Herd Behavior in Venture Capital Market: Evidence from China

Ruijun Zhang, Xiaotong Yang, Nian Li, Muhammad Asif Khan

1 School of Business, Renmin University of China, Beijing 100872, China; zhangrj@ruc.edu.cn (R.Z.); yangxiaoton9@ruc.edu.cn (X.Y.)
2 School of Economics and Management, Yanshan University, Qinhuangdao 066004, China
3 Department of Commerce, Faculty of Management Sciences, University of Kotli, Azad Jammu and Kashmir, Kotli 11100, Pakistan

* Correspondence: linian@ruc.edu.cn (N.L.); khanasif82@uokajk.edu.pk (M.A.K.)

Abstract: This paper aims to empirically analyze the herd behavior in the VC market in the context of China, including the existence, causes and consequences of herding among venture capitalists. For our empirical analysis, we first construct a herding measure and confirm the existence of herd behavior in the Chinese VC market. Then, we perform OLS/logit regression to examine the causes and consequences of herding among venture capitalists. Our results suggest that herd behavior in the venture capital market are driven by positive signals of essential information and a higher degree of information uncertainty. However, we find no evidence of the influence of feedback trading signals on herding among venture capitalists. Further analysis suggests that a better external information environment would help weaken the herding among venture capitalists, while their reputation concerns might amplify the herding effect. Finally, we examine the economic consequence of the herding and find that the herd behavior of venture capitalists would have an adverse effect on their exit performance. In addition to the enrichment and development of herding theory, our study also provides an essential theoretical frame and policy implications for the steady growth of the venture capital market in emerging economies.

Keywords: venture capital; venture capitalist; herd behavior

1. Introduction

Herd behavior in financial markets has been the subject of considerable academic attention over the past decades. Starting with the pioneering works of Kraus and Stoll [1], existing literature has presented compelling evidence on the existence of herd behavior in the stock market [2,3], the loan market [4] and the buyout market [5]. However, little attention has been paid to herd behavior in the venture capital (VC, hereafter) market. Li, Gan, Mai [6] developed a game model based on Banerjee’s [7] herd behavior model and proved the existence of herd behavior in the Chinese VC market, their study did not provide further empirical evidence. Concerning the investment behaviors of venture capitalists, a vast body of research has been carried out to investigate their investment preference [8,9], investment strategy [10–12] and investment performance [13–15]. However, whether their peers influence the investment decisions of venture capitalists has received scant attention, and little attention has been paid to herding among venture capitalists. The purpose of this study is to fill this vital void by investigating herd behavior in the VC market.

We examine the herd behavior of venture capitalists in the Chinese VC market for the following reasons. First, China represents one of the fastest-growing markets for VC investments in the world. Since the 1980s, the venture capital industry in China has been experiencing a rapid pace of development [16]. In recent years, with an intense mass entrepreneurship and innovation campaign and supply-side reform, the vitality of the VC market and the enthusiasm of VC investors have been further stimulated. According to the PitchBook report, China became the second-largest venture capital market by total capital
invested in 2018, behind only America. As a result, the Chinese VC market has garnered increased interest from researchers [17,18].

Second, existing literature on the investment behavior of VC investors is mainly focused on western countries. Unlike what happens in these countries, emerging economies like China have weak institutions and volatile institutional environments, where information asymmetry is rampant and contracts are weakly enforced [19,20]. These institutional differences call for more attention to investigate how VC firms make investment decisions in an emerging economy.

Third, China’s venture capital scene has often made headlines because of investment bubbles and high-profile debacles, which have received extensive attention from investors, government and scholars. For instance, the rapid rise of the Chinese bike-sharing firm OFO has intrigued VC investors. To ensure their investments keep up with the pack, many VC investors have chosen to invest in bike-sharing firms and poured a lot of money into this field. This led to overfunding in many cases and finally resulted in a string of bankruptcies of bike-sharing startups and vast piles of impounded bikes. The chaotic VC investments also strengthened investment bubbles and led to inefficient capital allocation. According to Guangzheng Hang Seng Advisory’s statistical work on 108 enterprises listed on the science and technology innovation board in 2019, 7.79% of the enterprises had a higher primary market evaluation than the total market value after issuance as estimated by investment banks, which is known as “flour is more expensive than bread”. These phenomena in the VC market may have their root in the investment behaviors of venture capitalists, explicitly concerning their tendency to exhibit herd behavior. Moreover, Li, Gan and Mai’s [6] model also proves herd behavior in the Chinese VC market. Hence, China provides an exciting and robust setting to investigate the herd behavior of venture capitalists.

To explore the herd behavior in the Chinese VC market, we compiled VC investment data from the CV Source from 2001 to 2017. On this basis, we perform an in-depth study to examine the existence of herd behavior of VC firms empirically and further understand its influencing factors and economic consequences. Our results suggest that herd behavior exists in the VC market. It is more salient when there are positive fundamental information signals and a higher degree of information uncertainty. However, we find no evidence of the influence of feedback trading signals on herding among venture capitalists. We also find that the herd behavior of VC firms tends to cause an adverse effect on their exit performance. Moreover, our results suggest that the better external information environment would help weaken the herding influence, while venture capitalists’ reputation concerns might amplify the herding impact.

This study makes several contributions to the existing literature. First, our study contributes to the growing literature on herd behavior. Previous literature mainly focuses on the herd behavior of investors in the secondary market, such as individual investors, analysts, and institutional investors represented by QFII and mutual funds on the secondary markets [21–24]. We contribute to this strand of literature by firstly empirically exploring the herd behavior of venture capitalists, a major participator in the primary market, thus complementing the herding theory. Second, our study enriches the literature on VC investment. We examine the herd behavior in venture capitalists’ project selection, which could help understand their investment decision-making processes. Third, our study extends the literature on VC in emerging economies. Despite the growing research interest in emerging economies on the impact of VC on a series of economic performances, both at a micro (e.g., firm growth, corporate governance and corporate innovation) and macro-level (e.g., entrepreneurship rates, employment and aggregate income) [11,25,26], few scholars have adopted a rigorous research design to investigate VC investment decisions. Our study, therefore, adds an essential missing piece in understanding how VC firms make decisions in emerging markets.

The remainder of this paper proceeds as follows. We review related literature and develop our hypothesis in the next section. Section 3 describes the empirical design. Section 4 reports the empirical results and Section 5 concludes the study.
2. Literature Review and Hypothesis Development

2.1. The Existence of Herd Behavior in the Venture Capital Market

Herd behavior is common in the financial market. Kraus and Stoll [1] define a classic herd behavior as “parallel trading”, where market participants tend to trade simultaneously in the same way. Herding could be either intentional or unintentional [27]. Specifically, unintentional herding refers to a cluster of investment decisions based on a similar underlying information environment. In contrast, intentional herding happens when investors follow each other’s trading decisions regardless of their personal beliefs. A growing body of literature documents that there is herd behavior in financial markets, such as the stock market, the loan market, and the buyout market, suggesting the prevalence of herd behavior [2,4,5].

Venture capitalists make their investment decisions based on information obtained from the public market, financial intermediaries (e.g., analysts and finance advisors), or even private channels. Theoretically, as a professional investment institution, most VC firms receive the same public market signals and have fund managers of homogenous professional and educational backgrounds. They also tend to interpret public market information using a similar economic model and information analysis technologies [28]. In this way, VC investors can easily make analogous investment decisions, resulting in unintentional herding. On the other hand, since the venture capital market is highly uncertain due to the limited information provided by startups when venture capitalists make investments decision, they would also refer to the choices of other venture capitalists regarding project selection and investment behavior and then herding among venture capitalists will occur. In addition, VC funds are usually operated by a fund manager, which is similar to other funds; the main difference is that their investment projects might be riskier and less predictable. The incentives provided by the compensation scheme and reputation concerns may also lead fund managers who invest on behalf of others to imitate other managers to reduce risk [29,30]. In this case, they would end up making a similar investment decision, leading to intentional herding among VC firms.

