous logistic regression was conducted to identify the effects of Moneyauction's internal credit scores on the investors' funding decisions and on borrowers' repayment performances. In addition, a relative weight analysis was conducted to investigate the relative importance of Moneyauction's internal credit scores on investors' funding decisions and on borrowers' repayment performances. Here, we also compare the difference in the predictability of investors' funding decisions regarding borrowers' repayment performances between situations in which the internal credit score is considered and those in which it is not considered. Through these findings, this study discusses the roles of platform operators in a P2P lending market.

The results have shown that while investors consider a borrower's internal credit score as the most important factor when making funding decisions, its relative importance with regard to the borrower's actual repayment performance is considerably lower than other factors. Surprisingly, it is found that investors can better predict borrowers' repayment performances when they do not consider their internal credit scores in their funding decisions as compared to when these scores are considered. In the end, while investors hold Moneyauction's internally assessed credit score as the most important factor in their funding decisions, in reality, it brings about a result in which investors' predictive performances are deteriorated.

The results of this study provide practical implications for platform operators to secure a competitive advantage in circumstances where the P2P lending market is still at an early stage of development at home and abroad and the size of the market does not match that of the traditional finance market. It also has theoretical implications in that none of the previous studies on P2P lending markets has investigated individual platform failure cases. In particular, with most studies related to P2P lending focusing on cases in China and the US, this study is distinct in that it analyzes the special case of the Korean P2P lending market. From the methodological perspective here, this study attempts to identify the relative importance of each factor through a relative weight analysis, going further from a relationship analysis, whereas previous studies were based on analyses of the relationships between various factors and investor funding decisions or borrower repayment performance outcomes.

The rest of the paper is organized as follows. Section 2 reviews the literature dealing with the effects of borrower credit scores on investor funding decisions or borrower repayment performances in the P2P lending market. Section 3 provides details of the empirical data and analytic methodology. In Section 4, the results demonstrate the effects and importance of Moneyauction's self-assessed credit scores on investor decisions and borrower repayment performance outcomes. The predictive power of these internal credit scores is also analyzed. Implications and limitations are discussed in Section 5.

## II. Literature Review

Not a few studies have shown that credit scores in a P2P lending market are closely related to investor decisions and borrower repayment performances (Duarte, Siegel, and Young 2012, Emekter et al. 2015, Jagtiani and Lemieux 2018, Kim, Maeng, and Cho 2020). However, there are two main types of credit scores in these studies: external credit scores provided by third-party professional credit rating agencies and internal credit scores produced by the P2P lending platforms themselves. Because China does not yet have a public credit rating agency on a national level (Chen, Huang, and Ye 2018), studies of Chinese P2P lending platforms such as PPdai and Renrendai mainly covered internal credit scores (Chen, Huang, and Ye 2018, Tao, Dong, and Lin 2017). On the other hand, because U.S. platforms such as LendingClub and Prosper provide both external and internal credit scores (Malekipirbazari and Aksakalli 2015), studies related to these platforms discuss both factors at the same time (Emekter et al. 2015). Similar to LendingClub and Prosper, Moneyauction offers its own credit score as well as external credit scores produced by the Korea Credit Bureau (“KCB”) or NICE Information Service (“NICE”), third-party rating agencies in Korea. There are a few relevant studies (Kim, Maeng, and Cho 2020, Lee and Lee 2012).

Some of these studies argue that the internally assessed credit scores by platforms are less accurate (Giudici and Misheva 2018, Tao, Dong, and Lin 2017, Zhu 2018). Giudici and Misheva (2018) insist that unlike conventional financial institutions, a P2P lending platform operator cannot properly predict a borrower's repayment performance because they have little risk burden with regard to repayment failure by the borrower. Tao, Dong, and Lin (2017) also show, by analyzing the relationship between borrowers’ internal credit scores and the solvency rates of their loans using data from Renrendai, China's largest P2P lending platform, that a platform’s internal credit score does not properly reflect their borrowers' creditworthiness. Zhu (2018) argue, based on data from PPdai, China's first P2P loan platform, that if a platform operator guarantees a borrower's creditworthiness, the borrower's credit score can no longer be an indicator of repayment performance.

On the other hand, there are studies in which internal credit scores account for a borrower’s repayment performance or his/her loan rate better than other factors (Jagtiani and Lemieux 2018, Serrano-Cinca, Gutierrez-Nieto, and Lopez-Palacios 2015). Jagtiani and Lemieux (2018) argue that LendingClub's self-assessed rating model predicts a borrower’s repayment performance and explains their loan rate better than the FICO model, developed by a third-party public rating agency, because it reflects non-traditional factors pertaining to borrowers. Serrano-Cinca, Gutierrez-Nieto, and Lopez-Palacios (2015) also used LendingClub data and insist that an internal credit score is the best predictor of a borrower’s default probability compared to other factors in a P2P lending market.

Most of these studies proceed with a discussion based on the rationale that credit scores have a statistically significant impact on investors' decisions or on borrowers' repayment performances using linear regression analysis, logistic regression analysis, survival analysis, and other methods. However, discussions of how important the role played by the credit score is relative to other factors in explaining investor funding decisions or borrower repayment performance outcomes are rare. Moreover, differences in the actual importance of the credit score on borrower repayment performance outcomes compared to the level considered by investors when making funding decisions also have yet to be examined.

