Journal of Corporate Finance 60 (2020) 101533

Contents lists available at ScienceDirect

Journal of Corporate Finance

journal homepage: www.elsevier.com/locate/jcorpfin

Venture capital certification and customer response: Evidence from P2P lending platforms☆

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ARTICLE INFO

Keywords:
Venture capital certification
P2P lending platform
Information asymmetry

JEL classification:
G23
G24

ABSTRACT

This paper examines whether the certification effect of VCs extends to firm's potential customers, and whether, by certifying firms' values to potential customers, VCs provide value to firms. Using weekly trading data from P2P lending platforms in China, we find that the amount of loans facilitated and the number of lenders increase significantly by 25.7% and 49.3%, respectively, immediately after announcements that P2P lending platforms obtain VC investment. We find that this certification effect increases with measures of VC reputation and measures of information asymmetry between P2P lending platforms and potential customers. A difference-in-differences analysis provides consistent results, which are robust after controlling for the effects of news, advertising, and funding. We also document that VC-backed platforms are less likely to default than non-VC-backed platforms. This result provides indirect evidence that VC backing has long-term benefits beyond the news and advertising effects.

1. Introduction

The role of VC financing in value creation for entrepreneurial firms has been widely discussed in both academic and practitioner literature. Researchers argue that, in addition to providing financing, VCs can offer other services that considerably enhance private firms' likelihood of success through screening and monitoring (see, e.g., Chemmanur et al., 2010, 2014; Casamatta, 2003; Hellmann, 1998). VCs are also considered to reduce the information asymmetry between entrepreneurs and public investors in capital markets by certifying the value of securities issued by relatively unknown startups (Megginson and Weiss, 1991). Industry practitioners argue that, in addition to funding private firms and reducing information asymmetry in capital markets, VCs contribute to the success of firms in many other ways. For example, a VC's reputation and network can facilitate firms' access to potential customers in the product market.

We examine whether the certification effect of VCs extends to firm's potential customers, and whether, by certifying firms' quality to potential customers, VCs provide "extra-financing" value to firms. The empirical question of whether VCs provide certification to

☆ We thank Douglas Cumming (editor) and two anonymous referees for excellent comments that have dramatically improved the paper. We are grateful for comments and suggestions from our discussant, Jianfeng Hu and conference participants, Thomas J. Chemmanur, Sandeep Dahiya, Mark Grinblatt and John Wei, in the 2018 JCF special issue conference. We also thank Li An, Bibo Liu, Lyndon Moore, Stephan Siegel, Xuan Tian, Jingjian Xiao, Xiaoyan Zhang, Ning Zhu, and brownbag participants at University of Washington for their advice. We thank the WDZJ's help desk for prompt assistance and for clarification of their policies. We thank Yinghui Deng for excellent research assistance. Any errors are our own.

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https://doi.org/10.1016/j.jcorpfin.2019.101533
Received 29 January 2019; Received in revised form 12 September 2019; Accepted 20 October 2019
Available online 02 November 2019

customers has not yet been investigated in the literature, perhaps because there is a lack of data on private firm customers.

We conduct a novel sample study with several existing and hand-collected databases to examine the role of VCs in mitigating the information asymmetry between start-ups and their potential customers. We use a unique proprietary customer level database, which includes startup companies with similar business models and products in the P2P lending industry in China.[1] For each startup company, we collect weekly data associated with the company's customers (both lenders and borrowers), such as the amount of loans facilitated, number of lenders, and number of borrowers.

The context and data applied in this study have two key advantages that provide us with a rare opportunity to study whether VCs provide a certification effect to potential customers of relatively unknown companies in a market characterized by high information asymmetry between corporate insiders and their customers. The first key advantage is that our high-frequency data allow us to measure immediate customer responses to VC investment announcements. This overcomes some of the difficulties associated with the use of low-frequency survey data, which is the typical practice among researchers when measuring individual economic activities (Gelman et al., 2014). Specifically, our data consist of both pre-VC investment and post-VC investment customer responses in a real economy, which are difficult to obtain. The second key advantage is that the products from each startup company in our setting, P2P loans, are relatively homogenous from the perspective of the customer (P2P lender). Most Chinese P2P lending platforms have similar business models and lending procedures. In our sample period, almost all platforms provide a principal guarantee[2] that protects lenders' principal once borrowers default. Therefore, from the perspective of P2P lenders, P2P loans on different P2P lending platforms are relatively similar fixed income investments with the primary difference being the interest rates, maturities, and default risk associated with the platforms.[3] This advantage mitigates the potential biases caused by the heterogeneous features of products in other startup companies.

We answer three questions concerning the role played by VCs in certifying the value of the startup platforms in which they invest. First, do VCs provide a certification effect to potential customers and attract more of them (e.g., P2P lenders) immediately after VC investment announcements? Second, are the start-ups that receive investment from highly reputable VCs more likely to attract customers compared to those who receive investment from VCs with poor reputations? Third, is the magnitude of the certification effect associated with the degree of information asymmetry between platforms and their customers?

The results of our empirical analysis can be summarized as follows. We first find that the proxies for customer response of the amount of loans facilitated and number of lenders increase significantly by 25.7% and 49.3%, respectively, after the announcement of the first round VC investment in those startup platforms, while the number of borrowers does not change much. This result is consistent with the existence of the VC certification effect for potential customers. In our examination of the differences between high-reputation and low-reputation VCs, we find that the VC certification effect for customers is positively associated with the VC's reputation.[4] In the end, we show that the VC certification effect for potential customers decreases with platform age, a proxy that is negatively correlated with the information asymmetry between the companies and outsiders. We also find that the VC certification effect is prominent for the platforms' new lenders, who have greater information asymmetry with startup platforms compared to existing lenders. These results are consistent with Focarelli et al. (2008), who point out that the certification effect increases with information asymmetry. In addition, we examine customer response to VC investment announcements using propensity score matched pairs of VC-backed platforms and platforms that have never received VC investment and find consistent results.

Chemmanur and Yan (2009) note that advertising can be a signal that reduces information asymmetry associated with advertiser firms. This advertising effect can potentially explain an increase in customer response. To alleviate this concern, we first explore the dynamics of the number of news events around the time of VC investment announcements to provide indirect evidence of the advertising effect on customer response. We also find that VC investment size is not associated with customer response. Therefore, the supporting evidence shows that our baseline results cannot be entirely driven by the effects of news, advertising, or funding. Given the recent collapse of the P2P market in China, we document that VC-backed platforms are less likely to default than non-VC-backed platforms. This result provides indirect evidence that VC backing has long-term benefits for portfolio firms.

This study is the first to examine the role of VC certification by exploring whether VCs certify the quality of start-ups by reducing information asymmetry between start-ups and their potential customers. The study also contributes to the understanding of venture capital financing's role in creating value for entrepreneurial firms in general by documenting the certification role played by VCs in customer response. In addition, our study adds to the growing literature on venture capital financing's value creation for start-up firms in emerging markets. The certification effect in capital markets has been well documented since 1990 (Barry et al., 1990;

[1] P2P lending is a financing mechanism whereby borrowers and lenders are directly matched in marketplaces. The compound annual growth rate of P2P loan issuance in China, the United States, the United Kingdom, and Australia between 2010 and 2014 was 123%. The outstanding amount of P2P loans in China reached CNY 1224.6 billion at the end of 2017.

[2] Before August 2017, almost all platforms publicly announced that they would provide a principal guarantee to individual lenders on P2P lending platforms. After August 2017, the platforms are no longer allowed to make such public promotions on platform websites due to changes in Chinese regulations. Our current sample ends at June 2017, therefore the regulation changes do not have a direct impact on the current study. Even after August 2017, lenders and borrowers in the Chinese P2P lending market are well aware that platforms are in fact still providing such principal guarantees. We can also find evidence through the annual reports of the platforms that they continued to make principal guarantees to lenders throughout 2017 and 2018.

[3] Individual lenders are primarily exposed to the default risk of the P2P lending platforms and, to a much lesser extent, the individual borrowers' default risk.

[4] Following Nahata (2008), Gompers (1996), and Zhang and Liao (2011), we use accumulative IPO values, VC firm age, and a foreign VC indicator to measure VC reputation.

Megginson and Weiss, 1991). VC backing may provide valuable certification to outside investors and reduce IPO underpricing. In addition to the certification effect, VCs can improve efficiency (Chemmanur et al., 2011), provide mentoring services to firms (Hsu, 2004; Cochrane, 2005), play an administrative role in VC-backed firms (Barry et al., 1990; Lerner, 1995; Hellmann, 1998), stimulate innovation (Bernstein et al., 2016), and improve the timing of IPOs (Lerner, 1994). VCs can also create product market value and financial market value for portfolio firms by forming syndications (Tian, 2011). In emerging markets, Cheng and Schwienbacher (2016) investigate the choice of Chinese VC-backed companies between listing on the domestic market or foreign stock markets. They find that companies backed by foreign VCs are more likely to list on foreign stock markets. Johan and Zhang (2016) provide evidence that a better business and legal environment is associated with successful exits of PE (private equity) managers. In countries with higher levels of corruption, PE managers can increase the probability of exits through IPOs. Cumming and Zhang (2019) find that relative to PE/VC funds, angel investors are more sensitive to economic conditions. Investee firms funded by angels are less likely to successfully exit in either an IPO or acquisition. Our paper focuses on the certification effect of VCs for start-up firms by certifying their value to customers in an emerging market rather than the role VCs play in the exit choice or performance of start-up firms in emerging markets.

