This article was downloaded by: [155.246.103.35] On: 05 April 2017, At: 16:51
Publisher: Institute for Operations Research and the Management Sciences (INFORMS)
INFORMS is located in Maryland, USA

Management Science

Publication details, including instructions for authors and subscription information:
http://pubsonline.informs.org

Adverse Incentives in Crowdfunding

Thomas Hildebrand, Manju Puri, Jörg Rocholl

To cite this article:
Thomas Hildebrand, Manju Puri, Jörg Rocholl (2017) Adverse Incentives in Crowdfunding. Management Science 63(3):587-608.
http://dx.doi.org/10.1287/mnsc.2015.2339

Full terms and conditions of use: http://pubsonline.informs.org/page/terms-and-conditions

This article may be used only for the purposes of research, teaching, and/or private study. Commercial use or systematic downloading (by robots or other automatic processes) is prohibited without explicit Publisher approval, unless otherwise noted. For more information, contact permissions@informs.org.

The Publisher does not warrant or guarantee the article's accuracy, completeness, merchantability, fitness for a particular purpose, or non-infringement. Descriptions of, or references to, products or publications, or inclusion of an advertisement in this article, neither constitutes nor implies a guarantee, endorsement, or support of claims made of that product, publication, or service.

Copyright © 2016, INFORMS

Please scroll down for article—it is on subsequent pages

INFORMS is the largest professional society in the world for professionals in the fields of operations research, management science, and analytics.
For more information on INFORMS, its publications, membership, or meetings visit http://www.informs.org

RIGHTSLINK

http://pubsonline.informs.org/journal/mnsc/

MANAGEMENT SCIENCE
Vol. 63, No. 3, March 2017, pp. 587–608
ISSN 0025-1909 (print), ISSN 1526-5501 (online)

Adverse Incentives in Crowdfunding

Thomas Hildebrand,[a] **Manju Puri,**[b,c] **Jörg Rocholl**[d]

[a] E.CA Economics, 10178 Berlin, Germany; [b] Fuqua School of Business, Duke University, Durham, North Carolina 27708; [c] National Bureau of Economic Research, Cambridge, Massachusetts 02138; [d] ESMT European School of Management and Technology, 10178 Berlin, Germany

Contact: hildebrand@e-ca.com (TH); mpuri@duke.edu (MP); rocholl@esmt.org (JR)

Received: July 10, 2013
Revised: October 8, 2014; May 12, 2015
Accepted: June 2, 2015
Published Online in Articles in Advance: March 7, 2016

https://doi.org/10.1287/mnsc.2015.2339

Copyright: © 2016 INFORMS

Abstract. This paper analyzes the substantially growing markets for crowdfunding, in which retail investors lend to borrowers without financial intermediaries. Critics suggest that these markets allow sophisticated investors to take advantage of unsophisticated investors. The growth and viability of these markets critically depend on the underlying incentives. We provide evidence of perverse incentives in crowdfunding that are not fully recognized by the market. In particular, we look at group leader bids in the presence of origination fees and find that these bids are (wrongly) perceived as a signal of good loan quality, resulting in lower interest rates. Yet these loans actually have higher default rates. These adverse incentives are overcome only with sufficient skin in the game and when there are no origination fees. The results from the analysis in this paper provide more general implications for crowdfunding, its structure, and its regulation.

History: Accepted by Wei Jiang, finance.

Keywords: finance • financial institutions • banks • markets • economics • microeconomic behavior

1. Introduction

Markets for crowdfunding, barely known to a broader public until recently, have rapidly and significantly grown into a multibillion-dollar industry worldwide, covering loan markets as well as other types of financing and securities. In these booming markets, individuals can directly finance other individuals or companies without financial intermediation, making use of the growing availability and verifiability of information on these individuals and companies. According to an industry study, there were more than 1,250 active crowdfunding platforms worldwide in 2014, and crowdfunding markets raised USD 16.2 billion in 2014—an increase of 167% compared with USD 6.1 billion in 2013 (Crowdsourcing.org 2015). In terms of volume raised, the most important regions were North America (USD 9.46 billion), Asia (USD 3.4 billion), and Europe (USD 3.26 billion) (Crowdsourcing.org 2015).

As a consequence, crowdfunding, with its applicability to various areas and its significant pool of capital, has also received strong bipartisan support as a means to alleviate constraints for the financing of individuals and small business and thus of economic growth.[1] Accordingly, President Obama signed the "Jumpstart Our Business Startups (JOBS) Act" on April 5, 2012, legalizing crowdfunding by authorizing U.S. Securities and Exchange Commission (SEC)-approved portals for companies to seek funding from anyone. Crowdfunding has attracted significant attention in particular in the form of online lending in peer-to-peer transactions, which, according to the Consumer Financial Protection Bureau (CFPB), "could have significant implications for consumers seeking alternative sources of credit."[2] Whereas crowdfunding is thus commonly viewed as a means to fundamentally change the investment and financing process as well as providing more transparency, the potential of investors being taken advantage of by unscrupulous lenders has been expounded by a large number of regulators and academicians.[3]

Despite the growing importance of crowdfunding markets and their perception as markets of the future, our understanding of their functioning is still quite limited. Clearly, they differ from traditional markets, in particular, because there is no formal intermediary. Is the absence of formal intermediaries made up by the endogenous creation of groups and certification by group leaders? What are the incentives of players? Are sophisticated investors taking advantage of unsophisticated investors whose learning process might be too slow to cope with other investors' opportunistic behavior? What are the implications for the kinds of loans originated as well as their interest and default rates? The answer to such questions would be a first step toward understanding these markets and discussing the appropriate regulatory framework for them.

In this paper we study the incentives of the players. In particular, we examine different modes of origination and the related incentives. We do this by examining the impact of the existence of origination fees for group leaders in the form of group leader rewards in the specific setting of the online social lending platform Prosper.com, on which lenders can give their money directly to borrowers without the intermediation of a financial institution.[4] Success rates of listings are

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 16:51 . For personal use only, all rights reserved.

RIGHTSLINK

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 16:51 . For personal use only, all rights reserved.

higher in groups suggesting that groups are important. However, what are the group leader incentives? We are able to examine incentive effects for group leaders and how these change with and without the presence of origination fees. We analyze how these group leaders bid when rewards exist and how their bidding then affects the listing success, interest rates, and default rates of loans in their groups. We compare this effect to the corresponding evidence for the *same* group leaders when rewards in their groups do not exist anymore as well as for the counterfactual—groups in which the group leaders do not get a reward. Our results suggest the presence of perverse incentives in crowdfunding that are not fully recognized in the market. These perverse incentives have highly economically significant implications for lenders and borrowers, with the potential to induce these markets to collapse. The implications are noticeable even after a substantial period of time in which investors have the chance to learn and adjust their behavior accordingly. We show that learning indeed plays an important role but that it is too slow to affect the overall outcomes.

We find a marked difference in group leaders' behavior before and after the elimination of rewards, in the number and kind of loans being originated, the interest rates of these loans, and their performance. When group leaders can earn rewards, they bid actively and promote listings, thus increasing the success probability of these listings. After the elimination of the rewards, group leaders bid on and thus promote far fewer listings, with the result that also far fewer listings become successful. Furthermore, we find that the default rates of loans on which group leaders bid substantially decrease once group leaders are not allowed any more to charge rewards.

This change in group leader behavior with the resulting decrease in loan volume and improvement in loan performance is consistent with the notion that group leaders promote questionable loans to earn substantial and significant rewards. A more benign explanation is that because group leaders do not receive compensation any more, they are no longer willing to undergo costly verification work and to screen opaque borrowers of marginal creditworthiness. So more risky, marginal loans are not promoted. Perhaps the best place to see whether group leaders behave strategically to maximize their rewards is to examine their bidding behavior, and this is where the bulk of our analysis is conducted.

We find that default rates are substantially higher for the listings that group leaders bid on when they earn rewards, yet the interest rates for these loans are substantially lower. Group leader bids thus enhance the credibility of loans and are perceived as a signal of higher quality. However, these loans have ex post higher default rates (suggesting that they are of lower quality). The evidence suggests the existence of adverse incentives for the group leaders that are not fully recognized by other lenders with group leaders using bidding as a strategic tool to induce other lenders to come in. These perverse incentives are overcome when the group leader has sufficient skin in the game, i.e., when he bids on and contributes a substantial fraction of the requested loan amount and is thus severely hurt by losing money when a borrower defaults. We find in this case that the default rates are significantly lower than for other loans and almost identical to those for loans after the elimination of group leader rewards.

Furthermore, the adverse incentives do not exist in these groups when the *same* group leaders no longer earn rewards and in groups in which group leaders never earn a reward. Here, both default rates and interest rates are significantly lower for the listings that group leaders bid on. In sum, the evidence in this paper suggests that group leaders forgo strategic bidding only when they have skin in the game, which results in their screening listings carefully. This result provides more general lessons for the booming crowdfunding markets for lending, but it may also provide evidence for the design of crowdfunding markets for other types of securities in which information asymmetries and thus the potential for opportunistic behavior might be even more prevalent.

To the best of our knowledge, ours is the first paper to analyze the incentives of players in the rapidly growing arena of crowdfunding and furthermore to provide evidence on adverse incentives that do not appear to be fully recognized by the markets. Our paper is related to a number of different literatures.

First, it relates to the growing literature on irresponsible advice and lending by financial intermediaries and the resulting need for regulatory intervention and consumer protection, such as Bolton et al. (2007), Bergstresser et al. (2009), and Inderst and Ottaviani (2009).

Second, it is related to the classic literature that theorizes how incentives shape behavior to draw implications for financial markets. In theory, there are a host of papers that look at how information asymmetry can result in agency problems and the mechanisms needed to overcome them; e.g., Holmstrom and Tirole (1997), Gorton and Pennacchi (1995) model the importance of skin in the game, i.e., of the informed lender or monitor taking enough of a financial interest in the firm to reassure investors that the classic problems of adverse selection and moral hazard are overcome. Empirical work documenting how theorized effects translate into reality has lagged behind, largely because there are few natural experiments or settings where one can directly test for incentive effects. There are a few notable exceptions; e.g., Muralidharan and Sundararaman (2011) examine an experiment testing incentive effects in a teacher pay performance program.

RIGHTSLINK

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 16:51 . For personal use only, all rights reserved.

By examining a setting where there is a change in rules that disallows origination fees, we can see whether, for the same lenders, there is a distinct change in behavior that would correspond to theory.

Third, it relates to the literature on the use of technological innovations and their effect on bank organization and lending processes. Examples include Ferrari et al. (2010), Degryse et al. (2009), and Berger and Udell (2002). The use of new technologies is also relevant in the context of the differentiation between hard and soft information, along the lines of Stein (2002) and Berger et al. (2005).

Finally, there are a growing number of papers that analyze online peer-to-peer lending. Hulme and Wright (2006) provide an overview of the historical origins and contemporary social trends of online social lending. Ravina (2012) and Pope and Sydnor (2011) analyze whether there is discrimination on Prosper.com in terms of sociodemographic variables such as race and gender. These characteristics are taken care of by the difference-in-difference methodology employed in this paper. Iyer et al. (2016) investigate whether lenders can infer soft information in Prosper. Lin et al. (2013) investigate which roles social networks and, in particular, "the company that borrowers keep" (p. 22) (i.e., the borrowers' friends) play for the lending outcome. Duarte et al. (2012) show that loans of borrowers who appear more trustworthy are funded with a higher probability compared with loans of borrowers who appear less trustworthy. Michels (2012) investigates whether unverifiable disclosures are associated with increased funding probabilities and/or reduced interest rates of loans. Unlike these papers, we look at the incentives of various players in crowdfunding and the implications for loan origination and performance, which have much broader implications for the sustainability and growth of crowdfunding markets.

2. Institutional Setting and Data

2.1. The Market for Crowdfunding on Prosper.com

The market for crowdfunding on Prosper.com brings together potential borrowers and potential lenders.[5] After registering on the platform, potential borrowers can post a listing in which they ask for money and provide different types of information so that potential lenders can better assess their creditworthiness. Until today, more than 250,000 loans have been originated from more than 2.5 million listings on Prosper.com. The total amount funded exceeds $3 billion.

Borrowers indicate the requested amount, which—during our sample period between February 13, 2007 and April 15, 2008—is between $1,000 and $25,000, as well as the maximum interest rate they are willing to pay.[6] In our sample period, we observe a total of 153,541 listings. The left-hand side of panel A of Table 1 shows that potential borrowers ask for an average amount of $8,164 and are willing to pay an average interest rate of 17.97%.[7] Panel B shows that 8% of the listings are successful; i.e., they become loans. Listings are bid on in 53% of the cases and receive on average 16.86 bids.

