Paying to Brag? A Structural Model of Cheap Talk in Online Crowdlending Market

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Abstract

Online crowdfunding platforms often allow fundraisers to provide various (but unverified) information about the focal projects. On one hand, these unverified descriptions of initiators' characteristics and project prospects (besides the verified information such as credit rating) may help funders evaluate the underlying projects, while on the other hand could result in cheap talk by the initiators that reduces the credibility of the information about the underlying projects. We study cheap talk in online crowdfunding platforms that could potentially undermine the crowdfunding efforts. We utilize detailed transaction data of an online crowdfunding platform and use text-mining tools to analyze the raw texts of over 11,000 project descriptions. Our analysis shows that cheap talk, on average, does not improve the crowdfunding outcome, though increases the funding prospects. However, the effect of cheap talk on crowdfunding is heterogeneous over projects. We find that cheap talk helps low credit rating initiators in crowdfunding, and this positive effect depreciates as the initiators' credit ratings improve. We build a structural model of cheap talk, which allows us to conduct counterfactual experiments of the effects of cheap talk. We find that paid "cheap talk" can actually benefit everyone in this market. We then discuss the related managerial implications for platforms and initiators.

1. Introduction

Crowdfunding though not a new concept, gain popularity worldwide in recent years. Such a platform-based crowd mechanism changed the way fundraising works. There are several methods of crowdfunding: debt-based, reward-based, equity-based and charity-based crowdfunding. The debt-based crowdfunding is widely used to raise funds from individuals, in return for investment interest. These crowdfunding-project initiators often provide various but unverified information about the projects in the platform. On one hand, these unverified descriptions of initiators' characteristics and project prospects may help funders evaluate the underlying projects, while on the other hand could result in cheap talk by the initiators that reduces the credibility of the information about the underlying projects.

1.1 Related Literature

Our work is related to several streams of research. Costly Signaling (Caldieraro et al., 2018; Chakraborty & Swinney, 2017. Netzer, Lemaire & Herzenstein (2018) use machine-learning method to predict the default; Zhang & Liu (2012) explore the observational learning in the lending market.

2. Institutional Setting and Data

2.1 Institutional Setting

We collect our data from a major online crowdlending platform in China.[1] By September 2018, this platform has over 23 million registered users and facilitated over $10 billion in loans.

Crowdlending on this platform proceeds as follows. A borrower (hereafter initiator) must create a listing to request for a loan. The listing specifies the loan rate, the amount of loan request (cannot exceed the loan ceiling which depends on the initiator's trustworthiness and is set by the platform) and the loan term. The loan rate is determined by the platform, based on the initiator's demographic profile and credit grade on this platform (to be described below). The listing also shows the initiator's demographic profile and highlights the credit grade

[1] For the sake of confidentiality, we do not disclose the identity of the platform.

of the initiator on this platform, which is a seven-point scale letter grade ranging from HR (high risk) to AA. The initiator's credit grade is computed based on his credit score on the platform. Table 1 displays the distribution of credit grades in the data and their corresponding credit scores. Moreover, the listing includes a statement that describes the purpose of loan, which is written by the initiator and *not* verified by the platform. The initiator posts his listing on the platform and the crowdlending starts.

A lender (hereafter backers) reviews the listing and decides whether to fund it, and if so, how much to contribute. The crowdfunding lasts for 7 days. If the listing is not fully funded after 7 days, then the crowdfunding is unsuccessful, in which case all backers receive their contributions back. Otherwise, the crowdfunding is successful, and a loan is created.

The loans in our data are protected by the principal payment guarantee scheme on the platform. The principal payment guarantee scheme protects the backers, in full, from the losses of principal caused by the initiator's default. In practice, the platform advances the payment of principal to backers when the initiator fails to repay the loan 30 days after the due date.[2] The principal payment guarantee scheme does not make loans on this platform risk free as the backer loses the interest payment upon the initiator's default.

2.2 Data

Our data contains a random sample of listings from 2010 to 2016 on the crowdlending platform. There are 11,932 listings that record various listing attributes, initiators' demographic profiles, crowdlending outcomes and payment status.

Table 2 summarizes loan characteristics on the listings. The average loan rate is 12.53%, with a standard deviation of 2.43%. The log of loan amount has a mean 9.50, which tells that the average loan size is CNY 13,360 (USD 1,967). The average of loan term is 12.68 months and the standard deviation is 7.57 months, so

[2] The platform maintains a team of professional debt collectors who can effectively and efficiently collect overdue payments from initiators.

the initiators are mainly short-term or medium-term borrowers. [TBA. Jian, please think about how to discuss the fluctuations in the loan rates]

Table 3 summarizes initiator characteristics. The average monthly income level of initiators is 4.15, which tells that initiators on average earn CNY 5,001 to 10,000 (USD 738 to 1,475) a month. These initiators are on average slightly above 32 years old. Of them, 35% own a car, and 54% own a restate. An initiator's monthly income, car ownership and restate ownership describe her financial status which constitutes her trustworthiness in crowdlending. Higher credit rated initiators are more likely to stay in a better financial status.[3] The initiators with the highest credit grade AA have average monthly income level 4.60. Of them, 79% own a car and 84% of them own a restate. This sharply contrasts to the financial status of initiators whose credit rating is HR, the lowest one. These initiators' average monthly income level is 4.05. Of them, only 29% own a car and 50% own a restate.

2.2.1 Loan Descriptions

We perform text analysis on the loan descriptions and identify those which explicitly state that the initiators is trustworthy. We develop a list of keywords (presented in the Appendix) and say an initiator explicitly states "I am trustworthy" if his loan description includes at least one keyword in the list. The list contains

We define an indicator variable

$$say\ trustworthy_i = \begin{cases} 1 & \text{if initiator } i's \text{ loan description includes at least one keyword in the list} \\ 0 & \text{otherwise} \end{cases}$$

Table 4 presents the summary statistics of this variable for each credit grade. On average, 38% of the initiators explicitly state in their loan description that they are trustworthy.

2.2.3 Crowdfunding Outcomes and Payment Status

[3] A better financial status does not imply that the initiator simultaneously has a higher monthly income level, more likely to own a car and a restate. Because all these three components describe the initiator's financial status and they are substitutable.

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2.3 Reduced-Form Analysis

TBA

3. Model

We develop a model of online lending-based crowdfunding to study the cheap talk signaling between initiators and backers. An initiator seeks for a unit fund to finance his project. The project is risky and yields the initiator a return of $1+R$ if it is successful, and zero otherwise. The probability with which the project is successful is ρ. We assume that ρ is uniformly distributed over the interval $[a, 1]$, where $a \geq 0$. The probability of project success ρ is the initiator's private information. The outside option of the initiator is normalized to zero.