Second, our study contributes to the literature on the real effects of signaling or the certification role played by financial institutions. In general, existing studies find that certification of financial institutions, such as debt rating agencies, investment banks, and commercial banks, has an important real effect for firms. For example, Sufi (2007) shows that rating agencies help firms increase the use of debt, asset growth, cash acquisitions, and investment in working capital. Titman and Trueman (1986) demonstrate that higher quality auditors and investment bankers signal a higher value of issuing firms and reduce issuance costs. Puri (1996) finds that bank underwriters also certify the issuing firm's value, leading to lower issuance costs. Slovin and Young (1990) argue that bank debt or credit lines signal the good value of firms and hence lower IPO underpricing. Our study finds new evidence supporting the positive real effect of financial institutions' signaling and certification.

Finally, our study is also related to the growing literature on P2P lending. Duarte et al. (2012) find that P2P borrowers that appear more trustworthy have a higher likelihood of funding probability and a lower default rate. Lin et al. (2013) show that lenders are more likely to fund borrowers who have stronger online social networks. Lin and Viswanathan (2015) show that P2P lenders have local bias in borrower selection. Wei and Lin (2016) find that, in P2P lending, the posted-price mechanism leads to a higher likelihood of funding, higher interest rates, and a higher default rate. Jiang et al. (2019) examine how P2P lenders select from thousands of P2P lending platforms using cross-platform data, and find that platforms that are backed by state-owned enterprises have larger facilitated loan amounts, attract more lenders, and pay lower interest rates to lenders. Our study complements this growing strand of literature by highlighting the roles of VCs in P2P lenders' investment decisions.

The rest of the paper is organized as follows. Section 2 presents institutional features. Section 3 describes our data and proxies. Section 4 introduces our methodology and empirical results, and Section 5 concludes.

2. Institutional features

P2P lending is an example of how technology innovations have transformed financial services (Wei and Lin, 2016). In recent years, P2P lending has grown dramatically worldwide; from 2010 to 2014, the compound annual growth rate of P2P loan issuance in China, the United States, the United Kingdom, and Australia was 123% (Morgan Stanley, 2015). In fact, China has the largest P2P market in the world. Thousands of P2P lending platforms have been founded in China, and the outstanding balance of P2P loans in China reached CNY 1224.6 billion at the end of 2017. As with other startups, VCs are a major source of funding for P2P lending platforms. Before June 2017, VCs had backed approximately 180 P2P lending platforms or 2 to 3% of over 5000 P2P lending platforms. The presence of VC investment in P2P lending platforms provides us with a unique chance to study the real effects of VC certification on a relatively large number of homogenous startups (P2P lending platforms). In contrast to other product markets and industries, lenders from P2P lending platforms typically have a homogenous goal, which is to maximize financial returns from the funds they lend to borrowers.

We emphasize three key features of the Chinese P2P lending market documented in Jiang et al. (2019). First, almost all Chinese P2P lending platforms provide a principal guarantee to their P2P lenders: when borrowers default, the platforms compensate lenders for the unpaid principal. Therefore, individual lenders are primarily exposed to the default risk of the P2P lending platforms and, to a much lesser extent, the individual borrowers' default risk.

Second, Chinese P2P lending platforms have a high bankruptcy rate: over half of Chinese P2P lending platforms have ceased operations and are defunct. Jiang et al. (2019) find that 40% of defunct platforms engaged in fraudulent behavior, such as Ponzi schemes. No real borrowers were financed through these platforms, and the platforms listed forged loan applications to attract lenders' money. Some other defunct platforms are the result of inadequate risk management. Since weak risk management usually leads to a higher default rate among platform borrowers, these platforms are unable to fulfill guarantee obligations and subsequently go bankrupt. In most cases, defunct platforms result in huge losses for lenders. Thus, P2P lending platform default is one of the primary risks of Chinese P2P lenders.

Third, the Chinese P2P lending industry was almost unregulated during the early stages of the industry. The Chinese authorities released the first regulatory rules in August 2016, nine years after the introduction of P2P lending in China. Before August 2016, Chinese P2P lending platforms were not required to disclose their operational and financial information to the public or to P2P lenders, which also contributed to the substantial information asymmetry between P2P lending platforms and P2P lenders.

Therefore, the Chinese P2P lending market shares some characteristics with venture markets in general: high information asymmetry regarding products/services in a relatively under-regulated market. For example, the Chinese P2P lending market exhibits

similarities with startups in the ride-sharing and space-sharing industries. In these industries, the information asymmetry between individual customers and startups is relatively high as a result of the opaque nature of the business. Consequently, customers in these industries are typically unable to identify ex-ante whether the services provided by the startups are safe and of high quality. VC certification could be a central element to overcoming information asymmetries between potential customers and startups. However, our findings are less likely to apply to startups in the pharmaceutical industry, where external certification is required from government or other regulatory bodies.

3. Data and proxy measures

To examine the effect of VC certification, we obtain several comprehensive datasets. Our first dataset contains weekly platform-aggregated trading data from over 1500 P2P lending platforms. The data were collected from www.wdzj.com, the largest online information provider for the Chinese P2P lending market. This dataset includes the amount of loans facilitated, number of lenders, number of borrowers, interest rates, and maturities at the platform-week level.

The second dataset is obtained from www.P2Peye.com, the second largest information provider for the Chinese P2P lending market. The data comprise the weekly trading data of 348 P2P lending platforms, including the number of new P2P lenders and number of existing lenders for each platform in a given week. New lenders are those who begin to lend on the platform in a given week while existing lenders are those that have lent on the platform both before and during the given week.

The third dataset contains the weekly number of news events associated with each of the VC-backed P2P lending platforms between January 2012 and June 2017. For each platform-week observation, we searched Baidu News (the largest search engine for news in China) using the platform's name as the keyword, and collected the number of online news events associated with the platform and published in a given week.

The last dataset is a manually collected dataset that contains information related to the first-round of VC investments for Chinese P2P lending platforms. The data contain each investment's announcement date, which is the date of the investment's first published news event. Our dataset also contains information on each first-round financing and the corresponding lead VC. Following a series of papers (e.g., Barry et al., 1990; Lin and Smith, 1998; Lee and Wahal, 2004), we define the lead VC as the one with the largest equity position in the platform after the first financing round. The financing round information, such as the date and dollar value of the investments, and lead VC information, such as the founding year and investment history, is collected from PEdata, a leading database for VCs and startups in China. We cross-check this information with WIND, a leading financial data provider in China, and major news websites for P2P lending (e.g., wdzj.com and P2Peye.com) and early stage investment (e.g., Itjuzi.com and cyzone.cn) in China.

We manually combine the above data sources: our VC-backed platform sample includes all P2P lending platforms that had ever received investments from VCs prior to June 2017, together with customer lending and borrowing information collected from www.wdzj.com. The VC-backed platform sample includes 154 VC-backed P2P lending platforms and 21,134 platform-week observations between January 2012 and June 2017. With these data, we can compare immediate customer responses both before and after the announcement of VC investments in the P2P lending platforms.

Our key independent variable, *AfterVC*, is a dummy variable that takes the value of one for the week of or after the week of the VC investment announcement and zero for the weeks before the week of the VC investment announcement. To examine how P2P lenders respond to VC investments, we focus on two variables: *Amount* and *Lenders*. *Amount* is the amount of loans facilitated on a platform in a given week, and *Lenders* is the total number of P2P lenders that successfully lent on a platform in a given week. To study the response of P2P borrowers, we use *Borrowers*, which is the number of borrowers that successfully borrowed on a platform in a given week. The control variables are *Interest* and *Maturity*. *Interest* is the average annual interest rate across all P2P loans facilitated on a platform in a given week weighted by loan amount. *Maturity* is the average maturity of all loans facilitated weighted by loan amount. We also compute *News* as the number of news events associated with a platform in a given week and use it as a proxy for the effect of news on lenders' attention (Barber and Odean, 2008).

Panel A of Table 1 presents the summary statistics of the VC-backed platform sample. The mean and median values for the amount of loans facilitated are CNY 69.77 million and CNY 15.78 million per week, respectively. The mean and median of the number of lenders are 4702.45 and 755 in each week, while the mean and median for the number of borrowers are 2091.55 and 19, respectively. The average annual interest rate paid to lenders is 12.68%, and the average loan maturity is 6.19 months. The average number of news events associated with these platforms in each week is close to 1.

Panel B of Table 1 presents the summary statistics of 101,021 platform-weeks from 1388 non-VC-backed P2P lending platforms. The amount of weekly loans facilitated by these platforms is less than that of VC-backed platforms, and there are fewer lenders and borrowers on non-VC-backed platforms.

To investigate whether VCs play different certification roles for new lenders and existing lenders, we adopt a smaller sample using VC-backed platforms and customer trading information from the P2Peye data, which identifies the number of new and existing lenders. This sample includes 7393 platform-week observations of eighty-seven VC-backed platforms before June 2016. Panel C presents the summary statistics of the P2Peye sample. The average annual interest rate and maturity are 12.70% and 5.37 months, respectively, which are similar to our VC-backed platforms sample. The means of new lenders and existing lenders are 405.33 and 2368.01, respectively.

We construct several variables to document certain features of VC investments and examine the heterogeneity of the VC certification effect. We adopt three variables to measure VC reputation. For each lead VC, we also follow Nahata (2008) to compute *IPO_VC* as the cumulative market capitalization of IPOs before investment in the P2P lending platform. Following Gompers (1996), we compute *Age_VC* as the age of the lead VC in the year of investment in the P2P lending platform. We also use *Foreign*, an indicator

Table 1
Summary statistics.