Prosper.com assigns a unique identification number to each borrower and requires him to provide his social security and driver's license numbers so that Prosper.com can verify his identity and obtain his Experian Scorex PLUS^{SM} credit report. Credit grades range from AA for the best to HR for the worst customers and are based on the Experian credit score. Panel C of Table 1 shows the distribution of potential borrowers by credit grade. The largest number of potential borrowers has the worst credit grade of HR, but there is also a substantial number of potential borrowers with the best credit grades of AA/A and B. The borrower can provide additional information of which only some is verified, e.g., borrower state or house ownership.[8] Panel D of Table 1 shows that potential borrowers have an average debt-to-income ratio of 65%, and 34% of them own a house. They have been in their current jobs for 36 months.

Lenders can screen the listings and place one or several bids of at least $50 at any interest rate below or equal to the borrower's maximum rate. Bids cannot be canceled or withdrawn. The bidding is performed as an open uniform-price auction in which everybody can observe one another's actions. As long as the aggregate supply on a listing does not exceed the borrower's demand, bidders can see the amount but not the interest rates of the other bids. Once the aggregate supply exceeds the borrower's demand, bidders can also see the marginal interest rate. Lenders who offer the highest interest rates are outbid, and the resulting interest rate is bid down until the duration of the listing expires and the listing becomes a loan. Alternatively, borrowers can choose that the listing is closed as soon as the total amount bid reaches the amount requested. All winning bidders receive the marginal interest rate. In case the total amount bid does not reach the amount requested, the listing expires and no transaction takes place. In our sample period, all loans on Prosper.com are 36-month annuity loans, which can be paid back in advance. The platform charges fees to borrowers and lenders once a listing becomes a loan. Borrowers pay a one-time fee of between 1% and 5% of the loan amount depending on their credit grade, which is subtracted from the gross loan amount. Lenders pay a 1% annual servicing fee.

The right-hand side of panel A of Table 1 shows that the average amount of these loans is $7,097. Whereas borrowers indicate in their listings that they are willing to pay on average 20.01%, they end up paying 17.29%, as can be seen in panel B. Successful listings receive a

RIGHTSLINK

Table 1. Social Lending Overview

	Listings			Loans		
	N	Mean	S.D.	*N*	Mean	S.D.
Panel A: Listing characteristics						
Amount Requested ($1,000's)	153,541	8.16	6.49	12,183	7.10	6.01
Borrower Maximum Rate (%)	153,541	17.97	7.62	12,183	20.01	6.92
Duration (days)	153,541	7.52	2.11	12,183	7.70	2.12
Closed as Soon as Funded (dummy)	153,541	0.31	0.46	12,183	0.23	0.42
Panel B: Success measures						
Listing Success (dummy)	153,541	0.08	0.27	12,183	1.00	0.00
Number of Bids	153,541	16.86	63.29	12,183	161.64	152.67
Listing Was Bid On (dummy)	153,541	0.53	0.50	12,183	1.00	0.00
Borrower Rate (%)	153,541	17.75	7.57	12,183	17.29	6.62
Panel C: Distribution of credit grades						
AA/A	9,583			3,143		
B	8,517			1,979		
C	16,513			2,530		
D	24,771			2,292		
E	27,423			1,072		
HR	66,734			1,167		
Total	153,541			12,183		
Panel D: Borrower characteristics						
Debt-to-Income Ratio	153,541	0.65	1.65	12,183	0.40	1.18
Is Borrower Homeowner (dummy)	153,541	0.34	0.48	12,183	0.47	0.50
Current Delinquencies	153,541	3.63	4.95	12,183	1.19	2.90
Delinquencies Last 7 Years	153,541	11.51	16.82	12,183	5.53	11.99
Total Credit Lines	153,541	25.66	14.30	12,183	24.51	14.16
Months in Current Occupation	153,541	36.15	64.16	12,183	37.41	65.08

Notes. In this table we report general descriptive statistics on Prosper.com, distinguishing between listings (i.e., all requests for borrowing money) and loans (i.e., successfully and completely funded requests for borrowing money). Panel A summarizes listing characteristics, panel B reports success measures for these listings, panel C provides the distribution of credit grades, and panel D shows borrower characteristics.

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 16:51 . For personal use only, all rights reserved.

substantially higher number of bids, which amounts to more than 161. The distribution of loans across credit grades is substantially different from the distribution of listings, and most loans are given to customers with the credit grade of AA/A. Finally, panel D shows that borrowers with successful listings have a lower debt-to-income ratio and are more likely to be homeowners. A borrower who defaults on his loan is reported to credit bureaus. Prosper.com uses collection agencies to recover the outstanding balances, and their fees are borne by the lenders. Loans are unsecured with no second market unless they become overdue.

2.2. The Group System

Platform members can organize themselves in groups. Each user can form a group by defining the group purpose as well as the nature and interests of its members and thus become a group leader. Each user can be member and thus group leader of at most one group. The group leader administers her group and can also act as a lender or borrower. Furthermore, the group leader has the right to grant or deny users access to her group and ask for verification of the information they provide. Many group leaders request additional information from potential borrowers, a process referred to as vetting. Furthermore, some group leaders request to review every listing before it is posted in the group and explicitly offer help to potential borrowers in writing and designing the listing.

The group leader can exploit her informational advantage and the fact that everybody can observe each other's actions to promote listings in her group. In particular, she can place a bid on the respective listing, thereby signaling a financial commitment to the trustworthiness of the borrower. Furthermore, the group leader can write an endorsement for the potential borrower, i.e., a short text in which she describes why this respective borrower is particularly trustworthy. We concentrate on the analysis of bids as the most credible commitment by the group leaders, who are more active than other group members and the key facilitators in their groups.

Group leaders may either provide their service for free—for example, because of the interest they earn on loans or the benefits from social interaction—or charge a fee on loans closed in their group.[9] We distinguish between no-reward groups and reward groups and define a group as a *reward group* if the group leader requires a group leader reward for at least one listing in her group. Otherwise, the group is defined as a *no-reward group*.

RIGHTSLINK

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 16:51 . For personal use only, all rights reserved.

Table 2. Social Lending: Overview by Group Type

	Listings			Loans		
	No group	No-reward group	Reward group	No group	No-reward group	Reward group
			Panel A: Listing characteristics (means)			
Amount Requested ($1,000's)	8.34	7.70	7.56	7.09	6.35	7.22
Borrower Maximum Rate (%)	17.61	17.90	19.28	19.29	18.14	21.62
Duration (days)	7.42	7.87	7.86	7.46	7.84	8.10
Closed as Soon as Funded (dummy)	0.31	0.21	0.29	0.25	0.16	0.20
			Panel B: Success measures (means)			
Listing Success (dummy)	0.06	0.35	0.12	1.00	1.00	1.00
Number of Bids	13.66	60.75	25.83	157.10	155.33	170.93
Listing Was Bid On (dummy)	0.50	0.82	0.66	1.00	1.00	1.00
Borrower Rate (%)	17.44	16.84	18.91	16.70	15.12	18.70
			Panel C: Distribution of credit grades (N)			
AA/A	7,641	301	1,641	2,303	181	659
B	6,532	146	1,839	1,366	73	540
C	12,572	293	3,648	1,572	119	839
D	18,896	346	5,529	1,258	130	904
E	21,005	261	6,157	514	63	495
HR	52,037	545	14,152	432	88	647
Total	118,683	1,892	32,966	7,445	654	4,084
			Panel D: Borrower characteristics (means)			
Debt-to-Income Ratio	0.63	0.61	0.74	0.31	0.59	0.53
Is Borrower Homeowner (dummy)	0.35	0.35	0.34	0.49	0.42	0.44
Current Delinquencies	3.60	2.34	3.84	0.87	1.29	1.77
Delinquencies Last 7 Years	11.39	8.68	12.11	4.55	5.66	7.31
Total Credit Lines	25.56	24.79	26.07	24.10	24.30	25.31
Months in Current Occupation	31.33	43.07	53.11	27.02	43.07	55.45
			Panel E: Group characteristics (means)			
GL Bid (dummy)		0.46	0.32		0.70	0.58
GL Bids Successfully (dummy)		0.41	0.29		0.55	0.33
Vetting (dummy)		0.29	0.09		0.30	0.14
Listing Review Requirement (dummy)		0.66	0.41		0.80	0.64
GL Offers Help (dummy)		0.18	0.08		0.28	0.11
GL Endorsement (dummy)		0.33	0.12		0.57	0.39
N	118,683	1,892	32,966	7,445	654	4,084

Notes. In this table we report general descriptive statistics on Prosper.com, distinguishing between listings (i.e., all requests for borrowing money) and loans (i.e., successfully and completely funded requests for borrowing money). We further distinguish whether the listing was not posted in a group ("No group"), in a no-reward group ("No-reward group"), or in a reward group ("Reward group"). Panel A summarizes listing characteristics, panel B reports success measures for these listings, panel C provides the distribution of credit grades, panel D shows borrower characteristics, and panel E gives group characteristics for those listings/loans that were posted in groups.

Table 2 provides an overview of listings and loans across reward groups, no-reward groups, and outside groups. The left-hand side of panel B shows that the success probability is highest for listings in no-reward groups, followed by those in reward groups and outside groups. This observation is mirrored by the different number of bids and the different probabilities with which there was bidding at all across these different groups. Panel C shows that most listings are posted either outside a group (118,683) or in a reward group (32,966); far fewer listings are posted in no-reward groups (1,892). Panel D presents the borrower characteristics for the different types of groups and shows that the debt-to-income ratio as well as current and past delinquencies are lowest for potential borrowers in no-reward groups. Finally, panel E shows the information on group-specific characteristics. Group leaders are most active in no-reward groups in terms of bidding on listings. The share of listings with at least one group leader bid is here (46%) considerably higher than in reward groups (32%).

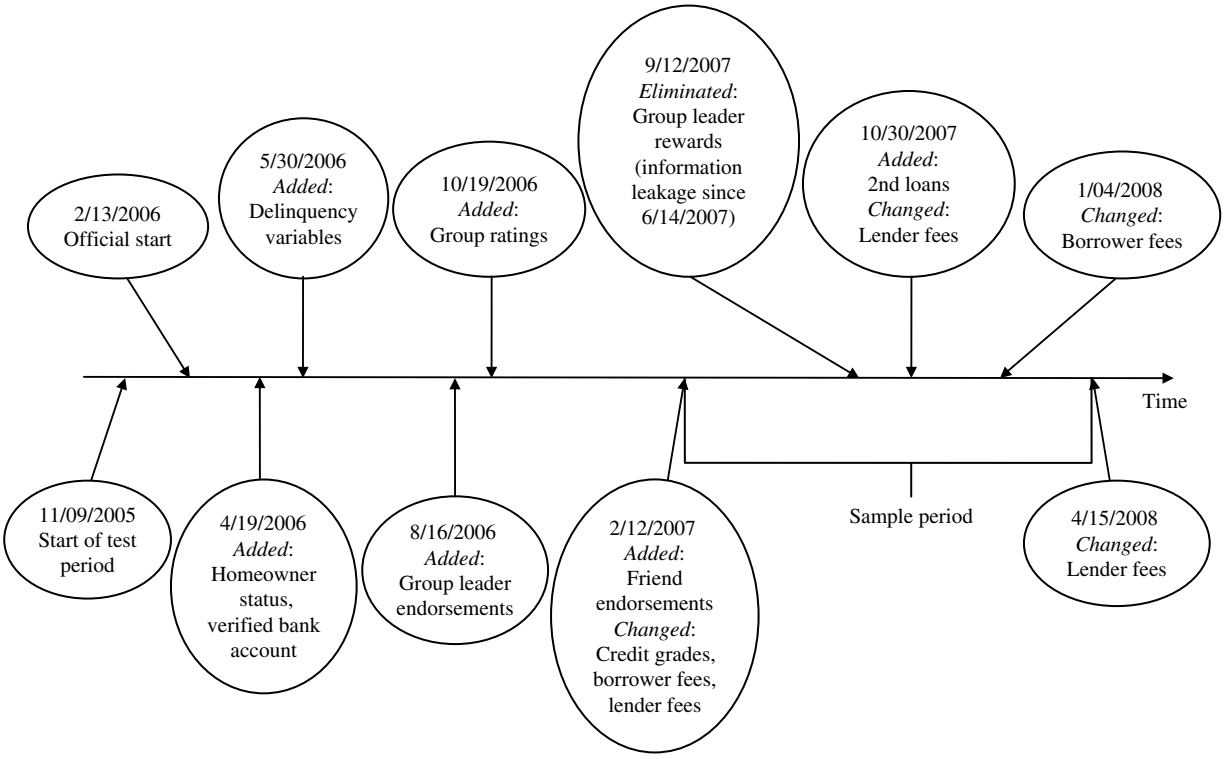
2.3. The Existence and Elimination of Rewards

Prosper.com officially started its business in 2006. Since then, there have been several policy changes on the platform, which are summarized in Figure 1.