Based on the analysis above, we developed our first hypothesis as follows:

**Hypothesis 1 (H1). There exists herd behavior in the venture capital market.**

2.2. Causes of Herding Among Venture Capitalists

Distinguishing causes and different types of herd behavior could help us understand how it affects the VC market and is also crucial for regulatory purposes and for discovering whether herding leads to market inefficiency. Grounding on the information asymmetry theory and following the work of Bikhchandani, Hirshleifer and Welch [31] and Kremer and Nautz [27], we explore the causes and types of herding via the link between herding and information factors. Concerning venture capitalists, both public market signals (fundamental information signals and feedback trading signals) and information uncertainty are essential factors that may lead VC capitalists to exhibit herd behavior. Hence, our analysis was carried out for the relation between herding and the three information factors mentioned above.

2.2.1. Fundamental Information Signals

The returns of VC funds are highly correlated with the returns of the market as a whole [14,32]. As a result, public market signals are also an essential basis for VC firms to predict their returns. Fundamental information is often regarded as public market signals about potential investment opportunities and serves as a basis for investment decisions. Favorable essential information is therefore seen as a positive signal by venture capitalists. After professional fund managers conduct a proper analysis of these signals, more possibilities are opened for VC firms to make homogenous investment decisions based on the positive aspects of the market that they are already aware of. In other words, their investment decisions on projects might converge to the consensus. Favorable fundamental information that points out positive aspects of the industry might increase the
possibilities for venture capitalists to make similar decisions since they perceive the same positive development prospect of the industry after being informed. Thus, it is expected that the positive association between positive fundamental information signals and herding among venture capitalists is evidence in favor of unintentional herding in the VC market.

Based on the analysis above, we developed our hypothesis as follows:

Hypothesis 2a (H2a). Positive fundamental information signals are associated with higher herding levels.

2.2.2. Feedback Trading Signals

Positive feedback trading is an investment strategy that calls for buying winners and selling losers [33]. Researchers have looked into positive feedbacks investment strategy and proved that this strategy has been widely adopted in the financial market and is the underlying causes of herding [34–36]. As major participators in the financial market, VC firms also have the incentives to engage in positive feedback trading. In the Chinese capital market, the excess valuation seems to be encouraged. As VC firms are relatively young without mature knowledge of venture investment, they might be attracted by soaring existing returns and the intensive trading activities of others and invest in a hot industry. In addition, fund managers are judged according to their funds’ financial performance. Some fund managers driven by performance pressure might invest in ascending sectors of the industry to chase high exit returns. Therefore, positive feedback trading may also be one of the potential causes of herd behavior in the VC market. If past existing returns drive herding among venture capitalists, this would be interpreted as unintentional herding [28,37].

Based on the analysis above, we developed our hypothesis as follows:

Hypothesis 2b (H2b). Positive feedback trading signals are associated with higher herding levels.

2.2.3. Information Uncertainty

Given the uncertainties of development prospects and limited information of startups in the VC market, the investment decision of venture capitalists is made under conditions of high uncertainty and severe information asymmetries. In an industry with less historical information, venture capitalists might find it more costly to obtain information. It is more difficult for them to evaluate the quality of their venture projects [38]. To improve their disadvantageous position in obtaining adequate information, they are likely to infer information from other investors’ actions. They tend to imitate the investment behavior of early entrants or their peers who might get access to more private information, thus causing intentional herd behavior. Since the industry size usually reflects the quantity and quality of available information [34]. Therefore, one would expect higher levels of herding among venture capitalists in the industry with fewer investments (high degree of information uncertainty) to be evidence in favor of intentional herding.

Based on the analysis above, we developed our hypothesis as follows:

Hypothesis 2c (H2c). High degree of information uncertainty is associated with higher herding levels.

3. Research Design

3.1. Sample Selection

We exploited 2001–2017 VC investment data from the CV Source database, a widely used source of data on VC [17,18]. The reason for using 2001 as the starting year of this study is that the number of local Chinese VC firms rose to prominence in 2001. Before that, not many VC firms were occupying the market. The amount of VC investment data before 2001 is too small, which reduces the accuracy of the measurements for VC herd behavior [17]. For this study period, we collected 24,204 investment data and 2916 exit data
involving a total of 1288 VC firms and 13,065 venture projects. We also obtained financial statement data from the China Securities Market and Accounting Research (CSMAR) database and the RESSET database.

Following previous studies, this paper adopted the following selection criteria to construct the baseline sample: First, we excluded the investment data of investment institutions that were not VCs to sharpen our focus on this research’s main subject. Second, we excluded the observations with incomplete investment or financial information. Finally, we winsorized all continuous variables at the level of 1% and 99% to minimize the effect of outliers. This left us with a total of 416 industry-quarter VC investment observations and 1665 VC exit observations.

3.2. Main Variables

3.2.1. Herding Measure (HM)

Existing literature refers to two groups of herding measures that are used in tests performed to detect herding. The first group originates from Christie and Huang [39] and Chang, Cheng and Khorana [40] and focuses on the relationship between stock market movements and the cross-sectional correlation of individual stock returns. The second group originates from Lakonishok, Shleifer and Vishny [34], Wermers [41] and Sias [37] and focuses on the simultaneous or subsequent changes in investors’ investment decisions.

It is worth noting that the VC market is different from the stock market in many aspects, and the herd behavior in these two markets differs as well. First, the stock market usually counts on open and transparent information, while the information in the VC market is not often publicly disclosed and might be available only at an exit event (e.g., IPO or M&As). This means that herd behavior in the VC market cannot be observed based on the valuation of venture projects. Therefore, we could only observe herd behavior in the VC market by closely examining the investment decisions made by venture capitalists. Second, differently from free trading in the stock market, the VC market has limited exit channels and inherent exit limitations. Hence, herding among venture capitalists cannot be judged solely based on unbalancing between VC investors’ selling and buying decisions. Third, because of the limited number of shareholders and equity transactions of startups and weaker transaction frequency (especially compared to the secondary market), VC investments are often not accumulated at the firm level. Instead, venture capitalists’ investment decisions are about industry selection based on industry development prospects. As a result, VC investments are mostly clustered at the industry level.

We followed the aforementioned second group of herding measures as they are investment-based measures and then construct industry-level herding measures. Following the China Securities Regulatory Commission’s industry classification issued in 2012, we assign each VC projects to each industries based on the first two digits of its disclosed industry codes. The herding measure for industry \( i \) in month \( t \) is computed as follows:

\[
|HM_{it}| = |p_{bit} - E[p_{bit}]| - E[|p_{bit} - E[p_{bit}]|]
\]

where \( p_{bit} \) is equal to the number of increased VC investments in the industry \( i \) in quarter \( t \) in proportion to the accumulated number of VC investments in the industry \( i \). \( E[p_{bit}] \) is the average growth rate of VC investments (across all industries) during quarter \( t \). The first term in the equation measures the imbalance of VC investments across industries and the second term is the expected value of this herding measure, representing the adjustment term. Specifically, we followed Xu, Yu and Yi [42] and used the mean value of \( |p_{bit} - E[p_{bit}]| \) after subtraction of 1.96 standard deviations as an adjustment item to construct HM. In essence, this model examines whether VC investment is abnormally focused in a specific type of industry. Only when the imbalance of VC investments across industries reaches a certain degree, it is considered that herd behavior exists among venture capitalists in their project selection.
3.2.2. Fundamental Information Signals (IndQ)

Following previous studies, we adopted the industry average Tobin’s Q as a proxy for fundamental information signals [43], a widely applied measure in the investment model [44]. A higher Tobin’s Q indicates a better prospect of an industry and is regarded as a positive public market signal that can make the sector more attractive to venture capitalists.