	N	Mean	Std	Min	Q1	Median	Q3	Max
Panel A. VC-backed platforms								
AfterVC	21,134	0.63	0.48	0	0	1	1	1
Amount (CNY Million)	21,134	69.77	146.06	0.04	4.79	15.78	58.80	908.27
Lenders	19,957	4702.45	12,465.26	5	189	755	2708	80,118
Borrowers	21,042	2091.55	10,303.89	1	3	19	160	84,497
Interest (%)	21,134	12.68	3.86	6.26	9.87	12.00	14.99	25.04
Maturity (Months)	21,134	6.19	7.00	0.41	2.15	3.97	6.73	34.66
News	21,134	0.82	2.31	0	0	0	1	16
Panel B. Non-VC-backed platforms								
Amount (CNY Million)	101,021	15.67	50.00	0.03	0.87	2.64	8.50	487.43
Lenders	100,317	628.76	2704.29	2	29	77	250	31,827
Borrowers	98,290	212.79	4011.07	1	1	4	13	268,884
Interest (%)	101,021	13.66	5.00	5.67	10.05	12.77	16.10	34.60
Maturity (Months)	101,021	3.93	3.99	0.29	1.58	2.87	4.79	30.21
Panel C. P2Peye sample								
AfterVC	7393	0.58	0.49	0	0	1	1	1
Interest (%)	7393	12.70	3.07	6.84	10.28	12.52	15	20.18
Maturity (Months)	7393	5.37	6.26	0.45	1.86	3.49	5.93	33.84
Newlenders	7393	405.33	1051.20	0	14	62	256	7834
Existinglenders	7393	2368.01	6437.22	0	102	433	1556	45,683
Panel D. VC-backed platforms and lead VC								
Age_VC (Years)	154	8.05	13.75	0	1	3.5	10	145
IPO_VC (CNY Billion)	154	46.42	231.98	0.00	0.00	0.00	0.00	2005.91
Foreign	154	0.097	0.297	0	0	0	0	1
Age_platform (Years)	154	1.38	1.24	0	0	1	2	6

Panel A reports the summary statistics for the VC-backed platform sample. The sample consists of 21,134 platform-week level observations of 154 VC-backed platforms between January 2012 and June 2017. Panel B presents the summary statistics of non-VC-backed platform sample. The sample consists of 101,021 platform-week level observations of 1388 non-VC-backed platforms between January 2012 and June 2017. *AfterVC* is a dummy variable that takes the value of one for the week of or after the week of the VC investment announcement and zero for the weeks before the week of the VC investment announcement. *Amount* is the amount of loans facilitated on a platform in a given week. *Lenders* is the total number of P2P lenders that successfully lent on a platform in a given week. *Borrowers* is the number of borrowers that successfully borrowed on a platform in a given week. *Interest* is the average annual interest rate across all P2P loans facilitated on a platform in a given week weighted by loan amount. *Maturity* is the average maturity of all loans facilitated weighted by loan amount. *News* is the number of news events associated with a platform in a given week. Panel C summarizes the variables in the dataset collected from www.P2Peye.com. The data consist of the weekly information of 87 VC-backed P2P lending platforms between January 2012 and June 2016. *Existinglenders* are the number of lenders who have invested on a platform both before and during a given week. *Newlenders* are the number of lenders who begin to invest on a platform in a given week. Panel D reports the summary statistics of 154 VC-backed platforms and the corresponding lead VCs. *Age_VC* is the age of the lead VC in the year of investment in the P2P lending platform. IPO_VC is the cumulative market capitalization of IPOs before investment in the P2P lending platform. *Foreign* is a dummy variable that takes the value of 1 when a lead VC firm's headquarter is in foreign countries. *Age_Platform* is the age of the platforms at the time of the VC investment announcement.

variable that takes the value of one if the lead VC firm's headquarters is abroad (Guo and Jiang, 2013), as a proxy for reputation, since Zhang and Liao (2011) show evidence that foreign VCs may be seen in the Chinese IPO market as more reputable. To measure the information asymmetry between platforms and lenders, we follow Avramov et al. (2007) and, for each platform, compute *Age_Platform* as the platform's age in the year of the VC investment.

Panel D presents the summary statistics for the 154 VC-backed P2P lending platforms and the corresponding lead VCs. Before the date of the VC investment, lead VCs had taken companies public with an average cumulative market capitalization of CNY 46.42 billion. The mean and median age of the lead VC are 8.05 and 3.5 years, respectively. Foreign VC firms account for 9.7% of the sample, and the mean age of P2P lending platforms in the year of VC investment is 1.38 years.

4. Empirical results

The objective of our study is to examine the VC certification effect on customer response. In our baseline analysis, we examine customer response to VC investment announcements. Subsections 4.1.1, 4.1.2, and 4.1.3 report the results. In Section 4.2, we examine customer response and the default probability of the lending platforms using propensity score matched pairs of VC-invested platforms and platforms that never received VC investment. In Section 4.3, we explore the news pattern around VC investment announcements and the amount of the funding round to address alternative interpretations of our main results.

4.1. Baseline findings

First, we investigate how P2P lending platform customers respond to VC investment announcements. Following Agrawal (2013), we estimate the coefficients of the following OLS regression model.

$$Y_{it} = \beta AfterVC_{it} + \gamma X_{it} + u_i + v_t + \varepsilon_{it} \quad (1)$$

In Model (1), the dependent variable, Y_{it}, includes the logarithm of the amount of loans facilitated, the logarithm of the number of lenders, and the logarithm of the number of borrowers. $AfterVC_{it}$ is a dummy variable that takes the value of one if week t is the same week or after the week of the announcement of the first round of VC investment in platform i, and zero otherwise. X_{it} denotes control variables, including the average interest rate and average maturity of loans transacted on platform i at week t. u_i denotes the platform fixed effects that control for the time-invariant feature of P2P lending platforms. v_t denotes the week fixed effects and controls for the time trend, and ε_{it} is the error term. Similar to the framework of Agrawal (2013), the coefficient β is a DiD estimate of the effect of VC investment announcements on the dependent variable.

To show the dynamics of the customer response around the VC investment, we estimate the following model:

$$Y_{it} = \sum_{j=1}^{j=5} \beta_{-j} Month\_before(j)_{it} + \sum_{j=1}^{j=5} \beta_j Month\_after(j)_{it} + \beta_6 Month\_after(6+)_{it} + \gamma X_{it} + u_i + v_t + \varepsilon_{it} \quad (2)$$

In Model (2), $Month\_before(j)_{it}$ (j = 1,2,3,4,5) is a dummy variable representing whether the observation for platform i at week t takes place j months before the announcement week of VC investment in that platform. $Month\_after(j)_{it}$ (j = 1,2,3,4,5) is a dummy variable representing whether the observation for platform i at week t takes place j months after the VC investment announcement week. $Month\_after(6+)_{it}$ is a dummy variable representing whether the observation for platform i at week t takes place six or more months after the VC investment announcement week. X_{it} are control variables. The coefficients of these dummy variables, $\{\beta_j\}$, represent the dynamics of the dependent variables around the announcement week.

After each regression, we run three F-tests. First, we test whether each dependent variable changes in the period preceding VC investment announcements by performing an F-test on whether the coefficients of $Month\_before(j)_{it}$ (j = 1,2,3,4,5) are jointly equal. Second, to examine whether the dependent variable changes immediately after VC investment, we look at and test the difference between the coefficient of $Month\_after(1)_{it}$ and the average of the coefficients of $Month\_before(j)_{it}$ (j = 1,2,3,4,5). Third, to examine whether the effect is present in longer horizons, we also test the difference between the average coefficients of $Month\_before(j)_{it}$ (j = 1,2,3,4,5) and those of $Month\_after(j)_{it}$ (j = 1,2,3,4,5).

4.1.1. Customer response and VC investment

In Panels A, B, and C of Fig. 1, we graphically plot the time dynamics of the logarithms of the amount of loans facilitated, number of lenders, and number of borrowers, respectively.

Fig. 1 suggests that there are no significant changes in transacted amount (number of lenders, number of borrowers) during the five months preceding VC investment announcements. Right after the announcement of VC investment, the amount of loans facilitated and number of lenders increases significantly. However, the number of borrowers does not significantly change after VC investment announcements.

These results are consistent with the results in Table 2, suggesting the existence of certification.

Table 2 Panel A reports the results of estimating the coefficients in Model (1). In Column (1), we use the logarithm of the amount of loans facilitated as the dependent variable and include only *AfterVC*, platform fixed effects and week fixed effects on the right-hand side. The results indicate that the amount of loans facilitated on the same platform increased by 25.7% (=Exp(0.229)−1) after the announcement of VC investment. These results are robust when we include the interest rate and maturity as control variables (Column (2)).

In Column (3), we use the logarithm of the number of lenders as the dependent variable. In Column (3), the coefficient of *AfterVC* is 0.401 with a t-statistic of 18.370, suggesting that the number of lenders increases by 49.3% (=Exp(0.401)−1) after the announcement of VC investment when netting out platform and week fixed effects. In Column (4), we also control for the interest rate and maturity and find similar results.

In Column (5), we use the logarithm of the number of borrowers as the dependent variable. The coefficient of *AfterVC* is −0.008 with a t-statistic of −0.279. This suggests there is no significant difference between the number of borrowers before and after the announcement of VC investment. In Column (6), we also control for the interest rate and maturity and find similar results.

To mitigate the concern that our results are mainly driven by small-size P2P lending platforms, we conducted subsample tests on platforms excluding the small platforms and the results remain consistent.

