Modularized Risk Control of P2P Two-sided Market

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Abstract: Recently, peer-to-peer (P2P) lending has been growing rapidly. It provides an alternative channel for SME (Small and Medium Enterprises) or individuals who cannot obtain financial support from traditional financial institutions. A key challenge for P2P platform is the risk control ability between the two-sided market of both borrowers and investors. However, traditional risk management model cannot meet the needs of two-sided users on P2P platform based on big data level. In this study, we propose an explicit mechanism of data-driven risk management based on big data mining. In this paper, we have designed a two-sided risk control model, which has the ability of monitoring, evaluating and alarming the risk of information flow and cash flow during each procedure from two-sided market. Besides, to validate our proposed model, we have done several practical experiments on real P2P lending platforms and testified that the proposed model can effectively control the risk of P2P lending platform process.
Keywords: P2P Platform, Two-sided Market, Modularize, Risk Control

1. Introduction

Since Zopa was founded in UK in 2005, Prosper in 2006 and Lending Club in 2007, P2P lending platforms become an internet-based financial intermediary. They use borrowers' personal information, historical credit records, amounts and terms of the loans, mortgage assets and other conditions to provide risk ratings for each loan, just like the techniques of traditional commercial bank. After 10 years learning by doing, each platform has their own rating system gradually. Different with traditional financial intermediaries**,** P2P lending platforms are facing a two-sided financial market.

1.1 System Risks of P2P Platform

In economics, systemic risk is the risk of a collapse of an entire economic system or market. When central bank adjusts the deposit benchmark interest rate, the costs of financing in whole economics will make adjustment accordingly, investors' risk-return consideration might cause the **Interest Rate Risk**, their investment flows across P2P platforms and other fixed-income securities.

Various laws and regulations are pressing on P2P platform nowadays, Consumer Protection Act, Financial Disclosure System, Privacy Protection Act, Intellectual Property Protection Law, and Internet-finance Directive Opinions issued in 2015, all make the composition of **Legal Risk.**

1.2 Borrower-side Risk

Liquidity Risk comes from insufficient diversification of the loans and borrowers, a major risk control module is to make balance among profitability, liquidity and security.

If borrowers cannot implementation their repayment by the maturities, this **Default Risk** will cause principal and interest loss. Rating-based credit risk assessing models are practically utilized by all kinds of financial institutions for issuing credit cards and loans. The widely accepted criterion FICO credit rating model from Fair & Isaac Company in 1950s possesses a great market share till now. Emerging of Chinese P2P platforms draws various kinds of grading systems based on Chinese localized clients' credit criterion.

1.3 Investor-side Risk

More than 600 (out of about 2000) platforms in China have gone bankruptcy so far, fake assets and projects might attract attention of investors, but once the cash flows cannot meet the requirements, some platforms couldn't handle the broken capital chain, they might choose to disappear with all the investments and cause great losses of their investors. In the contrary of above **Moral Risk**，all platform facing **Market Selection Risk,** information asymmetry may cause unfair reputation of a platform, leading clients and investments away.

1.4 Extraordinary Risk

Technical Risk accompanies all internet-based platforms, virus coming from internet, hardware damages, system collapse should be guarded and draw experience from traditional e-bank, such as digital certificate of CFCA (China Financial Certification Authority), cipher code in IC card, and various passwords to technically keep confidentiality and security of their clients.

Meanwhile, not only P2P platforms, but also financial institutions have to control the **Operating Risk** during daily operating in case there're any loophole or carelessness in internal program, corporate personnel, and external incidences. Big data era sets even higher standards for stability, hacker attack, funding embezzlement, information tempering and stealing could happen anytime. Low threshold and reproduction cost led many immature platforms join P2P lending industry, their main clients are with poor endowments like small and micro businesses and ordinary individuals, combined with inefficient credit approval, it will definitely cause greater operating risk than traditional financial institutions.

2. Literature Review

Jun Zhao (2015) builds a mathematical P2P model based on data processing, with 70 personal loan application records, attempt to target the importance of personal credit risk evaluation system. Yu Jing & Yudan Zhu (2015) make a data-driven approach to predict default risk of loans for P2P lending, they used data from Lending Club to explore the characteristics of loans and its applicants, and used random data to do the selection process. Zhao and Hu (2015) analyze three kind of default sources of P2P platform: probability of default, exposure at default and loss-given default, they summarize four risk control models of P2P platform: CPD(Control the Probability of Default) model, CRE(Control the Risk Exposure) model, CLGD(Control the Loss

Given Default) model and the corresponding risk control methods. Zang et al (2014) points out credit risk is the leading factor of internet finance stability, they introduce BP neural network model to evaluate the risk of credits quantitatively, they build an empirical model with the lending club data and find out risk evaluation method has a predominant performance.

Researches on internet externality have been led to a rising field of two-sided market, which are the platforms for many industries. Rochet & Tirole (2003, 2004), Armstrong (2006) provided an initiating framework and Evans (2003) proposed that E-commerce was market creating and demand adjusting two-sided market industry.

Modularized thinking (Baldwin & Clark, 1997) and Financial Choice Theory (Merton, 1973) builds module networks actualizing labor division, therefore gains much more value and efficiency than traditional industrial organizations, the more modularized, higher efficiency it gets.