We focus our analysis on group leader rewards, which existed at the beginning of our sample period on February 13, 2007, and were eliminated in the summer of 2007. As early as on June 14, 2007, the first rumors of their elimination appeared in online platforms.[10] The official policy change then took place on September 12, 2007.[11] Because the first rumors may have already changed group leader behavior, we choose the midpoint between the occurrence of the first rumors

RIGHTSLINK

Figure 1. Timeline of Policy Changes on Prosper.com



and the official change as the relevant date, which is the week of July 30, 2007. Prosper.com motivated the elimination of group leader rewards in its announcement: "[t]he original philosophy . . . was to enable borrowers in close-knit communities to leverage the reputation and peer pressure of their group . . . where compensation is not the dominant motivation for the group leader's services" (Matt 2007). This event imposed a change on reward group leaders and systematically changed their incentives in the loan granting process. It thus represents an ideal setting to analyze how group leaders bid when rewards exist and what this means for loan outcomes. It also allows us to analyze how group leaders' bidding behavior and loan outcomes react to this sudden change in incentives. To exclude possible influences of other significant policy changes, we restrict our analysis to the loans originated between February 13, 2007 and April 15, 2008, in which no other significant policy change occurs and follow their performance until March 1, 2010.[12] The policy change of interest in our study is thus well centered in the sample period.

3. Empirical Analysis and Results

3.1. Univariate Analysis

3.1.1. Group Leader Bids. Group leaders can use bids as an important mechanism to promote listings in their groups. However, the existence of rewards for group leaders may create adverse incentives for these group leaders. Rewards for successful listings may induce them to use bids to persuade other lenders to bid even on weak listings by making other lenders believe that these listings are creditworthy. Thus, in the first step, it is important to understand how bids are used in no-reward and reward groups and which outcomes are associated with them. In the observed period, group leaders bid on 32.7% of the listings, and these bids tend to be successful; among all first group leader bids on a listing, only 13% are outbid. Most of these bids constitute small amounts—very often \$50 or \$100—so that the median amount of the first group leader bid is \$70. Usually, these bids are placed very quickly. If a group leader bids, her first bid is typically also the first overall bid on the respective listing.[13]

Table 3 analyzes for no-reward and reward groups the listing success, interest rates, and loan performance based on whether the group leaders bid on a listing.

Panel A of Table 3 shows how success rates of listings are related to group leader bids. In no-reward groups, success rates for listings with (52.8%) are much higher than for those without a group leader bid (19.2%). This is true for all credit grades, which shows that group leader bids increase the probability of funding regardless of the riskiness of the listing. The analysis of reward groups draws a similar picture: here, only 7.7% of the listings without a group leader bid are funded, whereas the listing success is significantly increased by group leader bids (22.4%). From panel B of Table 3, we observe that in no-reward groups, group leader bids do not significantly influence the interest the borrower has

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 16:51 . For personal use only, all rights reserved.

RIGHTSLINK

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 16:51 . For personal use only, all rights reserved.

Table 3. Listing Success, Interest Rates, and Loan Performance by Group Leader Bid

Panel A: Listing success

	No-reward groups (N = 1,892)			Reward groups (N = 32,966)		
Credit grade	Without GL bid (%)	With GL bid (%)	t-Statistic	Without GL bid (%)	With GL bid (%)	t-Statistic
AA/A	46.8	78.1	−5.92***	33.6	50.0	−6.65***
B	38.3	64.6	−3.26***	23.1	38.5	−6.99***
C	21.9	60.6	−7.27***	17.0	33.2	−10.76***
D	14.4	56.0	−9.09***	10.6	26.4	−14.20***
E	10.1	42.5	−6.11***	3.8	18.0	−15.05***
HR	4.7	32.4	−8.30***	2.0	11.1	−17.49***
Average	19.2	52.8	−16.01***	7.7	22.4	−33.24***

Panel B: Interest rates

	No-reward groups (N = 654)			Reward groups (N = 4,084)		
Credit grade	Without GL bid (%)	With GL bid (%)	t-Statistic	Without GL bid (%)	With GL bid (%)	t-Statistic
AA/A	9.3	9.3	−0.17	11.1	11.4	−1.43
B	13.6	12.4	1.73*	15.4	14.6	2.49**
C	15.5	15.6	−0.08	18.3	16.8	5.47***
D	19.2	17.4	1.74*	20.7	19.7	3.44***
E	21.8	20.6	0.82	24.6	23.8	2.03**
HR	24.2	19.7	2.41**	26.2	24.2	4.84***
Average	14.2	15.5	5.47***	18.6	18.8	−1.12

Panel C: Loan performance

	No-reward groups (N = 654)			Reward groups (N = 4,084)		
Credit grade	Without GL bid	With GL bid	t-Statistic	Without GL bid	With GL bid	t-Statistic
AA/A	3.0	6.9	10.00***	8.1	11.6	12.74***
B	12.4	5.0	−9.86***	14.4	16.5	6.19***
C	9.5	11.0	2.27**	17.2	16.8	−1.31
D	8.2	12.0	5.19***	16.9	17.4	1.73*
E	17.7	13.9	−3.23***	18.3	22.1	9.26***
HR	28.3	20.5	−5.78***	22.6	24.4	4.34***
Average	10.8	12.2	4.29***	16.1	18.6	19.40***

Notes. In this table we report univariate results by group leader bids and credit grade. The table distinguishes between No-reward groups and Reward groups. Panel A shows success rates of listings (i.e., of the requests for borrowing money) by the different credit grades from AA/A (best) to HR (worst). Panel B shows the corresponding interest rates of loans (i.e., of the successfully and completely funded requests for borrowing money). Panel C shows failure rates of loans (per 1,000 loan-days). In this panel, any payment that is not made on time is considered as a failure, so that failure events are late payments, charge-offs, and defaults. t-Statistics of the test on equality of means.

***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

to pay, except for slightly lower interest rates for credit grades B, D, and HR. The effect is more pronounced for reward groups. The analysis by credit grade reveals that loans with a group leader bid are associated with significantly smaller interest rates, in particular for the riskier credit grades. For example, borrowers with a loan in the credit grade HR pay on average 26.2% if the listing has no group leader bid but only 24.2% if the group leader bids on the listing. From panel C of Table 3, we see that in no-reward groups, loans of the riskier credit grades E and HR have lower failure rates if they have a group leader bid. By sharp contrast, loans in reward groups with a group leader bid in general have significantly higher failure rates than loans without a group leader bid. This is the case for almost all credit grades. Apparently, group leader bids do not work as credible signals in reward groups, as they lead to loans with higher default rates yet lower interest rates.

Taken together, in both group types the success rates of listings with group leader bids are much higher than for listings without these bids. Yet while in no-reward groups this mechanism is associated with listings of good quality despite their bad credit grade E or HR, in reward groups failure rates are systematically increased for listings with a group leader bid and interest rates are decreased. Group leader bids thus lead to adverse outcomes in reward groups. If this is due to

RIGHTSLINK

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 16:51 . For personal use only, all rights reserved.

adverse incentives for group leaders, then we should expect to see a different pattern in their behavior before and after the change in reward structure. Our subsequent analysis thus focuses on group leader bidding behavior in reward groups before and after the elimination of rewards.

3.1.2. Group Leader Bidding Before and After the Elimination of Group Leader Rewards. We analyze next how the existence of rewards affects the group leader bidding behavior. Figure 2 shows the weekly share of listings with at least one group leader bid in no-reward and reward groups. In no-reward groups, this share does not show any remarkable trend over the sample period. By sharp contrast, in reward groups the share decreases dramatically from about 40% to less than 10% once group leader rewards are eliminated.[14]

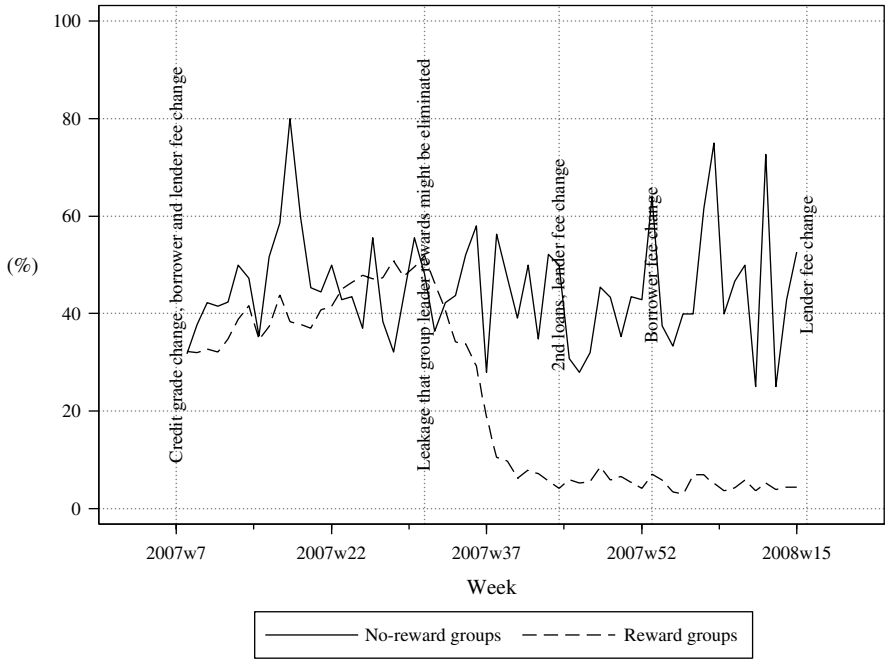
Group leaders of reward groups thus significantly lower the effort they put into listings and in particular risky listings after the elimination of rewards—as opposed to group leaders of no-reward groups who do not change their behavior.

The bidding behavior and outcome patterns are analyzed in more detail in Table 4. In particular, Table 4 distinguishes between the time period before and after the elimination of rewards and analyzes the effect of group leader bids on the different outcomes before and after this change. Panel A shows that the listing success increases with a group leader bid both before and after the elimination of rewards. This pattern holds for each credit grade and is both statistically and economically highly significant. The results suggest that group leader bids are perceived as a credible signal for loan quality and help to induce other lenders to contribute to a loan. They also show that the impact of a group leader bid tends to be even more important after the elimination of rewards. Whereas the listing success without a group leader bid is very similar before and after the change, it is much higher for group leader bids after the change than for group leader bids before the change. For example, for credit grades AA/A, before the change the listing success increases from 33.9% without a group leader bid to 48.0% with a group leader bid; the corresponding increase after the change is from 32.6% to 67.6%.

Panel B of Table 4 shows the results for the analysis of the interest rates. The pattern is again very similar before and after the elimination of the rewards.[15] Interest rates are significantly lower for loans with group leader bids than for loans without group leader bids, and this pattern holds in particular before the change. Group leader bids are thus again perceived as a credible signal for the quality of borrower listings and induce other lenders to charge lower interest rates for the resulting loans.

Finally, panel C of Table 4 analyzes the performance of loans before and after the elimination of group leader rewards dependent on whether the group leader bids on them. In strict contrast to the results in panels A and B, the patterns here are completely different before and after the change. Before the change, loans with a group leader bid exhibit significantly higher default rates than loans without a group

Figure 2. Group Leader Bids



Note. In this figure we report, by group type, the weekly share of listings (i.e., of requests for borrowing money) with at least one group leader bid.

RIGHTSLINK

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 16:51 . For personal use only, all rights reserved.

Table 4. Listing Success, Interest Rates, and Loan Performance in Reward Groups by Group Leader Bid (Before vs. After Elimination of Group Leader Rewards)

Panel A: Listing success

	Before (N = 25,990)			After (N = 6,976)		
Credit grade	Without GL bid (%)	With GL bid (%)	t-Statistic	Without GL bid (%)	With GL bid (%)	t-Statistic
AA/A	33.9	48.0	−5.25***	32.6	67.6	−5.36***
B	23.0	37.2	−6.10***	23.8	59.1	−4.43***
C	17.5	32.9	−9.62***	15.6	38.2	−3.69***
D	11.2	25.9	−12.42***	9.1	40.3	−5.11***
E	3.9	18.1	−14.41***	3.6	15.8	−2.87***
HR	1.9	10.9	−17.04***	2.4	18.7	−4.60***
Average	8.1	21.8	−29.65***	6.8	35.9	−12.69***

Panel B: Interest rates

	Before (N = 3,483)			After (N = 601)		
Credit grade	Without GL bid (%)	With GL bid (%)	t-Statistic	Without GL bid (%)	With GL bid (%)	t-Statistic
AA/A	11.2	11.4	−0.87	10.9	11.7	−1.39
B	15.3	14.6	2.05**	15.7	14.6	1.12
C	18.3	16.8	4.84***	18.5	16.6	2.35**
D	20.8	19.8	3.56***	20.3	19.3	1.12
E	24.1	23.8	0.86	25.8	23.6	1.02
HR	25.8	24.1	4.23***	27.1	25.8	0.83
Average	18.2	18.9	−3.21***	19.5	17.2	3.82***

Panel C: Loan performance

	Before (N = 3,483)			After (N = 601)		
Credit grade	Without GL bid	With GL bid	t-Statistic	Without GL bid	With GL bid	t-Statistic
AA/A	8.4	11.4	10.2***	7.2	12.8	8.05***
B	14.0	16.6	6.77***	15.5	15.6	0.17
C	17.9	17.1	−2.51**	14.5	11.0	−4.39***
D	17.9	17.8	−0.47	13.9	9.7	−5.95***
E	18.1	22.4	9.23***	18.8	14.0	−3.90***
HR	22.2	24.7	5.10***	23.3	18.5	−4.51***
Average	16.2	19.0	18.97***	15.7	13.4	−6.33***

Notes. In this table we report univariate results for reward groups by credit grade. We distinguish whether the listing (i.e., the request for borrowing money) or the loan (i.e., the successfully and completely funded request for borrowing money) was created before or after the elimination of group leader rewards and whether or not the group leader placed a bid on it. Panel A shows success rates of listings by the different credit grades from AA/A (best) to HR (worst). Panel B shows the corresponding interest rates of loans. Panel C shows failure rates of loans (per 1,000 loan-days). In this panel, any payment that is not made on time is considered as a failure, so that failure events are late payments, charge-offs, and defaults. t-Statistics of the test on equality (before versus after the elimination of group leader rewards) are reported in parentheses.