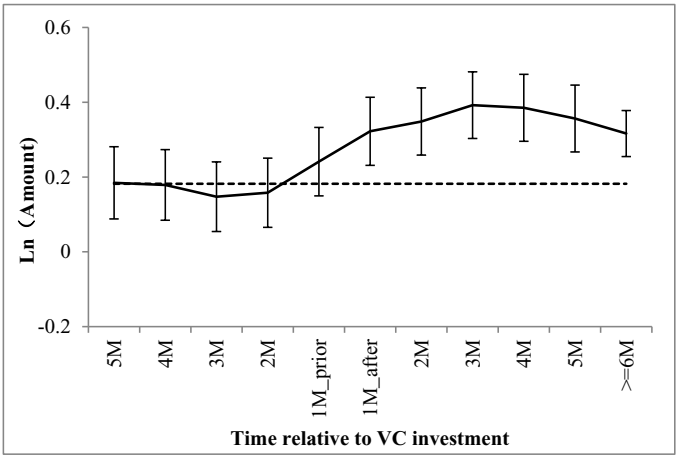
We argue that our results cannot be primarily driven by the possibility that VCs improve platform quality after investment. We use the first media news about the VC investment as the event date, which is normally within one month of the actual investment. In a discussion with an experienced practitioner from the Chinese VC industry, we learned that a VC firm would generally not make any changes in startups within nine months to one year after the initial investment. As shown in Fig. 1, P2P lenders respond to VC investment announcements within one month, during which time a VC is not likely to get involved in improving business operations. In addition, we restrict our event window to three months before and after the VC investment announcements and find consistent results (Table 3).

Table 4 shows that the average loan size increases after VC investment announcements. This is consistent with our baseline results

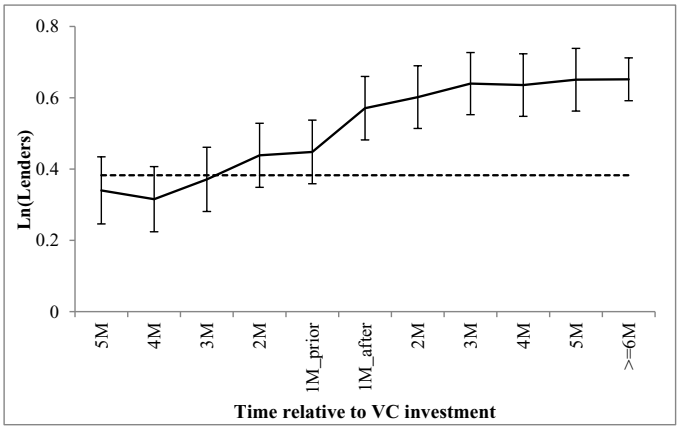
that the number of lenders increases after VC investment announcements while the number of borrowers remains unchanged. Borrowers with large-size loan applications are more likely to be funded after VC investment announcements, suggesting an increase in the average loan size.

Following Agrawal (2013), we estimate Model (2) to examine the dynamics of the amount of loans facilitated, number of lenders, and number of borrowers around VC investment announcements. As shown by the F-statistics in Column (1) of Table 5, the coefficients of $Month\_before(j)_{it}$ (j = 1,2,3,4,5) are not jointly significantly different, suggesting that the amount of loans facilitated does

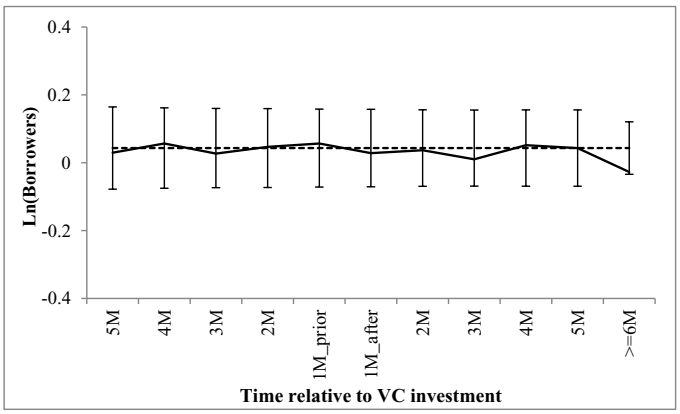
Panel A. The Amount of Loans facilitated



Panel B. The Number of Lenders



Panel C. The Number of Borrowers



(caption on next page)

Fig. 1. Customer response dynamics around VC investment announcements.
This figure illustrates the dynamics of the amount of loans facilitated, the number of lenders, and the number of borrowers around the announcement date of VC investment. The graph presents the estimated coefficients of time dummies in the following regression model.

$$Y_{it} = \sum_{j=1}^{j=5} \beta_{-j} \text{Month\_before(j)}_{it} + \sum_{j=1}^{j=5} \beta_{j} \text{Month\_after(j)}_{it} + \beta_{6} \text{Month\_after(6+)}_{it} + \gamma X_{it} + u_i + v_t + \varepsilon_{it}$$

The sample consists of the weekly information of 154 VC-backed platforms between January 2012 and June 2017. Y_{it} includes the logarithm of the amount of loans facilitated, the logarithm of the number of lenders, and the logarithm of the number of borrowers. $\text{Month\_before(j)}_{it}$ (j = 1,2,3,4,5) is a dummy variable representing whether the observation for platform i at week t takes place j months before the announcement week of VC investment in that platform. $\text{Month\_after(j)}_{it}$ (j = 1,2,3,4,5) is a dummy variable representing whether the observation for platform i at week t takes place j months after the VC investment announcement week. $\text{Month\_after(6+)}_{it}$ is a dummy variable representing whether the observation for platform i at week t takes place six or more months after the VC investment announcement week. X_{it} includes *Interest and Maturity*. *Interest* is the average annual interest rate across all P2P loans facilitated on a platform in a given week weighted by loan amount. *Maturity* is the average maturity of all loans facilitated weighted by loan amount. The vertical bands represent the 95% confidential interval. The horizontal dashed line denotes the average coefficients of Month_before(j) (j = 1,2,3,4,5).

Table 2
Baseline regression.

	(1)	(2)	(3)	(4)	(5)	(6)
	Ln(Amount)	Ln(Amount)	Ln(Lenders)	Ln(Lenders)	Ln(Borrowers)	Ln(Borrowers)
AfterVC	0.229***	0.239***	0.401***	0.413***	−0.008	−0.016
	(10.334)	(10.804)	(18.370)	(19.040)	(−0.279)	(−0.579)
Interest		0.041***		0.068***		0.023***
		(10.965)		(17.850)		(4.789)
Maturity		−0.004		0.005**		0.030***
		(−1.598)		(2.046)		(10.376)
Platform FE	YES	YES	YES	YES	YES	YES
Week FE	YES	YES	YES	YES	YES	YES
Observations	21,134	21,134	19,957	19,957	21,042	21,042
R-squared	0.796	0.797	0.823	0.826	0.841	0.842

This table presents the OLS estimates of our baseline model. The sample consists of the weekly information of 154 VC-backed platforms between January 2012 and June 2017. *Amount* is the amount of loans facilitated on a platform in a given week. *Lenders* is the total number of P2P lenders that successfully lent on a platform in a given week. *Borrowers* is the number of borrowers that successfully borrowed on a platform in a given week. *AfterVC* is a dummy variable that takes the value of one for the week of or after the week of the VC investment announcement and zero for the weeks before the week of the VC investment announcement. *Interest* is the average annual interest rate across all P2P loans facilitated on a platform in a given week weighted by loan amount. *Maturity* is the average maturity of all loans facilitated weighted by loan amount. T-statistics are reported in parentheses. ***, **, * denote the significance at the 1%, 5%, and 10% level, respectively.

Table 3
Baseline regression (3-month window).

	(1)	(2)	(3)	(4)	(5)	(6)
	Ln(Amount)	Ln(Amount)	Ln(Lenders)	Ln(Lenders)	Ln(Borrowers)	Ln(Borrowers)
AfterVC	0.095**	0.108**	0.088**	0.106**	−0.032	−0.037
	(2.106)	(2.413)	(2.092)	(2.522)	(−0.890)	(−1.018)
Interest		0.025*		0.035***		−0.017
		(1.791)		(2.654)		(−1.540)
Maturity		−0.053***		−0.049***		0.019***
		(−6.131)		(−4.900)		(2.642)
Platform FE	YES	YES	YES	YES	YES	YES
Week FE	YES	YES	YES	YES	YES	YES
Observations	2670	2670	2559	2559	2666	2666
R-squared	0.902	0.904	0.923	0.924	0.970	0.970

This table presents the OLS estimates of our baseline model. The sample consists of the weekly information of 154 VC-backed platforms 3 months before and after VC investment announcements. *Amount* is the amount of loans facilitated on a platform in a given week. *Lenders* is the total number of P2P lenders that successfully lent on a platform in a given week. *Borrowers* is the number of borrowers that successfully borrowed on a platform in a given week. *AfterVC* is a dummy variable that takes the value of one for the week of or after the week of the VC investment announcement and zero for the weeks before the week of the VC investment announcement. *Interest* is the average annual interest rate across all P2P loans facilitated on a platform in a given week weighted by loan amount. *Maturity* is the average maturity of all loans facilitated weighted by loan amount. T-statistics are reported in parentheses. ***, **, * denote the significance at the 1%, 5%, and 10% level, respectively.

Table 4
VC Investment announcement and loan size.

	(1)	(2)
	Ln(Loansize)	Ln(Loansize)
AfterVC	0.215***	0.207***
	(10.426)	(10.054)
Interest		−0.042***
		(−11.988)
Maturity		−0.016***
		(−7.502)
Platform FE	YES	YES
Week FE	YES	YES
Observations	21,134	21,134
R-squared	0.781	0.786

This table presents the OLS estimates of our baseline model. The sample consists of the weekly information of 154 VC-backed platforms between January 2012 and June 2017. *Loansize* is the average amount of transacted loans on a platform in a given week. *AfterVC* is a dummy variable that takes the value of one for the week of or after the week of the VC investment announcement and zero for the weeks before the week of the VC investment announcement. *Interest* is the average annual interest rate across all P2P loans facilitated on a platform in a given week weighted by loan amount. *Maturity* is the average maturity of all loans facilitated weighted by loan amount. T-statistics are reported in parentheses. ***, **, * denote the significance at the 1%, 5%, and 10% level, respectively.

not change within the first five months preceding the announcement date. Our second and third F-statistics suggest that $Month\_after(1)_{it}$ is significantly larger than the average coefficients of $Month\_before(j)_{it}$ ($j = 1,2,3,4,5$), and the average coefficients of $Month\_after(j)_{it}$ ($j = 1,2,3,4,5$) are also significantly larger than $Month\_before(j)_{it}$ ($j = 1,2,3,4,5$). These results are consistent with the previous results showing that the amount of loans facilitated for P2P lending platforms increases significantly after VC investment announcements.