3.2.3. Feedback Trading Signals (LIndIPO)

We adopted the number of VC-backed IPOs of a prior period in an industry as a proxy for feedback trading signals. IPO is one of the most essential means for venture investors to profit by exiting from investment [43]. Furthermore, the number of companies that the lead venture capitalist made public is positively related to the capital raised by VC funds [45]. This means that the increased number of IPOs in a specific industry is a positive feedback trading signal and may attract more VC investors. In addition, as the economic significance of the outcomes cannot be guaranteed due to the lack of information about exit returns, we did not use exit returns as a proxy for feedback trading signals.

3.2.4. Information Uncertainty (Indinfor)

The industry size generally reflects the quantity and quality of available information [27]. A small size industry is often related to a lack of investments and reliable information. In this paper, the natural logarithm of accumulated investment amount (US$ M) was adopted for measurement of industry size, serving as a proxy for the uncertainty of industry information.

3.2.5. Exit Performance (Performance)

We measured VC performance using a dummy variable that is equal to 1 if the VC exit through IPO (Exit_IPO) and a dummy variable that is equal to 1 if the VC exit through IPO or M&A (Exit_Performance). One of the main reasons to use this variable is that IPOs and M&As are by far the most important (and profitable) means for venture capitalists to exit an investment [46]. It is also widely used to assess whether the VC investment is successful or not [47,48]. Moreover, due to a large number of missing data in the existing database regarding VC investors’ exit performance measures, e.g., internal rate of return (IRR), biased errors may occur when using these measurements as the proxy for VC exit performance.

3.3. Model Specification

3.3.1. Causes of Herding among Venture Capitalists

Following previous studies [27,43], we examined the cause of herding among venture capitalists using the following OLS model:

\[ HM = \beta_0 + \beta_1 \times IndQ + \beta_2 \times LIndIPO + \beta_3 \times IndInfor + \gamma \times Z + Industry + Quarter + \epsilon \]  

(2)

where \( HM \) is the herding measure. \( IndQ \) represents the fundamental information signals, measured by the industry average Tobin’s Q. \( LIndIPO \) represents the feedback trading signals, measured by the natural log of the one-quarter-lagged number of VC-backed IPOs in an industry. \( Indinfor \) represents the uncertainty of industry information, measured by the natural log of accumulated investment amount (US $M) in an industry. \( Z \) are control variables, which include VC fund age (VCAge), VC experience (VCInv), VC fund type (VCtype) and the round of VC investment (Turn). Moreover, we added industry dummies and quarter dummies to control the industrial fixed effect and dynamic changes in the macroeconomic environment. We clustered standard errors by industry to control for cross-sectional correlation. All continuous variables were winsorized at the 1st and 99th percentiles to mitigate the influence of outliers. The definition of all main variables is presented in Appendix A.
3.3.2. The Consequences of Herding among Venture Capitalists

Following previous studies [9,47,49], we examined the economic consequences of herding with the following logit model:

\[
\text{Performance} = \beta_0 + \beta_1 \times \text{HM} + \gamma \times X + \text{Industry} + \text{Quarter} + \epsilon
\]  

(3)

where \(\text{Performance}\) represents the VC exists performance. We measured the VC exists performance using both a dummy variable that is equal to 1 if the VC exits through IPO (Exit_IPO) and a dummy variable that is equal to 1 if the VC exits through IPO or M&A (Exit_Performance). The key explanatory variable HM is the herding measure. \(X\) are control variables that include the age of the VC firm (in months) at the time of exit (Exitage), VC reputation (VCipo), VC holding period (Hold), the accumulated VC investment amount (Q) and IPO market conditions (IndIPO). Moreover, we added industry dummies and quarter dummies to control the industrial fixed effect and dynamic changes in the macroeconomic environment. We clustered standard errors by industry to control for cross-sectional correlation. All continuous variables were winsorized at the 1st and 99th percentiles to mitigate the influence of outliers. The definition of all main variables is presented in Appendix A.

4. Empirical Results and Discussion

4.1. Summary Statistics

Table 1 shows the summary statistics for the main variables used in this study. It can be seen from Table 1 that the mean (median) value of HM was 0.205 (0.194). We found that HM was significantly positive at the level of 1% through further analysis, supporting herd behavior in the Chinese VC market [41]. The mean (median) value of VC fund type (VCtype) was 0.893 (0.935), indicating that most of VC firms in China raise funds from domestic parties, e.g., wealthy individuals and government agencies. The mean (median) value of the round of VC investment (VCround) was 1.576 (1.538), suggesting that VC investments in China were mainly early-stage investments. Summary statistics of other main control variables are shown in the table and are consistent with those reported in previous studies on Chinese venture capital [17,18].

Table 1. Summary statistics for the main variables.

| Panel A: VC Investment Statistics at Industry-Quarter Level | | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| Variables | \(N\) | Mean | SD | Min | Median | Max |
| HM | 416 | 0.205 | 0.050 | 0.169 | 0.194 | 0.636 |
| IndQ | 416 | 3.071 | 2.599 | 0.232 | 2.549 | 26.199 |
| IndIPO | 416 | 1.132 | 0.688 | 0.000 | 1.099 | 2.708 |
| Indinfor | 416 | 7.640 | 1.522 | 2.949 | 7.080 | 10.322 |
| VCAge | 416 | 4.522 | 0.409 | 2.303 | 4.550 | 5.572 |
| VChist | 416 | 3.646 | 0.857 | 0.693 | 3.797 | 5.489 |
| VCtype | 416 | 0.893 | 0.140 | 0.000 | 0.935 | 1.000 |
| VCround | 416 | 1.576 | 0.396 | 1.000 | 1.538 | 3.500 |

Panel B: VC Exit Statistics at VC Firm Level

| Variables | \(N\) | Mean | SD | Min | Median | Max |
| --- | --- | --- | --- | --- | --- | --- |
| Performance | 1665 | 0.589 | 0.492 | 0 | 1 | 1 |
| Exitage | 1665 | 4.611 | 0.663 | 0.000 | 4.779 | 6.526 |
| Hold | 1665 | 3.685 | 0.653 | 0.000 | 3.761 | 5.403 |
| VCipo | 1665 | 1.965 | 1.148 | 0.000 | 1.609 | 4.997 |
| Q | 1665 | 4.026 | 15.498 | 0.000 | 2.130 | 415.000 |

4.2. Analysis of the Existence of Herd Behavior in the Venture Capital Market

Table 2 describes the characteristics of VC investments with summary statistics. It can be seen from Panel A of Table 2 that the number of VC firms, the number of VC
investments, the number of venture projects, and the amount of VC investments (US $M) varied significantly among different industries. The maximum number of investments in the industry accounted for more than 30% of the overall amount invested in the VC market, which also supports the existence of herd behavior. Panel B of Table 2 shows the current distribution of VC investment projects in the top five industries. It can be seen that the most popular industries in recent years include internet and related services and software and information technology services. These industries draw most of the investments and, consequently, most of the money, indicating salient herd behavior of venture capitalists.