## III. Data and Methodology

### A. Data

The data used in this study are from November of 2007, when Moneyauction started, to December of 2017, just before they closed. Through random sampling from all data, 4,130 samples are analyzed

regarding the relationship between the internal credit score and investor funding decisions, with 4,163 samples was used to analyze the relationship between internal credit scores and borrower repayment performance outcomes. The 4,163 samples related to loan repayments are all of the repayment cases we have extracted through our online platform. 4,130 samples related to funding decision were taken from approximately 15% of the total collected loan cases by a simple random sampling without replacement. The reason for using only partial samples of the entire cases for funding decision is the memory limitations for computation and the time constraints of analysis. In the case of relative weight analysis, 5000 times bootstrapping were performed, which were not possible due to this constraint when the entire cases were used. In order to make the confidence interval of relative importance comparable in both analyses, 15% of the whole funding cases were extracted and matched similarly to the number of samples in the loan repayment cases.

The Moneyauction platform provides demographic information pertaining to borrowers, such as their gender, age, marital status, residence, number of cohabitants, and types of residences, as well as their financial and credit information, such as income, debt, credit scores, job type, working period, public insurance status, loan amount, loan interest rate, loan duration, repayment method, loan purpose, and textual descriptions of their repayment plan. From this information, eleven factors, in this case the loan amount, loan interest rate, loan duration, loan purposes, number of words in the textual descriptions, internal credit score, external credit score, gender, age, marital status, and public insurance status, were selected, except for some information that lacked completeness or was not significant according to a preliminary screening and analysis step. Among them, we used external and internal credit scores, which are of interest to this study, as explanatory variables and the remaining variables as control variables. In addition, the unemployment and economic growth indicators were added as control variables to reflect the impact of macroeconomic factors, considering the long collection period of data used in the analysis from 2007 to 2016. The status of the funding result and repayment performance, which have two types of results (i.e., success or failure), were used as dependent variables. A detailed description of the variables is provided in Table 1.

## B. Methodology

Because both dependent variables are dichotomous categorical variables with the levels of success or failure, binary logistic regression was utilized to analyze the statistical significance between the explanatory variables and each dependent variable (Fox and Weisberg 2018). By selecting variables through forward stepwise logistic regression method, the variables were narrowed down from all borrower information that investors could access, thereby the possibility of bias due to the omitted variables were tried to be resolved. Consequently, this study produced the following research models.

$$\begin{aligned}\Pr(Y_i) = \beta_0 &+ \beta_1 \cdot External\ \ Credit\ \ Score \\ &+ \beta_2 \cdot Internal\ \ Credit\ \ Score \\ &+ \sum_j \gamma_j \cdot Controls_i + u_i\end{aligned}$$

where, for each subject $i$, $Y_i$ is the binary dependent variable, i.e., *Funding* or *Repayment*. $Y_i$ = 1 means that the listing is successfully funded (in case of *Funding*) or is fully repaid (in case of *Repayment*).

Furthermore, a relative weight analysis was conducted for each logistic regression model to determine the relative importance of the explanatory variables (Tonideandel and LeBreton 2015). Relative weight analysis (Johnson 2000) handles the problem from correlated variables with a variable transformation method to create a set of new variables, which are uncorrelated to one another. As the correlation between variables is resolved, the dependent variable can be regressed with this new set of variables generating a series of standardized regression coefficients. Because these coefficients are produced using the transformations of the original variables, they have

**Table 1.** Variables

| Variables | Description |
|---|---|
| **Dependent variables** | |
| *Funding* | Bidding results after the loan application matured. [Categorical: 1=Funded, 0=Failed] |
| *Repayment* | Repayment results after the loan duration expired. [Categorical: 1=Repaid, 0=Failed] |
| **Explanatory variables** | |
| *External Credit Score* | Credit score evaluated by individual credit risk model from KCB (credian.kcb4u.co.kr) or NICE (www.mycredit.co.kr), third-party credit information providers. Ranged from 0 to 1000. [Continuous] |
| *Internal Credit Score* | Adjusted by the formula, external credit score - (internal credit score * 1000 / 600). The internal credit score is evaluated by Moneyauction, the P2P lending market platform provider ranged from 0 to 600. [Continuous] |
| **Control variables** | |
| *Amount* | Loan amount requested by borrower, in ten thousand KRW. Adjusted by annual price index [Continuous] |
| *Rate* | Interest rate offered by borrower in the application. [Continuous] |
| *Duration* | Time interval from loan initiation to maturity, in months. [Continuous] |
| *Purpose* | One of two values showing loan purpose. [Categorical: 1=Debt repayment, 0=Other] |
| *Number of Words* | Word count in loan request description. [Continuous] |
| *Public Insurance* | Subscription status to the four types of public insurance in Korea: national pension, health insurance, unemployment insurance, and occupational safety insurance. [Categorical: 1=Insured, 0=Uninsured] |
| *Gender* | Gender of borrower. [Categorical: 1=Male, 0=Female] |
| *Age* | Age of borrower in years. [Continuous] |
| *Marriage* | Marital status of borrower. [Categorical: 1=Married, 0=Single] |
| *Unemployment Rate* | Annual unemployment rate. [Continuous] |
| *Real GDP Growth Rate* | Annual real GDP Growth Rate. [Continuous] |

no problems caused by collinearity. Then, these coefficients are rescaled back to the original variables by multiplying them with the standardized regression coefficients generating an estimate of relative weight for each variable. The detailed coding is available at RWA-Web (http://relativeimportance.davidson.edu/). In order to improve the accuracy of the analysis, each analysis used standard errors for the explanatory variables; these were generated through a bootstrapping method with 5,000 rounds (R = 5,000). All analyses were performed using the statistical package R (version 1.2).