The initiator receives a loan rate r from the crowdfunding platform which is determined based on his profile and credit history, and then chooses a message $m \in \mathcal{M}$ in his loan description. Once the initiator submits the loan request to the crowdfunding platform, a loan listing is created and is displayed on the platform.

A backer has access to one unit of funds, at unit cost, which she can lend to the initiator. The outside option of the lender is w. We assume that w is uniformly distributed over the interval $[0, \omega]$. The backer observes the loan rate r and loan description m, then decides whether to fund this project. A loan is created if the backer funds this project. We assume that the initiator does not have alternative source of income, so he is able to return the money back to the initiator only if the project is successful.[4] Following the institutional setting in our data, we assume that the loan is protected by the principal payment guarantee scheme that the platform will advance the payment of principal to the backer if the initiator defaults. Therefore, the backer receives $1+r$ if

[4] We relax this assumption in our empirical specification, and show that all our analytical results are robust.

the initiator repays and 1 otherwise. The initiator imposes a reputation penalty w on the backer if she receives a payment 1.[5]

The sequence of actions is as follows. The initiator privately observes the project success probability ρ and receives the loan rate r from the crowdfunding platform, and then chooses a cheap talk message $m \in \mathcal{M}$. The initiator submits a loan request that states the loan rate r and the cheap talk message m. The backer decides whether to lend funds given the initiator's loan request. If the backer refuses to lend funds, then crowdfunding is unsuccessful, and both the initiator and the backer take their outside option. If the backer agrees to lend funds, then the initiator invests then in his project. The initiator repays $1 + r$ to the backer if the project is successful, and claims default otherwise. In this case, the backer receives a principal payment 1 from the platform and imposes a reputation penalty w on the initiator.

3.1 Analysis

The solution concept is the Perfect Bayesian Equilibrium. The backer updates her belief of the initiator's project success probability $\beta \in [0,1]$ upon learning the initiator's loan request. The loan request shows the loan rate r and the cheap talk message m. The former is determined by the crowdfunding platform based on the initiator's profile and credit history, so it does not signal the initiator's project success probability.[6] Therefore, the backer updates her belief β via the message m.

$$\beta = E[\rho \mid m] \tag{1}$$

The backer evaluates the funding decision based on her posterior belief β, and lends to the initiator if and only if

[5] The backer may generate bad word of mouth about the initiator on the crowdfunding platform and other social media platforms. The crowdfunding platform knows the identity of the initiator, so can help the backer impose such reputation penalty on the initiator who defaults.

[6] In Table 10A, we provide reduced-form evidence that there is no significant relationship between the loan rate and the project outcome (e.g., whether payments overdue). Therefore, in our data, the loan rate does not signal the project success probability.

$$\underbrace{\beta \cdot (1+r) + (1-\beta) \cdot 1}_{\text{expected benefit of lending}} - \underbrace{1}_{\text{cost of funds}} \geq \underbrace{w}_{\text{value of outside option}}$$

Thus, the backer agrees to fund the project if her outside option

$$w \leq \beta r \tag{2}$$

and her expected payoff is

$$\pi = \max\{\beta r, w\}. \tag{3}$$

The initiator carries out the project if the backer lends funds, and receives his outside option zero otherwise. His expected payoff is

$$u = \int_0^{\beta r} \rho \cdot \underbrace{(R-r)}_{\substack{\text{payoff when} \\ \text{project is successful}}} + (1-\rho) \cdot \underbrace{(-w)}_{\substack{\text{reputation} \\ \text{penalty}}} \; dw. \tag{4}$$

The initiator chooses a cheap talk message $m \in \mathcal{M}$ that maximizes his expected payoff u, described above, subject to the backer's belief updating rule (1) and funding rule (2). We are interested in the amount of information that the cheap talk message delivers in equilibrium. The following lemma shows that in equilibrium, the backer never perfectly learns the project success probability from the initiator's cheap talk message.

Lemma: *There is no fully informative equilibrium.*

This lemma eliminates the possibility of a truth-telling equilibrium. The intuition is as follows. The initiator's message choice is based on his expected payoff which depends on the induced backer's belief of his project success probability. If the backer's posterior belief is consistent with that stated in the cheap talk message, then the initiator will have an incentive to inflate his project success probability to increase the chance that the backer funds the project. The backer expects this, so she does not simply take everything in the initiator's cheap talk message when updating her belief of the project success probability.

The impossibility of a truth-telling equilibrium does not imply that the backer cannot learn anything from the initiator's message. In fact, as described in the following proposition, the backer could imperfectly learn the project success probability from the initiator's cheap talk message, provided that the probability is sufficiently heterogeneous.[7]

Proposition: *If* a *is smaller than* $\hat{a}$*, then there is a partially informative equilibrium in which*

$$m^* = \begin{cases} m_1 & \text{if } a \le \rho < \hat{\rho} \\ m_2 & \text{if } \hat{\rho} \le \rho \le 1 \end{cases} \tag{5}$$

for some $\hat{\rho} \in [a, 1]$.

The proposition introduces a threshold $\hat{\rho}$ (derived in the appendix) for the initiator's project success probability, below which the initiator's cheap talk message is m_1, and m_2 otherwise. We follow an insight from Farrell and Rabin (1996) to interpret messages m_1 and m_2 that the literal meaning of messages is a starting point for the backer. we interpret m_1 as the project success probability is smaller than $\hat{\rho}$ and m_2 as the project success probability is greater than $\hat{\rho}$.

Figure 1 graphically illustrates this proposition. The intuition is as follows. An inflation of project success probability not only increases the funded probability, but also raises the expected reputation penalty. A large discrete increase in the project success probability may bring the backer to this deal who can impose a huge reputation penalty on the initiator upon receiving a payment 1 (i.e., the project is unsuccessful). This huge reputation penalty may exceed the initiator's payoff when the project is successful (i.e., $R - r$). As a result, the initiator has little incentive to choose m_2 if the project success probability ρ is low ($\rho < \hat{\rho}$). On the other hand, if the project success probability ρ is high ($\rho > \hat{\rho}$), the initiator does not want to choose m_1 to depreciate his project success probability. Therefore, we expect the initiator to choose m_1 (m_2) if his project success probability ρ is low (high).

[7] We focus on the binary case of cheap talk or not, as in the literature of discrete types. As in our empirical analysis later on, the text mining analysis shows generally there are two types of messages: one with cheap talk, the other without. We leave the possible continuous categorization of cheap talk messages (which is a very interesting informational design question) for future research. The project descriptions in our data also suggest this equilibrium as the initiators either explicitly state or do not state in their project descriptions that they are trustworthy.