Table 2. The characteristics of VC investments in China.

| Variables | N   | Mean   | SD    | Min | Median | Max |
|-----------|-----|--------|-------|-----|--------|-----|
| The number of VC investments | 416 | 28.582 | 39.989 | 1.000 | 14.000 | 171.000 |
| The amount of VC investments (US $M) | 416 | 257.320 | 455.972 | 0.000 | 86.855 | 2007.910 |
| The number of VC projects | 416 | 21.108 | 23.487 | 1.000 | 13.000 | 93.000 |
| The number of VC firms | 416 | 20.656 | 26.885 | 1.000 | 11.000 | 111.000 |
| Industry capitalization/market capitalization (US $M) | 416 | 0.070 | 0.094 | 0.000 | 0.033 | 0.398 |
| The number of VC investments in an industry/The number of VC investments in the VC market | 416 | 0.069 | 0.076 | 0.001 | 0.042 | 0.307 |

Panel B: The Distribution of Top Five Industry in the Chinese VC Market at the Year Level (2016–2017)

| Industry | Industry capitalization/market capitalization (US $M) | Industry | Industry capitalization/market capitalization (US $M) |
|----------|-------------------------------------------------------|----------|-------------------------------------------------------|
| Internet and related services | 0.330 | 0.405 | Internet and related services | 0.375 | 0.415 |
| Software and information technology services | 0.167 | 0.109 | Software and information technology services | 0.122 | 0.173 |
| Manufacturing of computers, communications and other electronic equipment | 0.056 | 0.050 | Manufacturing of computers, communications and other electronic equipment | 0.022 | 0.070 |
| Commercial service industry | 0.043 | 0.020 | Special-purpose equipment manufacturing | 0.005 | 0.027 |
| Special-purpose equipment manufacturing | 0.036 | 0.011 | Commercial service industry | 0.054 | 0.019 |

Table 3 shows the t-test results for herding measure $HM$. It can be seen from Table 3 that the mean value of $HM$ was 0.205 and was significantly positive at the level of 1%, providing supporting evidence for the existence of herd behavior in the Chinese VC market.

Table 3. Herding measures: results from the t-test.

| Variables | N     | Mean   | Std. Err | Std. Dev. | 95% Conf. Interval |
|-----------|-------|--------|----------|-----------|--------------------|
| $HM$ mean = mean ($HM$) | 416 | 0.205 | 0.002 | 0.497 | 0.200 - 0.210 |
| $H0$: mean = 0 | | | | | $t = 83.981$ degrees of freedom = 415 |
4.3. Causes of Herding among Venture Capitalists

Table 4 presents the baseline regression results of the influence of public market signals (fundamental information signals and feedback trading signals) and uncertainties of industry information on herd behavior in the VC market.

### Table 4. Causes of herding among venture capitalists.

|                | (1) | (2) | (3) | (4) |
|----------------|-----|-----|-----|-----|
|                | HM  | HM  | HM  | HM  |
| IndQ           | 0.002 ** | 0.002 *** |       |       |
|                | (2.58) | (2.90) |       |       |
| LIndIPO        | 0.003 | 0.004 |       |       |
|                | (0.74) | (0.79) |       |       |
| Indinfor       |     | −0.009 ** | −0.010 ** |       |
|                |     | (−2.31) | (−2.51) |       |
| VCInv          | 0.006 | 0.006 | 0.006 | 0.006 |
|                | (1.53) | (1.54) | (1.47) | (1.52) |
| VCAge          | −0.007 | −0.008 | −0.006 | −0.007 |
|                | (−1.33) | (−1.30) | (−1.11) | (−1.17) |
| VType          | −0.020 | −0.015 | −0.014 | −0.023 |
|                | (−0.96) | (−0.64) | (−0.62) | (−1.12) |
| VCround        | 0.004 | 0.004 | 0.005 | 0.006 |
|                | (0.71) | (0.76) | (0.85) | (0.96) |
| Constants      | 0.196 *** | 0.195 *** | 0.276 *** | 0.279 *** |
|                | (5.13) | (5.00) | (6.30) | (7.00) |
| Quarter        | Yes | Yes | Yes | Yes |
| Industry       | Yes | Yes | Yes | Yes |
| N              | 416 | 416 | 416 | 416 |
| R-Square       | 0.460 | 0.456 | 0.464 | 0.473 |
| Adj. R-Square  | 0.37 | 0.36 | 0.37 | 0.38 |

Note: (1) ***, ** and * indicates significance levels at 0.01, 0.05 and 0.10, respectively, using two-tailed tests. (2) We report in parentheses t-statistics based on standard errors that are clustered within the industry. (3) All the continuous variables are winsorized at 1 and 99%. (4) See Appendix A for variable definitions.

It can be seen from Column (1) of Table 4 that the coefficient of $LIndQ$ was 0.002 and was statistically significant at the level of 5%, indicating that fundamental information signals drove herd behavior. Column (2) shows that the coefficient of $LIndIPO$ was positive but insignificant, suggesting that the trading feedback signals had no significant effect on herding among VC firms. This happened because IPO activities need to gain approval from China’s securities regulators and were affected by regulatory policies in China. Furthermore, the requirements for IPO were rigorous. Therefore, the stimulation of feedback signals on herd behavior in VC investments was limited. Column (3) shows that the coefficient of $LinInfor$ was $-0.009$ and was significantly negative at the level of 5%, suggesting that the high uncertainty of industry information can explain the high herding level of venture capitalists. In column (4), we included all information factors as the explanatory variables. We found that the coefficient of $LIndQ$ was still significantly positive and the coefficient of $LinInfor$ was still significantly negative. In contrast, the coefficient of $LIndIPO$ was still insignificant. Unlike herding in stock market that is found to be mainly unintentional and partly driven by the use of similar risk models [27], our results show that there was both unintentional herding among VC driven by fundamental information signals and intentional herding due to imperfect information.

4.4. Further Analysis

Findings in the previous sections show that herd behavior existed in the VC market. Based on that, we further examined herding among VC under different external information environments and the impact of VC reputation on the herd behavior of venture capitalists.
Furthermore, we looked at the influence of herd behavior of venture capitalists on their exit performance.

4.4.1. Herding under Different External Information Environment

Previous findings suggest that VC may be more likely to imitate their peers in the face of decision-making with inadequate information, thus causing intentional herd behavior. The stock market usually provides open and transparent information; industry information in this market might compensate for the lack of information in the VC market. The better the external information environment, the more capable the environment provides the necessary high-quality industry information for VC investors. Thus, it will weaken the herd behavior in the VC market caused by information asymmetry within the industry. Therefore, we expect that the transparent information environment of the stock market will weaken the negative association between industry information asymmetry and herd among VC.

In this study, we utilized two measures as a proxy for the information environment in the stock market. One measure is institutional investors’ ownership ($Inshold$). Institutional investors are viewed as essential participants in financial markets [50,51]. Compared with other investors, institutional investors have strong incentives to collect industry information due to their large shareholdings and long-term investment horizon [52]; In addition, the sizable stakes of institutional investors also empower them to monitor management and induce firms to provide better information [53], thus reducing information asymmetry. Therefore, one would expect that higher institutional holdings in a given industry would improve the transparency of information disclosure in this industry.

The second measure to proxy for the external information environment is the analysts following. It is measured by the number of analysts following a given industry ($Cover2$) and the number of earnings forecasts provided by the analysts ($Cover1$) in a given industry. Analysts play an important role as information intermediaries by processing and producing firm and macroeconomic information [54,55]. This can increase the amount of available industry information for VCs. Analysts could also acquire private information through site visits, telephone interviews, and personal relationships with senior executives. They could then disclose such information to public markets to overcome the limitations of public information [56]. This will effectively reduce information asymmetry both within and without industry and significantly influence decision-making.