## C. Descriptive Statistics

First, in data related to the status of funding success, the nine remaining variables, excluding the *Gender* and *Age* variables, have significantly different means with regard to when a loan is successfully funded and when it fails, at the 99% significance level (except for the *Marriage* variable, which is significant at the 95% level). The *Amount* is smaller, the *Rate* is higher, and the *Duration* is shorter when the loan succeeds compared to when it fails. There is a greater weight for loans for another *Purpose* compared to loans for repayment of existing loans, a higher *Internal Credit Score* and a higher *External Credit Score*, and a greater weight for loans with *Public Insurance* in cases of loan funding success. Moreover, there is a large *Number of Words* when loans succeed in their funding effort.

In the data showing borrowers' repayment performance outcomes, except for the *Number of Words*,

**Table 2.** Descriptive statistics

| Variables | Model I (N = 4,130) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | All | | | Funded | | | Failed | | |
| | N | Mean | S.E. | N | Mean | S.E. | N | Mean | S.E. |
| ***External Credit Score*** | 4,130 | 595.662 | 2.192 | 1,092 | 627.079 | 3.928 | 3,038 | 584.369 | 2.593 |
| ***Internal Credit Score*** | 4,130 | 245.922 | 2.396 | 1,092 | 207.91 | 4.288 | 3,038 | 259.85 | 2.829 |
| ***Amount*** | 4,130 | 547.165 | 7.601 | 1,092 | 355.958 | 7.692 | 3,038 | 615.894 | 9.657 |
| ***Rate*** | 4,130 | 0.285 | 0.001 | 1,092 | 0.300 | 0.002 | 3,038 | 0.279 | 0.002 |
| ***Duration*** | 4,130 | 21.059 | 0.112 | 1,092 | 18.995 | 0.211 | 3,038 | 21.801 | 0.129 |
| ***Purpose*** | 4,130 | 0.309 | 0.007 | 1,092 | 0.250 | 0.013 | 3,038 | 0.330 | 0.009 |
| *Debt Repayment* | *1,276* | | | *273* | | | *1,003* | | |
| *Others* | *2,854* | | | *819* | | | *2,035* | | |
| ***Number of Words*** | 4,130 | 481.716 | 6.293 | 1,092 | 529.020 | 13.202 | 3,038 | 464.713 | 7.095 |
| ***Public Insurance*** | 4,130 | 0.511 | 0.008 | 1,092 | 0.590 | 0.015 | 3,038 | 0.483 | 0.009 |
| *Insured* | *2,110* | | | *644* | | | *1,466* | | |
| *Uninsured* | *2,020* | | | *448* | | | *1,572* | | |
| ***Gender*** | 4,130 | 0.669 | 0.007 | 1,092 | 0.677 | 0.014 | 3,038 | 0.667 | 0.009 |
| *Male* | *2,765* | | | *739* | | | *2,026* | | |
| *Female* | *1,365* | | | *353* | | | *1,012* | | |
| ***Age*** | 4,130 | 38.360 | 0.114 | 1,092 | 38.193 | 0.206 | 3,038 | 38.420 | 0.136 |
| ***Marriage*** | 4,130 | 0.379 | 0.008 | 1,092 | 0.351 | 0.014 | 3,038 | 0.389 | 0.009 |
| *Married* | *1,565* | | | *383* | | | *1,182* | | |
| *Single* | *2,565* | | | *709* | | | *1,856* | | |
| ***Unemployment Rate*** | 4,130 | 3.398 | 0.003 | 1,092 | 3.387 | 0.006 | 3,038 | 3.402 | 0.004 |
| ***Real GDP Growth Rate*** | 4,130 | 3.323 | 0.027 | 1,092 | 3.325 | 0.047 | 3,038 | 3.322 | 0.032 |
| Variables | Model II (N = 4,163) | | | | | | | | |
| | All | | | Repaid | | | Failed | | |
| | N | Mean | S.E. | N | Mean | S.E. | N | Mean | S.E. |
| ***External Credit Score*** | 4,163 | 657.972 | 1.827 | 2,717 | 667.301 | 2.232 | 1,446 | 640.443 | 3.127 |
| ***Internal Credit Score*** | 4,163 | 229.425 | 1.797 | 2,717 | 231.474 | 2.298 | 1,446 | 225.576 | 2.847 |
| ***Amount*** | 4,163 | 444.905 | 4.642 | 2,717 | 428.108 | 5.582 | 1,446 | 476.465 | 8.221 |
| ***Rate*** | 4,163 | 0.305 | 0.001 | 2,717 | 0.299 | 0.001 | 1,446 | 0.314 | 0.001 |
| ***Duration*** | 4,163 | 20.352 | 0.105 | 2,717 | 19.533 | 0.132 | 1,446 | 21.892 | 0.162 |
| ***Purpose*** | 4,163 | 0.323 | 0.007 | 2,717 | 0.335 | 0.009 | 1,446 | 0.302 | 0.012 |
| *Debt Repayment* | *1,346* | | | *909* | | | *437* | | |
| *Others* | *2,817* | | | *1,808* | | | *1,009* | | |
| ***Number of Words*** | 4,163 | 599.558 | 7.589 | 2,717 | 589.793 | 9.328 | 1,446 | 617.905 | 13.037 |
| ***Public Insurance*** | 4,163 | 0.630 | 0.007 | 2,717 | 0.659 | 0.009 | 1,446 | 0.575 | 0.013 |
| *Insured* | *2,623* | | | *1,791* | | | *832* | | |
| *Uninsured* | *1,540* | | | *926* | | | *614* | | |
| ***Gender*** | 4,163 | 0.670 | 0.007 | 2,717 | 0.661 | 0.009 | 1,446 | 0.688 | 0.012 |
| *Male* | *2,791* | | | *1,796* | | | *995* | | |
| *Female* | *1,372* | | | *921* | | | *451* | | |
| ***Age*** | 4,163 | 32.811 | 0.102 | 2,717 | 32.864 | 0.122 | 1,446 | 32.712 | 0.183 |
| ***Marriage*** | 4,163 | 0.393 | 0.008 | 2,717 | 0.388 | 0.009 | 1,446 | 0.403 | 00013 |
| *Married* | *1,637* | | | *1,054* | | | *583* | | |
| *Single* | *2,526* | | | *1,663* | | | *863* | | |
| ***Unemployment Rate*** | 4,163 | 3.429 | 0.003 | 2,717 | 3.429 | 0.004 | 1,446 | 3.429 | 0.006 |
| ***Real GDP Growth Rate*** | 4,163 | 3.591 | 0.030 | 2,717 | 3.552 | 0.037 | 1,446 | 3.664 | 0.049 |