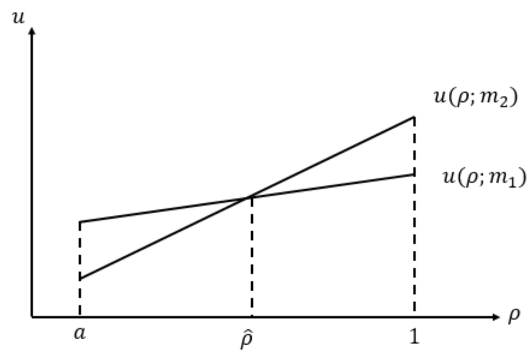

Figure 1: Partial informative equilibrium

The proposition highlights the importance of project success probability heterogeneity (a is small) to the existence of the partially informative equilibrium. The initiator always wants to inflate his project success probability in the cheap talk message, but not to overdo it.[8] If the project success probability is not sufficiently heterogeneous (a is large), the initiator who has a risky project ($\rho < \hat{\rho}$) will find the gap small between his project success probability and the backer's posterior belief upon observing m_2, which makes m_2 an worthy inflation of project safety. In equilibrium, only m_2 appears in the loan description, so the backer cannot learn anything about the initiator's project success probability from the cheap talk message. The following corollary presents this result.

Corollary: *If a is greater than $\hat{a}$, then there is no partially informative equilibrium. However, there is a babbling equilibrium in which the cheap talk message is completely uninformative.*

The corollary is consistent with the finding of our reduced-form analysis that the positive effect of stating high project quality in the loan description (sending m_2) on the crowdfunding outcome depreciates as the initiator has a better credit rating (a increases). Once the initiator's credit rating is sufficiently high ($a > \hat{a}$), the backer completely ignores the cheap talk message and makes her funding decision only based on the initiator's credit profile (the project success probability lower bound a).

[8] The first half is shown in the lemma, and the second half is discussed in the proposition.

4. Empirical Model and Estimation

In this section, we introduce the crowdfunding platform's payment collection rule to our analytical model, so that our empirical model fits the institutional setting in our data. We show (in the appendix) that all results in the previous section survive in this extended model. Then we discuss our model parametrization and identification strategy.

4.1 Crowdfunding Platform and Payment Collection

An important feature of the crowdfunding platform in our data is that it employs a team of professional debt collectors who help collect payments when the initiator claims default. They introduce alternative repayment plan and income opportunity to the initiator, under which the initiator works, earns money and repays the loan. The initiator may find this option unfavorable and not take it, so the debt collectors cast hassles to the initiator, such as mass calling and disturbance calling, to enforce the repayment, though such enforcement is *imperfect*.

We incorporate this feature into our model by adding a payment collection stage in which the crowdfunding platform proposes alternative repayment plan and income opportunity to the initiator. If the initiator takes this option, he works, earns $1 + r$ from the income opportunity and repays. If the initiator rejects this plan, the platform penalizes the initiator by imposing him a hassle cost c. We assume that the hassle cost c follows a distribution $F(\cdot)$, and does not realize until the payment collection stage.[9] The distribution of hassle cost $F(\cdot)$ is common knowledge.

The sequence of actions in our empirical model is as follows. The initiator privately observes the project success probability ρ and receives the loan rate r from the crowdfunding platform, and then chooses a cheap talk message $m \in \mathcal{M}$. The initiator submits a loan request that states the loan rate r and the cheap talk message m. The backer decides whether to lend funds given the initiator's loan request. If the backer refuses to lend funds, then crowdfunding is unsuccessful, and both the initiator and the backer take their outside option. If the backer

[9] The hassle cost c depends on the matching between the initiator and the debt collector who casts hassle on the initiator, which is not realized until the payment collection stage.

agrees to lend funds, then the initiator invests then in his project. The initiator repays $1 + r$ to the backer if the project is successful, and claims default otherwise. In the latter case, the platform proposes alternative repayment plan and income opportunity to the initiator. If the initiator takes this option, he works, earns $1 + r$ from the income opportunity and repays. If the initiator rejects this plan, the platform penalizes the initiator by imposing him a hassle cost c. The hassle cost c follows a distribution $F(\cdot)$, and does not realize until the payment collection stage. The backer receives a full payment $1 + r$ from the initiator if the initiator repays, and a principal payment 1 from the platform if the initiator claims default and rejects the alternative repayment plan. The backer imposes a reputation penalty w on the initiator upon receiving the principal payment 1.

As we show in the appendix, our lemma, proposition and corollary in the previous section survive in this extended model.

4.2 Econometric Specification

We need to parametrize the project return R, the lower bound of project success probability a and the hassle cost distribution $F(\cdot)$ to estimate the model. In our model, the platform sets the loan rate r_i for initiator i. We write

$$r_i = \theta_i R_i \tag{6}$$

where θ_i and R_i denote the platform's loan rate policy and project return for initiator i respectively. Since the loan rate policy θ_i is determined based on the initiator i's profile and credit history and is between 0 and 1, we assume that

$$\theta_i = \Phi(X_i \gamma) \tag{7}$$

where $\Phi(\cdot)$ is the cumulative distribution function of a standard normal random variable and X_i is a vector of initiator i's observable characteristics.

The initiator i's project return R_i is non-negative and could depend on characteristics that are unobservable to the researchers. We assume that

$$R_i = \exp(X_i\beta + \epsilon_i) \tag{8}$$

where $\exp(\cdot)$ is the exponential function, X_i is a vector of initiator i's observable characteristics and ϵ_i denotes initiator i's unobservable characteristic. We further assume that the initiator i's unobservable characteristic has zero mean conditional on his observable characteristics

$$E[\epsilon_i \mid X_i] = 0. \tag{9}$$

The lower bound of the initiator i's project success probability a_i is between 0 and 1 and could also depend on characteristics that are unobservable to the researchers. We assume that

$$a_i = \Phi(X_i\xi + \nu_i) \tag{10}$$

where $\Phi(\cdot)$ is the cumulative distribution function of a standard normal random variable, X_i is a vector of initiator i's observable characteristics and ν_i denotes initiator i's unobservable characteristic. Similarly, we further assume that the initiator i's unobservable characteristic has zero mean conditional on his observable characteristics

$$E[\nu_i \mid X_i] = 0. \tag{11}$$

We assume that the cumulative distribution function of hassle cost

$$F(c_i) = 1 - \frac{h_i}{c_i}, \qquad c_i \geq h_i \tag{12}$$

where h_i is the lower bound of hassle cost that the debt collector imposed on the initiator. Since the enforcement (via casting hassle) is imperfect, this lower bound h_i is between 0 and the loan payment $1 + r_i$. We further assume that

$$h_i = (1 + r_i)\Phi(X_i\eta) \tag{13}$$

where $\Phi(\cdot)$ is the cumulative distribution function of a standard normal random variable and X_i is a vector of initiator i's observable characteristics.

