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Voluntary disclosures and peer-to-peer lending decisions: Evidence from the repeated game

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Abstract

This study investigates the effect of voluntary disclosures on lending decisions in the repeated game. Using a unique dataset from a peer-to-peer lending platform, "ppdai" (*paipaidai*), we document that voluntary disclosures in the repeated game play a stronger role in promoting funding success than those in the one-shot game. We argue that voluntary disclosures improve the bidding activity in the repeated game through which they increase funding success. In addition, the greater impact of voluntary disclosures on funding success in the repeated game only holds for loans without a personal guarantee attribution. Our extended results suggest that the subjective voluntary disclosures in the repeated game have greater information content only when borrowers have a successful borrowing experience. We also point out that voluntary disclosures in the repeated game are associated with a lower probability of default. Our results are robust to the Heckman two-step estimation that addresses the self-selection effect and a specification designed to rule out the alternative explanation from reputation in the repeated game. Our study provides new insights into the real effects of costless, voluntary and unverifiable disclosures on lending decisions.

Keywords: Online peer-to-peer(P2P) lending, Voluntary disclosures, Repeated game, Lending decisions, Funding success, Information asymmetry

Introduction

The traditional lending style of person-to-person is popular again with the rapid development of the Internet nowadays. Since Zopa, the first peer-to-peer (P2P) online platform in the world was born in 2005 in the UK, the P2P lending model has developed rapidly over the past 10 years. At the end of 2017, there were more than 2414 online lending platforms in China, and the total trade amount reached up to RMB61,038.24 billion (WIND database). Because of it having some advantages summarized by Klafft (2009), disintermediation is happening in the credit market in which bank credit is dominant (Berger and Gleisner 2009; Bruett 2007; Tang 2019).

Territorial restrictions in trade are being broken by the Internet. In the real world, two people who do not even know each other can establish contact on the Internet. Some of the attributes of the Internet could result in people making some non-rational decisions and even neglecting fraud risk due to trusting each other excessively

(Friedman et al. 2000). Under the online P2P lending model, there is serious information asymmetry between the lenders and borrowers because of anonymous transactions. It is difficult for the lenders to judge the quality of the deal. Thus, alleviating the information asymmetry and establishing trust between the borrowers and lenders are the key and basis of bidding a loan and decreasing credit risk (Friedman et al. 2000; Pötzsch and Böhme 2010; Sonenshein et al. 2011).

On online P2P lending platforms, potential lenders can only get the borrowers' credit rating verified by the platform and it is hard information (Li et al. 2014). Nevertheless, on online P2P lending platforms, there is very little credible information like what the traditional economic theory describes, which can affect lending decisions. Therefore, many scholars focus on how to alleviate information asymmetry through social capital (Briceño Ortega and Bell 2011; Freedman and Jin 2011; Lin et al. 2013). Existing research documents that the social capital of borrowers is conducive to forming a debtor–creditor relationship. It involves a group of real friends on an online P2P lending platform or involves communication with the members of the community (Liu et al. 2015). The more social capital the borrower has, the higher the success rate of getting a loan is and the lower the interest rate is (Collier and Hampshire 2010; Everett 2015; Freedman and Jin 2017; Greiner and Wang 2009). This is because, on the one hand, actual relationships among participants would supervise the borrower's repayment behavior, on the other hand, in the acquaintance model, once the borrower defaults, then he/she will face tremendous social punishment such as losing his/her circle of friends or gaining a bad reputation of not being credible in real life.

Social capital can alleviate the information asymmetry between the lenders and the borrowers through mutual supervision and social punishment. However, the fundamental measures of solving information asymmetry lie in enhancing information disclosure and raising the credibility of information. On the web page of an online P2P lending platform, in addition to the borrower's credit rating and his/her personal information, there is another module for the borrower to disclose personal information voluntarily. In this module, the borrower describes and explains personal information, borrowing purpose, repayment ability, borrowing history, and any delinquent information that potential lenders would consider useful. For the content of information disclosed voluntarily, on the one hand, it is difficult to verify the authenticity of the information because both the debtor and creditor are anonymous; on the other hand, even though false information disclosures are detected, it is difficult for the borrower to be punished based on false information. In the case of a cheap-talk model like this, some studies focus on whether voluntary disclosures affect lending decisions or not and the influence mechanisms.

Existing literature has argued that voluntary information disclosures have an influence on lending decisions. Michels (2012) finds that although the costless and unverifiable information disclosed voluntarily is not credible, the more this kind of information the borrower discloses, then the lower the interest rate is and the higher the bid activity is. In addition, for the borrower with a lower credit rating, the role of this kind of information is more significant. Herzenstein et al. (2011) find that personality traits in the information disclosed voluntarily affect lending decisions. Increasing disclosures of personality traits is helpful to raise the success rate of getting a loan. Furthermore, they find different personality traits have different influence on lending decisions. Some descriptions of personality traits express the truth, whereas some could mislead potential

lenders. Larrimore et al. (2011) find whether increasing the number of words in the personal statement or using specific expressions can improve the credibility. Moreover, expressions related to repayment ability can raise the success rate of getting a loan, while expressions of personal information and reasonable explanations for personal financial status decrease the success rate of getting a loan. Li et al. (2014) use "ppdai" (*paipaidai*) trading data and extract six personality traits, including honesty, stability, morality, enterprising, pursuing life quality, and family oriented. They find increasing the number of these personality traits can improve borrowing efficiency, i.e., the success rate is higher and it takes less time to get funded. Some borrowers temporarily fund through the online P2P lending model, while other borrowers wish to get a loan repeatedly and treat this model as a necessary channel in the long run due to the exclusion from traditional credit or the complexity of borrowing procedure. We posit voluntary information disclosures have an important effect on the survival of the borrowers on online lending platforms. Therefore, how voluntary disclosures influence the lenders' decisions, in the case of having borrowing experience, is an important empirical question.

In this study, we investigate the relationship between voluntary disclosures and lending decisions within the context of the repeated cheap-talk game using a unique dataset of unsecured personal loan listings from the online lending platform "ppdai." The process of lending is a game between the borrower and lender. A borrower posts loan request and discloses information voluntarily. Then the lender decides whether to bid according to the borrower's loan request, voluntary information disclosures and the borrowing history. In this process, the borrower takes an action from the strategies of the combination of whether to repay and whether to send a message factually, then the lender chooses a strategy of whether to offer a loan in the case of not knowing the real risk type of the borrower. The borrower's payoff is to get a loan and pay the interest, and the lender's payoff is to earn interest income if the borrower repays the principal and interest at the expiry. The stage game could be repeated if the contract is fulfilled very well.

Our empirical results demonstrate that voluntary disclosures have a stronger positive effect on lending decisions in the repeated cheap-talk game than in the one-shot game. Specifically, for borrowers who have a borrowing history, voluntary disclosures have a stronger positive relationship with funding success. Meanwhile, for borrowers who have a history of getting a loan successfully, this study finds voluntary disclosures are positively associated with funding success. Thus, in the repeated cheap-talk game, the voluntary disclosures are more credible, while in the one-shot game the credibility of voluntary disclosures is relatively poor. In addition, we find two mechanisms through which voluntary disclosures have a greater impact on funding success in a cheap-talk repeated game. One is that voluntary disclosures improve the bidding activity in the cheap-talk repeated game, and the other is that the greater effect of voluntary disclosures on the funding success in the cheap-talk repeated game only holds for the loan listings without a personal guarantee attribution.