Based on the above analysis, it is expected that when there are higher institutional holdings in a given industry and more analysts following a given industry, more industry information will be available for VC to make venture investment decisions in this industry. As a result, the reliance of venture investment on historical VC investment information is reduced, weakening the influence of uncertainties of industry information on herd behavior of venture capitalists. We added the interaction among external information environment measures ($Inshold$, $Cover1$ and $Cover2$) and uncertainties of industry information ($Indinfor$) to our baseline model (model (2)) and presented the regression results in Table 5.
Table 5. Herding under a different external information environment.

|                | (1)        | (2)        | (3)        |
|----------------|------------|------------|------------|
|                | HM         | HM         | HM         |
| IndQ           | 0.003 ***  | 0.003 ***  | 0.003 ***  |
|                | (3.75)     | (3.71)     | (3.25)     |
| LIndLPO        | 0.004      | −0.019 *** | −0.017 *** |
|                | (0.95)     | (−3.52)    | (−3.25)    |
| Indinfor       | −0.018 *** | 0.003      | 0.003      |
|                | (−3.71)    | (0.50)     | (0.58)     |
| Inshold        | −0.082 **  |           |            |
|                | (−2.68)    |            |            |
| Inshold* Indinfor | 0.012 **  |            |            |
|                | (2.57)     |            |            |
| Cover1         |            | −0.085 **  |            |
|                |            | (−2.73)    |            |
| Cover1 * Indinfor | 0.012 **  |            |            |
|                |            | (2.57)     |            |
| Cover2         |            | −0.060     |            |
|                |            | (−1.58)    |            |
| Cover2 * Indinfor | 0.009 *  |            |            |
|                |            | (1.72)     |            |
| Constants      | 0.344 ***  | 0.352 ***  | 0.328 ***  |
|                | (7.71)     | (7.95)     | (7.37)     |
| Control        | Yes        | Yes        | Yes        |
| Quarter        | Yes        | Yes        | Yes        |
| Industry       | Yes        | Yes        | Yes        |
| N              | 413        | 413        | 413        |
| R-Square       | 0.490      | 0.493      | 0.487      |
| Adj. R-Square  | 0.39       | 0.40       | 0.39       |

Note: (1) ***, ** and * indicates significance levels at 0.01, 0.05 and 0.10, respectively, using two-tailed tests. (2) We report in parentheses t-statistics based on standard errors that are clustered within the industry. (3) For brevity, all control variables from model (2) are included but not shown. (4) All the continuous variables are winsorized at 1 and 99%. (5) See Appendix A for variable definitions.

Table 5 shows that the interaction terms between external information environment measures (Inshold, Cover1 and Cover2) and uncertainties of industry information (Indinfor) are generally positive and statistically significant, suggesting that the impact of information uncertainty (Indinfor) on herding among venture capitalists is less salient for industries with higher institutional holdings and more analysts following and analyst coverage. We interpreted this result to mean that a better external information environment would weaken the herd behavior in the VC market caused by information asymmetry within the industry. Our results indicate that herding among venture capitalists might be severe in some emerging markets where information asymmetry is rampant and might be weaken in mature markets where exhibits a transparent information environment.

4.4.2. Herding Among Venture Capitalists: The Role of VC Reputation

Reputation is an essential factor determining whether VC will be active, long-term players in the financial markets. Maintenance and reputation improvement is critically vital for VC investors [57,58]. VC firms with high reputations are more capable of collecting information. They have more sources of information to support their decision-making, being less affected by single public signals. In addition, several theories of reputation suggest that managers’ career concerns affect their decisions. Fund managers of VC firms with good reputations have “more to lose” in personal wealth, current income, and reputation should their funds fail. Consequently, reputable fund managers have strong incentives to imitate other fund managers and make similar investment decisions to reduce the risks for career concerns. Meanwhile, given their private channels to obtain valuable information and historic successful performance outcomes of reputable VC firms, other
VC firms might tend to pay close attention to the investment behaviors of these successful branches, infer the private information from their trading and select the same industrial program with reputable VC firms. Based on the above analysis, we expect intentional rather than unintentional herding driven by fundamental information signals in industries composed of reputable VC firms. In contrast, we suppose that, in industries with less reputable VC firms, there will be more unintentional herd behavior driven by fundamental information signals and less intentional herd behavior, as there are few reputable VC firms that provide valuable information and few reputable VC firms to attract other VC firms to imitate.

To examine the above argument, we divided the VC samples into two groups based on their reputation in the industry. Following Dimov and Milanov [59], we used the accumulated numbers of IPO exits of VC firms as the proxy variable for their reputation (VCrep). Then, we divided our sample into two subgroups using VCrep: (a) the high-reputation VC firms subgroup (above median VCrep within each year); and (b) the low-reputation VC firms subgroup (below median VCrep within each year). Then, we ran the regressions separately for these two subgroups. The result is shown in Table 6.

Table 6. Herding among venture capitalists: the role of VC reputation.

|                      | (1)                      | (2)                      |
|----------------------|--------------------------|--------------------------|
|                      | High-Reputation VC Firms | Low-Reputation VC Firms  |
| HM                   | HM                       | HM                       |
| IndQ                 | −0.001                   | 0.002 **                 |
|                      | (−0.19)                  | (2.16)                   |
| LIndIPO              | 0.004                    | 0.002                    |
|                      | (0.56)                   | (0.54)                   |
| Indinfor             | −0.011 *                 | −0.002                   |
|                      | (−2.01)                  | (−0.18)                  |
| VCIInv               | 0.011 *                  | 0.001                    |
|                      | (1.77)                   | (0.27)                   |
| VCtype               | 0.002                    | −0.010                   |
|                      | (0.07)                   | (−0.26)                  |
| VCround              | 0.010                    | 0.004                    |
|                      | (1.06)                   | (0.62)                   |
| VCAGE                | 0.009                    | −0.014                   |
|                      | (0.72)                   | (−1.24)                  |
| Constants            | 0.162                    | 0.256 ***                |
|                      | (1.68)                   | (5.00)                   |
| Quarter              | Yes                      | Yes                      |
| Industry             | Yes                      | Yes                      |
| N                    | 231                      | 185                      |
| R-Square             | 0.683                    | 0.373                    |
| Adj. R-Square        | 0.57                     | 0.07                     |

Note: (1) ***, ** and * indicates significance levels at 0.01, 0.05 and 0.10, respectively, using two-tailed tests. (2) We report in parentheses t-statistics based on standard errors that are clustered within the industry. (3) For brevity, all control variables from model (2) are included but not shown. (4) All the continuous variables are winsorized at 1 and 99%. (5) See Appendix A for variable definitions.

Table 6 shows that in industries concentrated with high-reputation VC firms, the coefficient was significantly negative (−0.011) and the coefficient of LIndQ was not statistically significant. However, in industries concentrated with low-reputation VC firms, the coefficient of LIndQ was significantly positive (0.002) and the coefficient was not statistically significant. This was consistent with our argument that unintentional herd behavior caused by imperfect information mainly existed in industries concentrated with VC firms of high reputation. In contrast, unintentional herd behavior driven by fundamental information signals mainly exists in industries concentrated with low-reputation VC firms. Previous studies provide a strong theoretical foundation for reputational herding [21] and provide
evidence that reputation-based herding contributes to herding among institutional investors and analysts [60,61]. Our findings present evidence that reputational herding might also contribute to herding among venture capitalists, which is consistent with reputational herding theory.

4.4.3. The Consequences of Herding among Venture Capitalists

In this subsection, we investigated the consequences of the herd behavior established in the previous sections. According to Sias [37], herding is not particularly problematic if it only reflects the incorporation of basic information into the investment. In this case, one would expect a positive association between the herding of venture capitalists and their subsequent exit returns. In contrast, if VC investors overreact to fundamental information signals or follow and imitate their peers’ investment decisions blindly, one would expect to observe a negative association between the herding of venture capitalists and their subsequent exits returns. To examine the economic consequence of herding, we looked at the influence of the herd behavior of venture capitalists on their exit performance. The result is shown in Table 7.