4.3 Identification

We take four steps to estimate our parameters $\{\beta, \gamma, \eta, \xi, \omega\}$, and start with identifying β and γ. By (6) – (8), we have

$$r_i = \Phi(X_i\gamma)\exp(X_i\beta + \epsilon_i)$$

We take log on the both sides of the equation above and get

$$\log(r_i) = X_i\beta + \log(\Phi(X_i\gamma)) + \epsilon_i \quad (14)$$

Utilizing the zero conditional mean assumption in (9), we perform non-linear least square estimation to estimate β and γ in (14). Intuitively, equation (14) studies both linear and non-linear effects of the initiator i's observable characteristics on the log of his loan rate r_i. The linear part identifies the effect of observables (i.e., X_i) on the project return R_i and the non-linear part identifies the effect of observables (i.e., X_i) on the platform's loan rate policy θ_i. Let $\hat{\beta}$, $\hat{\gamma}$ and $\hat{\epsilon}_i$ denote the parameter estimates and the error respectively. Then we compute the estimated loan rate policy

$$\hat{\theta}_i = \Phi(X_i\hat{\gamma}) \quad (15)$$

and the estimated project return

$$\hat{R}_i = \exp(X_i\hat{\beta} + \hat{\epsilon}_i) \quad (16)$$

Next, we estimate η in the hassle cost distribution. In our empirical model, the platform fails to enforce the repayment in the payment collection stage if the hassle cost c_i is smaller than the loan payment $1 + r_i$. In this case, the platform has to advance the principal payment 1 to the backer. Then, the probability of the platform advancing the principal payment is

$$\Pr(c_i < 1 + r_i) = 1 - \frac{h_i}{1 + r_i} = 1 - \Phi(X_i\eta) \quad (17)$$

We leverage the data that whether the platform advances the principal payment to the backer after the initiator claims default and use maximum likelihood estimation to recover η. Let $\hat{\eta}$ denote the parameter estimate. Then we compute the estimated lower bound of hassle cost distribution

$$\hat{h}_i = (1 + r_i)\Phi(X_i\hat{\eta}) \tag{18}$$

and the implied probability of successful enforcement

$$\hat{\delta}_i = \Pr(c_i \geq 1 + r_i) = \Phi(X_i\hat{\eta}) \tag{19}$$

Third, we estimate ξ in the lower bound of the initiator i's project success probability a_i. By the proposition, we solve for the cut-off (derived in appendix)

$$\hat{\rho}_i = \hat{\rho}_i(a_i; r_i, \hat{R}_i, \hat{\theta}_i, \hat{h}_i)$$

below (above) which the initiator sends m_1 (m_2). We empirically interpret m_1 as not stating "high credibility" in the loan description and m_2 as explicitly stating "high credibility" in the loan description. In equilibrium, the probability that the initiator sends m_2 is

$$\Pr(m^* = m_2) = \frac{1 - \hat{\rho}}{1 - a_i} \tag{20}$$

We utilize the data that whether the initiator explicitly states "high credibility" in his loan description and apply maximum likelihood estimation to recover a_i. Let $\hat{a}_i$ denote the parameter estimate. By (10) and the zero conditional mean assumption in (11), we perform OLS to estimate ξ in the following equation.

$$\Phi^{-1}(\hat{a}_i) = X_i\xi + \nu_i \tag{21}$$

Moreover, we compute the estimated equilibrium cut-off for initiator i

$$\hat{\hat{\rho}}_i = \hat{\hat{\rho}}_i(\hat{a}_i; r_i, \hat{R}_i, \hat{\theta}_i, \hat{h}_i) \tag{22}$$

Last, we estimate ω in the distribution of the backer's outside option. In our empirical model, the equilibrium funded probability (derived in appendix) is

$$\begin{cases} \dfrac{\left(\dfrac{\hat{a}_i + \hat{\hat{\rho}}_i}{2} + \left(1 - \dfrac{\hat{a}_i + \hat{\hat{\rho}}_i}{2}\right) \cdot \hat{\delta}_i\right) \cdot r_i}{\omega} & \text{if } m^* = m_1 \\ \dfrac{\left(\dfrac{1 + \hat{\hat{\rho}}_i}{2} + \left(1 - \dfrac{1 + \hat{\hat{\rho}}_i}{2}\right) \cdot \hat{\delta}_i\right) \cdot r_i}{\omega} & \text{if } m^* = m_2 \end{cases} \tag{23}$$

We leverage the data of the backer's funding decision and use maximum likelihood estimation to recover ω.

5. Estimation Results

We present our parameter estimates in Table 11. On the initiator side, the initiator's credit score has a positive and significant effect on the project success probability lower bound a. Notice that the initiator's project success probability ρ is uniformly distributed over the interval $[a, 1]$, a higher credit score suggests that the initiator's project is more likely to succeed. The initiator's age has a negative (positive) and significant effect on the project return R (the project success probability lower bound a). Older initiators usually are more risk adverse than younger initiators, so they develop projects that yield less return but are more likely to succeed.

On the backer side, the estimated maximal return of a backer's outside option is 24.79%. Since the maximal loan rate suggested by the crowdfunding platform is 24%, none of the projects on this platform will be funded with certainty ex-ante.

On the platform side, the initiator's credit score has a negative and significant effect on the loan rate policy θ. This is consistent with common practice that initiators with better credit ratings are entitled to lower loan rates. The initiator's credit score also has a positive and significant effect on the lower bound of hassle cost h. Notice that the initiator's credit score summarizes his profile and credit history on the platform, a high credit score suggests that the platform knows the initiator very well, besides his trustworthiness. A good knowledge of the initiator helps the debt collector (on this platform) effectively cast hassle to the initiator when the initiator claims default and refuses to take the alternative repayment plan. Therefore, initiators with better credit ratings are more likely to take the alternative repayment plan when their projects fail, which ensures a full payment to the backer in the end. The initiator's age has a negative and significant effect on the lower bound of hassle cost h. Older initiators usually are more knowledgeable and experienced in bargaining and social interactions, which allows them to mitigate the loss from the hassle imposed by the debt collectors. The fall in the hassle cost weakens the enforcement power of the payment collection mechanism adopted by the debt collector, and encourages the initiators to dishonor their loan obligations when their projects fail.

6. Counterfactual Analysis

In this section, we perform policy simulations to explore the effect of cheap talk. We carry out two experiments that compare the market equilibrium when cheap talk (i.e., include a loan description in the loan request) is unavailable, a free service or a paid service in crowdfunding. We discuss the implications of cheap talk on crowdfunding and consumer welfare and demonstrate the potential that the platform prices the cheap talk in crowdfunding.