Column (2) shows the results using the logarithm of the number of lenders as the dependent variable. The results are similar to those in Column (1): the number of lenders does not change within the first five months prior to VC investment announcements, but increases significantly after VC investment announcements.

Column (3) shows the results using the logarithm of the number of borrowers as the dependent variable. The number of borrowers does not change significantly within the first five months before VC investment announcements. However, neither the coefficient of $Month\_after(1)_{it}$ nor the average coefficient of $Month\_after(j)_{it}$ ($j = 1,2,3,4,5$) are significantly different from the average coefficient of $Month\_before(j)_{it}$ ($j = 1,2,3,4,5$), indicating that the number of borrowers does not significantly change after the announcement of VC investment.

4.1.2. VC reputation and certification effect

Researchers have documented that the certification effect increases with the reputation of the certifier; for example, the VC, the investment bank, and firm management (see, e.g., Chemmanur and Paeglis, 2005; Gompers, 1996). Next, we test whether the certification effect on startup company customers is related to the reputation of the VC. We use three variables to measure the reputation of VCs: 1) the accumulative IPO value of the VC before the investment (Nahata, 2008), 2) the age of the VC firm in the investment year (Gompers, 1996), and 3) foreign VC (Zhang and Liao, 2011). We estimate the coefficients of the following model.

$$Y_{it} = \beta AfterVC_{it} + \theta AfterVC_{it} * Reputation_i + \xi Reputation_i + \gamma X_{it} + u_i + v_t + \varepsilon_{it} \quad (3)$$

In Model (3), $Reputation_i$ is cumulative market capitalization of IPOs of the lead VC, the VC firm's age, or whether the VC is a foreign VC at the date of the VC investment announcement. θ measures how the certification effect is related to the VC's reputation. As the VC certification effect is expected to increase with reputation level, we expect that θ is significantly larger than zero.

Table 6 shows the results.[5] In Panel A, we use the logarithm of the cumulative IPO value as a proxy for the VC's reputation. Column (1) shows the results with the logarithm of the amount of loans facilitated as the dependent variable. The coefficient of *AfterVC*ln(IPO_VC)* is 0.008 with 1% significance, suggesting that the VC certification effect increases with the VC's reputation. With respect to economic significance, the estimated certification effect on platforms backed by highly reputable VCs (90th percentile of IPO capitalization value) is 39.3%, 16.3 percentage points higher than that of VCs that never conduct IPOs. In Column (2), we control for the interest rate and maturity on the right-hand side and find similar results.

In Column (3), we use the logarithm of the number of lenders as the dependent variable. The average estimated certification effect increases from 37.6% (=Exp(0.319)−1) to 112.5% (=Exp(0.319 + 0.028 * Ln(1 + 55.23 * 10^9))−1), when the measure for the VC's

[5] The reputation variables are dropped automatically from the regression, since these variables are time-invariant for each platform and we include platform fixed effects.

Table 5
Customer response dynamics around VC investment announcements.

	(1)	(2)	(3)
	Ln(Amount)	Ln(Lenders)	Ln(Borrowers)
Month_before(5)	0.184***	0.340***	0.030
	(3.745)	(7.080)	(0.479)
Month_before (4)	0.179***	0.315***	0.057
	(3.714)	(6.760)	(0.938)
Month_before (3)	0.147***	0.371***	0.027
	(3.104)	(8.071)	(0.450)
Month_before (2)	0.158***	0.439***	0.047
	(3.347)	(9.564)	(0.786)
Month_before (1)	0.241***	0.448***	0.057
	(5.164)	(9.837)	(0.964)
Month_after(1)	0.322***	0.571***	0.028
	(6.938)	(12.556)	(0.487)
Month_after (2)	0.349***	0.602***	0.037
	(7.610)	(13.418)	(0.639)
Month_after (3)	0.392***	0.640***	0.010
	(8.630)	(14.384)	(0.174)
Month_after (4)	0.385***	0.636***	0.052
	(8.432)	(14.202)	(0.902)
Month_after (5)	0.356***	0.651***	0.043
	(7.811)	(14.509)	(0.750)
Month_after (6+)	0.316***	0.652***	−0.027
	(10.073)	(21.257)	(−0.692)
Interest	0.042***	0.070***	0.023***
	(11.197)	(18.569)	(4.828)
Maturity	−0.003	0.005**	0.031***
	(−1.465)	(2.107)	(10.445)
F-Statistics: The coefficients of Month_before(j) (where j = 1,2,3,4,5) are jointly equal			
	0.70	1.85	0.07
F-Statistics: $\text{Month\_after}(0) = 1/5 * \sum_{j=1}^{5} \text{Month\_before(j)}$			
	8.94***	16. 8***	0.06
F-Statistics: $\sum_{j=1}^{5} \text{Month\_after(j)} = \sum_{k=1}^{5} \text{Month\_before(k)}$			
	42.07***	77.54***	0.07
Platform FE	YES	YES	YES
Week FE	YES	YES	YES
Observations	21,134	19,957	21,042
R-squared	0.796	0.825	0.841

This table presents the regression results showing the dynamics of customer response around the time of the VC investment announcement. The sample consists of the weekly information of 154 VC-backed platforms between January 2012 and June 2017. *Amount* is the amount of loans facilitated on a platform in a given week. *Lenders* is the total number of P2P lenders that successfully lent on a platform in a given week. *Borrowers* is the number of borrowers that successfully borrowed on a platform in a given week. *Month_before(j)* (j = 1,2,3,4,5) is a dummy variable representing whether the observation for platform i at week t takes place j months before the announcement week of VC investment in that platform. *Month_after (j)* (j = 1,2,3,4,5) is a dummy variable representing whether the observation for platform i at week t takes place j months after the VC investment announcement week. *Month_after(6+)* is a dummy variable representing whether the observation for platform i at week t takes place six or more months after the VC investment announcement week. *Interest* is the average annual interest rate across all P2P loans facilitated on a platform in a given week weighted by loan amount. *Maturity* is the average maturity of all loans facilitated weighted by loan amount. F-statistics are with respect to the corresponding F-tests. ***, **, * denote the significance at the 1%, 5%, and 10% level, respectively.

reputation increases from zero to its 90th percentile. In Column (4), we also control for the interest rate and maturity and find similar results.

In Panel B, following Gompers (1996), we use the age of the VC firm as the proxy for VC reputation. In Column (1), the logarithm of the amount of loans facilitated is used as the dependent variable. The results suggest that the estimated certification effect on the amount of loans facilitated increases from 15.5% (=Exp(0.132 + 0.012 * 1)−1) to 27.1% (=Exp(0.132 + 0.012 * 10)−1) when the age of the VC increases from the first quartile to the third quartile. In Column (2), we include the interest rate and maturity as control variables and find that the coefficient of *AfterVC*Age_VC* is also significantly positive. In Columns (3) and (4), we use the logarithm of the number of P2P lenders as the dependent variable and find that the coefficients of *AfterVC*Age_VC* are also significantly positive. These results demonstrate that the VC certification effect on the amount of loans facilitated and the number of lenders increases with the VC's age, consistent with the prediction that VC reputation is positively related to its certification effect on P2P lending platforms.

In emerging markets, researchers have provided evidence that foreign VCs in China have a higher reputation compared to domestic VCs in the IPO market (Zhang and Liao, 2011); therefore, we collected additional data related to foreign VCs and use foreign

Table 6
VC Reputation and certification effect.

Panel A. Accumulated IPO value as the proxy for reputation

	(1)	(2)	(3)	(4)
	Ln(Amount)	Ln(Amount)	Ln(Lenders)	Ln(Lenders)
AfterVC	0.207***	0.222***	0.319***	0.343***
	(8.848)	(9.513)	(13.933)	(15.033)
AfterVC*ln(IPO_VC)	0.008***	0.006**	0.028***	0.024***
	(3.102)	(2.394)	(11.323)	(9.823)
Interest		0.041***		0.065***
		(10.775)		(17.160)
Maturity		−0.004*		0.003
		(−1.761)		(1.266)
Platform FE	YES	YES	YES	YES
Week FE	YES	YES	YES	YES
Observations	21,134	21,134	19,957	19,957
R-squared	0.796	0.797	0.825	0.827

Panel B. VC Firm age as the proxy for reputation

	(1)	(2)	(3)	(4)
	Ln(Amount)	Ln(Amount)	Ln(Lenders)	Ln(Lenders)
AfterVC	0.132***	0.128***	0.350***	0.343***
	(5.206)	(5.070)	(13.990)	(13.846)
AfterVC*Age_VC	0.012***	0.014***	0.006***	0.008***
	(7.845)	(9.057)	(4.173)	(5.799)
Interest		0.045***		0.070***
		(11.837)		(18.371)
Maturity		−0.005**		0.004
		(−2.343)		(1.566)
Platform FE	Y	Y	Y	Y
Week FE	Y	Y	Y	Y
Observations	21,134	21,134	19,957	19,957
R-squared	0.796	0.798	0.824	0.827