Table 7. The consequences of herding among venture capitalists.

|       | (1)       | (2)       |
|-------|-----------|-----------|
|       | Exit_Performance | Exit_IPO   |
| HM    | −7.408 *** | −5.198 ** |
|       | (−3.21)   | (−2.42)   |
| Exitage | 0.235 *  | 0.178 *  |
|       | (1.91)    | (1.67)    |
| Hold | −0.956 *** | −0.326 ***|
|       | (−7.57)   | (−3.34)   |
| IndIPO | 0.192 *  | 0.080    |
|       | (1.89)    | (0.83)    |
| VCipo | −0.041    | −0.090    |
|       | (−0.61)   | (−1.45)   |
| Q    | 0.107     | 0.472 *** |
|       | (1.16)    | (5.92)    |
| Constants | −2.718 | −6.204    |
|       | (−0.01)   | (−0.02)   |
| Quarter | Yes       | Yes       |
| Industry | Yes       | Yes       |
| N    | 1665      | 1665      |
| Pseudo R-Square | 0.3486 | 0.2062 |

Note: (1) ***, ** and * indicates significance levels at 0.01, 0.05 and 0.10, respectively, using two tailed tests. (2) We report in parentheses t-statistics based on standard errors that are clustered within industry. (3) All the continuous variables are winsorized at 1 and 99%. (4) See Appendix A for variable definitions.

Column (1) of Table 7 shows the exit performance (Exit_Performance) measured by whether venture capitalists exit through IPO or M&A. In column (2), the exit performance (Exit_IPO) was estimated based on whether venture capitalists exit through IPO. Table 7 indicates that the coefficients of the herding measure (HM) in columns (1) and (2) were both significantly negative. This suggests the herd behavior of venture capitalists had a negative influence on their exit performance. There may be several reasons for this result. On the one hand, the later entrants followed and imitated the investment decisions of earlier entrants without the acquisition of adequate information or in-depth surveys. Such behaviors carry significant risks because it is likely that an investment project selected based on limited asymmetric information does not have reasonable prospects, or there are still many questions concerning whether the market will accept their new technologies, products and business model. On the other hand, even in a case of unintentional herding driven by fundamental information signals, where VC investors make an investment decision based on an in-depth analysis, as the interest “cake” is relatively fixed, the more investors
share, the lower their exit returns will be. Previous studies suggest that herding might increase market efficiency by incorporating fundamental information into asset prices, or make stock market unstable and less efficient by promoting over-investment and driving stock prices from fundamental values \[27,37\]. Our findings suggest that herd behavior may cause VC investments to be concentrated in industry, thereby reducing the efficiency of venture capital markets.

4.5. Robustness Tests

Following Xu, Yu and Yi \[42\], we also proposed an alternative approach to constructing the measurement for herding among VC. Specifically, we adopted the following procedure to construct the adjustment item \((E|P_{i,t} - E(P_{i,t})|)\) in the model (1): (a) we used the mean value of \(|P_{i,t} - E(P_{i,t})|\) as an adjustment item to construct HM1; (b) HM2: we used the mean value of \(|P_{i,t} - E(P_{i,t})|\) after subtraction of one standard deviation as an adjustment item and construct HM2; (c) HM3: we used the mean value of \(|P_{i,t} - E(P_{i,t})|\) after subtraction of 1.96 standard deviations as an adjustment item to construct HM3. Our empirical results with these three methods provided consistent evidence. As previously stated in Section 3.2.1, we reported only the regression result of HM3 as our baseline regression results but reported the other two adjustment methods in robust tests.

The regression results using HM1 and HM2 as the measurement for herd behavior of VC firms are shown in Table 8. The results were consistent with our baseline results, indicating that our results were robust to alternative herding measures.

Table 8. Robustness tests: alternative herding measures.

| Panel A: Causes of Herding among Venture Capitalists: Robustness Tests | (1) | (2) |
|---|---|---|
| | HM1 | HM2 |
| IndQ | 0.002 *** | 0.002 *** |
| | (2.85) | (2.85) |
| LIndIPO | 0.004 | 0.004 |
| | (0.86) | (0.86) |
| Indinfor | -0.010 ** | -0.010 ** |
| | (-2.46) | (-2.46) |
| VCinv | 0.006 | 0.006 |
| | (1.62) | (1.62) |
| VCage | -0.009 | -0.009 |
| | (-1.34) | (-1.34) |
| VCtype | -0.024 | -0.024 |
| | (-1.22) | (-1.22) |
| VCround | 0.005 | 0.005 |
| | (0.96) | (0.96) |
| Constants | 0.063 | 0.175 *** |
| | (1.60) | (4.45) |
| Quarter | Yes | Yes |
| Industry | Yes | Yes |
| N | 416 | 416 |
| R-Square | 0.475 | 0.38 |
| Adj. R-Square | 0.38 | 0.38 |

| Panel B: Consequence of the Herd Behavior of Venture Capitalists: Robustness Tests | (1) | (2) |
|---|---|---|
| | Exit_Performance | Exit_IPO |
| HM1 | -7.470 *** | -7.846 *** |
| | (-3.26) | (-2.98) |
| HM2 | -0.952 *** | -1.000 *** |
| | (-7.57) | (-7.81) |
| Exitage | 0.240 * | 0.232 * |
| | (1.95) | (1.78) |
| Hold | -0.046 | -0.038 |
| | (-0.69) | (-0.56) |
| IndIPO | 0.192 * | 0.181 * |
| | (1.99) | (1.74) |
| VCipo | -0.046 | 0.017 |
| | (-0.69) | (1.02) |
| Q | -4.526 | -3.678 |
| | (-10.01) | (-10.03) |
| Constants | Yes | Yes |
| Industry | Yes | Yes |
| N | 1665 | 1665 |
| R-Square | 0.3486 | 0.3493 |

Note: (1) ***, ** and * indicates significance levels at 0.01, 0.05 and 0.10, respectively, using two-tailed tests. (2) We report in parentheses t-statistics based on standard errors that are clustered within the industry. (3) All the continuous variables are winsorized at 1 and 99%. (4) See Appendix A for variable definitions.
5. Conclusions

In this study, we present the empirical evidence on the existence, influencing factors and economic consequences of herding among venture capitalists using a Chinese sample from 2001 to 2017. First, we constructed a herding measure and confirmed the existence of herd behavior in the Chinese VC market. Second, we ground our hypotheses on the information asymmetry theory and tested the influences of the public market information (industry-level fundamental information signals and trading feedback signals) and industry information uncertainty on herding among venture capitalists. Our results suggest the evidence of higher herding levels for venture capitalists can be explained by more positive industry-level fundamental information signals and a higher degree of industry information uncertainty and is not driven by a trading feedback signal. We also found that a better external information environment weakened the herd behavior caused by information asymmetry within the industry, while venture capitalists’ reputation concerns might amplify it. Finally, we examined the economic consequence of the herding and found that the herd behavior of venture capitalists would have an adverse effect on their exit performance.

Our study contributes to the literature on herd behavior, VC investments and VC in emerging economies, where information asymmetry is rampant and may exhibit herd behavior in their VC market. Our findings also have important policy and practice implications. For policymakers, understanding the herd behavior of venture capitalists in practice is the basis for regulating the factors that cause such a phenomenon, which is helpful to improve investment efficiency. This can inhibit venture investment bubbles and make venture capital allocation more efficient. At the same time, understanding the causes of herd behavior and its economic consequences will help VC firms to timely adjust irrational investment decisions in their decision-making process and avoid following a trend blindly, which can improve their capital allocation and investment returns.

In this study, we detected herd behavior in the venture capital market at the industry level. However, the lack of detailed VC investment data in China limits our further exploration of the existence of herding biases at the individual (venture capitalists) level, which is also an important issue worthy of further research. In addition, our study was conducted in the context of China. There might be institutional factors that influence our results. For example, it may be the unstable institutional environment and the opaque information environment that leads to herd behavior in the venture capital market. Thus, future research could replicate this study in other countries to assess the generalizability of our findings.