6.1 Effect of Cheap Talk

We study the effect of cheap talk along two dimensions, the funded probability and consumer welfare. Using our model estimates, we solve for the equilibrium when cheap talk is unavailable and when it is a free service, and compute the equilibrium funded probability, the initiator's expected payoff and the backer's expected payoff. We consider the following two scenarios:

S1. The initiator cannot send any text message (i.e., loan description) to the backer in crowdfunding.

S2. The initiator can send a text message (i.e., loan description) $m \in \mathcal{M}$ to the backer in crowdfunding.

S1 is the scenario in which cheap talk is unavailable. In this case, the initiator puts the loan rate r received from the platform in his loan request, and the backer makes her funding decision only based on this loan rate r. S2 is the scenario in our data in which cheap talk is a free service in crowdfunding. In this case, the initiator learns his loan rate r and then chooses his message $m \in \mathcal{M}$, and the backer decides whether to fund the project based on the loan rate r and the message m. Comparing the equilibrium between these two scenarios tells the effect of cheap talk.

The effect of cheap talk depends on both the initiator (i.e., his project success probability distribution or the lower bound a in our model) and the underlying project (i.e., his project success probability ρ). We fix an observation (e.g., initiator) in our data and draw 10,000 projects based on this initiator's a. Following the results in our empirical model, we solve for the equilibrium for this initiator and compute the funded probability, the initiator's expected payoff and the backer expected payoff for every *project*. We take the average of them and get the overall funded probability, the initiator's expected payoff and the backer's expected payoff for this *initiator*. We also calculate the loan-rate measure of equivalent variation[10] for different initiators and use this measure to compare the welfare effects of cheap talk on different initiators. The loan rate is the price of loan, so our loan-rate measure is consistent with the conventional wisdom of equivalent variation, and is a reasonable tool for our welfare comparison.

We calculate the funded probability and consumer welfare for the initiators, and for the sake of brevity, we present our counterfactual analysis of two initiators in Table 12A (HR credit rating) and Table 12B (A credit rating). We mainly discuss the results in Table 12A, because the results in the other table tell a similar story. Without cheap talk (**S1**), the initiator's expected payoff is 0.0463 and the backer's expected payoff is 0.1566. When cheap talk is a free service (**S2**), the initiator's expected payoff increases to 0.0486 and the backer's expected payoff rises to 0.1569. Similar results hold for the initiator with A credit rating. The cheap talk clearly on average benefits both the initiator and the backer. The benefit comes from the improved matching between the good projects (e.g., projects with high success probability) and the backer's funds when cheap talk is available. Indeed, without cheap talk, *all* projects share the same funded probability 0.5133. This funded probability deceases to 0.4046 for the mediocre projects (e.g., project success probability is between 0.5674 and 0.6437) and increases to 0.5366 for the good projects (e.g., project success probability is at least 0.6437) when cheap talk is available. The change in the funded probability implies the imperfect learning about the project success probability by the backer from the equilibrium cheap talk message, which is consistent with our analytical findings.

6.1.1 Cheap Talk Effect Heterogeneity: Project

The overall positive effect of the cheap talk on the initiator does not imply that the initiator is always better off with the cheap talk regardless of his focal project. In fact, the effect of the cheap talk on the initiator is heterogenous across the initiator's project. In Table 12A, the individual project effect shows that as the initiator's project success probability ρ increases, in equilibrium, the initiator is first better off, then worse off,

[10] The loan-rate measure of equivalent variation (i.e., equivalent rate) is defined as the loan rate that the initiator (backer) is willing to pay to let the initiator access the cheap talk service.

and again better off with the cheap talk. The intuition that the cheap talk hurts the initiator when his project success probability ρ is medium is as follows. By the proposition in our analytical analysis, there are two incentives that determine the initiator's choice of cheap talk message. One is to inflate the project success probability through the cheap talk message, and the other one is to not overdo it. The second row in the individual project effect presents the group of projects that in equilibrium, the cheap talk message operates against the first incentive, deflating the project success probability. In contrast to pooling with *all* projects when cheap talk is unavailable, these projects now pool with the ones whose success probabilities are lower and therefore, are less likely to be funded (i.e., from 0.5133 to 0.4046). The third row in the individual project effect shows the group of projects that in equilibrium, the cheap talk message acts against the second incentive, overinflating the project success probability. Unlike the projects described in the second row, these projects pool with the ones whose success probabilities are higher. They are at the lower end of the good projects, so the pooling significantly inflates their project success probabilities perceived by the backer (i.e., the backer's posterior belief). Such an inflation greatly raises the reputation penalty and is unprofitable. Therefore, these projects yield the initiator lower expected payoff when cheap talk is available.

6.1.2 Cheap Talk Effect Heterogeneity: Initiator

The effect of cheap talk is also heterogenous across initiators. A comparison of overall welfare effect between Table 12A and Table 12B shows that the positive effect of cheap talk on the initiator and the backer's welfare diminishes as the initiator's credit rating improves. The loan-rate measure of equivalent variation (i.e., equivalent rate) for the initiator is 2.81% when the initiator's credit rating is HR. This measure drops to 0.09% when the initiator's credit rating rises to A. Similar results hold for the loan-rate measure of equivalent variation for the backer when the initiator's crediting upgrades from HR to A (i.e., from 0.08% to 0.0001%). This finding further reinforces our insight into the cheap talk effect heterogeneity from our reduced-form and analytical analysis.

6.2 When Cheap Talk Is Not Cheap

The imperfect learning by the backer in the partially informative equilibrium naturally raises a question that whether the platform can improve its design of cheap talk communication service and further facilitate the communication between the initiator and the backer. In our second experiment, we examine this question and allow the platform to price its cheap talk communication service in crowdfunding. That is, we investigate the following scenario:

S3. The initiator can send a text message (i.e., loan description) $m \in \mathcal{M}$ to the backer in crowdfunding after paying a price $p \geq 0$ to the platform.

S3 departs from S2 that the initiator learns his loan rate r and then decides whether to pay the platform p to send a message to the backer. If so, the initiator chooses his message $m \in \mathcal{M}$. The backer makes her funding decision based on the loan rate r, the initiator's purchasing decision, and if purchased, the message m. We examine the equilibrium in S3, compare it with that in S2, and then discuss the marketing implications of this (pricing) strategy.

Similar to the previous experiment, we fix an observation (e.g., initiator) in our data and draw 10,000 projects based on this initiator's a. For any price $p \geq 0$, we solve for the equilibrium, compute the demand for this cheap talk communication service (e.g., send a message to the backer), calculate the platform's profit[11] and consumer welfare.