*Gender*, *Age*, and *Marriage* variables, the remaining seven variables have significantly different means with regard to when the loan is successfully repaid and when it is not, at the 99% significance level (except for the *Purpose* variable, which is significant at the 95% level). Loans with a smaller *Amount*, a lower *Rate,* a shorter *Duration*, fewer *Number(s) of Words*, a higher *Internal Credit Score*, and a higher *External Credit Score* have better repayment outcomes. Additionally, loans stating a *Purpose* of repayment of an existing loan have better repayment performance than loans requested for other purposes. Detailed descriptive statistics are shown in Table 2.

The correlation coefficients are slightly high between *Age* and *Marriage* at 0.488 in the data related to the status of funding success, and between *Rate* and *Internal Credit Score* at -0.563, between *Rate* and *External Credit Score* at -0.488, between *Internal Credit Score* and *External Credit Score* at 0.483, and between *Age* and *Marriage* at 0.489 in the data explaining the status of repayment performance. However, both datasets show that the VIF values of all variables are lower than 2; thus, there are no multicollinearity problems. All correlation coefficients among the variables are described in Appendices 1 and 2, as are the VIF values for each regression analysis in Table 3 and 4.

## IV. Results

As shown in Table 3, the results of the analysis of the relationship between the explanatory variables and investor funding decisions (Model I) demonstrate that the *Internal Credit Score* has a statistically significant effect on *Funding*. In particular, the relative weight analysis shows that the importance of the *Internal Credit Score* (19.0%) is much higher than

**Table 3.** Results of the logistic regression analysis and the relative weight analysis for Model I

| Variables | *Binary logistic regression analysis (R = 5,000)* | | | | *Relative weight analysis (R = 5,000)* | | | |
|---|---|---|---|---|---|---|---|---|
| | $\beta$ | *S.E.* | *p-value* | *VIF* | *RW* | *RRW* | *99% C.I.* | |
| | | | | | | | *Lower* | *Upper* |
| **Explanatory variables** | | | | | | | | |
| *External Credit Score* | 0.012 ** | 0.001 | 0.000 | 2.451 | 0.074 | 0.277 ** | 0.057 | 0.092 |
| *Internal Credit Score* | -0.009 ** | 0.000 | 0.000 | 2.377 | 0.051 | 0.190 ** | 0.040 | 0.062 |
| **Control variables** | | | | | | | | |
| *Amount* | -0.002 ** | 0.000 | 0.000 | 1.298 | 0.074 | 0.278 ** | 0.057 | 0.091 |
| *Rate* | 0.087 ** | 0.007 | 0.000 | 1.397 | 0.028 | 0.106 ** | 0.020 | 0.037 |
| *Duration* | -0.046 ** | 0.006 | 0.000 | 1.171 | 0.017 | 0.064 ** | 0.011 | 0.024 |
| *Purpose* | 0.123 | 0.098 | 0.212 | 1.121 | 0.002 | 0.009 ** | 0.000 | 0.005 |
| *Number of Words* | 0.001 ** | 0.000 | 0.000 | 1.123 | 0.008 | 0.029 ** | 0.004 | 0.013 |
| *Public Insurance* | 0.454 ** | 0.086 | 0.000 | 1.064 | 0.008 | 0.030 ** | 0.004 | 0.013 |
| *Gender* | -0.183 * | 0.091 | 0.045 | 1.071 | 0.000 | 0.001 | -0.002 | 0.001 |
| *Age* | 0.007 | 0.007 | 0.274 | 1.356 | 0.001 | 0.002 | -0.002 | 0.001 |
| *Marriage* | -0.148 | 0.100 | 0.137 | 1.351 | 0.001 | 0.002 | -0.001 | 0.002 |
| *Unemployment Rate* | -1.511 ** | 0.205 | 0.000 | 1.138 | 0.003 | 0.010 * | 0.003 | 0.006 |
| *Real GDP Growth Rate* | 0.106 ** | 0.027 | 0.000 | 1.104 | 0.001 | 0.002 | -0.002 | 0.001 |
| Constant | -2.979 ** | 0.774 | 0.000 | | | | | |