Panel C. Foreign VC as the proxy for reputation

	(1)	(2)	(3)	(4)
	Ln(Amount)	Ln(Amount)	Ln(Lenders)	Ln(Lenders)
AfterVC	0.209***	0.218***	0.391***	0.404***
	(9.133)	(9.571)	(17.388)	(18.098)
AfterVC*Foreign	0.173***	0.179***	0.088*	0.081*
	(3.776)	(3.924)	(1.949)	(1.791)
Interest		0.041***		0.068***
		(11.010)		(17.861)
Maturity		−0.004*		0.005*
		(−1.794)		(1.932)
Platform FE	YES	YES	YES	YES
Week FE	YES	YES	YES	YES
Observations	21,134	21,134	19,957	19,957
R-squared	0.796	0.797	0.824	0.827

This table presents the results of how VC reputation is associated with VC certification effect by using the cumulative market capitalization of IPOs as the proxy for VC reputation. The sample consists of the weekly information of 154 VC-backed platforms between January 2012 and June 2017. *Amount* is the amount of loans facilitated on a platform in a given week. *Lenders* is the total number of P2P lenders that successfully lent on a platform in a given week. *AfterVC* is a dummy variable that takes the value of one for the week of or after the week of the VC investment announcement and zero for the weeks before the week of the VC investment announcement. *IPO_VC* is the cumulative market capitalization of IPOs before investment in the P2P lending platform. *Age_VC* is the age of the lead VC of a P2P lending platform in the year of investment. *Foreign* is a dummy variable that takes the value of 1 when a lead VC firm's headquarter is in foreign countries. *Interest* is the average annual interest rate across all P2P loans facilitated on a platform in a given week weighted by loan amount. *Maturity* is the average maturity of all loans facilitated weighted by loan amount. T-statistics are reported in parentheses. ***, **, * denote the significance at the 1%, 5%, and 10% level, respectively.

Table 7
Information asymmetry (platform age) and certification effect.

	(1)	(2)	(3)	(4)
	Ln(Amount)	Ln(Amount)	Ln(Lenders)	Ln(Lenders)
AfterVC	0.766***	0.757***	0.629***	0.610***
	(22.251)	(22.023)	(18.401)	(17.968)
AfterVC* Age_Platform	−0.275***	−0.266***	−0.116***	−0.100***
	(−20.251)	(−19.570)	(−8.651)	(−7.531)
Interest		0.036***		0.066***
		(9.653)		(17.384)
Maturity		−0.004*		0.004*
		(−1.782)		(1.912)
Platform FE	YES	YES	YES	YES
Week FE	YES	YES	YES	YES
Observations	21,134	21,134	19,957	19,957
R-squared	0.800	0.801	0.824	0.827

This table presents the results of how information asymmetry is associated with VC certification effect by using the platform age as the proxy for information asymmetry. The sample consists of the weekly information of 154 VC-backed platforms between January 2012 and June 2017. *Amount* is the amount of loans facilitated on a platform in a given week. *Lenders* is the total number of P2P lenders that successfully lent on a platform in a given week. *AfterVC* is a dummy variable that takes the value of one for the week of or after the week of the VC investment announcement and zero for the weeks before the week of the VC investment announcement. *Age_Platform* is the age of the platforms at the year of VC investment announcement. *Interest* is the average annual interest rate across all P2P loans facilitated on a platform in a given week weighted by loan amount. *Maturity* is the average maturity of all loans facilitated weighted by loan amount. ***, **, * denote the significance at the 1%, 5%, and 10% level, respectively.

VCs as a proxy for reputation. We show that P2P lending platforms backed by foreign VCs have a larger customer response compared to those backed by domestic VCs after the VC investment announcement (Table 6 Panel C).

4.1.3. Information asymmetry and certification effect

According to various theoretical and empirical evidence (e.g., Focarelli et al., 2008), the magnitude of the certification effect should be larger when information asymmetry between two agents is larger. Following Avramov et al. (2007), we use the age of the platforms at the time of the VC investment announcement to measure the level of information asymmetry since it is argued that older platforms/startups have less information uncertainty compared to new platforms/startups.

To investigate this, we estimate the coefficients of the following model.

$$Y_{it} = \beta AfterVC_{it} + \theta AfterVC_{it} * Age\_Platform_i + \xi Age\_Platform_i + \gamma X_{it} + u_i + v_t + \varepsilon_{it} \quad (4)$$

In Model (4), Y_{it} is the logarithm of the amount of loans facilitated or the logarithm of the number of lenders. $AfterVC_{it}$, X_{it}, u_i, v_t, and ε_{it} are defined as in the previous sections. $Age\_Platform_i$ is the age of platform i at the time of the VC investment announcement; θ measures the relationship between the certification effect and the age of the platform. We expect that θ is significantly less than zero as the VC certification effect is expected to increase with the level of information asymmetry.

Table 7 shows the results.[6] In Column (1), we use the logarithm of the amount of loans facilitated as the dependent variable. The coefficient of $AfterVC_{it} * Age\_Platform_i$ is −0.275 with a *t*-statistic of −20.275. This suggests that the VC certification effect on the amount of loans facilitated decreases with the platform's age, indicating that greater information uncertainty is associated with a larger certification effect. With respect to economic significance, we show that the estimated certification effect on the amount of loans facilitated decreases dramatically from 115.1% (=Exp(0.766–0.275 * 0)−1) to 24.1% (=Exp(0.766–0.275 * 2)−1) when the platform's age increases from the first quartile (zero years) to the third quartile (two years). In Column (2), we control for the interest rate and maturity and obtain similar results.

In Column (3), we replace the logarithm of the amount of loans facilitated with the logarithm of the number of lenders. The estimated certification effect on the number of lenders decreases dramatically from 87.6% (=Exp(0.629–0.116 * 0)−1) to 48.7% (=Exp(0.629–0.116 * 2)−1) when the platform's age increases from the first quartile to the third quartile. The results indicate that the certification effect on the number of lenders decreases with the platform's age. In Column (4), we also control for the interest rate and maturity and find similar results.

In addition, we examine the role of the VC certification effect among different types of startup platform customers. We use a smaller dataset collected from www.P2Peye.com, which separates the numbers of new lenders and existing lenders, and investigate the effect of VC investment on these two types of lenders. For the same P2P lending platforms, we expect greater information asymmetry between platforms and new lenders compared to the information asymmetry between platforms and existing lenders. Therefore, if the certification effect increases with information asymmetry, we should find the effect is more prominent among new lenders compared to existing lenders.

[6] *Age_platform* is also dropped automatically from the regression with the use of platform fixed effects.

Table 8
Certification effect on new and existing lenders.

	(1)	(2)	(3)	(4)
	Ln(Existinglenders)	Ln(Existinglenders)	Ln(Newlenders)	Ln(Newlenders)
AfterVC	0.048	0.047	0.180 ***	0.180***
	(1.336)	(1.330)	(3.451)	(3.455)
Interest		0.085***		−0.034***
		(10.337)		(−2.855)
Maturity		−0.014***		−0.017**
		(−2.895)		(−2.465)
Platform FE	YES	YES	YES	YES
Week FE	YES	YES	YES	YES
Observations	7393	7393	7393	7393
R-squared	0.853	0.855	0.681	0.682

This table presents the results of VC certification effect on existing lenders and new lenders. The data consist of the weekly information of 87 VC-backed P2P lending platforms between January 2012 and June 2016. *Existinglenders* are the number of lenders who have invested on a platform both before and during a given week. *Newlenders* are the number of lenders who begin to invest on a platform in a given week. *AfterVC* is a dummy variable that takes the value of one for the week of or after the week of the VC investment announcement and zero for the weeks before the week of the VC investment announcement. *Interest* is the average annual interest rate across all P2P loans facilitated on a platform in a given week weighted by loan amount. *Maturity* is the average maturity of all loans facilitated weighted by loan amount. T-statistics are reported in parentheses. ***, **, * denote the significance at the 1%, 5%, and 10% level, respectively.

Table 8 shows the results. In Column (1), we find that the coefficient of *AfterVC* is 0.048 with a t-statistic of 1.336, suggesting that there is no significant certification effect on the number of existing lenders. In Column (2), we include the interest rate and maturity on the right-hand side and find similar results. However, when using the number of new lenders as the dependent variable in Columns (3) and (4), we find that the coefficient of *AfterVC* is larger than zero at the 1% significance level in both regressions. The effect is economically significant, as the coefficient shows that the number of new lenders increases by 19.7% (=Exp(0.180)−1) after the announcement of VC investment. This result is consistent with the prediction that the VC certification effect for P2P lending platforms increases with information asymmetry.

4.2. The difference-in-differences approach

A reasonable concern regarding the analysis so far is that our study only focuses on a sample of lending platforms that receive VC investment. It is possible that VC firms choose to invest in platforms with certain characteristics that are associated with future customer growth. Our previous empirical methods fail to control for this effect. Therefore, conclusions drawn solely based on an analysis of VC-backed platforms could be misleading.

To address this concern, we implement an analysis of customer response from propensity score matched pairs of VC-backed and non-VC-backed platforms. We explore a DiD analysis around the VC investment announcement, which mitigates this concern to a certain extent.

For the DiD analysis, we consider VC investment announcements as the “treatment.” We first construct a pre-match sample that consists of a treatment group and a control group: the treatment group includes the platform-weeks of all VC investment announcement weeks of VC-backed platforms, whereas the control group includes the platform-weeks of non-VC-backed platforms for the period January 2012 to June 2017.

Table 9 Panel A compares the VC-backed and non-VC backed platforms. We find that the two groups of platforms are different in terms of our key variables. To minimize the concern that our results may be driven by the differences between these observable characteristics, we perform a 1–2 nearest neighbor propensity matching with respect to the following variables: platform age, average interest rate, maturity, amount of loans facilitated, and number of lenders in the prior 24 weeks.