Our paper contributes to the nascent literature in two ways: First, prior research demonstrates that voluntary disclosures have an effect on lending decisions, but it does not distinguish influence differences between the first borrowing and multiple borrowings from an online P2P lending platform (Herzenstein et al. 2011; Larrimore et al. 2011; Michels 2012). This study examines the influence of voluntary disclosures on lending

decisions in the setting of the repeated game. This enhances our understanding of how investors use voluntary disclosures in making decisions. Second, existing studies examine the information content of voluntary disclosures from different sides. For instance, Michels (2012) focuses on the objective information related to the loan and repayment situation; Herzenstein et al. (2011) examine the subjective information of personal traits, character, and life state; Larrimore et al. (2011) focus on the style and language of information disclosures. However, voluntary disclosures in a loan listing are made up of the overall description of the borrower and his/her loan details. They express the borrower's economic situation and ability to repay through objective facts, and his/her personality traits. We infer that investors synthesize all the information disclosed voluntarily to analyze and make lending decisions. This study comprehensively analyzes the information content of voluntary disclosures that include objective and subjective dimensions. It is helpful to demonstrate the impact of voluntary disclosures accurately.

The reminder of this paper proceeds as follows: Section 2 reviews the related literature and develops the research hypotheses. Section 3 describes the data, variable construction, and model. Section 4 presents the baseline results. Section 5 includes further discussion and robustness analysis. Finally, we conclude the paper in section 6.

Related research and hypothesis development

Research in psychology and behavioral economics demonstrates that uninformative content affects decisions (DellaVigna and Gentzkow 2010; Gilbert et al. 1993; Nisbett et al. 1981). Mullainathan et al. (2008) and Bertrand et al. (2010) argue that uninformative content has an effect on consumers' choice behavior. Studies on voluntary information disclosures of publicly traded firms document that voluntary disclosures can decrease the costs of capital (Botosan 1997; Sengupta 1998), induce significant changes in price and trading volume (Sivakumar and Waymire 1994), and are associated with less IPO underpricing (Leone et al. 2007).

Existing studies find voluntary disclosures on online platforms have an impact on lending decisions. Voluntary disclosures constitute soft information that is unverifiable. Greiner and Wang (2010) examine the cognitive process of decision making of lenders and demonstrate that lenders process hard information through the central route and soft information through peripheral cues. Peripheral cues help to build trust mechanisms that affect the bidding behavior (Li and Sheng 2016). Michels (2012) argues that one generally hates to lie and it costs something to tell the truth (Gneezy 2005; Evans III et al. 2001), so people do not want to get concessional loans through misleading disclosures. Herzenstein et al. (2011) argue that voluntary disclosures can make the borrower be trusted through an impression management channel (Leary and Kowalski 1990; Schlenker and Weigold 1992), and people's first reaction to information presented to them is to believe it (Gilbert 1991; Gilbert et al. 1993). Thus, the borrower can win the trust of potential lenders through strategic disclosures. Iyer et al. (2015) document that, using the soft and nonstandard information presented by the borrower, peers predict an individual's probability of defaulting on a loan with 45% greater accuracy than by using the borrower's credit score that is generated according to the hard and standard financial information.

In addition, some studies find the appearance of the borrower affects lending decisions. For instance, Duarte et al. (2012) show that borrowers who appear to be more

trustworthy increase the likelihood of getting a loan. Ravina (2019) argues that an increase in the beauty rating increases the probability of getting a loan.

To sum up, the impact of voluntary disclosures on decisions has a theoretical basis from psychology and behavioral economics and there is some evidence from the areas of marketing, stock markets and P2P lending markets to support this view. However, in a cheap-talk game, the credibility of speech lies in that the speech must be self-signaling and self-committing, i.e., the speech is real and the speaker has the incentive to fulfill if his/her speech is believed to be true (Farrell and Rabin 1996; Gibbons 1992). The necessary condition of self-signaling and self-committing is having no conflict between the sender and the receiver. In the online P2P lending market, the borrower strongly desires to get a loan no matter what type he/she is, whereas the lender would only fund the borrower who has the ability and willingness to repay the loan. Therefore, in the one-shot cheap-talk game of the P2P lending market, this necessary condition is false and thus the credibility of voluntary disclosures is in doubt.

In the online P2P lending market, the borrower who tries to raise funds from the online P2P lending platform for the first time and thus has no borrowing history is equivalent to the information discloser in the one-shot game. Online P2P lending is still a relatively new borrowing model and has not been widely accepted and used by the public. Most of the borrowers have not completely approved of online P2P lending when they first borrow, and do not tend to treat this lending model as a long-term borrowing channel. They lack a long horizon and only care about whether they can get a loan or not. They do not pay close attention to the opinions of other traders on the online platform, and hence do not make an effort to establish a good reputation. They are even likely to fake disclosures in order to get funded successfully. Therefore, the truth and credibility of the disclosures presented by first-time borrowers are in doubt.

Subsequent studies gradually relax the necessary conditions of the cheap-talk game. Stocken (2000) conducts a game analysis on voluntary disclosures of listed firms, and finds in the one-shot game voluntary disclosures cannot deliver information effectively, while in the repeated game managers always reveal their information truly and voluntary disclosures can transmit sound information to investors.

Borrowers with borrowing experience are more likely to treat P2P lending as a long-term borrowing channel. For them, the long-term synthetic return of the repeated borrowings in the future exceeds the temporal benefits of defaulting on the first loan,so the game will be repeated. They try to establish a good reputation on the P2P lending platform to get loans. If borrowers fake their disclosures and do not repay loans, then lenders will think the borrowers are not credible and will implement a punishment strategy of not offering loans. In this case, the game between them stops with high probability (Fudenberg and Tirole 1991; Gibbons 1992), and it is difficult for borrowers to get a loan from the platform or the cost of borrowing would increase. Therefore, the voluntary disclosures presented by repeated borrowers are more credible. Michels (2012) also makes a similar conjecture, but it is difficult to test in his study due to limited data. Based on the analysis above, we develop a hypothesis as follows:

> *Hypothesis 1: Voluntary disclosures presented by first-time borrowers on an online peer-to-peer lending platform have low credibility and play a weak role in promoting lending decisions. Whereas voluntary disclosures presented by*

borrowers with a borrowing history have high credibility and play a stronger role in promoting funding success.

Some borrowers who try to raise funds from an online P2P lending platform but do not succeed may not treat the P2P lending model as a long-term borrowing channel. They just try over and over again. In addition, voluntary disclosures presented by first-time borrowers have relatively low credibility. This situation would strengthen the investors' faith that their disclosures are not credible. Thus, although voluntary disclosures presented subsequently by borrowers who never succeed to get a loan are improved, potential investors still think the voluntary disclosures are not credible. This leads to the following hypothesis:

Hypothesis 2: Voluntary disclosures presented by borrowers who never succeed in getting a loan on an online peer-to-peer lending platform have low credibility and play a weak role in promoting lending decisions. Whereas voluntary disclosures presented by borrowers who have a history of getting a loan successfully have high credibility and play a stronger role in promoting funding success.

Research design

In this section, we present the sample selection procedures, the measures of key variables and the model specification.

Sample selection

The data we use is from the "ppdai" lending platform during the period from July 1, 2011 to June 30, 2013, and we extract 4130 observations from a total sample of 122,967 observations by random sampling. Then we manually fetch other information from the platform website according to the identity number of borrowers. We gather 3935 observations after dropping missing data. The period of July 1, 2011 to June 30, 2013 is chosen as the research interval because "ppdai" has entered rapid development since 2011, there have been many borrowing bids and data integrity is relatively high. Moreover, trading rules remained constant during this period. Referring to Michels (2012), we select a random sample rather than the whole sample because each loan listing needs to be read and then we fetch information manually in developing the disclosure measures.

Variables

Dependent variables

Following Duarte et al. (2012) and Li et al. (2014), we use whether the loan listing is funded successfully as the dependent variable. It takes a value of 1 when the loan listing is funded, 0 otherwise. Whether the loan listing is funded successfully is a reflection of the lender's decision. The bidding activity is used as the dependent variable to conduct the mechanism analysis. Following Michels (2012) and Duarte et al. (2012), it is measured by using the number of bids after standardization by the amount of the loan listing.