We present our findings of this counterfactual experiment in Table 12. The upper part of Table 12 describes the platform's price p and the induced market equilibrium. We introduce two threshold prices $\hat{p}$ and $\tilde{p}$ (shown in the Table 12) for the platform. If the price p is smaller than $\hat{p}$, in equilibrium, the initiator whose project success probability is low does not buy the service, the initiator whose project success probability is medium buys the service but does not state "high credibility" in the loan description, and the initiator whose project success probability is high buys the service and states "high credibility" in the loan description. For example, when price p is 0.0001, the initiator does not buy the service if his project success probability is smaller than 0.6425. The initiator buys the service but not state "high credibility" in the loan description if his project success probability is between 0.6425 and 0.6455. The initiator buys the service and states "high credibility" in the loan

[11] We only compute the platform's profit from pricing this cheap talk communication service.

description if his project success probability is greater than 0.6455. If the price p is between $\hat{p}$ and $\tilde{p}$, in equilibrium, the initiator whose project success probability is low does not buy the service, the initiator whose project success probability is high buys the service and states "high credibility" in the loan description. For example, when price p is 0.0002, the initiator does not buy the service if his project success probability is smaller than 0.6464. The initiator buys the service and states "high credibility" in the loan description if his project success probability is greater than 0.6464. If the price p is greater than $\tilde{p}$, in equilibrium, the initiator never buys the service. For the sake of our interest, in the remaining analysis, we focus on the cases in which in equilibrium, at least some initiator buys the service (i.e., $p \leq \tilde{p}$).

These cases share a common property that the platform pricing of the cheap talk communication service operates as an entry barrier that deters the initiator with a low success probability project from sending any (cheap talk) message to the backer in crowdfunding. Such deterrence helps elicit promising projects and enhances the backer's learning about the project quality through the initiator's message. As the price p increases, only the initiator whose project success probability is high buys the service. In this case, buying the service becomes a costly signal that tells the backer about this initiator's (high) project quality. Once this signal is strong enough, the backer no longer relies on the initiator's (cheap talk) message to learn the project quality. As a result, all initiators state "high credibility" in their loan description when the price p is high. This result is consistent with the findings in our reduced-form analysis, analytical analysis and the first counterfactual experiment.

6.2.1 Induced Demand

Built on the equilibrium, we derive the market demand for the cheap talk communication service. Figure 2 illustrates the demand curve, which is more elastic when the price p is smaller than $\hat{p}$. Indeed, if the price p is smaller than $\hat{p}$, an increase in p raises the signaling cost of buying the service and reduces the signaling benefit of the initiator's (cheap talk) message. The latter comes from the fact that an increase in p raises the entry barrier of sending a (cheap talk) message to the backer in crowdfunding, so the signaling benefit of the message depreciates. However, if the price p is greater than $\hat{p}$, an increase in p only raises the signaling cost of buying the service. This is because, in equilibrium, the initiator who buys the service always states "high credibility" if the price p is greater than $\hat{p}$, so the message becomes completely uninformative and yields zero benefit to the initiator. Therefore, the market demand is elastic if the price p is small (i.e., $p < \hat{p}$).

6.2.2 Welfare and Platform Design

Utilizing the induced demand curve, we examine the market implications of the platform's (pricing) strategy. The lower part of Table 12 presents our findings. For this initiator, the platform's profit maximizing price is 0.0131 per dollar loan.[12] This result is also graphically presented in Figure 3, which illustrates the inversed-U shaped profit function. The next two lines uncover an interesting price region (i.e., $p < 0.00003$ for the initiator and $p < 0.0213$ for the backer) in which both the initiator and the backer are better off when the platform charges the initiator p for the cheap talk communication service. Figure 4 and 5 graphically present these results. The intuition is the following. If the price p is small, it only deters the initiator whose project success probability is very low from sending the (cheap talk) message to the backer. In this case, in equilibrium, though yet imperfectly, the backer learns more about the initiator's project than she would have learned otherwise (i.e., scenario S2). This enhanced learning sharpens the backer's funding decision which could yield both the initiator and the backer a higher expected payoff than otherwise (i.e., scenario S2) even the initiator has to pay a (small) price p.

This interesting result leads to an important policy implication that all participants (i.e., the initiator, the backer and the platform) will be better off if the platform properly prices the cheap talk communication service. In other words, everyone could be happier if cheap talk is not cheap.

7. Discussion and Conclusion

TBA

[12] The profit maximizing price depends on the initiator's a, so it varies across initiators.

Reference

Farrell, J., & Rabin, M. (1996). Cheap talk. *Journal of Economic perspectives*, 10(3), 103-118.

Gardete, P. M. (2013). Cheap-talk advertising and misrepresentation in vertically differentiated markets. *Marketing Science*, 32(4), 609-621.

Appendix

Table 1: Distribution of Credit Grade

Credit Grade	Credit Score	# of Observations (in percentage)
AA	≥ 210	168 (1.41%)
A	180 – 209	24 (0.20%)
B	150 – 179	162 (1.36%)
C	130 – 149	355 (2.98%)
D	110 – 129	1738 (14.57%)
E	100 – 109	3344 (28.03%)
HR	≤ 99	6141 (51.47%)
Total		11932 (100.00%)

Table 2: Loan Characteristics Summary Statistics

Credit Grade	Loan Rate		Log(Loan Amount)		Loan Term (months)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
AA	11.57%	3.04%	9.46	1.33	10.23	8.30
A	11.17%	2.04%	9.62	1.62	8.00	5.13
B	12.72%	2.81%	10.32	1.42	10.43	6.72
C	13.07%	3.16%	9.76	1.34	10.29	7.02
D	12.33%	2.63%	9.63	1.02	11.50	7.25
E	12.10%	1.86%	9.59	0.72	14.12	7.33
HR	12.82%	2.52%	9.37	0.81	12.52	7.69
Total	12.53%	2.43%	9.50	0.88	12.68	7.57

Table 3: Initiator Characteristics Summary Statistics

Credit Grade	Monthly Income		Age		Own Car		Own Restate	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
AA	4.60	1.35	34.42	5.18	0.79	0.41	0.84	0.37
A	4.46	1.32	36.83	7.92	0.54	0.51	0.96	0.20
B	5.38	1.45	36.09	7.07	0.59	0.49	0.75	0.44
C	4.64	1.56	35.72	7.26	0.64	0.48	0.71	0.45
D	4.52	1.33	33.46	6.88	0.46	0.50	0.62	0.49
E	4.01	1.14	31.33	6.05	0.32	0.47	0.51	0.50
HR	4.05	1.24	31.99	6.49	0.29	0.45	0.50	0.50
Total	4.15	1.27	32.23	6.54	0.35	0.48	0.54	0.50

Note: Initiator's monthly income level: Level 1: < 1,000 CNY; Level 2: 1,001 – 2,000 CNY; Level 3: 2,001 – 5,000 CNY; Level 4: 5,001 – 10,000 CNY; Level 5: 10,001 – 20,000 CNY; Level 6: 20,001 – 50,000 CNY; Level 7: > 50,001 CNY. Own Car / Restate = 1 if the initiator owns a car / restate property.