Note: Cox & Snell $R^2$ = 0.249, Nagelkerke $R^2$ = 0.363, Hosmer-Lemeshow Test ($\chi^2$ = 8.3665, *df* = 8, *p-value* = 0.399)
RW and RRW stands for original relative weights and rescaled relative weights, respectively.
** and * indicate statistical significance at the 1% and 5% levels, respectively.

that of the *Rate* (10.6%), *Duration* (6.4%), *Public Insurance* (3.0%) and *Number of Words* (2.9%), following the *Amount* (27.8%) and *External Credit Score* (27.7%). This means that investors consider the internal credit score as one of the most important factors when making funding decisions in the Moneyauction platform. Accordingly, H1 is supported.

However, as seen in Table 4, the results of an analysis of the relationship between the explanatory variables and borrowers' actual repayment performances (Model II) reveal that the *Internal Credit Score* does not have a statistically significant effect on *Repayment* at the 95% confidence level. The relative weight analysis also indicates that the *Internal Credit Score* is statistically not important in explaining *Repayment* at the 99% confidence level. As such, H2 is also proved. The *Duration* (36.7%) variable is found to be most important, followed by *Rate* (21.0%), *External Credit Score* (11.1%), *Amount* (10.2%), *Public Insurance* (8.3%), and *Purpose* (7.4%). As a result, the importance of the *Internal Credit Score* variable affecting a borrower's actual repayment performance (1.4%) is found to be very low compared to the importance considered by the investor when making funding decisions (19.0%). Rather, it is found that the *External Credit Score* variable is much more important with regard to explaining borrower repayment performances than the *Internal Credit Score* variable. In addition, although investors consider the *External Credit Score* and the *Amount* as significantly important when making funding decisions (the sum of the weights of the two variables is 55.5%), in fact, only 21.3% of these variables affect repayment performance, indicating that investors' abilities to make funding decisions does not adequately reflect actual repayment performance outcomes.

In order to reaffirm the insignificance of the relationship between the Internal Credit Score and Repayment, additional logistic regression analyses were performed by altering the baseline model as

**Table 4.** Results of the logistic regression analysis and the relative weight analysis for Model II

| Variables | *Binary logistic regression analysis (R = 5,000)* | | | | *Relative weight analysis (R = 5,000)* | | | |
|---|---|---|---|---|---|---|---|---|
| | *β* | *S.E.* | *p-value* | *VIF* | *RW* | *RRW* | *99% C.I.* | |
| | | | | | | | *Lower* | *Upper* |
| **Explanatory variables** | | | | | | | | |
| *External Credit Score* | 0.002** | 0.000 | 0.000 | 2.682 | 0.008 | 0.111** | 0.003 | 0.015 |
| *Internal Credit Score* | -3.5e$^{-4}$ | 0.000 | 0.401 | 2.077 | 0.001 | 0.014 | -0.002 | 0.002 |
| **Control variables** | | | | | | | | |
| *Amount* | -0.001** | 0.000 | 0.000 | 1.348 | 0.007 | 0.102** | 0.002 | 0.015 |
| *Rate* | -0.049** | 0.008 | 0.000 | 1.687 | 0.014 | 0.210** | 0.006 | 0.024 |
| *Duration* | -0.056** | 0.006 | 0.000 | 1.194 | 0.025 | 0.367** | 0.015 | 0.038 |
| *Purpose* | 0.525** | 0.080 | 0.000 | 1.205 | 0.005 | 0.074** | 0.001 | 0.012 |
| *Number of Words* | 9.5e$^{-5}$ | 0.000 | 0.177 | 1.081 | 0.000 | 0.003 | -0.002 | 0.002 |
| *Public Insurance* | 0.334** | 0.072 | 0.000 | 1.086 | 0.006 | 0.083** | 0.001 | 0.012 |
| *Gender* | -0.195** | 0.075 | 0.009 | 1.071 | 0.001 | 0.017 | -0.001 | 0.006 |
| *Age* | 0.007 | 0.006 | 0.280 | 1.434 | 0.000 | 0.005 | -0.002 | 0.002 |
| *Marriage* | -0.015 | 0.079 | 0.854 | 1.303 | 0.000 | 0.002 | -0.003 | 0.002 |
| *Unemployment Rate* | -0.030 | 0.180 | 0.092 | 1.256 | 0.000 | 0.005 | -0.002 | 0.002 |
| *Real GDP Growth Rate* | -0.018 | 0.019 | 0.326 | 1.163 | 0.000 | 0.007 | -0.002 | 0.004 |
| Constant | 3.159** | 0.736 | 0.000 | | | | | |

Note: Cox & Snell $R^2$ = 0.070, Nagelkerke $R^2$ = 0.096, Hosmer-Lemeshow Test ($\chi^2$ = 12.741, *df* = 8, *p-value* = 0.122)
RW and RRW stands for original relative weights and rescaled relative weights, respectively.
** and * indicate statistical significance at the 1% and 5% levels, respectively.

seen in Table 5. Consequently, results such as the baseline model (Model II) are also found in both the absence of other control variables included in p2p loan transactions (Model II-1) and the absence of macroeconomic control variables (Model II-2). In other words, while the *External Credit Score* has a significant relationship with the *Repayment*, the *Internal Credit Score* has not.