Voluntary disclosures

Information that borrowers disclose includes many aspects and it is expressed through declarative language. So we need to extract verifiable, universal, reliable and measurable

indicators. This study follows Herzenstein et al. (2011), Larrimore et al. (2011), Li et al. (2014), and Michels (2012) to develop the indicators. Combined with the social and cultural background of China, we extract the indicators of voluntary disclosures from objective and subjective dimensions. The design of indicators needs to stick to the principles of accuracy and analyzability.

Objective indicators refer to the objective content in voluntary disclosures, that is, we can obtain this kind of information directly from the personal statement without subjective understanding or judgment. Referring to Larrimore et al. (2011), Li et al. (2014), and Michels (2012), our paper develops five objective indicators as follows through textual analysis and extracting keywords.

The number of words in the personal statement. The number of words in a personal statement is an intuitive index that reflects the extent to which the borrower pays attention to his/her personal statement. If the borrower believes that a good personal statement can improve the success rate of getting a loan and winning potential lenders' trust, he/she will carefully prepare personal statements and present himself/herself from multiple aspects. Obviously, having no personal statement or containing only one sentence in a personal statement can convey far less information than a specific, detailed personal statement. Larrimore et al. (2011) also find increasing the number of words in a personal statement and using more specific expressions can increase the borrower's credibility.

Expressions related to the purpose of raising funds. The purpose of borrowing is an important aspect of the borrowing detail. Michels (2012) considers the purpose as one of the indicators of voluntary disclosures. We find there are three kinds of expression related to the purpose of borrowing in voluntary disclosures. One is consumption, another is operation, and the last is that there is no statement about the borrowing purpose. On the one hand, the borrowing purpose is one part of the basic borrowing information. There are two reasons for the borrower not to disclose the borrowing purpose. One is that he/she may forget to disclose it, and the other is shunning it deliberately. In this case, it may lead to potential lenders' distrusting the borrower. Therefore, whether the borrowing purpose is disclosed is a major part of judging the content of voluntary disclosures. On the other hand, different borrowing purposes may have different influences on the success rate of getting funded. Michels (2012) finds that borrowers can get a loan readily if their borrowing purpose is to repay another loan. However, with the social and cultural background in China, the idea of borrowing money to consume is not yet prevalent, and thus such a motive may encounter a negative assessment. Therefore, the borrowing purpose of consumption or operation is an important aspect of voluntary disclosures. Based on this, we construct two indicators related to the borrowing purpose. One is whether consumption is disclosed as the purpose of borrowing and the other is whether operation is disclosed as the purpose of borrowing.

Expressions related to revenue. Revenue is an important aspect of economic strength and repayment capacity that the borrower conveys on the platform. Michels (2012) considers whether disclosing yearly or monthly revenue is an important indicator. He finds many borrowers say their revenue is stable in their personal statement. However, it is only a qualitative description and it is difficult to convey a clear concept. Therefore, this paper takes stating the specific amount of revenue as an indicator of voluntary disclosures. Larrimore et al. (2011) also find digital

expressions related to repayment capacity or revenue can increase the probability of repayment.

Expressions related to being an online seller. Some borrowers claim they are online sellers of Taobao or other online shops. They also state the grade of the online shop and explain they need to borrow for capital turnover and stock in peak season. This kind of statement, on the one hand, can convey the borrower's personal identity and occupation information to potential lenders. On the other hand, it provides an information channel for potential lenders to know the borrower's operation state. For instance, potential lenders are able to visit the borrower's store to find out about its sales and credit, and so on.

Subjective indicators measure the borrower's personal characteristics and quality which can reflect their credibility. A borrower discloses voluntarily to express that he/she is trustworthy. Arrow (1974) and Mayer et al. (1995) point out that integrity, kindness and capacity are indicators of the borrower's credibility. Thus, we develop the subjective indicators according to the three characteristics of integrity, kindness and capacity.

Following Li et al. (2014), we build the subjective indicators. First, we employ four research assistants who have similar characteristics to borrowers on the P2P online lending platform and are strangers to each other. Second, the research assistants extract nine characteristics at least through analyzing the borrower's disclosures. Finally, each characteristic is kept if the four research assistants have all extracted this characteristic. We keep the characteristic which two or three of the research assistants have extracted while the four research assistants reach a consensus.

By doing so, we choose *Credibility*, *Stability*, *Family*, *Quality*, *Enterprise*, *Morality* as the subjective indicators. If the borrower's disclosure contains the characteristic which an indicator represents, this indicator would take a value of 1, otherwise 0.

In Table 1, we report all the indicators and examples of voluntary disclosures. We present the frequency distribution of the indicators of voluntary disclosures in Panel A of Table 2. About 25.14% of borrowers state the purpose of borrowing is operation or consumption. 25% of borrowers describe their level of income in detail. 39.81% of borrowers state that they have a stable income. 36.51% of borrowers have their own business. 18.79% of borrowers show that they are credible. 24.03% of borrowers hope to have a high quality life. However, only 8.19% of the borrowers have the characteristic of morality and only 7.85% of the borrowers are family-centered. This implies the information content of subjective voluntary disclosures is relatively low.

In Panel B of Table 2, we present the correlations between the indicators of voluntary disclosures. The correlative coefficients among indicators are relatively low. This suggests there is little overlapping information among these indicators and these indicators reflect the voluntary disclosures well from different perspectives.

Repeated game. We define the repeated game as two dummy variables. One is whether borrowers have borrowing experience (*Ltimes*) and the other is whether borrowers have a successful borrowing experience (*Lsuccess*). *Ltimes* takes a value of 1 when the borrower has never issued a loan listing on the P2P platform, 0 otherwise. *Lsuccess* takes a value of 1 when the borrower has never successfully gotten a loan on the P2P platform, 0 otherwise. For robustness, we also use the times of the repeated game to check the research hypotheses hereafter. It includes the times of borrowing (*Times*) and the times of successful funding (*Success*).

Table 1 Definitions and examples of voluntary disclosure

Indicator	Definition	Example
Stwords	The number of words. It takes a value of 1 when the number of words in a personal statement is greater than the median, 0 otherwise.	
Consumption	It takes a value of 1 when the purpose of borrowing clearly in a personal statement is for consumption, 0 otherwise.	I usually go outside to play a game and chat online at the weekend. I feel inconvenienced, so I want to buy a PC.
Operation	It takes a value of 1 when the purpose of borrowing clearly stated in a personal statement is for operation, 0 otherwise.	During the Universiade period, there are many exhibitions, and I received some orders for exhibition arrangement and promotion on the weekend. In the early stage, I need to advance some expenses (including propaganda, exhibition arrangement, equipment, personnel salary and other expenses). The payback party is the exhibition work center, and the payback is guaranteed.
Income	It takes a value of 1 when there is a specific description statement about revenue in the personal statement, 0 otherwise.	I am running a game room with a monthly income of RMB4500. My wife is running a lottery station with a monthly income of RMB3000. The total monthly income is RMB7500.
Taobao	It takes a value of 1 when the borrower is an online seller, 0 otherwise.	My Taobao store is for website construction and cooperation with distributors and is now a five-star shop. I hope to expand the business scale. I hope everybody will support it. Store: http://weiq888.taobao.com
Credibility	The borrower's description makes other people believe that he/she can repay the loan on time and is honest.	I hope friends support! Repay as early as possible. Have borrowed many times and had no default, and repayment is guaranteed.
Stability	The borrower has stable revenue. His/her occupation and life are also stable, and there is a fixed monthly salary.	I am a wage earner and have stable work, revenue and bonuses, and no pressure to repay.
Family	The borrower pays attention to family and therefore borrows for his/her family.	Installing gas pipes in my mother's house.
Quality	The borrower has a demand for a great quality life and therefore hopes to obtain a loan in order to consume and travel, and so on.	I want to change to a new apple phone. I want to borrow from the online lending platform because my money has been occupied and experience the borrowing process on the "ppdai" lending platform. Hope everybody will support!
Enterprise	The borrower has his/her own business and wishes to expand his/her business.	I am a Taobao double crown seller and borrow from an online lending platform in order to stock. In the last month, for various reasons, my online store was almost interrupted. Now peak season is coming and business will be back to normal. The loan will be used to pay for stocking. Special payment is for a special purpose.
Morality	The borrower is a moral person and can be strict with himself/herself.	I want to use this money to look after my friends.