Author Contributions: Conceptualization, R.Z. and X.Y.; methodology, X.Y.; software, X.Y.; validation, N.L., R.Z. and M.A.K.; formal analysis, R.Z., X.Y., N.L. and M.A.K.; investigation, R.Z. and X.Y.; resources, R.Z., X.Y., N.L. and M.A.K.; data curation, X.Y.; writing—original draft preparation, R.Z. and X.Y.; writing—review and editing, N.L. and M.A.K.; visualization, N.L. and M.A.K.; supervision, N.L. and M.A.K.; project administration, N.L. and M.A.K.; funding acquisition N.L. All authors have read and agreed to the published version of the manuscript.

Funding: This research is funded by the soft science research project of Hebei province: “Research on the high-quality development mechanism of small and medium-sized sci-tech enterprises under the guidance of innovation” (205576103D) and the major project of the education department of Hebei province: “Research on the path selection and countermeasures for accelerating the transformation and upgrading of state-owned enterprises in Hebei province” (ZD201904).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: All data that support the findings of this study are available from the corresponding author upon reasonable request.

Acknowledgments: We wish to thank anonymous referees for valuable comments and suggestions.

Conflicts of Interest: The authors declare no conflict of interest.
Appendix A. Definition of Variables

Table A1. This table provides definitions of all variables used.

| Variables       | Definition                                                                                           | Reference                                                                 | Source  |
|-----------------|-------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|---------|
| HM              | See model (1)                                                                                         | Xu, Yu and Yi [42]                                                       | CV Source |
| Exit_Performance| A dummy variable that equals 1 if VC exit through IPO or M&A, and 0 otherwise.                        | Gompers, Kovner, Lerner and Scharfein [43]                                | CV Source |
| Exit_IPO        | A dummy variable that equals 1 if VC exit through IPO, and 0 otherwise.                              | Gompers, Kovner, Lerner and Scharfein [43]                                | CV Source |
| IndQ            | The industry average Tobin’s Q                                                                      | Gompers, Kovner, Lerner and Scharfein [43]; Fazzari, Hubbard and Petersen [44] | CSMAR   |
| LIndIPO         | Natural logarithm of 1 plus the one-quarter-lagged number of VC-backed IPOs in a given industry      | Gompers, Kovner, Lerner and Scharfein [43]                                | CV Source |
| IndInfor        | Natural logarithm of accumulated investment amount (US $M) in a given industry                        | Kremer and Nautz [27]                                                   | CV Source |
| VCAge           | For each VC firm, natural logarithm of 1 plus the total number of months since the VC’s establishment is calculated, and then the mean value in a given industry is taken. | Hochberg, Ljungqvist and Lu [49]                                      | CV Source |
| VCInv           | For each VC firm, natural logarithm of 1 plus the total number of investments before this investment for a VC firm is calculated, and then the mean value in a given industry is taken. | Hochberg, Ljungqvist and Lu [49]                                      | CV Source |
| VCtype          | The proportion of domestic VC fund in a given industry                                               | Zheng and Xia [18]                                                      | CV Source |
| VCround         | The mean value of investment round of VC investment in an industry                                   | Zheng and Xia [18]                                                      | CV Source |
| Exitage         | Natural logarithm of 1 plus the total number of months from the VC firm’s establishment to its exits | Cumming, Fleming and Schwienbacher [62]                                 | CV Source |
| VCipo           | Natural logarithm of 1 plus the number of IPOs for a given VC firm before this investment            | Cumming and Na [9]                                                      | CV Source |
| Hold            | Natural logarithm of 1 plus the total number of months from the VC firm’s investment to its exits    | Cumming, Fleming and Schwienbacher [62]                                 | CV Source |
| Q               | Natural logarithm of accumulated investment amount (US $M) since the VC firm’s investment until its exit | Hochberg, Ljungqvist and Lu [49]                                      | CV Source |
| IndIPO          | The institutional investors’ ownership in a given industry                                           | Zheng and Xia [18]                                                      | RESSET  |
| Inshold         | Natural logarithm of 1 plus the number of earnings forecasts given by analysts for a given industry  | Upadhyay and Zeng [64]                                                  | CSMAR   |
| Cover1          | Natural logarithm of the number of analysts issuing an annual forecast for firms in a given industry  | Upadhyay and Zeng [64]                                                  | CSMAR   |
| Cover2          | The accumulated numbers of IPO exit of VC firms                                                      | Dimov and Milanov [59]                                                  | CV Source |
References