***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

leader bid. This means that other lenders trust the group leader bid, as they are willing to participate in these loans at lower interest rates, but they are significantly hurt by the weaker performance of these loans. Whereas group leader bids are perceived as a signal for loans of higher quality, they are, in fact, associated with loans of lower quality. These bids lead other lenders to participate in loans in which they should not participate, at least not at the given interest rates.

After the change, however, loans with a group leader bid exhibit significantly lower default rates than loans without a group leader bid and thus show the same pattern as the results for the no-reward groups. The striking result in Table 3 that group leader bids in reward groups are associated with lower interest rates and yet higher default rates is thus only due to the pattern in the time when rewards exist. Without rewards, the patterns in these groups are very similar to those in no-reward groups.

Group leader bids thus do not work when group leader rewards exist; they work properly when no such rewards exist. The results suggest that group leaders much more carefully screen and choose the listings that are funded when they have skin in the game. An open question is why—when group leader rewards exist—other lenders are willing to contribute to loans with

RIGHTSLINK

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 16:51 . For personal use only, all rights reserved.

group leader bids at lower interest rates and yet higher default rates. This suggests that co-lenders do not fully foresee and adjust their behavior to the consequences of the adverse incentives created by up-front rewards, most likely because of the short period between the creation of the webpage and the point of time when these lenders have to make their decisions.[16] In the subsequent analyses, we control for the possibility of learning by taking into account the level of experience that lenders in specific loan listings have.

3.2. Multivariate Analysis

To determine the driving factors behind the results described above and to control for the joint influences, we now turn to the multivariate analysis. First, we only consider listings and loans in reward groups, conducting an event study in a traditional regression framework. Second, we use no-reward groups as the reference group for the evaluation of the developments in the reward groups, employing a difference-in-difference approach.

3.2.1. Traditional Regression Framework

3.2.1.1. *Listing Success.* Table 5 shows odds ratios of logistic regressions of listing success. In specification (1), we evaluate the influence that different listing characteristics and borrower characteristics have on listing success, abstracting from group characteristics and group leader bids. Listing success is decreasing in credit grade risk and debt-to-income ratio; it is increasing in homeownership and in income.[17] As suggested by Lin et al. (2013)—and using the definition

Table 5. Listing Success (Only Reward Groups)—Multivariate Analysis

	(1)	(2)	(3)
Group leader bids			
GL Bid		2.067*** (14.34)	
GL Bid: Before			1.998*** (13.21)
GL Bid: After			2.874*** (7.52)
Group characteristics			
Vetting		1.116 (1.62)	1.091 (1.28)
Listing Review Requirement		1.272*** (4.41)	1.273*** (4.42)
GL Offers Help		1.159** (1.97)	1.167** (2.06)
GL Endorsement		3.751*** (24.89)	3.744*** (24.82)
Group Members (1,000's)		0.931*** (−7.80)	0.933*** (−7.62)
Group Ratings	Yes	Yes	Yes
Listing characteristics			
After	0.569*** (−10.66)	0.917 (−1.42)	0.857** (−2.27)
Amount Requested ($1,000's)	0.891*** (−28.54)	0.882*** (−28.50)	0.882*** (−28.57)
Duration	1.088*** (8.77)	1.024** (2.29)	1.024** (2.32)
Closed as Soon as Funded	0.839*** (−3.78)	0.978 (−0.45)	0.978 (−0.46)
Average Lender Experience	4.871*** (48.57)	4.224*** (43.29)	4.215*** (43.22)
Borrower characteristics			
Credit Grade: B	0.678*** (−4.80)	0.654*** (−4.97)	0.657*** (−4.90)
Credit Grade: C	0.489*** (−9.62)	0.456*** (−9.97)	0.459*** (−9.88)
Credit Grade: D	0.297*** (−15.88)	0.264*** (−16.53)	0.266*** (−16.41)
Credit Grade: E	0.128*** (−23.13)	0.114*** (−22.97)	0.115*** (−22.86)
Credit Grade: HR	0.071*** (−29.30)	0.062*** (−28.95)	0.062*** (−28.87)
Debt-to-Income Ratio	0.959*** (−3.01)	0.962** (−2.57)	0.961*** (−2.66)
Is Borrower Homeowner	1.143*** (2.98)	1.161*** (3.16)	1.161*** (3.15)
Number of Friends (level 0)	1.419*** (13.94)	1.387*** (12.03)	1.386*** (11.98)
Income Status	Yes	Yes	Yes
Employment Status	Yes	Yes	Yes
Current and Previous Solvency	Yes	Yes	Yes
N	32,966	32,966	32,966
Pseudo R^2	0.237	0.315	0.315

Notes. In specification (3), the difference between the regression coefficients of *GL Bid: Before* and *GL Bid: After* is significant at 5%. In this table we report odds ratios of the logistic regression of funding success, i.e., the exponentiated regression coefficients. Coefficients larger (respectively, smaller) than 1 indicate relatively higher (respectively, smaller) success probabilities than in the reference group. In all three specifications, only listings (i.e., requests for borrowing money) in reward groups are considered. In specification (1), we do not account for any group-specific information. Specification (2) reports the overall effect of a group leader bid on listing success. Specification (3) compares effect of a group leader bid before and after the elimination of group leader rewards on listing success in the reward groups. The reference is AA/A listings before the elimination of group leader rewards without a group leader bid. *t*-Statistics are reported in parentheses. The full table of coefficients is available from the authors upon request.

***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

RIGHTSLINK

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 16:51 . For personal use only, all rights reserved.

that they adopt in their paper—we also control for the number of friends that the borrower has on Prosper.com and find that friends increase the likelihood of listing success.[18] We also find that listings with on average more experienced lenders have a higher listing success.

In addition to these general listing characteristics and borrower characteristics, in specifications (2) and (3) we also evaluate the influence of different group characteristics. The probability that the listing is funded increases significantly if the group leader requires the listing to be reviewed before it is posted in the group (*Listing Review Requirement*), if the group leader offers help in designing the listing (*GL Offers Help*), or if the group leader writes an endorsement (*GL Endorsement*). Larger groups exhibit a lower listing success (*Group Members*). Likewise, better groups tend to have a lower listing success (*Group Ratings*: 1 *Star*, . . . , 5 *Stars*).[19] Most importantly for the purpose of our study, group leader bids are highly important for the success of a listing, as can be seen at the top of specifications (2) and (3). In specification (2), we include a dummy variable for group leader bids into the regression (*GL Bid*). Listings with a *GL Bid* exhibit particularly high funding probabilities; *GL Bid* is thus perceived as a signal of high quality, inducing other lenders to contribute to the loan amount. In specification (3), we analyze to what extent the influence of this *GL Bid* on listing success in reward groups is different before and after the elimination of group leader rewards. The specification shows that the influence of a group leader bid on listing success in reward groups is significant both before and after the change, and it is higher after the change. Both results are consistent with the evidence from the univariate analysis and indicate that—after the elimination of group leader rewards—potential lenders trust more than before the correctness of the group leader's signal that comes from his bid. This suggests that after this change, lenders might be less concerned about the group leader behaving opportunistically and promoting listings only for their own benefit.

3.2.1.2. *Interest Rates of Loans.* To determine the influence of the different variables on the interest rates that borrowers have to pay to the lenders if their listing is funded, we run Tobit regressions of this interest rate (in percent) on the same independent variables as in the regressions in Table 5. Table 6 reports the results, where the dependent variable is truncated at left at 0% and at right at 35%, which is the maximum interest rate possible on Prosper.com.[20] Naturally, the sample is restricted to those listings that are completely funded and therefore become loans.

The interest rate of loans in the reference group, AA/A loans, is about 7%. The borrower's credit grade is by far the most important factor for the interest rate charged to the borrower. Apart from that, the interest rate is increasing in the debt-to-income ratio and in the number of historical and current records in the credit report. Furthermore, a higher amount requested typically increases the interest rate. Furthermore, the more friends the borrower has on Prosper.com, the lower the interest rate of the loan. Finally, loans with, on average, more experienced lenders have a smaller interest rate.

Specification (2) shows that loans originated from listings with a *GL Bid* benefit from particularly low interest rates. Consistent with the earlier evidence, *GL Bid* is perceived as a credible signal for the quality of a loan and induces other lenders to ask for lower interest rates. We also find that the interest rate of the loan is significantly lower if the group leader claims to verify additional information from the borrower (*Vetting*) or if the group leader offers help in designing the listing (*GL Offers Help*). Finally, from specification (3) we deduce that a group leader bid is associated with lower interest rates before and after the elimination of rewards. Other lenders thus trust the group leader bid as a credible signal throughout the sample period, independently of whether the group leader earns a reward or not. However, after the elimination of group leader rewards, the interest rate of loans with a *GL Bid* in reward groups is about 0.7 percentage points smaller than before. This result indicates that group leader bids have a significant influence on the resulting interest rate in this group type, whereas the signal is more credible after the elimination of group leader rewards than before.

3.2.1.3. *Loan Performance.* To analyze the determinants of loan performance in reward groups, we specify Cox proportional hazards models with the same independent variables as before.[21] The underlying assumption of the models is that the coefficients are not time-varying; i.e., the importance of a variable for the probability of defaulting or being late is constant over time.[22] Loans are exposed to the process from the time they are originated until they are completely paid back, they default, or their data run out. The results are reported in Table 7.

Specification (1) of Table 7 shows that hazard rates are increasing in the credit grade risk and the debt-to-income ratio. Hazard rates are decreasing in income, whereas borrowers who are unemployed or retired have higher hazard rates. Furthermore, if the listing has a short duration or if it is closed as soon as it is funded, the corresponding loan is potentially exposed to a higher hazard rate. Together, this suggests that borrowers in urgent need of money exhibit higher hazard rates. Furthermore, hazard rates are decreasing in the number of the borrower's friends. We also find that listings with, on average, more experienced lenders have a lower likelihood to default. This result implies that learning has an important positive effect on defaults, significantly reducing their occurrence. The results in specifications (2)–(4) suggest that hazard

RIGHTSLINK

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 16:51 . For personal use only, all rights reserved.

Table 6. Interest Rates (Only Reward Groups)—Multivariate Analysis

	(1)	(2)	(3)
Group leader bids			
GL Bid		−0.737*** (−5.69)	
GL Bid: Before			−0.666*** (−4.97)
GL Bid: After			−1.351*** (−4.12)
Group characteristics			
Vetting		−0.606*** (−3.71)	−0.546*** (−3.29)
Listing Review Requirement		0.214 (1.50)	0.217 (1.52)
GL Offers Help		−0.313* (−1.76)	−0.329* (−1.85)
GL Endorsement		−0.194 (−1.52)	−0.175 (−1.38)
Group Members (1,000's)		−0.032 (−1.27)	−0.033 (−1.32)
Group Ratings	Yes	Yes	Yes
Listing characteristics			
After	1.722*** (11.52)	1.524*** (9.43)	1.731*** (9.06)
Amount Requested ($1,000's)	0.289*** (27.47)	0.295*** (27.95)	0.297*** (28.03)
Duration	−0.033 (−1.27)	−0.005 (−0.19)	−0.005 (−0.21)
Closed as Soon as Funded	3.321*** (24.89)	3.125*** (23.08)	3.130*** (23.12)
Average Lender Experience	−0.098*** (−2.72)	−0.097*** (−2.72)	−0.095*** (−2.68)
Borrower characteristics			
Credit Grade: B	2.992*** (15.24)	2.972*** (15.26)	2.959*** (15.20)
Credit Grade: C	5.803*** (31.72)	5.781*** (31.78)	5.764*** (31.68)
Credit Grade: D	8.637*** (44.79)	8.668*** (45.19)	8.651*** (45.08)
Credit Grade: E	12.231*** (51.94)	12.354*** (52.48)	12.333*** (52.37)
Credit Grade: HR	12.990*** (53.77)	13.187*** (54.48)	13.168*** (54.39)
Debt-to-Income Ratio	0.150*** (3.84)	0.168*** (4.33)	0.171*** (4.40)
Is Borrower Homeowner	−0.518*** (−4.29)	−0.542*** (−4.53)	−0.546*** (−4.56)
Number of Friends (level 0)	−0.138** (−2.35)	−0.133** (−2.29)	−0.131** (−2.26)
Income Status	Yes	Yes	Yes
Employment Status	Yes	Yes	Yes
Current and Previous Solvency	Yes	Yes	Yes
Constant	7.129*** (13.74)	6.704*** (10.67)	6.673*** (10.62)
N	4,084	4,084	4,084
Pseudo R^2	0.182	0.185	0.185

Notes. In specification (3), the difference between the regression coefficients of *GL Bid: Before* and *GL Bid: After* is significant at 5%. In this table we report the regression coefficients from Tobit regressions of the lender interest rate of loans (i.e., of successfully and completely funded requests for borrowing money). In all three specifications, only loans in reward groups are considered. In specification (1), we do not account for any group-specific information. Specification (2) reports the overall effect of a group leader bid on the interest rate. Specification (3) compares the effect of a group leader bid before and after the elimination of group leader rewards on the interest rate in the reward groups. The reference is AA/A loans before the elimination of group leader rewards without a group leader bid. *t*-Statistics are reported in parentheses. The full table of coefficients is available from the authors upon request.