In addition, investors do not consider the *Purpose*, whereas it is in fact more important than the *Internal Credit Score*. It is found that borrowers applying for loans for the purpose of repaying an existing loan show better performance than those requested for other purposes. While a borrower tries to persuade investors with textual expressions describing his/her current circumstances and the repayment plan if the loan is funded, the results of Models I and II show that such efforts by the borrower are significantly related to neither investor funding decisions nor borrower repayment performances. Although investors take this persuasion effort by the borrower into account when making investment decisions (i.e., the *Number of Words* variable affects *Funding* in a positive direction at the 99% significance level), they appear to consider this factor as not very important (i.e., the relative weight of the *Number of Words* variable on *Funding* is only 2.9%).

Figure 1 shows ROC curves comparing the predictability of two logistic regression models with regard to borrower repayment performance outcomes: a model reflecting the *Internal Credit Score* variable in funding decisions (Model I) and another that does not reflecting this variable (Model III). As indicated, the predictive power of the model that does not consider the *Internal Credit Score* variable (Model III) is superior to that of the model that does consider this variable (Model I), meaning that Moneyauction's self-assessed credit score in fact weakens investors' judgement power and thereby deteriorates their ability to predict borrower repayment performances. This supports H3. Meanwhile, the AUC values of Models I and III are only 0.5797 and 0.5923, respectively, indicating that investors are not able to make good decisions about the creditworthiness of borrowers.

**Table 5.** Results of the logistic regression analysis for variations of Model II

| Variables | *Model II* | | *Model II-1* | | *Model II-2* | |
|---|---|---|---|---|---|---|
| | *β* | *p-value* | *β* | *p-value* | *β* | *p-value* |
| **Explanatory variables** | | | | | | |
| *External Credit Score* | 0.002** | 0.000 | 0.002** | 0.000 | 0.001** | 0.001 |
| *Internal Credit Score* | -3.5e$^{-4}$ | 0.401 | -0.001 | 0.114 | -1.1e$^{-4}$ | 0.769 |
| **Control variables** | | | | | | |
| *Amount* | -0.001** | 0.000 | | | -0.007** | 0.000 |
| *Rate* | -0.049** | 0.000 | | | -0.052** | 0.000 |
| *Duration* | -0.056** | 0.000 | | | -0.054** | 0.000 |
| *Purpose* | 0.525** | 0.000 | | | 0.516** | 0.000 |
| *Number of Words* | 9.5e$^{-5}$ | 0.177 | | | 7.7e$^{-5}$ | 0.274 |
| *Public Insurance* | 0.334** | 0.000 | | | 0.334** | 0.000 |
| *Gender* | -0.195** | 0.009 | | | -0.019* | 0.012 |
| *Age* | 0.007 | 0.280 | | | 0.008 | 0.219 |
| *Marriage* | -0.015 | 0.854 | | | -0.013 | 0.873 |
| *Unemployment Rate* | -0.030 | 0.092 | -0.172 | 0.310 | | |
| *Real GDP Growth Rate* | -0.018 | 0.326 | -0.027 | 0.134 | | |
| Constant | 3.159** | 0.000 | -0.112 | 0.841 | 2.194** | 0.000 |

Note: ** and * indicate statistical significance at the 1% and 5% levels, respectively.

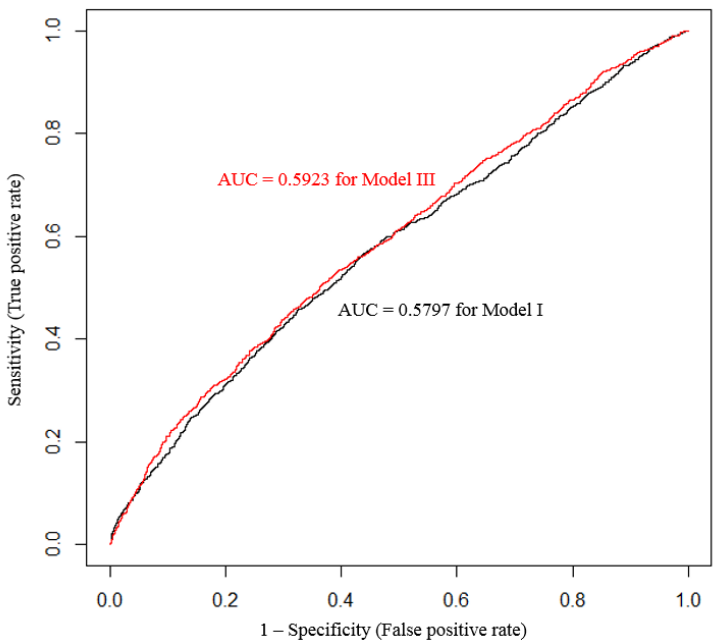


**Figure 1.** ROC curve for Model I and Model III

## V. Discussion

As shown in the results, investors consider Moneyauction's self-assessed credit score to be the one of the most important factors affecting their funding decisions. However, the internal credit score is not significant with regard to predicting borrower repayment performance outcomes. Hence, Moneyauction's internal credit score presents very low predictability for investors compared to other variables, prompting them to make incorrect decisions. With these findings, we consequently prove all of the aforementioned hypotheses H1, H2, and H3. At this point, this study seeks one possible explanation for why a platform provider may fail in its business in the P2P lending market, despite the rapid growth of this market. The speed at which platform providers enter the market outpaced the market growth rate in the early stages of the P2P lending market in Korea. In other words, supply was more active than demand. In this market environment, Moneyauction worsened investors' abilities regarding their funding decisions by providing them with low-quality credit rating information about borrowers, thus deteriorating their investment performance. This caused investors to move to other platforms, ultimately resulting in business failures. Thus, platform operators should be aware that providing self-assessed credit rating information without ensuring the predictability of these models with regard to the repayment performance capabilities of borrowers may have more side effects than originally intended.