Empirical model

To examine how voluntary disclosures affect the lending success in the repeated cheap-talk game, we estimate the following model:

$$Full = \alpha + \beta_1 \times Score + \beta_2 \times RepeatedGame + \beta_3 \times Score \times RepeatedGame \\ + \gamma \times Z + Year + \varepsilon. \tag{1}$$

The dependence variable (*Full*) in Eq. (1) is a dummy variable to measure whether the loan has been funded. Funding success is a comprehensive reflection of lending

Table 2 Summary statistics of voluntary disclosures

Panel A Frequency

	Stwords	Cosumption	Operation	Income	Taobao	Credibility	Stability
Frequency	49.60%	25.18%	25.65%	25.14%	5.11%	18.79%	39.81%
	Family	Quality	Enterprise	Morality			
Frequency	7.85%	24.03%	36.51%	8.19%			

Panel B Correlation

	Stwords	Consumption	Operation	Income	Taobao	Credibility	Stability
Stdwords	1						
Consumption	0.146***	1					
Operate	0.232***	−0.232***	1				
Income	0.392***	0.202***	0.030*	1			
Taobao	0.115***	− 0.097***	0.322***	− 0.040**	1		
Credibility	0.092***	0.005	0.040**	−0.006	0.039**	1	
Stability	0.398***	0.126***	0.058***	0.494***	0.031**	0.052***	1
Family	0.164***	0.190***	−0.043***	0.154***	−0.055***	− 0.02	0.101***
Quality	0.143***	0.602***	−0.184***	0.135***	−0.097***	−0.004	0.085***
Enterprise	0.278***	−0.172***	0.622***	0.082***	0.268***	0.065***	0.138***
Morality	0.004	− 0.022	−0.035**	− 0.042***	−0.028*	0.01	−0.069***

Panel B Correlation(con't)

	Family	Quality	Enterprise	Morality
Family	1			
Quality	0.146***	1		
Enterprise	− 0.069***	−0.240***	1	
Morality	0.029*	0.007	−0.067***	1

Notes. Panel A presents the frequency of the indicators of voluntary disclosures. Panel B presents the correlation matrix of the indicators of voluntary disclosures. *, **, *** represents 10%, 5% and 1% confidence levels, respectively

decisions. *RepeatedGame* is a dummy variable that represents the two variables of the repeated game. One is whether the borrowers have borrowing experience (*Ltimes*) and the other is whether the borrowers have a successful borrowing experience (*Lsuccess*). *Z* is a vector of controls that include the borrower's and bid's characteristics, including the amount, term, interest rate of the loan (*Lnamount, Months, Interest*) and number of authentication, gender, age, credit rate, occupation of the borrower (*Idnumber, Gender, Age, Bgrade, Salaried, Seller, Boss, Student*). We follow prior studies and use the determinants of lending success as these control variables (Herzenstein et al. 2011; Larrimore et al. 2011; Li et al. 2014; Michels 2012). *Year* captures fixed effect. We cluster the standard errors by year in our baseline tests. Definitions of the variables are presented in Table 14 in the Appendix.

The interaction term in Eq. (1) is the key variable of interest in this study. If the hypothesis is true, the coefficient of the interaction between *Score* and *RepeatedGame* is significantly negative.

Empirical results

Summary statistics

Table 3 presents the summary statistics of the main variables used in this study. About 44% of the borrowers have no borrowing history, and 64% of the borrowers have no successful borrowing history. This suggests more than 35% of the borrowers have a borrowing or successful borrowing experience on the "ppdai" platform. This data

Table 3 Descriptive statistics of main variables

Variable	No. of Obs.	Mean	Std.Dev.	Min	Median	Max
Full	3935	0.71	0.45	0	1	1
Score	3935	2.87	1.86	0	3	10
Ltimes	3935	0.44	0.49	0	0	1
Lsuccess	3935	0.64	0.48	0	1	1
Bidnumber	3935	0.50	0.44	0	0	5
Lnamount	3935	8.09	0.99	5	8	13
Months	3935	5.86	3.17	1	6	12
Interest	3935	19.87	4.44	3	22	26
Bgrade	3935	2.11	1.04	1	2	6
Guarantee	3935	0.16	0.36	0	0	1
Idnumber	3935	1.99	0.86	1	2	3
Gender	3935	0.76	0.42	0	1	1
Age	3935	2.15	0.93	1	2	4
Worker	3935	0.70	0.46	0	1	1
Seller	3935	0.09	0.29	0	0	1
Boss	3935	0.12	0.32	0	0	1
Student	3935	0.03	0.16	0	0	1
Delinquency	1462	0.06	0.24	0	0	1

Notes. This table presents the summary statistics of the main variables. See Table 14 for detailed definitions of the variables

feature provides an ideal setting for us to examine the impact of voluntary disclosures on lending decisions within the context of the cheap-talk repeated game.

About 71% of the loan listings are funded successfully. The content of voluntary disclosures is relatively low and its mean is 2.87. There are ten indicators at most in the 11 indicators of voluntary disclosures and some of the borrowers do not reveal any information. As regards demographics, the average value of gender is 0.76, and hence most of the borrowers are male. Their age concentrates between 26 and 31, and the average age is 28. 70% of the borrowers are wage earners, and 12% of the borrowers are private entrepreneurs, 9% of the borrowers are online sellers, and only 3% of the borrowers are students. Most of the loan listings have high interest rates and are short-term. About 6% of the loans are 90 days past due.

We further analyze the difference of the content of voluntary disclosures between the fully funded loan listings and unfunded loan listings. Table 4 presents the results. For the two indicators of *Credibility* and *Taobao*, the mean value of fully funded listings is significantly greater than unfunded listings. Nevertheless, for the five indicators of *Score*, *Consumption*, *Income*, *Family*, and *Quality*, the mean value of fully funded listings is significantly lower than unfunded listings. Thus, simply increasing the voluntary disclosures in the loan listing cannot ensure an increase of the likelihood of success funding.

Borrowing experience, voluntary disclosures and funding success

We first analyze the influence of borrowing experience on the relationship between voluntary disclosures and funding success. Table 5 reports the results. For robustness, we use six different models to examine the impact of borrowing experience on the

Table 4 Information content of voluntary disclosures

	Unfunded			Funded		Mean.Diff.	
	N	Mean	Std.Dev	N	Mean	Std.Dev	Mean.Diff.	Std.Dev
Score	1141	3.013	1.653	2794	2.808	1.939	0.205***	3.136
Stwords	1141	0.479	0.500	2794	0.481	0.500	−0.002	−0.122
Consumption	1141	0.366	0.482	2794	0.186	0.389	0.180***	12.265
Operation	1141	0.261	0.439	2794	0.255	0.436	0.006	0.413
Income	1141	0.282	0.450	2794	0.223	0.416	0.060***	3.979
Taobao	1141	0.023	0.149	2794	0.069	0.254	−0.046***	−5.77
Credibility	1141	0.158	0.365	2794	0.206	0.404	−0.048***	−3.477
Stability	1141	0.384	0.487	2794	0.397	0.489	−0.013	−0.781
Family	1141	0.114	0.318	2794	0.056	0.230	0.058***	6.402
Quality	1141	0.342	0.475	2794	0.198	0.398	0.144***	9.734
Enterprise	1141	0.380	0.486	2794	0.388	0.487	−0.007	−0.424
Morality	1141	0.068	0.252	2794	0.064	0.244	0.005	0.537

Notes. This table presents the summary statistics of voluntary disclosures by whether the loan is funded or not. *, **, *** represents 10%, 5% and 1% confidence levels, respectively

relationship between voluntary disclosures and lending decisions. These models are based on whether we control for *Year* as well as several simplified specifications without the interaction term or the control variables.