This matching procedure generates a post-match sample of 113 platform-weeks in the treatment group and 226 platform-weeks in the control group. For each platform-week observation in the control group, we refer to the “week” as the “pseudo VC announcement week” of the platform. Panel B shows that after matching, the two groups of platforms are not significantly different in terms of these observable characteristics.

We perform a DiD analysis using the weekly information of the platforms in the post-match sample for the period January 2012 to June 2017. This analysis compares the consumer response around the VC announcement weeks of treatment platforms with the consumer response around the “pseudo” VC announcement weeks of control platforms. Hence, we estimate the following model.

$$Y_{it} = \alpha VCbacked_i * After_{it} + \Theta After_{it} + \gamma X_{it} + u_i + v_t + \varepsilon_{it} \quad (5)$$

where $VCbacked_i$ is a dummy variable indicating whether platform i is a VC-backed platform; $After_{it}$ is a dummy variable denoting whether week t is at or after the (pseudo) VC investment announcement week.

Panel C of Table 9 reports the results of the DiD analysis. Consistent with our baseline results in Section 4.1, the estimated treatment effect is significantly positive for transacted amount and the number of lenders, but insignificant for the number of borrowers.

Table 9
Customer response and VC investment announcements (DiD Approach).

Panel A: Pre-match sample

	Treatment Group		Control Group		Treatment-Control	
	N	Mean	N	Mean	Diff	T-statistics
Age_Platform	113	1.735	115,115	1.569	0.166	1.412
Year = 2012	113	0.018	115,115	0.002	0.016	1.262
Year = 2013	113	0.009	115,115	0.014	−0.005	−0.560
Year = 2014	113	0.212	115,115	0.086	0.126***	3.266
Year = 2015	113	0.407	115,115	0.250	0.157***	3.382
Year = 2016	113	0.310	115,115	0.446	−0.137***	−3.126
Year = 2017	113	0.044	115,115	0.202	−0.157***	−8.086
Ave_Interest	113	13.113	115,115	13.832	−0.719**	−2.350
Ave_Maturity	113	4.955	115,115	3.890	1.065**	2.124
Ave_Ln(Amount)	113	6.039	115,115	4.279	1.760***	10.026
Ave_Ln(Lenders)	113	15.893	115,115	14.586	1.307***	7.728

Panel B: Post-match sample (1–2)

	Treatment Group		Control Group		Treat-Control	
	N	Mean	N	Mean	Diff	T-stats
Age_Platform	113	1.735	226	1.513	0.221	1.638
Year = 2012	113	0.018	226	0.022	−0.004	−0.279
Year = 2013	113	0.009	226	0.009	0.000	0.000
Year = 2014	113	0.212	226	0.217	−0.004	−0.093
Year = 2015	113	0.407	226	0.394	0.013	0.234
Year = 2016	113	0.310	226	0.310	0.000	0.000
Year = 2017	113	0.044	226	0.049	−0.004	−0.183
Ave_Interest	113	13.113	226	12.910	0.203	0.504
Ave_Maturity	113	4.955	226	4.588	0.366	0.631
Ave_Ln(Amount)	113	15.893	226	15.858	0.034	0.154
Ave_Ln(Lenders)	113	6.039	226	6.006	0.033	0.148

Panel C. Customer response and VC investment announcement (difference-in-differences approach)

	(1)	(2)	(3)	(4)	(5)	(6)
	Ln(Amount)	Ln(Amount)	Ln(Lenders)	Ln(Lenders)	Ln(Borrowers)	Ln(Borrowers)
VCBacked*After	0.212***	0.236***	0.289***	0.303***	0.042	0.037
	(7.810)	(8.769)	(11.523)	(12.135)	(1.360)	(1.193)
After	0.081***	0.076***	0.043***	0.041***	−0.055***	−0.056***
	(5.571)	(5.284)	(3.259)	(3.054)	(−3.324)	(−3.372)
Interest		0.062***		0.036***		0.055***
		(30.187)		(19.071)		(23.111)
Maturity		−0.011***		−0.007***		0.036***
		(−6.743)		(−4.554)		(19.952)
Platform FE	YES	YES	YES	YES	YES	YES
Treat-Week FE	YES	YES	YES	YES	YES	YES
Observations	51,203	51,203	50,942	50,942	51,034	51,034
R-squared	0.816	0.819	0.848	0.849	0.855	0.858

This table reports the results of the propensity score matching and the DiD analysis. Panel A presents the summary statistics of the pre-match sample. The treatment group includes the platform-weeks of all the VC investment announcement weeks of VC-backed platforms, whereas the control group includes all the platform-weeks of all non-VC-backed platforms over the whole sample period. *Age_Platform* is the age of the platforms. *Ave_Interest*, *Ave_Maturity*, *Ave_Ln(Amount)*, and *Ave_Ln(Lenders)* are the average interest rate, maturity, Ln(Amount), and Ln(Lenders) in the prior 24 weeks. Year dummies represent the year of the observation. The platform-weeks where any of these observable characteristics are missing are excluded. Panel B presents the summary statistics of the post-match sample generated by using a 1–2 nearest neighbor propensity score matching with respect to *Age_Platform, Ave_Interest*, *Ave_Maturity*, *Ave_Ln(Amount)*, *Ave_Ln(Lenders),* and year dummies. Panel C presents the results of DiD regressions. The sample covers 51,203 platform-week observations of all the platforms in the post-match sample for the period of January 2012 to June 2017. *Amount* is the amount of loans facilitated on a platform in a given week. *Lenders* is the total number of P2P lenders that successfully lent on a platform in a given week. *Borrowers* is the number of borrowers that successfully borrowed on a platform in a given week. *VCbacked* is a dummy variable representing whether the given platform is a VC-backed platform. *After* is a dummy variable for the (pseudo) VC investment announcement week or weeks after the (pseudo) VC investment announcement week. *Interest* is the average annual interest rate across all P2P loans facilitated on a platform in a given week weighted by loan amount. *Maturity* is the average maturity of all loans facilitated weighted by loan amount. T-statistics are reported in parentheses. ***, **, * denote the significance at the 1%, 5%, and 10% level, respectively.

Table 10
Certification effect and news effect.

	(1)	(2)	(3)
	Ln(Amount)	Ln(Lenders)	Ln(Borrowers)
AfterVC	0.237***	0.413***	−0.021
	(10.707)	(19.009)	(−0.761)
Interest	0.039***	0.067***	0.018***
	(10.343)	(17.626)	(3.801)
Maturity	−0.004	0.005**	0.031***
	(−1.575)	(2.064)	(10.466)
Ln(News + 1)	0.139***	0.031**	0.280***
	(8.958)	(2.056)	(14.448)
Platform FE	YES	YES	YES
Week FE	YES	YES	YES
Observations	21,134	19,957	21,042
R-squared	0.798	0.827	0.844

This table presents the results of the association between the news effect and the VC certification effect. The sample consists of 21,134 platform-week level observations of 154 VC-backed platforms between January 2012 and June 2017. *Amount* is the amount of loans facilitated on a platform in a given week. *Lenders* is the total number of P2P lenders that successfully lent on a platform in a given week. *Borrowers* is the number of borrowers that successfully borrowed on a platform in a given week. *AfterVC* is a dummy variable that takes the value of one for the week of or after the week of the VC investment announcement and zero for the weeks before the week of the VC investment announcement. *Interest* is the average annual interest rate across all P2P loans facilitated on a platform in a given week weighted by loan amount. *Maturity* is the average maturity of all loans facilitated weighted by loan amount. *News* is the number of news events associated with a platform in a given week. T-statistics are reported in parentheses. ***, **, * denote the significance at the 1%, 5%, and 10% level, respectively.

4.3. News, advertising, and investment size

The following are alternative explanations for the previous results: 1. News effect: Announcements of VC backing attract more lenders since the media-reported news of an investment arouses lenders' attention. 2. Advertising effect: Platforms that receive VC investments advertise more aggressively and, therefore, attract more customers. 3. Funding effect: Customers expect P2P lending platforms to obtain large cash flows from equity investors in the funding rounds and to be more capable of repaying lenders. Therefore, those lenders are more inclined to provide financial resources. We perform the analyses in Subsections 4.3.1 and 4.3.2 to reduce these concerns.

4.3.1. News and advertising

One alternative explanation for the previous results is the news effect: an announcement of VC backing attracts more lenders since the media-reported news of an investment arouses lenders' attention. We searched Baidu News using the platform's name as the keyword, and collected the number of associated online news events published in a given week as a measure of the news effect.

To control for the potential news effect/attention effect, we add the number of news events associated with P2P lending platforms as a control variable in our baseline regressions. As shown in Table 10, the results of our baseline regression remain robust after controlling for the news effect.

Platforms that receive VC investment may advertise more aggressively and, therefore, attract more customers. As noted by Chemmanur and Yan (2009), advertising is a signal that reduces the information asymmetry associated with advertiser firms. This advertising effect can potentially explain the increase in customer response. To alleviate this concern, we first explore the dynamics of the number of news events around VC investment announcements to provide indirect evidence of the advertising effect on customer response. Second, we investigate the relationship between VC investment and platform default probability.

Rinallo and Basuroy (2009) show that media coverage or news is positively associated with companies' advertising efforts. If our results are mainly driven by the advertising effect, we expect to see a long-term increase in the number of news events. However, Fig. 2 shows that although the number of news events sharply increases in the first month after VC investment announcements, it reduces to the historic level in the longer term, which provides indirect evidence that VC-backed platforms have not increased their advertising efforts in the longer horizon.