***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

rates are reduced if the group leader verifies the information provided (*Vetting*). Better rated groups and smaller groups tend to have lower defaults.

Most importantly for the purpose of this study, specification (2) shows that a *GL Bid* increases failure rates. This result is again consistent with the evidence from the univariate analysis, because it shows that group leader bids in reward groups do not work properly as a signal of good listing quality. They are wrongly viewed as loans with high quality because their default rates are higher, yet their interest rates are lower than those for loans without a *GL Bid*. One may wonder whether before the elimination of group leader rewards it is profitable for the group leaders of reward groups to promote listings in their groups by placing a group leader bid on them. Further analysis shows that in this time period, the group leader rewards more than compensate for the slightly higher failure rates in these groups.

Most importantly, the influence of the elimination of group leader rewards on loan performance in reward groups can be deduced from specification (3): whereas before this policy change a *GL Bid* is associated with a ceteris paribus higher hazard rate (coefficient of 1.023), after this event the hazard rate is significantly smaller not only than before the change but also than the benchmark of 1 (coefficient of 0.853). In line with the evidence from the univariate analysis, the overall higher default rates for loans with group leader bids are thus due only to the time period when rewards exist. By contrast, group leader bids work properly as a quality signal after the elimination. Consequently, the results suggest that—before the elimination of group leader rewards—leaders in these groups overpromote bad listings with the help of their bids, which leads

RIGHTSLINK

Table 7. Loan Performance (Only Reward Groups)—Multivariate Analysis

	(1)	(2)	(3)	(4)
Group leader bids				
GL Bid		1.006 (0.61)		
GL Bid: Before			1.023** (2.19)	
GL Bid: After			0.853*** (−5.72)	
GL Bid: Before, Particip. ≤ 33%				1.025** (2.37)
GL Bid: Before, Particip. > 33%				0.939** (−2.04)
GL Bid: After, Particip. ≤ 33%				0.871*** (−5.00)
GL Bid: After, Particip. > 33%				0.249*** (−5.87)
Group characteristics				
Vetting		0.946*** (−4.35)	0.962*** (−3.01)	0.964*** (−2.79)
Listing Review Requirement		1.074*** (6.48)	1.073*** (6.40)	1.072*** (6.34)
GL Offers Help		1.025* (1.78)	1.021 (1.52)	1.019 (1.33)
GL Endorsement		1.070*** (7.28)	1.074*** (7.60)	1.074*** (7.61)
Group Members (1,000's)		1.011*** (5.65)	1.010*** (5.52)	1.010*** (5.49)
Group Ratings	Yes	Yes	Yes	Yes
Listing characteristics				
After	0.967*** (−2.82)	1.063*** (4.71)	1.118*** (7.41)	1.117*** (7.38)
Amount Requested ($1,000's)	1.042*** (53.04)	1.041*** (50.91)	1.042*** (51.25)	1.042*** (51.05)
Duration	0.992*** (−4.24)	0.990*** (−5.14)	0.990*** (−5.15)	0.990*** (−5.16)
Closed as Soon as Funded	1.116*** (12.07)	1.139*** (13.77)	1.140*** (13.87)	1.138*** (13.65)
Average Lender Experience	0.987*** (−4.66)	0.986*** (−4.90)	0.986*** (−4.84)	0.986*** (−4.98)
Borrower characteristics				
Credit Grade: B	1.522*** (23.39)	1.492*** (22.26)	1.487*** (22.07)	1.484*** (21.96)
Credit Grade: C	1.722*** (32.37)	1.678*** (30.74)	1.669*** (30.36)	1.667*** (30.31)
Credit Grade: D	1.888*** (36.52)	1.855*** (35.31)	1.846*** (34.99)	1.845*** (34.95)
Credit Grade: E	2.420*** (45.34)	2.392*** (44.17)	2.377*** (43.81)	2.378*** (43.83)
Credit Grade: HR	2.765*** (51.11)	2.748*** (50.01)	2.727*** (49.54)	2.730*** (49.59)
Debt-to-Income Ratio	1.006** (2.33)	1.006** (2.21)	1.006** (2.32)	1.007** (2.55)
Is Borrower Homeowner	1.074*** (8.06)	1.088*** (9.51)	1.088*** (9.52)	1.087*** (9.45)
Number of Friends (level 0)	0.969*** (−6.26)	0.973*** (−5.55)	0.973*** (−5.50)	0.973*** (−5.50)
Income Status	Yes	Yes	Yes	Yes
Employment Status	Yes	Yes	Yes	Yes
Current and Previous Solvency	Yes	Yes	Yes	Yes
N	180,300	180,300	180,300	180,300

Notes. In specification (3), the difference between the regression coefficients of *GL Bid: Before* and "*GL Bid: After* is significant at 1%. In this table we report the exponentiated regression coefficients from a Cox proportional hazards model. Any payment that is not made on time is considered as a failure so that failure events are late payments, charge-offs, and defaults. In all three specifications, only loans (i.e., successfully and completely funded borrowing requests) in reward groups are considered. In specification (1), we do not account for any group-specific information. Specification (2) reports the overall effect of a group leader bid on the failure probability of loans. Specification (3) compares the effect of a group leader bid before and after the elimination of group leader rewards on the failure probability of loans in the reward groups. Finally, specification (4) analyzes whether before the elimination of group leader rewards, the group leader participates with more than 33% of the loan amount in the loan, if she places a bid on the listing (i.e., whether she has skin in the game). The reference is AA/A loans before the elimination of group leader rewards without a group leader bid. *t*-Statistics are reported in parentheses. The full table of coefficients is available from the authors upon request.

***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

to higher failure rates for these loans. By contrast, after the policy change, the mechanism works properly because the group leader no longer has an incentive to bid strategically.[23]

The evidence so far suggests that rewards give group leaders an incentive to promote bad listings by bidding on them, as these rewards more than offset the losses due to the higher likelihood of failure. This behavior is different when the same group leaders can no longer earn rewards. An alternative way to align incentives, i.e., to make group leaders screen listings very carefully, would be for group leaders to participate in a large fraction of the loan and thus have substantial skin in the game even when they earn rewards.

The threshold for this large fraction of the loan is determined as follows. A listing yields a negative payoff to a regular bidder under the following simplified condition: $-\alpha+\alpha I(1-p)+\alpha(1-p)<0$, with α denoting the share of the loan amount supplied by this bidder, I the interest rate obtained, and p the probability of default. The recovery rate is assumed to be zero. This can be simplified to $-\alpha(Ip+p-I)<0$, so that $\alpha>0$ implies $(Ip+p-I)>0$ for a listing with a negative payoff. Suppose the group leader knows p and I from historical data. To make it profitable for him to still bid on a listing with a negative payoff, group leader fees and up-front payment have to outweigh the loss: $F(1-p)+U>\alpha(Ip+p-I)$, where F denotes the group leader fee (interest rate paid on the full loan amount) and U the up-front payment to the group leader (relative to the loan amount). Since $(Ip+p-I)>0$, as before, $(F(1-p)+U)/(Ip+p-I)>\alpha$ yields an upper bound for a profitable group leader bid on this listing. For each credit grade we compute the critical value α according

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 16:51 . For personal use only, all rights reserved.

RIGHTSLINK

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 16:51 . For personal use only, all rights reserved.

to this last formula. As an example, consider a borrower with the credit grade B in a reward group. For this borrower, we have the average interest rate $I = 14\%$, the probability of default $p = 18\%$, the group leader fee $F = 2\%$, and the up-front fee $U = 0.5\%$. According to the formula above, this yields a cutoff criterion of $(0.02 \times (1 - 0.18) + 0.005)/(0.14 \times 0.18 + 0.18 - 0.14) = 0.327 > \alpha$. Consequently, the reward group leader should not participate in more than 32.7% of B loans in which a regular bidder would lose money. The cutoff criteria for the different credit grades vary—the resulting overall cutoff criterion of 33% is the average over the cutoff criteria for the different credit grades.

We therefore further differentiate in specification (4) whether a group leader participates in more or less than 33% of the loan.[24] The results show that the failure rates are substantially lower before the elimination of group leader rewards when the group leader participates in more than 33% of the loan. By contrast, before the event, the failure rate is higher than 1 if the group leader participates in less than 33% of the loan. This means that the potential losses in this case are not high enough to outweigh the rewards; i.e., only substantial skin in the game induces a group leader to carefully screen borrowers and promote the creditworthy listings by bidding on them, even if he can earn rewards. These results suggest that a high and credible bid by the group leader serves indeed as a credible signal about the quality of screening, as the other lenders correctly assume that a higher participation by the group leader leads to skin in the game and thus more careful screening.

3.2.2. Difference-in-Difference Approach. An alternative approach to the traditional regression framework discussed so far is to use the no-reward groups as a reference group and to carry out a difference-in-difference analysis. The crucial assumptions for this analysis are that the elimination of group leader rewards only affects reward group leaders and that all other trends affect both group types in the same way, i.e., are uncorrelated with the group type.[25] We now present the corresponding results.

3.2.2.1. *Listing Success.* Table 8 shows odds ratios of logistic regressions of listing success, similar to Table 5. The difference between Tables 5 and 8 is that in the latter we do not only consider reward groups but also no-reward groups and, in specification (1), also listings posted outside groups. Specification (1) shows that listings that are not posted in a group (*No Group*) or that are posted in a reward group (*Reward Group*) have significantly lower funding probabilities than those posted in no-reward groups. More importantly for our study, specifications (2)–(4) of Table 8 show that the results obtained in the event study with respect to listing success continue to hold and are specific to the reward groups.

Specification (3) breaks down the influence of group leader bids for reward and no-reward groups. The results show that a *GL Bid* works in the same way and is thus perceived as a signal of a high quality of loans in both groups, whereas the effect is stronger for no-reward than for reward groups. Specification (4) constitutes the key part of our difference-in-difference analysis with two sources of identifying variation: (i) the time before and after the removal of rewards and (ii) the distinction between listings inside and outside reward groups. Our inference is based on evaluating whether reward groups perform differently after the elimination of rewards. The specification shows that after this event the influence of a group leader bid in the reward groups is significantly higher than before.

3.2.2.2. *Interest Rates of Loans.* Table 9 reports the estimation results of Tobit regressions of interest rates in the difference-in-difference setting. Specification (1) shows that interest rates of loans funded outside groups (*No Group*) or in reward groups (*Reward Group*) are higher than those of loans in no-reward groups.

As in the event study, specification (2) shows that a *GL Bid* as a signal of perceived high quality decreases the interest rate. Specification (3) further distinguishes this effect of a *GL Bid* in no-reward and reward groups. Finally, specification (4) again employs the difference-in-difference approach. In particular, a *GL Bid* reduces interest rates before and after the elimination of rewards, whereas this effect is more pronounced afterwards. Altogether, the results are again fully consistent with those for the traditional regression framework (Table 6).

3.2.2.3. *Loan Performance.* Table 10 presents the results for loan performance. Specification (1) shows that the group type significantly influences hazard rates even after controlling for other factors. Loans in reward groups (*Reward Group*) and loans resulting from listings posted outside groups (*No Group*) exhibit higher hazard rates than loans in no-reward groups as the reference group. The other results remain stable when compared to those obtained in Table 7. Additionally, from specification (3) of Table 10 we see again that the adverse effect of *GL Bid* only applies to reward groups, whereas in no-reward groups *GL Bid* significantly lowers the hazard rate of the loan.

Overall, we find that the results from the difference-in-difference approach strongly support those obtained from the earlier analysis. This evidence assures that the effects described above are indeed driven by the existence and elimination of group leader rewards and not by any other event or trend that hits all group listings (i.e., those of both reward and no-reward groups) in the same way.

RIGHTSLINK

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 16:51 . For personal use only, all rights reserved.