The coefficients of *Score* in columns 1 and 4 are positive and significant at the 1% level, suggesting that voluntary disclosures are positively associated with funding success. This evidence is consistent with Li et al. (2014) and Larrimore et al. (2011) basically. However, this evidence does not consider whether the borrowers have a borrowing or successful borrowing history.

Consistently across the models in columns 3 and 6, the coefficients of *Ltimes×Score* are negative and significant at the 5% level, suggesting voluntary disclosures play a stronger role in promoting funding success when borrowers have borrowing experience on the platform. To be more concrete, according to the coefficient of *Ltimes×Score* in column 6, voluntary disclosures presented by the borrowers who have a borrowing history have a 1.3% greater impact on the probability of funding success than those presented by borrowers who have no borrowing history. This finding is consistent with the hypothesis that voluntary disclosures presented by the borrowers who have a borrowing history have a high level of credibility and play a stronger role in promoting funding success.

The signs on the coefficients of the control variables are as expected. The coefficients of *Lnamount*, *Months* and *Interest* are negative and significant. This suggests the loan listings with a smaller amount, shorter term, and lower interest can get funded more easily. This finding also indicates that lenders pay close attention to the credit risk and liquidity of P2P lending rather than only pursuing high returns.

The positive and significant coefficient of *Idnumber* indicates that more certifications are helpful to enhance the probability of funding success. The negative and significant coefficient of *Gender* indicates that investors would rather fund female borrowers than male borrowers. This finding is consistent with the results of Pope and Sydnor (2011) and Ravina (2019). As expected, the coefficient on *Age* is significantly positive, indicating investors would rather fund older borrowers. Maybe this

Table 5 Borrowing experience, voluntary disclosures and funding success

	(1)	(2)	(3)	(4)	(5)	(6)
Ltimes×Score		−0.014**	−0.014**		−0.013*	− 0.013**
		(−0.007)	(−0.006)		(−0.007)	(− 0.006)
Ltimes		−0.217***	−0.032		−0.221***	− 0.024
		(−0.024)	(−0.024)		(−0.024)	(− 0.024)
Score	0.014***	0.016***	0.022***	0.009***	0.017***	0.017***
	(−0.003)	(−0.005)	(− 0.005)	(−0.003)	(− 0.005)	(−0.005)
Lnamount	−0.063***		−0.063***	−0.070***		−0.069***
	(−0.007)		(−0.007)	(−0.007)		(−0.007)
Months	−0.012***		−0.013***	−0.012***		−0.012***
	(−0.002)		(−0.002)	(−0.002)		(−0.002)
Interest	−0.030***		−0.028***	−0.028***		−0.026***
	(−0.002)		(−0.002)	(−0.002)		(−0.002)
Bgrade	−0.008		−0.012	0.022*		0.014
	(−0.01)		(−0.01)	(−0.011)		(−0.011)
Idnumber	0.204***		0.187***	0.195***		0.182***
	(−0.01)		(−0.01)	(−0.01)		(−0.01)
Gender	−0.085***		−0.087***	−0.103***		−0.103***
	(−0.014)		(−0.014)	(−0.015)		(− 0.015)
Age	0.049***		0.050***	0.047***		0.048***
	(−0.007)		(−0.007)	(− 0.007)		(−0.007)
Worker	−0.019		−0.024	− 0.004		− 0.009
	(−0.021)		(−0.021)	(− 0.021)		(− 0.022)
Seller	0.149***		0.148***	0.165***		0.162***
	(−0.034)		(− 0.035)	(−0.035)		(−0.035)
Boss	0.029		0.031	0.034		0.035
	(−0.024)		(−0.025)	(− 0.025)		(−0.025)
Student	0.026		0.028	0.015		0.018
	(−0.037)		(− 0.038)	(−0.037)		(−0.038)
Year	No	No	No	Yes	Yes	Yes
N	3935	3935	3935	3935	3935	3935
Pseudo R^2	0.289	0.08	0.296	0.298	0.082	0.304

Notes. Robust standard errors are reported in parentheses. *, **, *** represents statistical significance at the 10%, 5% and 1% confidence levels, respectively

is because older borrowers are more economically stable and can make repayments. The positive and significant coefficient of *Seller* indicates an online seller can get a loan readily.

Successful borrowing experience, voluntary disclosures and funding success

Next, we examine the influence of successful borrowing experience on the relationship between voluntary disclosures and funding success. Table 6 presents the results. For robustness, we use several different models that are based on whether we control for *Year* or not and simplified specifications without the control variables. Consistently across the models in columns 1 and 3, the coefficients of

Table 6 Successful borrowing experience, voluntary disclosures and funding success

	(1)	(2)	(3)	(4)
Lsuccess×Score	−0.043***	−0.037***	−0.042***	− 0.036***
	(0.010)	(0.009)	(0.010)	(0.009)
Lsuccess	−0.297***	−0.095***	− 0.299***	−0.081***
	(0.028)	(0.030)	(0.028)	(0.030)
Score	0.046***	0.045***	0.045***	0.041***
	(0.009)	(0.008)	(0.009)	(0.008)
Lnamount		−0.071***		−0.075***
		(0.007)		(0.007)
Months		−0.014***		−0.014***
		(0.002)		(0.002)
Interest		−0.024***		−0.023***
		(0.002)		(0.002)
Bgrade		−0.038***		−0.013
		(0.011)		(0.012)
Idnumber		0.188***		0.182***
		(0.010)		(0.010)
Gender		−0.089***		−0.102***
		(0.014)		(0.015)
Age		0.049***		0.047***
		(0.007)		(0.007)
Worker		−0.021		−0.009
		(0.020)		(0.021)
Seller		0.141***		0.152***
		(0.034)		(0.035)
Boss		0.024		0.029
		(0.024)		(0.024)
Student		0.036		0.026
		(0.036)		(0.036)
Year	No	No	No	Yes
N	3935	3935	3935	3935
Pseudo R²	0.134	0.312	0.136	0.318

Notes. Robust standard errors are reported in parentheses. *, **, *** represents statistical significance at the 10%, 5% and 1% confidence levels, respectively

Lsuccess× Score are negative and significant at the 1% level. The coefficients of *Lsuccess×Score* are still negative and significant at the 1% level and the magnitudes have little effects even while controlling for the other variables of the loan's and borrower's characteristics. This suggests voluntary disclosures play a stronger role in promoting funding success when borrowers have a successful borrowing experience on the platform. To be more concrete, according to the coefficient of *Lsuccess× Score* in column 4, voluntary disclosures presented by borrowers who have a successful borrowing history have a 3.6% greater impact on the probability of funding success than those presented by borrowers with no successful borrowing history.

This evidence is consistent with the hypothesis that voluntary disclosures presented by borrowers with a successful borrowing experience have high credibility and play a

stronger role in promoting funding success. Overall, whether it is in the case of having a borrowing history or a successful borrowing history, our baseline results suggest that voluntary disclosures have higher credibility in the repeated game than in the one-shot game.

Mechanisms

In this subsection, we explore the possible underlying mechanisms through which voluntary disclosures in the repeated game of P2P lending affect funding success. Specifically, we examine whether the bidding activity and the personal guarantee attribution are possible underlying economic mechanisms through which voluntary disclosures in the repeated game of P2P lending play a role in promoting funding success.

Influence of voluntary disclosures on bidding activity

Voluntary disclosures may first influence the bidding behavior in the repeated game, and finally all the lenders' bidding behaviors affect funding success. Therefore, it is possible that voluntary disclosures increase the probability of getting funded through improving the bidding activity in the repeated game. Michels (2012) finds the number of bids on a loan listing increases as the amount of voluntary, unverifiable information increases in a loan listing. However, this finding is only based on the one-shot game. In this subsection, we examine whether the bidding activity is an underlying mechanism in the context of the repeated game.