Table 4: Loan Description Summary Statistics

Credit Grade	Says "High Credibility" in Loan Description	
	Mean	S.D.
AA	0.35	0.48
A	0.54	0.51
B	0.50	0.50
C	0.32	0.47
D	0.30	0.46
E	0.41	0.49
HR	0.28	0.45
Total		

Table 5: Crowdfunding Outcome and Payment Status Summary Statistics

Credit Grade	Crowdfunding Successful		Payment Overdue		Paid by Platform	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
AA	0.25	0.43	0.08	0.28	0	0
A	0.46	0.51	0.18	0.40	0	0
B	0.19	0.39	0.10	0.30	0	0
C	0.23	0.42	0.34	0.48	0	0
D	0.49	0.50	0.21	0.41	0.01	0.10
E	0.81	0.39	0.21	0.41	0.01	0.07
HR	0.61	0.49	0.69	0.46	0.32	0.47
Total	0.63	0.48	0.45	0.50	0.24	0.43

Note: Payment Overdue is equal to 1 if the backer fails to repay by the due date given the loan is funded. Paid by Platform is equal to 1 if Platform advances the payment of principal to backers given the payment is overdue.

Table 6: Crowdfunding Outcome and Loan Description

Credit Grade	Crowdfunding Successful when not saying "High Credibility"		Crowdfunding Successful when saying "High Credibility"		Difference in Funding Probability	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
AA	0.21	0.04	0.33	0.06	-0.12^{*}	0.07
A	0.27	0.14	0.62	0.14	-0.34^{*}	0.20
B	0.14	0.04	0.25	0.05	-0.11^{*}	0.06
C	0.19	0.03	0.30	0.04	-0.11^{**}	0.05
D	0.46	0.01	0.58	0.02	-0.12^{***}	0.03
E	0.76	0.01	0.88	0.01	-0.12^{***}	0.01
HR	0.56	0.01	0.72	0.01	-0.15^{***}	0.01
Total						

Note: (a) *** denotes significance at the 1% level, ** denotes significance at the 5% level, * denotes significance at the 10% level. (b) Difference in funding probability is equal to column 1 minus column 3.

Table 7: Reduced-Form Analysis of Cheap Talk Signaling – Initiators

Dependent Variable: Payment Overdue		
Variable	Mean	S.E.
Says "High Credibility" in Loan Description	-28.7190***	2.0965
Credit Grade	-0.4571***	0.0222
Constant	-10.0261***	0.7551

Note: (a) *** denotes significance at the 1% level. (b) Heckman two-stage model with IV probit regression correcting the endogeneity of "Says 'High Credibility' in Loan Description". The instruments is the average of the log of outstanding debt for initiators with the same credit score.

Table 8: Reduced-Form Analysis of Cheap Talk Signaling – Backers

Dependent Variable: Successful Crowdfunding				
Variable	Exogenous Message		Endogenous Message	
	Mean	S.E.	Mean	S.E.
Says "High Credibility" in Loan Description	0.4132***	0.0276	-0.9098***	0.0950
Loan Rate	45.1942***	3.4451	29.3459***	3.4053
Log(Loan Amount)	0.2386***	0.0148	0.1872***	0.0147
Loan Term	0.0518***	0.0019	0.0431***	0.0021
Constant	-8.3724***	0.4714	-5.4420***	0.5110

Note: (a) *** denotes significance at the 1% level. (b) In the "Exogenous Message" Model, the endogenous variable is the loan rate (instrument: the log of initiator's credit score). (c) In the "Endogenous Message" Model, the endogenous variables are the loan rate and the "Says 'High Credibility' in Loan Description" (instruments: the average of the log of outstanding debt for initiators with the same credit score).

Table 9: Reduced-Form Analysis of Heterogeneous Effects of Cheap Talk Signaling

Dependent Variable: Successful Crowdfunding		
Variable	Mean	S.E.
Says "High Credibility" in Loan Description	2.2375***	0.4451
Says "High Credibility" in Loan Description × Log(Credit Score)	-0.2325***	0.0831
Loan Rate	43.4756***	3.7009
Log(Loan Amount)	0.2229***	0.0199
Loan Term	0.0475***	0.0039
Constant	-8.2256***	0.5011

Note: *** denotes significance at the 1% level.

Table 10A: Reduced-Form Analysis of Loan Rate Signaling – Initiators

Dependent Variable: Payment Overdue		
Variable	Mean	S.E.
Loan Rate	-0.4598	3.9403
# of Past Payment Overdue	0.0677*	0.0054
Constant	0.4150	0.4868

Note: (a) * denotes significance at the 1% level. (b) Heckman two-stage model with IV probit regression correcting the endogeneity of "Loan Rate". The instrument is the log of initiator's credit score.

Table 10B: Reduced-Form Analysis of Loan Amount Signaling – Initiators

Dependent Variable: Payment Overdue		
Variable	Mean	S.E.
Log(Loan Amount)	0.0096	0.0080
Credit Grade	-0.1364*	0.0081
# of Past Payment Overdue	0.0574*	0.0020
Constant	0.5018*	0.0736

Note: (a) * denotes significance at the 1% level. (b) Heckman two-stage model with IV probit regression correcting the endogeneity of "Log(Loan Amount)". The instrument is the Log(1 + initiator's loan ceiling).

Table 10C: Reduced-Form Analysis of Loan Term Signaling – Initiators

Dependent Variable: Payment Overdue		
Variable	Mean	S.E.
Loan Term	-0.0020	0.0134
Credit Grade	-0.1340*	0.0073
# of Past Payment Overdue	0.0577*	0.0017
Constant	0.6158*	0.1722

Note: (a) * denotes significance at the 1% level. (b) Heckman two-stage model with IV probit regression correcting the endogeneity of "Loan Term". The instrument is the Log(1 + initiator's outstanding debt amount).

Table 11: Estimation Results

Initiators			
Project Return $\boldsymbol{R}$		**Project Success Rate Lower Bound $\boldsymbol{a}$**	
Log(credit score)	-0.0131 (0.0347)	Log(credit score)	0.0532*** (0.0022)
Age	-0.0078*** (0.0025)	Age	0.0043*** (0.0001)
Own Car	0.3667*** (0.1314)	Own Car	-0.3381*** (0.0018)
Constant	-1.0675*** (0.0223)	Constant	0.9110*** (0.0109)
Backers			
Outside Option $\boldsymbol{\omega}$			
ω	0.2479*** (0.0010)		
Crowdfunding Platform			
Loan Rate Policy $\boldsymbol{\theta}$		**Overdue Penalty $\boldsymbol{h}$**	
Log(credit score)	-0.0827** (0.0348)	Log(credit score)	1.0676*** (0.0275)
Age	0.0110*** (0.0034)	Age	-0.0982*** (0.0033)
Own Car	-0.3965*** (0.1180)	Own Car	-0.0001 (0.0514)

Note: *** denotes significance at the 1% level, and ** denotes significance at the 5% level.