We can also think about the utility of such external credit scores here. Although the P2P lending market consists mainly of those with low credit scores as borrowers, implying that the credit distribution of all borrowers differs from that in the existing financial markets (Kim, Maeng, and Cho 2020), the credit score model of the existing financial system is still more valid than the internal rating model used by P2P lending platforms. Therefore, from the platform operators' perspective, they should acknowledge that the accuracy of their internal rating model may be very low considering that the P2P lending market is still in its early stages and there is not much cumulative experience with transaction data. Accordingly,

it may be more useful to be provided with external credit score information for the time being until sufficient data is accumulated.

Given that platform operators' revenue is generated by the fees charged to investors and borrowers at a certain rate for each loan transaction, it is necessary for platform operators to encourage loan transactions as much as possible. This may cause the platform operators to induce investors to engage in more funding activities by presenting higher borrower credit ratings than the actual values. This may lead to overestimations of borrower creditworthiness levels. Hence, this study also emphasizes the need to provide external credit rating information rather than relying on the internally assessed credit rating models used by platform providers.

As indicated by the results here, investors place far too much faith in internal credit scores and loan amounts, whereas in reality, these must be judged more comprehensively because certain other variables have also important effects on repayment performance outcomes. Individual investors taking part in the P2P lending market will be inevitably inferior to existing financial firms in terms of their credit evaluation capabilities. Therefore, it is necessary to make comprehensive decisions based on a variety of information about the borrowers who use these platforms.

# VI. Conclusion

## A. Implication

As the P2P lending market is growing rapidly with the emergence of alternative financing around the globe, thus far academic studies have focused mainly on market understanding aspects, such as market operating mechanisms and participant behaviors. This is the first study of the P2P lending market to address the failure of a lender platform. While there are several markets in which a handful of operators already form an oligopoly, such as the U.S., there are many markets where many platforms compete fiercely, such as those of China and Korea. Especially in such markets, new players are expected actively to enter the market for the time being, as these markets are still in their early stages. Therefore, identifying why a business fails at the operator level may provide important implications for operators in such highly competitive markets. In addition, a series of business failures in a market in the early stages of growth could make it difficult for such a market to grow as a promising means of alternative finance due to the mounting distrust of potential participants and the exodus of existing investors. Therefore, the results of this study may present important issues to be discussed in relation to healthy market growth.

Thus far, most studies of P2P lending markets have been based on the Chinese and the U.S. platforms. In particular, research related to Chinese platforms is overwhelming. In addition to the few existing studies related to the Korean market, the present study expands the geographical diversity associated with P2P lending research. Because there are no cases of first-mover operators that have been leading the market for a long time as in Korea in the early stages of the market, this study is meaningful in that it deals with the unique case of the Korean market. In particular, there are no cases of first-moved operators that had been leading the market for a long time before they failed. To this end, this study is also meaningful in that it deals with a unique first-mover business failure in the Korean P2P lending market.

In a P2P lending market, unlike in existing financial markets, a borrower’s credit risk is fully borne by investors, not by platform operators. Platform operators only receive a certain level of fees from participants while providing market functions. Thus far, the importance of the platform with regard to credit evaluations of borrowers has not been emphasized much. However, as seen in the case of Moneyauction, if the platform operator provides inaccurate credit information about borrowers, investors will lose confidence in the market and will exit, which in turn leads to the failure of the platform. Therefore, for healthy market development, platform operators must provide investors with information about

borrowers as faithfully and accurately as possible and continuously provide feedback to investors about the empirical effects of each type of information pertaining to borrower creditworthiness. In this respect, the findings here are meaningful in that they emphasize the importance of the platform operator's role, even in the absence of the burden of their borrowers' credit risk.

Existing studies mainly focus on the statistical significance of the effects of borrower characteristics on investors' decisions or borrowers' repayment performances. This study is also distinct in terms of its methodology in that it goes one step further and discusses the relative importance among all aspects of the borrowers' characteristics. Rather than simply discussing whether the relationships between components are statistically significant, showing how important each component is relative to others can provide a more intuitive meaning from both practical and theoretical perspectives.

## B. Limitations

In this paper, we focus on the inaccuracy of internal credit rating systems as the cause of the failure of the P2P lending platform. However, there are other possible differences in the recent replacement of existing platforms by more advanced forms of new competitors. First, compared to Moneyauction, which was the earliest platform, the biggest difference of emerging platforms can be found in loan interest rates. In other words, Moneyauction sets high interest rates for borrowers at a high level of 20 to 30%, while recent competitors offer good mid-interest rates of around 10%. This difference in interest rates could be an important driver for potential borrowers to leave Moneyauction and move to new competitive platforms. Next, the new platforms are characterized by more strict pre-screening of borrowers compared to Moneyauction. They aim to reduce loan delinquency and increase investor confidence by targeting only borrowers with a certain level of creditworthiness. As a result, investors' higher confidence in new competitive platforms than Moneyauction, which is relatively weak in pre-validation of borrowers, may have led to investors leaving the earliest platform. Therefore, in addition to the credit rating factor, there may be another important factors that have caused the failure of Moneyauction, which will require further research.