Because voluntary disclosures presented by borrowers with a borrowing history or successful borrowing history have high credibility, voluntary disclosures attract more investors to bid on their loans. Therefore, we expect that voluntary disclosures presented by borrowers with a borrowing history or successful borrowing history augment the bidding activity.

To examine the influence of voluntary disclosures on the bidding activity in the repeated game of P2P lending, we estimate the following model:

$$\begin{aligned}
Activity = \alpha + \beta_1 \times Score + \beta_2 \times RepeatedGame + \beta_3 \times Score \\
\times RepeatedGame + \gamma \times Z + Year + \varepsilon.
\end{aligned} \tag{2}$$

The dependent variable in Eq. (2) captures the bidding activity. It is defined as the number of bids after standardization by the amount of the loan listing. Definitions of the variables are as defined in Table 14. All of the control variables are the same as in Eq. (1). The coefficient on the interaction term reflects the different effect of voluntary disclosures on the bidding activity for borrowers with no borrowing history or no successful borrowing history. If our conjecture is correct, i.e., if voluntary disclosures in the repeated game of P2P lending are more likely to improve the bidding activity, then we expect β_3 to be negative and significant.

We report the results in Table 7. The coefficient estimates of *Ltimes×Score* and *Lsuccess×Score* are negative in both specifications and significant at the 1% level. This finding suggests voluntary disclosures in the repeated game of P2P lending attract more lenders to bid and thus improve the bidding activity. As a consequence, the likelihood of funding success might significantly increase. In summary, consistent with our conjecture, this result suggests an increase of the bidding activity

Table 7 Influence of voluntary disclosures on bidding activity in the repeated game

(1)	(2)	(3)	(4)
−0.0384***		−0.0386***	
(0.0093)		(0.0093)	
	−0.0302***		−0.0301***
	(0.0077)		(0.0077)
0.0083**	0.0066*	0.0081**	0.0077**
(0.0039)	(0.0037)	(0.0041)	(0.0038)
Yes	Yes	Yes	Yes
No	No	Yes	Yes
2794	2794	2794	2794
0.2	0.21	0.21	0.21

Notes. Robust standard errors are reported in parentheses. *, **, *** represents statistical significance at the 10%, 5% and 1% confidence levels, respectively

appears to be one underlying mechanism through which voluntary disclosures have an effect on funding success in the repeated game of P2P lending.

Guarantee, voluntary disclosures and funding success in the repeated game

On the "ppdai" platform, a borrower can seek another registered individual to provide a guarantee for the borrower's loan. As compensation, the guarantor receives a payoff of up to 5% of the total loan amount. In this subsection, we examine whether the personal guarantee is a possible underlying mechanism through which voluntary disclosures in the repeated game of P2P lending affect funding success.

A guarantee can alleviate adverse selection and moral hazard due to information asymmetry between the borrower and lender (Hart and Moore 1998; John et al. 2003). It can also reduce the creditors' expected losses at default (Manove et al. 2001). Therefore, to some extent, guarantee can ensure the funds provided by lenders security, thus improving lenders' investment enthusiasm and facilitating lending transactions. However, this effect is contingent on a special relationship between the guarantor and borrower. On the "ppdai" platform, the borrower and the guarantor might not know each other very well. Therefore, a natural extension is to examine whether the personal guarantee affects the relationship between voluntary disclosures and lending decisions in the repeated game.

Because a guarantee can help to reduce the credit risk, the lenders might pay little attention to screening loan listings with personal guarantees. Borrowers who post their loan request with a personal guarantee anticipate this point, and then they may not deliberately shape the credibility through voluntary disclosures in the repeated game. Thus, we expect there is no significant difference in the information content of voluntary disclosures between the one-shot and repeated game for loans with a personal guarantee attribution, and the main finding that voluntary disclosures play a stronger role in promoting funding success in the repeated game only holds for loans without a personal guarantee attribution.

To assess how the personal guarantee affects the relationship between voluntary disclosures and funding success in the repeated game, we estimate Eq. (1)

separately for the loan listings with and without a personal guarantee. Table 8 reports the results. The coefficient estimates of *Ltimes×Score* and *Lsuccess×Score* in the sample of loan listings without a personal guarantee are negative and significant at the 5% and 1% level in columns 1 and 3, respectively, while those in the sample of loan listings with a personal guarantee are not statistically significant. This evidence is consistent with our conjecture.

Overall, the evidence presented in this subsection suggests voluntary disclosures increase the probability of funding success in the repeated game only when borrowers post the loan listings without a personal guarantee.

Further discussion and robustness checks
Different voluntary disclosures and funding success in the repeated game
As mentioned above, the information disclosed voluntarily includes objective and subjective information. The borrower discloses objectively through using concrete words, quantitative descriptions, and financial terms in general. These concrete words are the detailed representations of objects and allow for faster processing (Paivio 1990; Ter Doest et al. 2002). The concrete information in objective voluntary disclosures effectively reduces uncertainty and builds confidence regarding whether the borrower desires to repay the loan. With quantitative descriptions and the use of financial terms, based on the elaboration likelihood model (Petty and Cacioppo 1986), lenders are more likely to be persuaded by central cues as opposed to peripheral cues. Therefore, loan requests with quantitative descriptions and the use of financial terms are more likely to be successful. Larrimore et al. (2011) state that both specifying concreteness and quantitative information are positively correlated with funding success.

Nevertheless, too many humanizing details in objective disclosures could act as a red flag for lenders and may reduce funding success due to lenders suspecting that the borrower may be trying to avoid revealing a poor financial situation. Larrimore et al. (2011) provide the supporting evidence.

Table 8 Guarantee, voluntary disclosures and funding success in the repeated game

	Borrowing experience		Successful borrowing experience	
	Nonguaranteed	Guaranteed	Nonguaranteed	Guaranteed
	(1)	(2)	(3)	(4)
Ltimes×Score	− 0.015**	0.017		
	(0.007)	(0.022)		
Lsuccess×Score			−0.040***	− 0.049
			(0.010)	(0.095)
Score	0.023***	0.012	0.049***	0.066
	(0.005)	(0.016)	(0.009)	(0.094)
Controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
N	3322	613	3322	613
Pseudo R^2	0.239	0.364	0.252	0.350

Notes. Robust standard errors are reported in parentheses. *, **, *** represents statistical significance at the 10%, 5% and 1% confidence levels, respectively

Based on trust which involves three components: integrity, ability, and benevolence (Mayer et al. 1995), in subjective disclosures, the trustworthy, religious, moral and hardworking identities lead lenders to believe that borrowers ascribe to the lender-endorsed principle of fulfilling obligations and that success identity can increase perceptions of ability and the belief that the borrower is able to fulfill promises (Aquino et al. 2009; Butler 1991; Weaver and Agle 2002; Witt et al. 2002). These are conducive to increase funding success (Herzenstein et al. 2011; Newell and Swan 2000). However, providing justifications in the subjective disclosures cannot satisfy the need for centrally processed persuasion and would be more likely to be rejected by lenders (Larrimore et al. 2011). Consequently, it is negatively associated with funding success.

According to the above analysis, different types of voluntary disclosures have idiosyncratic effects on lending decisions. We think how each type of voluntary disclosures in the repeated game affects funding success is an important empirical question. In this subsection we further explore which kind of information investors pay more attention to, and whether they are equally important for lending decisions in the repeated game.