Table 8. Listing Success (Difference-in-Difference)—Multivariate Analysis

	All listings	Only listings in groups		
	(1)	(2)	(3)	(4)
Group leader bids				
GL Bid		2.167*** (16.20)		
GL Bid: No-Reward			3.265*** (8.89)	3.241*** (8.84)
GL Bid: Reward			2.074*** (14.75)	
GL Bid: Reward, Before				2.024*** (13.81)
GL Bid: Reward, After				2.663*** (7.14)
Group characteristics				
No Group	0.187*** (−29.32)			
Reward Group	0.425*** (−14.78)	0.472*** (−10.18)	0.611*** (−4.64)	0.602*** (−4.77)
Vetting		1.130** (1.99)	1.143** (2.18)	1.128* (1.96)
Listing Review Requirement		1.224*** (3.95)	1.220*** (3.88)	1.220*** (3.89)
GL Offers Help		1.252*** (3.32)	1.219*** (2.90)	1.221*** (2.93)
GL Endorsement		3.783*** (26.62)	3.788*** (26.63)	3.784*** (26.59)
Group Members (1,000's)		0.930*** (−8.15)	0.931*** (−8.09)	0.932*** (−7.93)
Group Ratings	Yes	Yes	Yes	Yes
Listing characteristics				
After	0.927*** (−2.82)	0.930 (−1.30)	0.920 (−1.51)	0.880** (−2.09)
Amount Requested ($1,000's)	0.876*** (−59.41)	0.881*** (−30.69)	0.881*** (−30.68)	0.880*** (−30.72)
Duration	1.052*** (9.64)	1.023** (2.29)	1.024** (2.43)	1.024** (2.44)
Closed as Soon as Funded	1.188*** (6.58)	0.991 (−0.20)	0.989 (−0.24)	0.988 (−0.25)
Average Lender Experience	5.454*** (80.83)	4.105*** (43.94)	4.110*** (43.97)	4.106*** (43.93)
Borrower characteristics				
Credit Grade: B	0.652*** (−11.09)	0.695*** (−4.51)	0.689*** (−4.62)	0.692*** (−4.57)
Credit Grade: C	0.338*** (−28.97)	0.459*** (−10.55)	0.454*** (−10.65)	0.456*** (−10.57)
Credit Grade: D	0.176*** (−42.73)	0.266*** (−17.36)	0.263*** (−17.47)	0.265*** (−17.37)
Credit Grade: E	0.070*** (−52.28)	0.119*** (−23.81)	0.118*** (−23.89)	0.119*** (−23.80)
Credit Grade: HR	0.032*** (−65.36)	0.064*** (−30.21)	0.063*** (−30.30)	0.063*** (−30.23)
Debt-to-Income Ratio	0.901*** (−10.39)	0.968** (−2.29)	0.967** (−2.31)	0.967** (−2.37)
Is Borrower Homeowner	1.161*** (5.75)	1.169*** (3.47)	1.171*** (3.51)	1.171*** (3.50)
Number of Friends (level 0)	1.471*** (39.21)	1.395*** (12.92)	1.394*** (12.87)	1.393*** (12.85)
Income Status	Yes	Yes	Yes	Yes
Employment Status	Yes	Yes	Yes	Yes
Current and Previous Solvency	Yes	Yes	Yes	Yes
N	153,541	34,795	34,795	34,795
Pseudo R^2	0.308	0.331	0.331	0.331

Notes. In specification (4), the difference between the regression coefficients of *GL Bid: Reward, Before* and *GL Bid: Reward, After* is significant at 5%. In this table we report odds ratios of the logistic regression of funding success, i.e., the exponentiated regression coefficients. Coefficients larger (respectively, smaller) than 1 indicate relatively higher (respectively, smaller) success probabilities than in the reference group. In specification (1) all listings (i.e., all requests for borrowing money) are considered; in specifications (2)–(4) only group listings are analyzed. Specification (2) reports the overall effect of a group leader bid on listing success. Specification (3) additionally distinguishes whether the group leader bid occurs in a listing in a no-reward group or in a reward group. Specification (4) compares the effect of a group leader bid before and after the elimination of group leader rewards on listing success in the reward groups. The reference is AA/A listings before the elimination of group leader rewards in no-reward groups without a group leader bid. *t*-Statistics are reported in parentheses. The full table of coefficients is available from the authors upon request.

***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

3.3. Economic Significance

To assess the economic significance of the results, we consider both the borrower's and the lender's perspectives. First, for the borrowers, we calculate the amount left on the table by considering percentages (IRRs) and dollar amounts. For the percentages, we analyze the difference between the IRR that the borrowers effectively pay and the IRR that the borrowers would pay if there were no reward system in place. The results show that this difference amounts to about one percentage point for each credit grade and is statistically significant. For the dollar amounts, these are a function of the amount borrowed and the difference between the IRR that borrowers effectively pay and the IRR that the borrowers would pay if no reward system were in place. The results provide evidence that the values range between USD 30 and 100, depending on the credit grade.

Second, for the group leaders, we calculate the average gain from a loan before the elimination of rewards by providing a breakdown into the losses on the loans these group leaders bid on and the rewards they

RIGHTSLINK

Table 9. Interest Rates (Difference-in-Difference)—Multivariate Analysis

	All loans	Only loans in groups		
	(1)	(2)	(3)	(4)
Group leader bids				
GL Bid		−0.753*** (−6.06)		
GL Bid: No-Reward			−1.039*** (−3.42)	−1.027*** (−3.38)
GL Bid: Reward			−0.715*** (−5.52)	
GL Bid: Reward, Before				−0.660*** (−4.97)
GL Bid: Reward, After				−1.231*** (−3.83)
Group characteristics				
No Group	1.990*** (12.31)			
Reward Group	1.291*** (7.82)	1.099*** (6.58)	0.874*** (3.19)	0.913*** (3.32)
Vetting		−0.481*** (−3.29)	−0.486*** (−3.33)	−0.449*** (−3.04)
Listing Review Requirement		−0.041 (−0.30)	−0.035 (−0.25)	−0.035 (−0.26)
GL Offers Help		−0.785*** (−5.06)	−0.761*** (−4.86)	−0.765*** (−4.88)
GL Endorsement		−0.103 (−0.86)	−0.104 (−0.86)	−0.091 (−0.75)
Group Members (1,000's)		−0.067*** (−2.69)	−0.066*** (−2.64)	−0.067*** (−2.72)
Group Ratings	Yes	Yes	Yes	Yes
Listing characteristics				
After	1.313*** (15.06)	1.473*** (10.17)	1.480*** (10.21)	1.613*** (9.86)
Amount requested ($1,000's)	0.256*** (36.92)	0.290*** (28.91)	0.290*** (28.93)	0.291*** (28.99)
Duration	−0.003 (−0.17)	0.013 (0.51)	0.011 (0.45)	0.012 (0.46)
Closed as Soon as Funded	3.245*** (36.57)	2.901*** (22.30)	2.908*** (22.32)	2.911*** (22.35)
Average Lender Experience	−0.110*** (−3.84)	−0.092*** (−2.59)	−0.092*** (−2.59)	−0.091*** (−2.58)
Borrower characteristics				
Credit Grade: B	3.618*** (31.25)	2.872*** (15.58)	2.876*** (15.60)	2.865*** (15.54)
Credit Grade: C	6.278*** (54.39)	5.670*** (33.06)	5.678*** (33.08)	5.662*** (32.95)
Credit Grade: D	9.569*** (74.30)	8.565*** (47.01)	8.574*** (47.01)	8.558*** (46.88)
Credit Grade: E	13.560*** (80.38)	12.177*** (54.19)	12.178*** (54.21)	12.160*** (54.08)
Credit Grade: HR	13.419*** (75.79)	12.853*** (55.47)	12.856*** (55.49)	12.843*** (55.42)
Debt-to-Income Ratio	0.160*** (4.82)	0.162*** (4.47)	0.162*** (4.47)	0.165*** (4.54)
Is Borrower Homeowner	−0.148* (−1.78)	−0.496*** (−4.33)	−0.497*** (−4.34)	−0.501*** (−4.37)
Number of Friends (level 0)	−0.163*** (−5.46)	−0.079** (−2.21)	−0.077** (−2.15)	−0.078** (−2.16)
Income Status	Yes	Yes	Yes	Yes
Employment Status	Yes	Yes	Yes	Yes
Current and Previous Solvency	Yes	Yes	Yes	Yes
Constant	5.252*** (13.09)	6.031*** (10.98)	6.246*** (10.63)	6.167*** (10.47)
N	12,183	4,736	4,736	4,736
Pseudo R^2	0.161	0.181	0.181	0.181

Notes. In specification (4), the difference between the regression coefficients of *GL Bid: Reward, Before* and *GL Bid: Reward, After* is significant at 10%. In this table we report the regression coefficients from Tobit regressions of the lender interest rate of loans (i.e., of successfully and completely funded requests for borrowing money). In specification (1) all loans are considered, in specifications (2) to (4) only group loans are analyzed. Specification (2) reports the overall effect of a group leader bid on the interest rate. Specification (3) additionally distinguishes whether the group leader bid occurs in a loan in a no-reward group or in a reward group. Specification (4) compares the effect of a group leader bid before and after the elimination of group leader rewards on the interest rate of loans in the reward groups. The reference is AA/A loans before the elimination of group leader rewards in no-reward groups without a group leader bid. *t*-Statistics are reported in parentheses. The full table of coefficients is available from the authors upon request.

***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

receive. The results show for no-reward groups that the group leader's investment pays off on average, except for loans of the credit grade HR—despite the fact that the group leader does not receive a reward. For the reward groups, however, we find that had there been no reward, the group leaders in fact would have made a loss; i.e., it is only the reward that makes their loan granting profitable. This finding underlines the substantial economic significance of rewards for the group leader. The difference between the group leaders' actual gain and their hypothetical (negative) gain without rewards amounts to USD 90 on average and is highly statistically significant for all credit grades. Depending on the credit grade, this amounts to 0.9%–1.4% of the average amount funded.[26]

4. Robustness

In this section we provide several analyses on the robustness of our results. In particular, we show that our results are not due to other policy changes during our sample period. We also investigate the choice

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 16:51 . For personal use only, all rights reserved.

RIGHTSLINK

Table 10. Loan Performance (Difference-in-Difference)—Multivariate Analysis

	All loans	Only loans in groups			
	(1)	(2)	(3)	(4)	(5)
Group leader bids					
GL Bid		1.009 (0.97)			
GL Bid: No-Reward			0.899*** (−3.65)	0.905*** (−3.39)	
GL Bid: Reward			1.017* (1.79)		
GL Bid: Reward, Before				1.033*** (3.31)	
GL Bid: Reward, After				0.855*** (−5.84)	
GL Bid: No-Reward, Particip. ≤ 33%					0.935** (−2.30)
GL Bid: No-Reward, Particip. > 33%					0.822*** (−3.56)
GL Bid: Reward, Before, Particip. ≤ 33%					1.037*** (3.65)
GL Bid: Reward, Before, Particip. > 33%					0.937** (−2.11)
GL Bid: Reward, After, Particip. ≤ 33%					0.872*** (−5.09)
GL Bid: Reward, After, Particip. > 33%					0.250*** (−5.86)
Group characteristics					
No Group	1.197*** (14.00)				
Reward Group	1.240*** (16.90)	1.027* (1.85)	0.937** (−2.51)	0.947** (−2.11)	0.964 (−1.43)
Vetting		0.967*** (−2.90)	0.964*** (−3.11)	0.978* (−1.88)	0.982 (−1.50)
Listing Review Requirement		1.048*** (4.56)	1.051*** (4.85)	1.050*** (4.74)	1.049*** (4.62)
GL Offers Help		0.971** (−2.39)	0.980 (−1.64)	0.978* (−1.77)	0.974** (−2.17)
GL Endorsement		1.057*** (6.25)	1.057*** (6.22)	1.060*** (6.56)	1.060*** (6.46)
Group Members (1,000's)		1.007*** (3.70)	1.007*** (3.96)	1.007*** (3.72)	1.007*** (3.61)
Group Ratings	Yes	Yes	Yes	Yes	Yes
Listing characteristics					
After	1.005 (0.79)	1.067*** (5.55)	1.069*** (5.67)	1.117*** (8.37)	1.118*** (8.43)
Amount Requested ($1,000's)	1.046*** (90.34)	1.043*** (55.94)	1.043*** (55.93)	1.044*** (56.28)	1.044*** (56.03)
Duration	0.992*** (−6.75)	0.990*** (−5.20)	0.990*** (−5.52)	0.990*** (−5.44)	0.990*** (−5.47)
Closed as Soon as Funded	1.220*** (35.10)	1.149*** (15.33)	1.150*** (15.44)	1.151*** (15.55)	1.150*** (15.39)
Average Lender Experience	0.990*** (−4.65)	0.985*** (−5.35)	0.985*** (−5.34)	0.985*** (−5.34)	0.985*** (−5.49)
Borrower characteristics					
Credit Grade: B	1.506*** (42.31)	1.487*** (23.13)	1.487*** (23.11)	1.482*** (22.91)	1.479*** (22.81)
Credit Grade: C	1.773*** (60.15)	1.701*** (33.15)	1.703*** (33.23)	1.693*** (32.79)	1.690*** (32.71)
Credit Grade: D	2.076*** (71.46)	1.883*** (37.88)	1.886*** (37.98)	1.875*** (37.60)	1.874*** (37.56)
Credit Grade: E	2.597*** (79.47)	2.435*** (47.30)	2.435*** (47.28)	2.418*** (46.87)	2.419*** (46.88)
Credit Grade: HR	2.924*** (86.21)	2.844*** (54.35)	2.844*** (54.34)	2.823*** (53.90)	2.827*** (53.93)
Debt-to-Income Ratio	1.004** (2.17)	1.005* (1.82)	1.005* (1.80)	1.005** (1.98)	1.006** (2.23)
Is Borrower Homeowner	1.110*** (17.76)	1.092*** (10.41)	1.092*** (10.37)	1.091*** (10.35)	1.091*** (10.27)
Number of Friends (level 0)	0.966*** (−12.64)	0.999 (−0.17)	1.000 (0.09)	1.000 (0.03)	1.000 (−0.13)
Income Status	Yes	Yes	Yes	Yes	Yes
Employment Status	Yes	Yes	Yes	Yes	Yes
Current/Previous Solvency	Yes	Yes	Yes	Yes	Yes
N	496,150	205,965	205,965	205,965	205,965