Table 12A: Effect of Cheap Talk Signaling (Low "a")

Total Effect (unit: per dollar loan)

	Funded probability	Initiator's expected payoff	Backer's expected payoff
Cheap talk is available	0.5093	0.0608	0.1591
Cheap talk is unavailable	0.5093	0.0526	0.1561
Equivalent rate		3.62%	1.00%

Individual Effect (unit: per dollar loan)

	Funded probability	Initiator is better off when cheap talk is	
		Available	Unavailable
$0.1462 \leq \rho < 0.3095$	0.2122	Yes	
$0.3095 \leq \rho < 0.3290$	0.2122		Yes
$0.3290 \leq \rho < 0.3923$	0.5903		Yes
$0.3923 \leq \rho < 1$	0.5903	Yes	

Note: (a) In this experiment, the initiator's a is 0.1462. (b) In equilibrium, the initiator does not say "High Credibility" if $0.1462 \leq \rho < 0.3290$ and says "High Credibility" if $0.3290 \leq \rho < 1$.

Table 11B: Effect of Cheap Talk Signaling (High "a")

Total Effect (unit: per dollar loan)

	Funded probability	Initiator's expected payoff	Backer's expected payoff
Cheap talk is available	0.5741	0.0728	0.1657
Cheap talk is unavailable	0.5741	0.0702	0.1648
Equivalent rate		2.96%	0.23%

Individual Effect (unit: per dollar loan)

	Funded probability	Initiator is better off when cheap talk is	
		Available	Unavailable
$0.2924 \leq \rho < 0.3421$	0.2851	Yes	
$0.3421 \leq \rho < 0.3476$	0.2851		Yes
$0.3476 \leq \rho < 0.4060$	0.5985		Yes
$0.4060 \leq \rho < 1$	0.5985	Yes	

Note: (a) In this experiment, the initiator's a is 0.2924. (b) In equilibrium, the initiator does not say "High Credibility" if $0.2924 \leq \rho < 0.3476$ and says "High Credibility" if $0.3476 \leq \rho < 1$.

Table 13: Effect of Paid Cheap Talk Signaling

Equilibrium (unit: per dollar loan)			
Price		Equilibrium	
$<$ 0.00015		Partially informative equilibrium (information size 3)	
$\geq$ 0.00015		Partially informative equilibrium (information size 2)	
Example (unit: per dollar loan)			
Price	Funded probability	ρ	Initiator's decision
0.0001	0.4042	$0.5674 \leq \rho < 0.6425$	Do not buy and no message
0.0001	0.4280	$0.6425 \leq \rho < 0.6455$	Buy and not say "High Credibility"
0.0001	0.5372	$0.6455 \leq \rho < 1$	Buy and say "High Credibility"
0.0002	0.4042	$0.5674 \leq \rho < 0.6464$	Do not buy and no message
0.0002	0.5375	$0.6464 \leq \rho < 1$	Buy and say "High Credibility"
Platform Pricing (unit: per dollar loan)			
Target	Price	Profit / Welfare	
Cheap talk fee maximizing	0.0131	0.0053	
Social welfare maximizing	0.0103	0.2074	
Initiator welfare improving	< 0.00003		
Backer welfare improving	< 0.0213		

Note: In this experiment, the initiator's a is 0.5674.

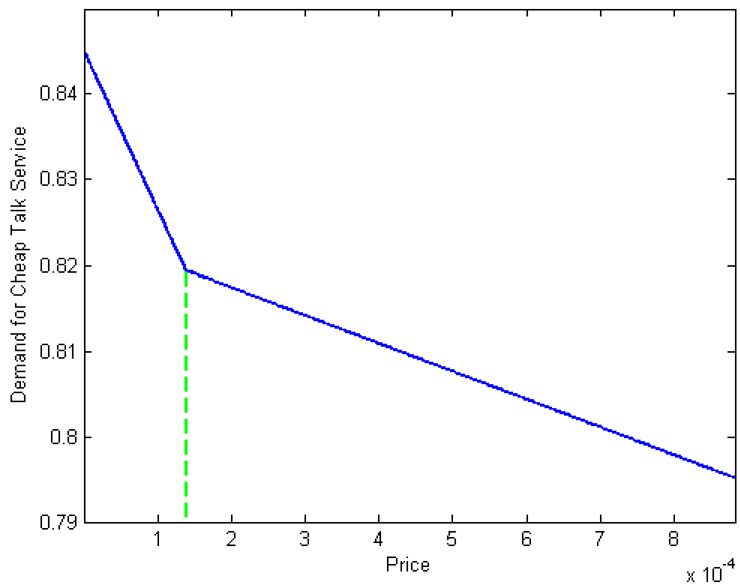

Figure 2: Demand Curve of Paid Cheap Talk Signaling

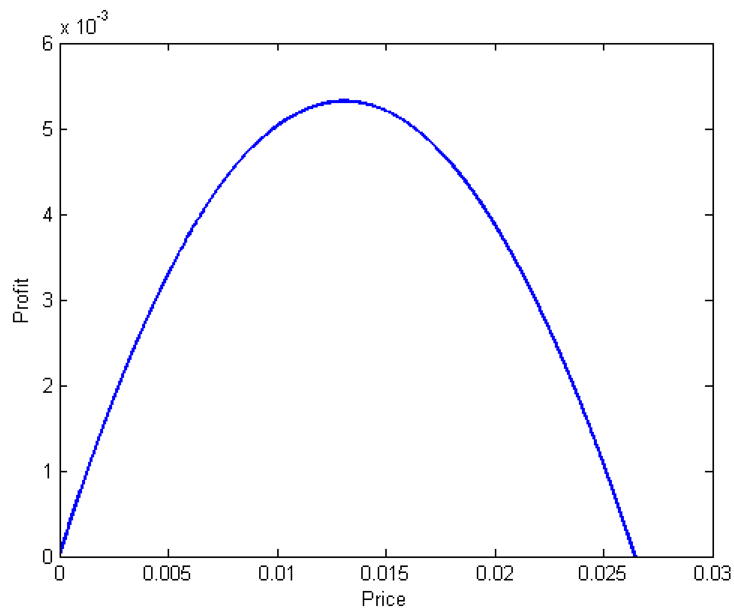

Figure 3: Crowdfunding Platform's Profit