Table 9 reports the results. The coefficient estimate of *Ltimes×ScoreObj* is negative and significant at the 5% level, while that of *Ltimes×ScoreSub* is not significant. This finding indicates when borrowers have a borrowing history, only the objective voluntary disclosures have a stronger effect on lending decisions. The coefficient estimates of *Lsuccess×ScoreObj* and *Lsuccess×ScoreSub* are all negative and significant at the 1% level. This finding suggests both objective and subjective voluntary

Table 9 Different voluntary disclosures and funding success in the repeated game

	Borrowing experience		Successful borrowing experience	
	Objective information	Subjective information	Objective information	Subjective information
	(1)	(2)	(3)	(4)
Ltimes×ScoreObj	−0.022**			
	(0.011)			
Ltimes×ScoreSub		−0.015		
		(0.012)		
Lsuccess×ScoreObj			−0.057***	
			(0.015)	
Lsuccess×ScoreSub				−0.050***
				(0.016)
ScoreObj	0.018**		0.057***	
	(0.008)		(0.015)	
ScoreSub		0.032***		0.065***
		(0.009)		(0.015)
Controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
N	3935	3935	3935	3935
Pseudo R^2	0.302	0.305	0.316	0.318

Notes. Robust standard errors are reported in parentheses. *, **, *** represents statistical significance at the 10%, 5% and 1% confidence levels, respectively

disclosures play a stronger role in promoting lending decisions when borrowers have a successful borrowing history. Based on the analysis above, in the case of having a successful borrowing history, both the objective and subjective voluntary disclosures contribute to the greater information content. However, in the case of having a borrowing history the greater information content of voluntary disclosures mainly stems from the objective rather than subjective disclosures. In this sense, the voluntary disclosures have greater information content in the repeated game in that the subjective disclosures affect lending decisions only when the borrowers have a successful borrowing history.

Influence of voluntary disclosures on loan performance in the repeated game

Prior studies have provided mixed evidence on the relationship between voluntary disclosures and loan performance. Michels (2012) finds voluntary and unverifiable disclosures have a strong negative association with future defaults. Herzenstein et al. (2011) document that as the number of identity claims in narratives increases, loan performance suffers. They also find identities focused on being trustworthy or successful are less predictive of loan performance than moral and economic hardship. Given that voluntary disclosures have a greater effect on lending decisions in the repeated game than in the one-shot game of P2P lending, a natural extension is to explore how voluntary disclosures in the repeated game of P2P lending relate to loan performance. To check this, we perform a Probit regression of an indicator for eventual loan default on *Score* and control variables in the two cases of having a borrowing history and having a successful borrowing history. The sample we use is limited to the listings that result in loans. The model is as follows:

$$Delinquency = \alpha + \beta_1 \times Score + \gamma \times Z + Year + \varepsilon, \tag{3}$$

where the dependent variable in Eq. (3) is the delinquency dummy. Following Gross and Souleles (2002) and Agarwal et al. (2015), we define it as an indicator that equals 1 when the loan is 90 days past due, 0 otherwise. All of the control variables are the same as in Eq. (1).

We present the results of this model in Table 10. Based on the coefficient estimate of *Score* in columns 2 and 4, an additional disclosure is associated with a 7.67% less probability of future default when borrowers have a borrowing experience and an 8.19% less probability of future default when borrowers have a successfully borrowing history. This finding indicates that voluntary disclosures negatively predict future default in the repeated game of P2P lending. This implies that voluntary disclosures can help lenders make decisions effectively in the repeated game of P2P lending and hence decrease the probability of default significantly. In the one-shot game, the influence of voluntary disclosures on loan performance is negative but not significant. Overall, this evidence again suggests that voluntary disclosures in the repeated game of P2P lending have greater credibility.

Table 10 Voluntary disclosures and loan performance in the repeated game

	Borrowing experience		Successful borrowing experience	
	No	Yes	No	Yes
	(1)	(2)	(3)	(4)
Score	−0.0313	−0.0767**	−0.0504	−0.0819*
	(0.0554)	(0.0391)	(0.0426)	(0.0457)
Controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
N	276	1074	460	940
Pseudo R²	0.21	0.21	0.19	0.21

Notes. Robust standard errors are reported in parentheses. *, **, *** represents statistical significance at the 10%, 5% and 1% confidence levels, respectively

Alternative explanation from reputation

The reputation of borrowers affects lenders' decisions (Diamond 1989). Prior transactions constitute reputation information (Weiss et al. 2008). On the P2P lending platform, in addition to honest voluntary disclosures, paying back loans on time can also build a good reputation. It is a major concern whether the voluntary disclosures still form the basis of lenders' decisions or not when borrowers have accumulated a good reputation in repeated transactions through paying back their loans on time.

To examine how reputation from the paying back the loans on time alters the impact of the voluntary disclosures on lending decisions in the repeated game, we perform a Probit regression of an indicator for whether the loan listing is funded on *Score*, *Reputation* and control variables. We use the times of repayments on time to construct the variable of *Reputation*. The sample we use is limited to the loan listings whose borrowers have a borrowing history or a successful borrowing history.

Table 11 presents the results. In the two cases of having a borrowing experience and a successful borrowing experience, in columns 2 and 4 respectively, the coefficient estimates of *Score* are all positive and significant at the 5% level. This finding suggests that even though the borrowers have a good reputation established through paying back their loans on time, voluntary disclosures would still be an

Table 11 Reputation, voluntary disclosures and funding success

	Borrowing experience		Successful borrowing experience	
	(1)	(2)	(3)	(4)
Score	0.011***	0.013**	0.013***	0.014**
	(0.004)	(0.005)	(0.004)	(0.006)
Reputation		0.095***		0.035**
		(0.019)		(0.016)
Controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
N	2186	2186	1293	1293
pseudo R²	0.252	0.250	0.199	0.222

Notes. Robust standard errors are reported in parentheses. *, **, *** represents statistical significance at the 10%, 5% and 1% confidence levels, respectively

important basis for the decision of lenders and contribute to funding success. Thus, we dismiss the alternative explanation from reputation.

Heckman treatment effect

Because the bidding activity can only be observed when the loan listing gets successfully funded, we estimate a Heckman two-step model (Heckman 1979). In the first step, we perform a regression of an indicator for the loan listing getting successfully funded on the interaction between *Ltimes* and *Score* when borrowers have a borrowing history, the interaction between *Lsuccess* and *Score* when borrowers have a successful borrowing history, and the control variables. In the second step, the dependent variable is the bidding activity and the inverse Mills ratio as an independent variable is introduced to the model to control for the selection effect. We omit *Guarantee* from the regression to avoid identification only through nonlinearity.

We report the results in Table 12. The inverse Mills ratio is computed according to the results of the first stage regression and is included in the second stage regression. The coefficient estimates of the Mills ratio in columns 2 and 4 are not statistically significant, suggesting little sample selection bias.

Given that the loan listing is funded successfully, voluntary disclosures presented by borrowers with a borrowing history have a 4% greater impact on the bidding activity than those presented by borrowers with no borrowing history. Meanwhile, voluntary disclosures presented by borrowers with a successful borrowing history have a 3.4% greater impact on the bidding activity than those presented by borrowers with no successful borrowing history. Thus, even though we have a concern over selection bias, the results from the Heckman two-step model are largely consistent with the main results.

Alternative measures of repeated game variables

In this subsection, we once again check the influence of voluntary disclosures on funding success in the repeated game using the times of borrowing (*Times*) and the times of getting successfully funded (*Success*) as the measure of the repeated game. Table 13 reports the Probit regression results. The coefficient estimates of *Times×Score* and *Success×Score* are positive and significant at the 5% level, suggesting that the influence of voluntary disclosures on funding success augments as the times of the repeated game increase. This finding once again shows that voluntary disclosures have a stronger effect on lending decisions in the repeated game than in the one-shot game.