Notes. In specification (4), the difference between the regression coefficients of *GL Bid: Reward, Before* and *GL Bid: Reward, After* is significant at 1%. In this table we report the exponentiated regression coefficients from a Cox proportional hazards model. Any payment that is not made on time is considered as a failure, so that failure events are late payments, charge-offs, and defaults. In specification (1) all loans (i.e., all successfully and completely funded borrowing requests) are considered, in specifications (2)–(5) only group loans are analyzed. Specification (2) reports the overall effect of a group leader bid on the failure probability of loans. Specification (3) additionally distinguishes whether the group leader bid occurs in a loan in a no-reward group or in a reward group. Specification (4) compares the effect of a group leader bid before and after the elimination of group leader rewards on the failure probability of loans in the reward groups. Specification (5) analyzes whether before the elimination of group leader rewards, the group leader participates with more than 33% of the loan amount in the loan, if she places a bid on the listing (i.e., whether she has skin in the game). The reference is AA/A loans before the elimination of group leader rewards in no-reward groups without a group leader bid. *t*-Statistics are reported in parentheses. The full table of coefficients is available from the authors upon request.

***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

of the time span used for the analysis of the loan performance.

4.1. Second Loans

Prosper.com allows borrowers with an existing loan to demand a second loan after October 30, 2007. In our previous analyses, we control for this fact by removing second loans from the sample. We further test the robustness of our results with respect to this policy change by completely removing from the sample all members with more than one loan—i.e., not only their second loans but their first ones as well as the corresponding listings. Our results do not change.

One may argue that the possibility to obtain a second loan may play a role not only for lenders who request

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 16:51 . For personal use only, all rights reserved.

RIGHTSLINK

Table 11. Robustness Checks (Only Reward Groups: Only Listings/Loans Between February 13 and October 30, 2007)—Multivariate Analysis

	Without group-specific information	With group-specific information		
	(1)	(2)	(3)	(4)
Panel A: Listing success				
Group leader bids				
GL Bid		2.001*** (13.23)		
GL Bid: Before			1.966*** (12.65)	
GL Bid: After			2.894*** (4.94)	
N	28,165	28,124	28,124	
Pseudo R^2	0.237	0.319	0.319	
Panel B: Interest rates				
Group leader bids				
GL Bid: Reward		−0.684*** (−5.56)		
GL Bid: Reward, Before			−0.676*** (−5.39)	
GL Bid: Reward, After			−0.822* (−1.86)	
N	3,708	3,708	3,708	
Pseudo R^2	0.196	0.199	0.199	
Panel C: Loan performance				
Group leader bids				
GL Bid: Reward		1.021** (2.04)		
GL Bid: Reward, Before			1.027*** (2.62)	
GL Bid: Reward, After			0.903** (−2.55)	
GL Bid: Reward, Before, Particip. ≤ 33%				1.030*** (2.81)
GL Bid: Reward, Before, Particip. > 33%				0.947* (−1.77)
GL Bid: Reward, After, Particip. ≤ 33%				0.920** (−2.09)
GL Bid: Reward, After, Particip. > 33%				0.448*** (−3.37)
N	163,717	163,717	163,717	163,717

Notes. In this table we summarize results from robustness checks of the multivariate regressions. More specifically, we only report the coefficients on group leader bids, which are of main interest for the purpose of our study. The full tables are available from the authors upon request. In all four specifications, only listings (i.e., requests for borrowing money) in reward groups are considered, and the sample is restricted to those observations that relate to listings/loans that were posted/funded before October 30, 2007. In specification (1), we do not account for any group-specific information. Specification (2) reports the overall effect of a group leader bid on listing success. Specification (3) compares the effect of a group leader bid before and after the elimination of group leader rewards on listing success in the reward groups. Finally, specification (4) analyzes whether before the elimination of group leader rewards, the group leader participates with more than 33% of the loan amount in the loan, if she places a bid on the listing (i.e., whether she has skin in the game). The reference is AA/A listings before the elimination of group leader rewards without a group leader bid. In panel A we report odds ratios of the logistic regression of funding success, i.e., the exponentiated regression coefficients. Coefficients larger (respectively, smaller) than 1 indicate relatively higher (respectively, smaller) success probabilities than in the reference group. Panel B reports the regression coefficients from Tobit regressions of the lender interest rate of loans (i.e., of successfully and completely funded requests for borrowing money). Panel C reports the exponentiated regression coefficients obtained from a Cox proportional hazards model. Any payment that is not made on time is considered as a failure, so that failure events are late payments, charge-offs, and defaults. *t*-Statistics are reported in parentheses.

***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

a second loan but also for lenders who do not do so (but may *have considered* doing so). To control for this, in a separate analysis we only consider those observations between the elimination of group leader rewards and October 30, 2007, when the possibility to request a second loan is introduced. The condensed Table 11 shows the coefficients of group leader bids for listing success (panel A), interest rates (panel B), and loan performance (panel C).[27] Compared with the corresponding numbers in Tables 5–7, the results do not change materially, showing that the possibility to obtain a second loan does not drive our results.

4.2. Fee Changes During the Sample Period

We also test whether the two fee changes after the elimination of group leader rewards—i.e., the change of lender fees on October 30, 2007 and the change of borrower fees on January 4, 2008—influence our results. This can also be controlled by limiting the analysis to the time period before October 30, 2007, when the first of the two fee changes takes place. Therefore, we again refer the reader to Table 11, which shows that our results are not driven by either of the two fee changes but, indeed, by the elimination of group leader rewards.[28]

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 16:51 . For personal use only, all rights reserved.

RIGHTSLINK

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 16:51 . For personal use only, all rights reserved.

Table 12. Variable Definitions

Variable	Definition
After (dummy)	The listing is created after the elimination of group leader rewards. "Before" is the reference in the multivariate analyses.
Amount Requested	The amount requested by the borrower in the listing, in thousands.
Average Lender Experience	For each listing, measures the number of loans that all bidders of this specific listing have successfully (i.e., the corresponding bid was successful and the corresponding listing also became a loan) bid on before on average.
Before (dummy)	The listing is created before the elimination of group leader rewards. "Before" is the reference in the multivariate analyses.
Borrower Rate (%)	Interest rate paid by the borrower.
Credit Grade: AA/A, B, C, D, E, HR	Each borrower is assigned a credit grade based on her Experian credit score. AA designates the lowest risk, HR the highest. "AA/A" is the reference in our analyses.
Debt-to-Income Ratio	The sum of the borrower's monthly debt payments divided by the borrower's monthly income. This value is capped at 10.01.
Duration (days)	The time for which the listing is open for bidding by potential lenders.
GL Bid (dummy)	The group leader places a bid on the listing.
GL Endorsement (dummy)	The group leader writes an endorsement (a short text statement) on the borrower or her listing before the loan is funded or the listing expires. This information is obtained from the data.
GL Offers Help (dummy)	The group leader provides help in designing and writing the listing. We obtain this information from the description of the group provided by the group leader: many group leaders state explicitly that they intend to help borrowers when composing their listings.
Group Ratings (1 star, 2 stars, 3 stars, 4 stars, 5 stars)	A measure for the quality of the group (derived from information on defaults in the groups), obtained from the data. The reference in our analyses is "no group rating."
Income Status Unavailable/$1–24,999/*etc.*	The income range of the borrower at the time the listing is created. "Unavailable" is the reference in the multivariate analyses.
Is Borrower Homeowner (dummy)	Specifies whether or not the member is a verified homeowner at the time the listing is created.
Closed as Soon as Funded (dummy)	The listing is automatically closed as soon as it is completely funded, i.e., once the total amount bid reaches or exceeds the amount requested.
Listing Review Requirement (dummy)	The group leader reviews the listing before it is open for bidding by the lenders. This group characteristic is directly observable in the data.
No Group (dummy)	The listing is not posted in any group.
No-Reward Group (dummy)	If the group leader does not request a reward for any listing posted in the group in the sample period, the group is considered a no-reward group. Otherwise, the group is considered a reward group.
Group Members	A measure for the size of the group that is obtained from the data, in thousands.
Employment Status: Full-time/part-time/etc.	The occupation status of the borrower at the time the listing is created. "Full-time" is the reference in the multivariate analyses.
Number of Friends (level 0)	The number of friends the borrower has on Prosper.com. In line with Lin et al. (2013, p. 18), these are "friends who have registered on Prosper.com."
Particip. > 33% (dummy)	The group leader participates in more than 33% of the listing/loan.
Reward Group (dummy)	If the group leader does not request a reward for any listing in the group in the sample period, the group is a no-reward group; otherwise, it is a reward group.
Vetting (dummy)	The group leader asks the borrower to provide information. We obtain this information from the description of the group provided by the group leader. In this description, many group leaders explicitly state that they do "vetting" of the information provided by the borrower (they explicitly use the word "vetting" or "vetted"). Other group leaders provide detailed descriptions of the information that a borrower needs to provide them with before the group leader allows this borrower to place a listing in her group (purpose of the loan, financial statements, explanation how the borrower intends to pay back the loan, corresponding repayment plan, etc.).

4.3. Stability of Groups

As described before, borrowers can choose which group they would like to belong to, and group leaders may then grant or deny access to their groups. We thus analyze the stability of the groups—in particular, the likelihood of a transition between the three types of groups: reward groups, no-reward groups, and no groups. We find that the likelihood is very high that a borrower applies for a loan in the same type of group to which he applies for his previous listing; i.e., the likelihood of switching to other types of groups is low, amounting to significantly less than 10% of all the cases. Furthermore, this likelihood of switching does not materially change between before or after the elimination of group leader rewards.

We also compare various borrower characteristics as well as the borrowers' distribution in terms of credit grades before and after the elimination of group leader rewards. We find that the distribution of borrowers' credit grades does not improve in reward groups after the elimination of group leader rewards, but rather it deteriorates. However, whereas the borrower pool may deteriorate, this is accompanied by an adequate change in the behavior of the group leaders.

RIGHTSLINK

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 16:51 . For personal use only, all rights reserved.

This evidence suggests that our results are not driven by a change in the borrower portfolio, but rather that the worse quality of borrowers afterwards is more than offset by the better incentives that are in place then.

5. Conclusion

The rapidly and significantly growing markets for crowdfunding, in which individuals directly finance other individuals or companies without financial intermediation, are applied to various types of financing worldwide and provide a significant potential pool of capital. This insight has led politicians across the spectrum to alleviate the constraints for this type of financing for companies, as well as to carefully watch online lending in peer-to-peer transactions across individuals. Proponents thus view crowdfunding as a way to fundamentally change the investment and financing process as well as the role of financial intermediation. However, a large number of regulators and academicians are concerned about the potential of lenders being taken advantage of by unscrupulous loan originators. These markets, despite having developed into a multibillion-dollar industry, have received relatively little attention with respect to the industry's appropriate regulation, and not much is known about the involved agents' actions.

We find, in the presence of rewards, group leader bids result in lower interest rates but higher default rates. Thus, although group leader bids enhance the credibility of an issue and the perception of higher quality, these issues do not appear to be of higher quality, as evidenced ex post by higher default rates suggesting that group leaders behave strategically. It is only when group leaders have sufficient skin in the game that we see default rates reduce along with a decrease in interest rates. The results suggest there are perverse incentives of the group leaders that are not fully recognized by the market. Although learning takes place, the process is too slow to avoid the described economic outcomes. We do not see similar perverse incentives in groups where the leaders do not get rewards. Interestingly, in the same groups, once the rewards are eliminated, this perverse behavior disappears; instead, now when group leaders bid, we see lower interest rates along with lower default rates.