The findings of this study are from the special case of Moneyauction in Korea. Thus, there is a limit to generalizing the results in this study, and further research is needed on additional platforms in similar situations in different markets.

There will be a variety of explanations of the business failure of a P2P lending platform. This study seeks to find such a reason, focusing particularly on the internal credit rating system of the platform operator. However, there is a lack of discussion about other possible explanations at the operator level or at the market level. Moreover, although this study attempts to explain the link between a poor internal credit rating system and performance deterioration experienced by investors and their market exit, there is a limit to providing concrete evidence of causality here.

This study discusses the relative importance of various explanatory variables through a relative weight analysis. However, relative importance is a numerical representation of how much each factor can account for the $R^2$ value of the entire model. In particular, Model II, a logistic regression analysis using borrower repayment performance as a dependent variable, has a very low $R^2$ value (e.g., an $R^2$ value of 0.096 according to the Nagelkerke method), which undermines the implications provided by the relative weight analysis.

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**Appendix 1.** Correlation matrix for Model I

| Variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *(1) External Credit Score* | 1 | | | | | | | | | | | | |
| *(2) Internal Credit Score* | 0.627 | 1 | | | | | | | | | | | |
| *(3) Amount* | 0.109 | 0.151 | 1 | | | | | | | | | | |
| *(4) Rate* | -0.193 | 0.073 | -0.226 | 1 | | | | | | | | | |
| *(5) Duration* | 0.011 | 0.027 | 0.299 | -0.012 | 1 | | | | | | | | |
| *(6) Purpose* | -0.030 | 0.052 | 0.247 | 0.041 | 0.222 | 1 | | | | | | | |
| *(7) Number of Words* | 0.047 | 0.087 | 0.112 | 0.097 | 0.056 | 0.133 | 1 | | | | | | |
| *(8) Public Insurance* | -0.018 | -0.179 | 0.093 | -0.074 | 0.066 | 0.092 | -0.051 | 1 | | | | | |
| *(9) Gender* | -0.011 | -0.053 | 0.042 | 0.049 | -0.056 | -0.018 | -0.073 | 0.094 | 1 | | | | |
| *(10) Age* | -0.055 | -0.080 | 0.140 | 0.069 | 0.067 | 0.023 | -0.054 | 0.051 | 0.092 | 1 | | | |
| *(11) Marriage* | -0.026 | -0.098 | 0.116 | -0.056 | 0.069 | -0.014 | -0.009 | 0.027 | -0.112 | 0.488 | 1 | | |
| *(12) Unemployment Rate* | 0.137 | 0.014 | -0.007 | -0.069 | -0.072 | 0.049 | 0.086 | -0.011 | 0.000 | 0.018 | -0.010 | 1 | |
| *(13) Real GDP Growth Rate* | 0.008 | 0.107 | 0.077 | -0.014 | -0.065 | 0.039 | 0.123 | 0.011 | 0.013 | 0.020 | 0.001 | 0.240 | 1 |

**Appendix 2.** Correlation matrix for Model II

| Variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *(1) External Credit Score* | 1 | | | | | | | | | | | | |
| *(2) Internal Credit Score* | 0.560 | 1 | | | | | | | | | | | |
| *(3) Amount* | 0.194 | 0.046 | 1 | | | | | | | | | | |
| *(4) Rate* | -0.488 | 0.036 | -0.230 | 1 | | | | | | | | | |
| *(5) Duration* | -0.060 | -0.016 | 0.331 | 0.014 | 1 | | | | | | | | |
| *(6) Purpose* | -0.144 | 0.055 | 0.183 | 0.108 | 0.227 | 1 | | | | | | | |
| *(7) Number of Words* | -0.044 | 0.033 | 0.149 | 0.103 | 0.115 | 0.100 | 1 | | | | | | |
| *(8) Public Insurance* | -0.013 | -0.194 | 0.038 | -0.138 | 0.025 | 0.048 | -0.082 | 1 | | | | | |
| *(9) Gender* | 0.000 | -0.065 | 0.042 | -0.030 | -0.046 | -0.063 | -0.031 | 0.101 | 1 | | | | |
| *(10) Age* | 0.067 | -0.134 | 0.196 | -0.198 | 0.025 | -0.123 | -0.094 | 0.059 | 0.183 | 1 | | | |
| *(11) Marriage* | 0.014 | -0.109 | 0.123 | -0.089 | 0.092 | -0.089 | -0.036 | 0.000 | -0.022 | 0.459 | 1 | | |
| *(12) Unemployment Rate* | 0.143 | -0.057 | 0.064 | -0.015 | -0.112 | 0.001 | 0.084 | 0.005 | -0.034 | -0.052 | -0.024 | 1 | |
| *(13) Real GDP Growth Rate* | -0.030 | -0.111 | 0.082 | 0.018 | 0.002 | 0.022 | 0.116 | 0.028 | -0.017 | -0.033 | -0.022 | 0.328 | 1 |