1. Kraus, A.; Stoll, H.R. Parallel Trading by Institutional Investors. *J. Financ. Quant. Anal.* 1972, 7, 2107–2138. [CrossRef]
2. Chong, T.T.-L.; Liu, X.; Zhu, C. What explains herd behavior in the Chinese stock market? *J. Behav. Financ.* 2017, 18, 448–456. [CrossRef]
3. Shah, S.S.H.; Khan, M.A.; Meyer, N.; Meyer, D.F.; Oláh, J. Does Herding Bias Drive the Firm Value? Evidence from the Chinese Equity Market. *Sustainability* 2019, 11, 5583. [CrossRef]
4. Zhang, J.; Liu, P. Rational Herding in Microloan Markets. *Manag. Sci.* 2012, 58, 892–912. [CrossRef]
5. Buchner, A.; Mohamed, A.; Schwienbacher, A. Herd behaviour in buyout investments. *J. Corp. Financ.* 2020, 60, 101503. [CrossRef]
6. Li, Y.; Gan, Z.; Mai, Y.Y. Analysis on Herd Behavior in Chinese Venture Capital Market. In Proceedings of the Second Singapore International Conference on Finance, Singapore, 17–18 July 2008. Available online: https://ssrn.com/abstract=1085092 (accessed on 19 May 2021).
7. Banerjee, A.V. A simple model of herd behavior. *Q. J. Econ.* 1992, 107, 797–817. [CrossRef]
8. Gompers, P.A.; Gornall, W.; Kaplan, S.N.; Strebulaev, I.A. How do venture capitalists make decisions? *J. Financ. Econ.* 2020, 135, 169–190. [CrossRef]
9. Cumming, D.; Na, D. Local bias in venture capital investments. *J. Empir. Financ.* 2010, 17, 362–380. [CrossRef]
10. Ewens, M.; Nanda, R.; Rhodes-Kropf, M. Cost of experimentation and the evolution of venture capital. *J. Financ. Econ.* 2018, 128, 422–442. [CrossRef]
11. Tian, X. The causes and consequences of venture capital stage financing. *J. Financ. Econ.* 2011, 101, 132–159. [CrossRef]
12. Meuleman, M.; Manigart, S.; Lockett, A. Private Equity Syndication: Agency Costs, Reputation and Collaboration. *J. Bus. Financ. Account.* 2009, 36, 616–644. [CrossRef]
13. Wang, L.; Wang, S. Economic freedom and cross-border venture capital performance. *J. Empir. Financ.* 2012, 19, 26–50. [CrossRef]
14. Kaplan, S.N.; Schoar, A. Private Equity Performance: Returns, Persistence, and Capital Flows. *J. Financ.* 2005, 60, 1791–1823. [CrossRef]
15. Cumming, D.J.; Grilli, L.; Murtinu, S. Governmental and Independent Venture Capital Investments in Europe: A Firm-Level Performance Analysis. *J. Corp. Financ.* 2017, 42, 439–459. [CrossRef]
16. Zhang, L. 1—A profile of China’s venture capital market. In *China’s Venture Capital Market*; Chandos Publishing: Cambridge, UK, 2015; pp. 1–23.
17. Gu, Q.; Lu, X. Unraveling the mechanisms of reputation and alliance formation: A study of venture capital syndication in China. *Strat. Manag. J.* 2014, 35, 739–750. [CrossRef]
18. Zheng, Y.; Xia, J. Resource Dependence and Network Relations: A Test of Venture Capital Investment Termination in China. *J. Manag. Stud.* 2018, 55, 295–319. [CrossRef]
19. Batjargal, B.; Hitt, M.A.; Tsui, A.S.; Arregle, J.-L.; Webb, J.W.; Miller, T.L. Institutional Polycentrism, Entrepreneurs’ Social Networks, and New Venture Growth. *Acad. Manag. J.* 2012, 56, 1024–1049. [CrossRef]
20. Hitt, M.A.; Ahlstrom, D.; Dacin, M.T.; Levitas, E.; Svobodina, L. The Institutional Effects on Strategic Alliance Partner Selection in Transition Economies: China vs. Russia. *Organ. Sci.* 2004, 15, 173–185. [CrossRef]
21. Scharfstein, D.S.; Stein, J.C. Herd Behavior and Investment. *Am. Econ. Rev.* 1990, 80, 465–479.
22. Jiang, H.; Verardo, M. Does Herding Behavior Reveal Skill? An Analysis of Mutual Fund Performance. *J. Financ.* 2018, 73, 2229–2269. [CrossRef]
23. Frey, S.; Herbst, P.; Walter, A. Measuring mutual fund herding—A structural approach. *J. Int. Financ. Mark. Inst. Money* 2014, 32, 219–239. [CrossRef]
24. Truong, B. Analyst forecasts and herding behavior. *Rev. Financ. Stud.* 1994, 7, 97–124. [CrossRef]
25. Bernstein, S.; Giroud, X.; Townsend, R.R. The Impact of Venture Capital Monitoring. *J. Financ. 2016, 71, 1591–1622. [CrossRef]
26. Chemmanur, T.J.; Loutskina, E.; Tian, X. Corporate Venture Capital, Value Creation, and Innovation. *Rev. Financ. Stud.* 2014, 27, 2434–2473. [CrossRef]
27. Kremer, S.; Nautz, D. Causes and consequences of short-term institutional herding—ScienceDirect. *J. Bank. Financ.* 2013, 37, 1676–1686. [CrossRef]
28. Froots, K.A.; Scharfstein, D.S.; Stein, J.C. Herd on the street: Informational inefficiencies in a market with short-term speculation. *J. Financ.* 1992, 47, 1461–1484. [CrossRef]
29. Chevalier, J.; Ellison, G. Career concerns of mutual fund managers. *Q. J. Econ.* 1999, 114, 389–432. [CrossRef]
30. Guerrieri, V.; Kondor, P. Fund managers, career concerns, and asset price volatility. *Am. Econ. Rev.* 2012, 102, 1986–2017. [CrossRef]
31. Bikhchandani, S.; Hirshleifer, D.; Welch, I. A Theory of Fads, Fashion, Custom, and Cultural Change as Informational Cascades. *J. Political Econ.* 1992, 100, 992–1026. [CrossRef]
32. Cochrane, J.H. The risk and return of venture capital. *J. Financ. Econ.* 2005, 75, 3–52. [CrossRef]
33. Jegadeesh, N.; Titman, S. Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency. *J. Financ.* 1993, 48, 65–91. [CrossRef]
34. Lakonishok, J.; Shleifer, A.; Vishny, R.W. The impact of institutional trading on stock prices. *J. Financ. Econ.* 1992, 32, 23–43. [CrossRef]
35. Bohl, M.T.; Siklos, P.L. Empirical evidence on feedback trading in mature and emerging stock markets. *Appl. Financ. Econ.* 2008, 18, 1379–1389. [CrossRef]

36. Dean, W.G.; Faifr, R. Feedback trading and the behavioural ICAPM: Multivariate evidence across international equity and bond markets. *Appl. Financ. Econ.* 2011, 21, 1665–1678. [CrossRef]

37. Sias, R.W. Institutional Herding. *Rev. Financ. Stud.* 2004, 17, 165–206. [CrossRef]

38. Hirshleifer, D.; Teoh, S.H. Herd Behaviour and Cascading in Capital Markets: A Review and Synthesis. *Eur. Financ. Manag.* 2003, 9, 25–66. [CrossRef]

39. Christie, W.G.; Huang, R.D. Following the pied piper: Do individual returns herd around the market? *Financ. Anal. J.* 1995, 51, 31–37. [CrossRef]

40. Chang, E.C.; Cheng, J.W.; Khorana, A. An examination of herd behavior in equity markets: An international perspective. *J. Bank. Financ.* 2000, 24, 1651–1679. [CrossRef]

41. Wermers, R. Mutual Fund Herding and the Impact on Stock Prices. *J. Financ.* 1999, 54, 581–622. [CrossRef]

42. Xu, N.; Yu, S.; Yi, Z. Institutional investors’ herd behavior and stock price crash risk. *J. Manag. World* 2013, 7, 31–43.

43. Gompers, P.A. Grandstanding in the venture capital industry. *J. Financ. Econ.* 2001, 15, 145–168. [CrossRef]

44. Fazzari, S.; Hubbard, R.G.; Petersen, B. Investment, financing decisions, and tax policy. *Am. Econ. Rev.* 1988, 78, 200–205.

45. Gompers, P.A. Grandstanding, certification and the underpricing of venture capital backed IPOs. *Ventur. Cap. Int. J. Entrep. Financ.* 2010, 94, 469–491. [CrossRef]

46. Gompers, P.A.; Kovner, A.; Lerner, J.; Scharfstein, D.S. Skill vs. Luck in Entrepreneurship and Venture Capital: Evidence from Serial Entrepreneurs; National Bureau of Economic Research: Cambridge, MA, USA, 2006; Available online: https://ssrn.com/abstract=933932 (accessed on 19 May 2021).

47. Hochberg, Y.V.; Ljungqvist, A.; Lu, Y. Whom you know matters: Venture capital networks and investment performance. *J. Financ.* 2007, 62, 251–301. [CrossRef]

48. Parrino, R.; Sias, R.W.; Starks, L.T. Voting with their feet: Institutional ownership changes around forced CEO turnover. *J. Financ. Econ.* 2003, 68, 3–46. [CrossRef]

49. Graham, J.R.; Harvey, C.R.; Rajgopal, S. The economic implications of corporate financial reporting. *J. Account. Econ.* 2005, 40, 3–73. [CrossRef]

50. Amihud, Y.; Li, K. The Declining Information Content of Dividend Announcements and the Effects of Institutional Holdings. *J. Financ. Quant. Anal.* 2006, 41, 637–660. [CrossRef]

51. Hutton, A.P.; Lee, L.F.; Shu, S.Z. Do Managers Always Know Better? The Relative Accuracy of Management and Analyst Forecasts. *J. Account. Res.* 2012, 50, 1217–1244. [CrossRef]

52. Sheikh, W.; Palepu, K.G. Information asymmetry, corporate disclosure, and corporate profitability: A study of the emerging market. *J. Account. Res.* 2003, 31, 405–440. [CrossRef]

53. Chen, X.; Cheng, Q.; Lo, K. The syndication of private equity: Evidence from the UK. *Ventur. Cap. Int. J. Entrep. Financ.* 1999, 1, 303–324. [CrossRef]

54. Lockett, A.; Wright, M. The syndication of private equity: Evidence from the UK. *Ventur. Cap. Int. J. Entrep. Financ.* 2004, 73, 375–407. [CrossRef]

55. Lee, P.M.; Wahal, S. Grandstanding, and the underpricing of venture capital backed IPOs. *J. Financ. Econ.* 2006, 87, 581–622. [CrossRef]

56. Amihud, Y.; Li, K. The Information Content of Dividend Announcements and the Effects of Institutional Holdings. *J. Financ. Quant. Anal.* 2006, 41, 637–660. [CrossRef]