Although the setting analyzed in this paper is specific and thus might not repeat itself, it allows us to draw some general lessons about how incentives work in the peer-to-peer world, including the slow learning process by market participants. They also provide some insight on the ongoing debate about the proper regulatory framework for consumer lending—for example, on the importance to require sufficient skin in the game. Although the results cannot be simply generalized to other financial markets in which consumer protection is also of vital interest, our results provide evidence from a clean experiment that shows that proper incentives are crucial for giving borrowers access to credit and to induce lenders to carefully screen loan applicants. Our results suggest the importance of further research on the necessary incentives to improve consumer protection in the markets for crowdfunding particularly and in the finance and lending industry more generally.

Acknowledgments

The authors are grateful to department editor Wei Jiang, the anonymous associate editor, and two anonymous referees for many valuable comments that helped improve this paper. The authors also thank Tim Adam, Arnoud Boot, Christian Ehm, Masami Imai, Michael Koetter, Benjamin Klaus, Nagpurnanand R. Prabhala, Enrichetta Ravina, and Yishay Yafeh, as well as seminar participants at the American Economic Association meetings, Western Finance Association meetings, 11th Annual Bank of Finland/Centre for Economic Policy Research Conference, German Finance Association meetings, European Finance Association meetings, Financial Management Association meetings, 21st Annual Conference on Financial Economics and Accounting at the University of Maryland, Deutsches Institut für Wirtschaftsforschung Berlin Finance Conference, London School of Economics, Tilburg University, BI Oslo, Duke University, ESMT Berlin, Humboldt University Berlin, University of Karlsruhe, University of Tübingen, University of Mannheim, and University of Maastricht. The authors are also grateful to Prosper.com for providing the data for this study.

Endnotes

[1] See, for example, Cortese (2011).

[2] See U.S. Government Accountability Office (2011, p. 56).

[3] The creation of the CFPB in the 2010 Dodd–Frank Act aims to protect consumers by regulating and enforcing consumer financial laws and thus restricting unfair treatment.

[4] It is important that origination fees in the context of this paper exclusively refer to the rewards that group leaders receive. Thus, these origination fees have to be distinguished from the fees that Prosper.com charges for providing the lending platform.

[5] Institutions are not allowed on Prosper.com during the sample period, so only private persons may serve as borrowers or lenders.

[6] In some states, there are interest rate caps, whereas in other states, the maximum interest rate may go up to 35%—an interest rate cap set by Prosper.com.

[7] Definitions for the variables in the tables of the paper are given in Table 12.

[8] Additionally, the borrower has the possibility to post one or more photos, e.g., of herself or the object that she wants to finance with the loan.

[9] The group leader obtains a one-time reward ("match reward," 0.5% of the loan amount except for E loans and HR loans) once the listing is completely funded and a monthly payment ("payment reward," 1% per annum (p.a.) for AA loans and A loans; 2% p.a. for B loans, C loans, and D loans; and 4% p.a. for E loans and HR loans.). Alternatively, the group leader can also choose to only partly capture this reward.

[10] http://www.getrichslowly.org/forum/viewtopic.php?f=2&t=399&sid=80594d9d8a970cf51dc7e011ddaf325c (accessed August 27, 2014).

RIGHTSLINK

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 16:51 . For personal use only, all rights reserved.

[11] Prosper.com abolished this group leader reward on September 12, 2007, following an announcement on September 5, 2007.

[12] During the sample period, there are two minor policy changes: On October 30, 2007, Prosper.com changed the lender servicing fee from 0.5% to 1% for A loans and from 0.5% to 0% for AA loans. Moreover, from this date on, Prosper.com allowed borrowers who already had a current loan to create a new listing in order to obtain a second loan. Second loans are allowed only for borrowers whose first loan has been active for some time and whose two loans together do not exceed the maximum amount of $25,000. To control for this latter policy change, we remove from the analysis the corresponding listings in which borrowers apply for second loans. On January 4, 2008, Prosper.com changed the borrower closing fees from 1% to 2% for the credit grades A and B, from 1% to 3% for the credit grades C and D, and from 2% to 3% for the credit grades E and HR. We provide further evidence for the robustness of our results to these additional changes in the robustness section.

[13] One may argue that not only group leader bids but also bids by other group members serve as an important signal for other group members. We note in this context, however, that (i) group leader bids are almost twice as frequent as bids by other group members, (ii) group leader bids are given significantly faster (on average, 65 hours since creation of listing compared with 137 hours for bids by other group members), (iii) group leaders bid a significantly larger amount (on average, USD 200 compared with USD 123 for bids by other group members), (iv) group leader bids are more successful (75%) than bids by other group members (56%), and (v) group leaders bid a significantly larger *participating* amount (on average, USD 101 compared with USD 63 for other group members). Taken together, this makes group leader bids significantly more important than bids by other group members, which is the reason why we concentrate on group leader bids in this paper.

[14] The decrease of group leader bids in reward groups is significant for all credit grades, and it is most distinct for riskier credit grades. For example, it decreases from 34.7% to 3.9% for credit grade HR.

[15] As panel B also shows, of the 601 loans in reward groups after the elimination of group leader rewards, 160 have a group leader bid, which we analyze further.

[16] Lenders do not possess the full information that is used in this paper because their decisions are made within the sample period, whereas the data for this paper cover the whole sample period.

[17] The full table of coefficients is available from the authors upon request.

[18] Lin et al. (2013) propose and test several alternative definitions of friendship on Prosper.com. At one extreme ("level 0"), one may consider "friends who have registered on Prosper.com" (Lin et al. 2013, p. 18). Alternatively, at the other extreme ("level 5"), they consider as friends "lender-friends who [. . .] bid and win on the listing [. . .]" (Lin et al. 2013, p. 18). In our regressions, we adopt the former definition; i.e., our corresponding variable captures the number of friends at level 0. However, we have also tested alternative specifications, replacing this variable with a corresponding friend level 5 variable. We find that this systematically makes the estimated effect of the friend variable stronger—not only for listing success but also for interest rates and defaults—suggesting that stronger friend ties (level 5) are more effective than the weaker ties (level 0). Most importantly, however, this does not affect our main results, i.e., the importance of group leader bids.

[19] The corresponding coefficients can be seen in the full table that is available from the authors upon request.

[20] Ordinary least squares regression results differ only marginally and are therefore not reported here.

[21] As an alternative specification, we have also analyzed the ultimate outcome of the loan by considering whether it is repaid or not. The main results of the corresponding logistic regressions on the influence of group leader bidding confirm the corresponding results obtained from the Cox proportional hazard models reported in this paper. As another variation, we have also analyzed the share of the loan that is paid back by the borrowers to the lenders. The corresponding Tobit regressions again confirm the main results obtained from the Cox proportional hazard models.

[22] If, for example, a loan with credit grade HR is more susceptible to have a failure than a loan of the reference group AA/A, the strength of this relationship does not depend on time. Thus, for example, the HR loan does not become more susceptible to fail over time, compared to the AA/A loan.

[23] To evaluate the effect of lender learning in this context, we test in addition what happens between the first rumors that rewards might be eliminated (June 15, 2007) and their actual elimination (September 12, 2007). We find that the adverse incentive of group leader rewards has been turned already (coefficient of 0.932, significantly smaller than 1 in this transition period). As expected, however, the effect is less pronounced than when we consider the entire time period after the elimination in the baseline regressions (coefficient of 0.853, also significantly smaller than 1).

[24] We also test other cutoff criteria. In particular, we use one cutoff criterion for each credit grade, and alternatively, we calculate a cutoff criterion for each individual loan. Our results are unchanged.

[25] Following Roberts and Whited (2013), we empirically test the assumption of parallel pre-trends of our main variables of interest. We first calculate the weekly average listing success for (i) listings in no-reward with a group leader bid, (ii) listings in no-reward groups without a group leader bid, (iii) listings in reward groups with a group leader bid, and (iv) listings in reward groups without a group leader bid. From there, we calculate the *relative* listing success (i.e., with versus without group leader bid) for both no-reward groups and reward groups. We then test whether—before the elimination of group leader rewards—the average of the implied weekly growth rates of this variable is statistically different between no-reward groups and reward groups. We find that the null hypothesis of equal growth rates is not rejected, indicating that the assumption of parallel pre-trends is indeed met. We also conduct a similar analysis for both the average borrower rate of loans and the average number of defaults of loans that were originated in a given week. Again, the average of the corresponding growth rates before the elimination of group leader rewards is not statistically different between no-reward groups and reward groups, suggesting that also here the assumption of parallel pre-trends is met.

[26] More detailed results for each credit grade as well as for borrowers and lenders are available upon request.

[27] To economize space, only these core results on group leader bids are reported. The results on listing characteristics, borrower characteristics, and the remaining group characteristics do not change substantially, either. The full tables are available upon request.

[28] We conduct a similar robustness check for the difference-in-difference approach. Again, the corresponding results show that our findings are robust with respect to the two fee changes described above. The corresponding tables are available from the authors upon request. As an alternative robustness test to the temporal restrictions, we also explicitly control for the fee changes. We do so by adding (i) a variable for the percentage point change in the borrower fees and (ii) a variable for the percentage point change in the lender fees. We find that (i) neither of these fee changes is relevant for listing success, (ii) both of these fee changes slightly increase the interest rate to be paid by the borrower (suggesting that the increase in the lender fees is passed through), and (iii) the fee changes may slightly increase default. However, explicitly controlling for these fee changes does not change our main results of interest on the impact of the group leader bids.

RIGHTSLINK

References

Berger AN, Udell GF (2002) Small business credit availability and relationship lending: The importance of bank organizational structure. *Econom. J.* 112(477):F32–F53.

Berger AN, Miller NH, Petersen MA, Rajan RG, Stein JC (2005) Does function follow organizational form? Evidence from the lending practices of large and small banks. *J. Financial Econom.* 76(2): 237–269.

Bergstresser D, Chalmers JMR, Tufano P (2009) Assessing the costs and benefits of brokers in the mutual fund industry. *Rev. Financial Stud.* 22(10):4129–4156.

Bolton P, Freixas X, Shapiro J (2007) Conflicts of interest, information provision, and competition in the financial services industry. *J. Financial Econom.* 85(2):297–330.

Cortese A (2011) Pennies from many. *New York Times* (September 25), http://www.nytimes.com/2011/09/26/opinion/a-proposal-to-allow-small-private-companies-to-get-investors-online.html.

Crowdsourcing.org (2015) 2015CF crowdfunding industry report. Research report, Crowdsourcing, Los Angeles.

Degryse H, Laeven L, Ongena S (2009) The impact of organizational structure and lending technology on banking competition. *Rev. Finance* 13(2):225–259.

Duarte J, Siegel S, Young L (2012) Trust and credit: The role of appearance in peer-to-peer lending. *Rev. Financial Stud.* 25(8): 2455–2483.

Ferrari S, Verboven F, Degryse H (2010) Investment and usage of new technologies: Evidence from a shared ATM network. *Amer. Econom. Rev.* 100(3):1046–1079.

Gorton GB, Pennacchi GG (1995) Banks and loan sales: Marketing nonmarketable assets. *J. Monetary Econom.* 35(3):389–411.

Holmstrom B, Tirole J (1997) Financial intermediation, loanable funds, and the real sector. *Quart. J. Econom.* 112(3):663–691.

Hulme MK, Wright C (2006) Internet based social lending: Past, present and future. Working paper, Social Futures Observatory, Sedbergh, UK.

Inderst R, Ottaviani M (2009) Misselling through agents. *Amer. Econom. Rev.* 99(3):883–908.

Iyer R, Khwaja AI, Luttmer EFP, Shue K (2016) Screening peers softly: Inferring the quality of small borrowers. *Management Sci.* 62(6):1554–1577.

Lin M, Prabhala NR, Viswanathan S (2013) Judging borrowers by the company they keep: Friendship networks and information asymmetry in online peer-to-peer lending. *Management Sci.* 59(1):17–35.

Matt (2007) Prosper eliminates group leader rewards. *Prosper Lending Review* (blog), September 5, http://prosperlending.blogspot.com/2007/09/prosper-eliminates-group-leader-rewards.html.

Michels J (2012) Do unverifiable disclosures matter? Evidence from peer-to-peer lending. *Accounting Rev.* 87(4): 1385–1413.

Muralidharan K, Sundararaman V (2011) Teacher performance pay: Experimental evidence from India. *J. Political Econom.* 119(1): 39–77.

Pope DG, Sydnor JR (2011) What's in a picture? Evidence of discrimination from Prosper.com. *J. Human Resources* 46(1):53–92.

Ravina E (2012) Love and loans: The effect of beauty and personal characteristics in credit markets. Working paper, Columbia University, New York.

Roberts MR, Whited TM (2013) Endogeneity in empirical corporate finance. Constantinides GM, Harris M, Stulz RM, eds. *Handbook of the Economics of Finance*, Vol. 2A (Elsevier, Amsterdam), 493–572.

Stein JC (2002) Information production and capital allocation: Decentralized versus hierarchical firms. *J. Finance* 57(5): 1891–1921.

U.S. Government Accountability Office (2011) Person-to-person lending: New regulatory challenges could emerge as the industry grows. Report GAO-11-613, U.S. Government Accountability Office, Washington, DC.

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 16:51 . For personal use only, all rights reserved.

RIGHTSLINK