Platforms that receive VC investment can advertise and market more aggressively, which is not likely to lead to better real outcomes in terms of non-performing loans and the probability of platform closure in the long term. We compare the long-term real outcomes between VC-backed platforms and non-VC-backed platforms to reduce concerns about the advertising effect. We compare the default outcomes for all 336 platforms in our propensity-score matched sample. The dependent variable is whether the platform has defaulted (or become defunct) by the end of June 2018. Table 11 shows that VC-backed P2P lending platforms are significantly less likely to default than non-VC-backed P2P lending platforms. The marginal effect is 7.38% or 40% of the average default rate after controlling for the observable characteristics. VC-backed platforms are less likely to default compared to non-VC-backed platforms, which is indirect evidence that VC backing has long-term benefits that extend beyond the advertising and marketing effects.

The above analysis shows that the news and advertising effects may be associated with an increase in customer response in the

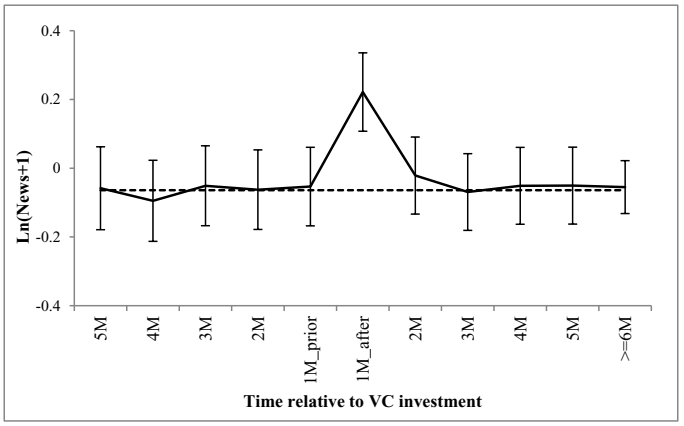


Fig. 2. News events dynamics around VC investment announcements.
This figure illustrates the dynamics of the number of news events around the announcement date of VC investment. The graph presents the estimated coefficients of time dummies in the following regression model.

$$Ln\,(News_{it}+1)=\sum_{j=1}^{j=5}\beta_{-j}\text{Month\_before(j)}_{it}+\sum_{j=1}^{j=5}\beta_{j}\text{Month\_after(j)}_{it}+\beta_{6}\text{Month\_after(6+)}_{it}+u_i+v_t+\varepsilon_{it}$$

The sample consists of the weekly news information of 154 VC-backed platforms between January 2012 and June 2017. *News* is the number of news events associated with a platform in a given week. Month_before(j)$_{it}$ (j = 1,2,3,4,5) is a dummy variable representing whether the observation for platform i at week t takes place j months before the announcement week of VC investment in that platform. Month_after(j)$_{it}$ (j = 1,2,3,4,5) is a dummy variable representing whether the observation for platform i at week t takes place j months after the VC investment announcement week. Month_after(6+)$_{it}$ is a dummy variable representing whether the observation for platform i at week t takes place six or more months after the VC investment announcement week. The vertical bands represent the 95% confidential interval. The horizontal dashed line denotes the average coefficients of Month_before(j) (j = 1,2,3,4,5).

Table 11
VC Backing and platform default.

	Prob(Default = 1)			
	(1)	(2)	(3)	(4)
VCBacked	−0.402**	−0.385**	−0.412**	−0.397**
	(−2.223)	(−1.972)	(−2.253)	(−1.995)
Age_Platform		0.031		0.044*
		(1.343)		(1.702)
Ave_Interest		−0.063*		−0.048
		(−1.932)		(−1.445)
Ave_Maturity		−0.143		−0.179*
		(−1.614)		(−1.948)
Ave_Ln(Amount)		−0.125		−0.106
		(−1.374)		(−1.132)
Ave_Ln(Lenders)		−0.014		−0.001
		(−0.158)		(−0.011)
Year Dummies			YES	YES
Observations	339	339	339	339
Pseudo-R2	0.016	0.166	0.037	0.189

This table presents the results of Probit regressions that examine how VC backing is related to platform default. The sample includes all the 339 P2P lending platforms in the post-match sample. *VCbacked* is a dummy variable representing whether the given platform is a VC-backed platform. *Age_Platform* is the age of the platform at the (pseudo) VC investment announcement week. *Ave_Interest*, *Ave_Maturity*, *Ave_Ln(Amount)*, and *Ave_Ln (Lenders)* are the average interest rate, maturity, logarithm of facilitated loan amount, and the logarithm of lender number in the 24 weeks prior to the (pseudo) VC investment announcement week. *Year Dummies* are dummies representing the year of the (pseudo) VC investment announcement week. T-statistics are reported in parentheses. ***, **, * denote the significance at the 1%, 5%, and 10% level, respectively.

Table 12
investment size and certification effect.

	(1)	(2)	(3)	(4)
	Ln(Amount)	Ln(Amount)	Ln(Lenders)	Ln(Lenders)
AfterVC	0.319***	0.352***	0.261***	0.295***
	(0.030)	(0.030)	(0.028)	(0.028)
AfterVC*Ln(ScaledInvestment)	−0.018	−0.014	0.011	0.017
	(0.013)	(0.012)	(0.012)	(0.012)
Interest		0.074***		0.073***
		(0.005)		(0.004)
Maturity		0.012***		−0.008***
		(0.003)		(0.003)
Platform FE	YES	YES	YES	YES
Week FE	YES	YES	YES	YES
Observations	12,960	12,960	12,658	12,658
R-squared	0.778	0.782	0.836	0.840

This table presents the results of how investment size of the funding round is associated with customer response. The sample consists of 12,960 platform-week observations of 93 VC-backed platforms that disclose the investment size of the funding round. *Amount* is the amount of loans facilitated on a platform in a given week. *Lenders* is the total number of P2P lenders that successfully lent on a platform in a given week. *AfterVC* is a dummy variable that takes the value of one for the week of or after the week of the VC investment announcement and zero for the weeks before the week of the VC investment announcement. *ScaledInvestment* is the investment size (scaled by the platforms' registered capital) of the VC funding rounds. *Interest* is the average annual interest rate across all P2P loans facilitated on a platform in a given week weighted by loan amount. *Maturity* is the average maturity of all loans facilitated weighted by loan amount. T-statistics are reported in parentheses. ***, **, * denote the significance at the 1%, 5%, and 10% level, respectively.

short run; however, the certification effect continues to exist beyond the news effect. There is no evidence supporting an increase in VCs' long-term advertising and marketing activities on those platforms after the investment.

4.3.2. Investment size

Another alternative explanation for positive customer response after VC investment announcements could be the funding effect. After VC investment announcements, customers or potential customers expect P2P lending platforms to obtain large cash flows from equity investors and be in a better position to repay lenders. Therefore, lenders are more inclined to lend. To reduce this concern, we examine whether customer response is associated with the investment size (scaled by the platforms' registered capital) of the VC funding rounds. We use weekly data of 93 VC-backed platforms that disclose the size of the funding round. In Table 12, we find no significant evidence that investment size is associated with customer response, suggesting our results cannot be primarily due to the funding effect.

5. Conclusion

Previous literature on the certification effect of VCs primarily focuses on the mitigation of information asymmetry between startups and outside investors in capital markets. In this study, we extend the literature by investigating whether VCs play a role in mitigating the information asymmetry between startups and their potential customers. Using the Chinese P2P lending market, a growing fintech industry with substantial information asymmetry between P2P lending platforms and P2P lenders, we find that VC backing plays a certification role in mitigating information asymmetry between startups (P2P lending platforms) and their customers (P2P lenders).

In this study, we use weekly trading data of 154 P2P lending platforms that have obtained VC investment. We also manually collect information regarding the P2P lending platforms and VCs. Using this high-frequency data, we find that after a VC investment announcement, both the amount of loans facilitated and the number of lenders increase significantly, suggesting that VC certification helps P2P lending platforms attract more P2P lenders (customers). However, the number of borrowers does not increase after VC investment announcements.

We also examine the heterogeneity of the certification effect. First, we find that the certification effect increases with the VC's age and accumulative IPO market value of all the portfolio companies of VCs and is more prominent for foreign VCs. This suggests that the certification effect increases with the VC's reputation. Second, we also find evidence that the certification effect increases with the extent of information asymmetry between P2P lending platforms and P2P lenders: the certification effect on an older platform is significantly lower than that on a younger platform, and the certification effect is more prominent for new lenders than for existing lenders. Our analysis of customer response from propensity score matched pairs of VC-backed and non-VC-backed platforms in a DiD setting provides consistent results that reduce selection concerns.

In addition, we show that the news and advertising effects may be associated with an increase in customer response in the short run, but the certification effect continues to exist beyond the news effect. We also document that VC-backed platforms are less likely to default compared to non-VC-backed platforms, providing indirect evidence that VC backing has long-term benefits that go beyond the advertising and marketing effects. Moreover, we find no evidence that VC increases long-term advertising and marketing

activities on platforms after investment announcements.

One limitation of this study is that we do not consider the different due diligence processes among P2P platforms due to data availability. This problem is not particularly severe in our current empirical setting when we compare customer response immediately before and after the VC investment announcement in our baseline regression; however, it may have some impact on our DiD analysis since we are unable to consider different due diligence processes in the corresponding propensity score matching procedure.

It is important to consider the due diligence process when performing cross-sectional analyses of different platforms. In their recent paper, Cumming et al. (2019) point out that understanding the due diligence of crowdfunding platforms is important, given the large information asymmetries in crowdfunding. It is certainly an important and interesting area for future research.

Declaration of Competing Interest

None.

Acknowledgements

Zhengwei Wang acknowledges the funding support from National Natural Science Foundation of China (NSFC) (71472100).

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