Conclusion

Although a large body of research examines the role of information disclosures in alleviating market inefficiencies, existing studies scarcely pay attention to voluntary and unverifiable disclosures, especially under the setting of the repeated game. Using a unique dataset from a P2P lending platform, "ppdai," we investigate the relationship between voluntary disclosures and lending decisions in the repeated game. We document that voluntary disclosures in the repeated game play a stronger role in promoting

Table 12 Voluntary disclosures and the bidding activity: The Heckman two–step estimation

	Borrowing experience		Successful borrowing experience	
	Stage1	Stage2	Stage1	Stage2
	(1)	(2)	(3)	(4)
Ltimes×Score	−0.051*	−0.040***		
	(−1.86)	(−5.08)		
Ltimes	−0.175*	0.225***		
	(−1.77)	(7.61)		
Lsuccess×Score			−0.122***	−0.034***
			(−3.32)	(−4.63)
Lsuccess			−0.542***	0.282***
			(−4.72)	(9.14)
Score	0.049**	0.014***	0.132***	0.015***
	(2.42)	(3.12)	(3.99)	(2.93)
Lnamount	−0.206***	−0.079***	−0.256***	−0.067***
	(−6.33)	(−9.42)	(−7.71)	(−7.60)
Months	−0.052***	−0.016***	− 0.061***	−0.013***
	(−6.27)	(−5.83)	(−7.09)	(−4.81)
Bgrade	0.226***	−0.041***	0.076	−0.020*
	(4.86)	(−3.64)	(1.54)	(−1.84)
Idnumber	0.713***	0.060***	0.731***	0.032*
	(14.87)	(3.03)	(15.27)	(1.70)
Age	0.251***	−0.017*	0.244***	−0.019**
	(8.66)	(−1.80)	(8.28)	(−2.14)
Worker	−0.324***	0.058***	−0.314***	0.061***
	(−4.41)	(2.86)	(−4.20)	(3.09)
Boss	−0.138	0.029	−0.137	0.035
	(−1.44)	(1.09)	(−1.40)	(1.31)
Gender	−0.458***	−0.019	− 0.460***	−0.005
	(−7.55)	(−1.02)	(−7.51)	(−0.27)
Student	−0.187	0.005	−0.119	−0.011
	(−1.20)	(0.09)	(−0.76)	(−0.20)
Guarantee	0.512***		0.496***	
	(6.81)		(6.44)	
MILLS		0.0652		−0.0137
		0.0586		0.0548
Constant	0.651**	1.280***	1.668***	1.123***
	(2.35)	(17.15)	(5.43)	(15.39)
Year	Yes	Yes	Yes	Yes
N	3935	3935	3935	3935

Notes. Robust standard errors are reported in parentheses. *, **, *** represents statistical significance at the 10%, 5% and 1% confidence levels, respectively

funding success than those in the one-shot game. This finding implies that voluntary disclosures in the repeated cheap-talk game are more credible than those in the one-shot game. We evaluate two mechanisms through which voluntary disclosures in the repeated game are more likely to increase funding success: the bidding activity and the

Table 13 Baseline regressions with alternative measures of the repeated game

	Borrowing experience		Successful borrowing experience	
	(1)	(2)	(3)	(4)
Times×Score	0.014**	0.014**		
	(0.006)	(0.006)		
Times	0.032	0.033		
	(0.024)	(0.024)		
Success×Score			0.016**	0.016**
			(0.006)	(0.006)
Success			0.027**	0.028**
			(0.013)	(0.013)
Score	0.008*	0.008*	0.009**	0.010***
	(0.004)	(0.005)	(0.004)	(0.004)
Student	0.028	0.031	0.035	0.038
	(0.038)	(0.038)	(0.036)	(0.036)
Controls	Yes	Yes	Yes	Yes
Year	No	Yes	No	Yes
N	3935	3935	3935	3935
Pseudo R^2	0.296	0.297	0.307	0.308

Notes. Robust standard errors are reported in parentheses. *, **, *** represents statistical significance at the 10%, 5% and 1% confidence levels, respectively

personal guarantee attribution. We argue that in the repeated game, voluntary disclosures improve the bidding activity. Furthermore, voluntary disclosures in the repeated game play a stronger role in promoting funding success only when the loan listing has no personal guarantee attribution. In addition, our extended results indicate that subjective voluntary disclosures have greater information content only when borrowers have a successful borrowing experience.

Lastly, we document that voluntary disclosures in the repeated game have a negative association with loan performance. Our results are robust to the Heckman two-step estimation that addresses the potential self-selection effect and a specification designed to rule out the alternative explanation from the impact of a good reputation. To sum up, our results shed light on the real effects of costless, voluntary and unverifiable disclosures on lending decisions.

Our study provides detailed evidence that voluntary disclosures have higher credibility in the repeated game than in the one-shot game. We find support for arguments by Stocken (2000), indicating private information in the repeated cheap-talk game is almost always revealed truthfully when compared with the one-shot game. Our study contributes to the literature on how voluntary disclosures affect investors' decisions and the literature on lending decisions in the P2P online lending market.

The findings of this study not only further the understanding of how borrowers make fund-raising decisions and how lenders make decisions according to voluntary and unverifiable disclosures, but also have important policy implications for strengthening the information intermediary role of a platform to improve P2P online lending market efficiency.

Li *et al. Frontiers of Business Research in China*   (2020) 14:7

Page 24 of 26

Appendix

Table 14 Variable definitions

Variable	Description
Full	Whether the loan listing is funded or not. It takes a value of 1 when the loan listing is funded, 0 otherwise.
Bidnumber	Bid activity. It is measured by using the number of bids after standardization by the amount of the loan listing.
Score	Voluntary disclosures. It is the sum of 0–1 indicators for the voluntary information disclosure.
ScoreObj	Objective information disclosed voluntarily. It is the sum of 0–1 indicators for the objective voluntary information disclosure.
ScoreSub	Subjective information disclosed voluntarily. It is the sum of 0–1 indicators for the subjective voluntary information disclosure.
Ltimes	Borrowing experience dummy. It takes a value of 1 when the borrower has never issued the loan listing on the ppdai platform, 0 otherwise.
Lsuccess	Successful borrowing experience dummy. It takes a value of 1 when the borrower has never successfully gotten a loan on the ppdai platform, 0 otherwise.
Times	Borrowing experience. It is the times of borrowing.
Success	Successful borrowing experience. It is the times of the borrower's loan listing to be funded.
Lnamount	Loan amount. It is the natural logarithm of the amount of the loan listing.
Months	Loan term. The loan term is 3–12 months on ppdai platform.
Interest	Interest rate at which a loan listed is funded. It is annualized.
Bgrade	Borrower's credit rating. It takes a value of 1 when the borrower's credit rating is HR, two when the borrower's credit rating is E, three when the borrower's credit rating is D, four when the borrower's credit rating is C, five when the borrower's credit rating is B, six when the borrower's credit rating is A. This credit rating is judged by the ppdai platform according to many factors including identification data, borrowing history and platform activity, and so on.
Idnumber	Number of authentication, including the identity authentication, mobile phone real-name authentication and video authentication. The borrower must provide at least one authentication and at most three authentications.
Guarantee	An indicator variable that takes the value of 1 when the loan listing has a guarantee attribution, 0 otherwise.
Gender	An indicator variable that takes the value of 1 when the borrower is male, 0 otherwise.
Age	The borrower's age. It takes a value of 1 when age ranges from 20 to 25, 2 when age ranges from 26 to 31, 3 when ranges from 32 to 38, 4 when age is above 39.
Worker	Salaried dummy. It takes a value of 1 when the occupation of the borrower is salaried, 0 otherwise.
Seller	Seller dummy. It takes a value of 1 when the occupation of the borrower is an online seller, 0 otherwise.
Boss	Boss dummy. It takes a value of 1 when the occupation of the borrower is the boss of a private company, 0 otherwise.
Student	Student dummy. It takes a value of 1 when the borrower is a student, 0 otherwise.
Reputation	The times of repayments on time.
Delinquency	An indicator variable that equals 1 when the loan is 90 days past due, 0 otherwise.

Authors' contributions
YL is a senior professor of Finance at the Business School of Renmin University of China and also is the doctoral supervisor. As the first author, YL proposed the original research question, conceived the study, and joined the research design. She also provided valuable modify advices and did much effort in the process of revision on earlier versions of the current version.

CL is a doctoral candidate in Renmin University of China. He reviewed the prior studies, joined the research design, undertook the empirical analysis, and drafted the manuscript.

YG received a PhD in Finance of Renmin University of China and now serves in Central Huijin Investment Co. She joined the research design and helped to draft the manuscript. She was also responsible for the construction of the indicators of voluntary disclosures.

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