3. Cases of Modularized Risk Control

3.1 Warranting Module of Hongling Capital

Hongling Capital is the first platform offering pre-paid principal with internal warrant, taking cash deposit of an independent department as collateral, some into ICBC fixed deposit, other saved for daily operations. This collateral fund is comprised of undistributed profit, 10% commission fee and VIP fee from online clients. Hongling Capital will not reimburse the capital when it goes bad debt to some clients who didn't pay VIP fees. Hongling Capital also requires companies whose loans exceeding 100,000 to pledge their assets.

3.2 Third Party Creditor Module of CreditEase

CreditEase starts a transferring model of obligatory right, they divide one investment into many little amounts, send them to different borrowers, CreditEase finds a third-party to keep the deposit during the time interval between investor and borrower. Every month payments from borrowers to investors are dynamically recorded on CreditEase platform, so as investors could monitor every repayment and interest revenue reports. Investors can also choose to reinvest their principal and revenue into another borrower.

4. Our Module

To measure interest-rate risk in **Interest-rate Module**, Duration and Convexity model are perfect suitable, Duration is to assess market value changing by interest rate (Macaulay, 1938):

$$\text{Duration} = \frac{\sum_{t=1}^{N} CF_t \times DF_t \times t}{\sum_{t=1}^{N} CF_t \times DF_t} = \frac{\sum_{t=1}^{N} \frac{CF_t}{(1+y)^t} \times t}{\sum_{t=1}^{N} \frac{CF_t}{(1+y)^t}} = \frac{\sum_{t=1}^{N} PV_t \times t}{\sum_{t=1}^{N} PV_t} = \frac{\sum_{t=1}^{N} PV_t \times t}{P}$$

$$= \sum_{t=1}^{N} tw_t$$

CF_t is cash payment at the end of period t, N is the life time of target security, DF_t is

discount rate of cash flow payment at the end of period t, y is yield to maturity, PV_t is present value of cash flow at the end of period t, t is maturity date, w_t is cash flow's value weight in the whole security portfolio.

Convexity (Stanley Diller, 1984) has modified the non-linear character of fixed income securities:

$$\text{Convexity} = \frac{1}{P} \cdot \frac{d^2P}{dy^2} = \frac{1}{P} \cdot \frac{1}{(1+y)^2} \cdot \sum_{t=1}^{T} \frac{t(t+1)C_t}{(1+y)^t}$$

Liquidity Risk Module uses Liquidity Gap, Linear Programming, Term Ladder and LAVR methods to supervise and control the liquidity risk.

There're several methods to evaluate the credit risk in **Credit Risk Module**: FICO credit score model is the most commonly used all over the world. Besides, Platform Lu employs credit system of Bank of Pingan, while CreditEase builds their own credit rating system.

From investor side, moral risk is a major concern, so as in Moral Risk Module, we could use VaR (Value at Risk) method to quantify the analyses. There're also many other ways to do this job, such as mean-variance model, Z-score model, and KMV model.

VaR Method is based on CreditMetrics Model (J.P. Morgan, 1997), it's a probability metric of transferring, it measures the probability of credit level changing for each situation:

Table 1 Transfer Metrics

level	AAA	AA	A	BBB	BB	B	CCC	违约
AAA	90.81	8.33	0.68	0.06	0.12	0	0	0
AA	0.70	90.65	7.79	0.64	0.06	0.14	0. 02	0
A	0.09	2.27	91.05	5.52	0.74	0.26	0.01	0.06
BBB	0.02	0.33	5.95	86.93	5.3	1.17	1.12	0.18
BB	0.03	0.14	0.67	7.73	80.53	8.84	1	1.06
B	0	0.11	0.24	0.43	6.48	83.46	4.07	5.2
CCC	0.22	0	0.22	1.3	2.38	11.24	64.86	19.79

Sources: Creditmetrics, J.P. Morgan.

Then we calculate the present value of each situation:

$$PV = P + \frac{P}{1+r_1+s_1} + \frac{P}{(1+r_2+s_2)^2} + \frac{P}{(1+r_3+s_3)^3} + \cdots + \frac{P+Mar}{(1+r_n+s_n)^n}$$

r_i is risk-free rate for 1 year, s_i is the disparity because of credit level changing, P is payment in each period, Mar is the market value of each platform.

With all kinds of present value, we could calculate VaR value. Assuming ΔV is standardized normal distribution, the mean-value and variance' computation formula is:

$$\mu = \sum p_i \Delta V_i$$

$$\sigma^2 = \sum p_i (\Delta V_i - \mu)^2$$

Then the VaR value is $\hat{\chi}_{1-\alpha} = -z_{1-\frac{\alpha}{2}} \frac{\sigma}{\sqrt{n}}$

5. Conclusions

In this paper, we have analyzed traditional risk management model and proposed an explicit mechanism of data-driven risk management based on big data mining. Further, we have designed a two-sided risk control model, which has the ability of monitoring, evaluating and alarming the risk of information flow and cash flow during each procedure from two-sided market. Besides, to validate our proposed model, we have done several practical experiments on real P2P lending platforms and testified that the proposed model can effectively control the risk of P2P lending platforms' process.

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