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Herding Behavior in Chinese Stock Markets during COVID-19

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ABSTRACT

This paper investigates herding behavior in the Chinese stock markets during the COVID-19 pandemic. We find that herding behavior is significantly lower than usual in Chinese stock markets during the COVID-19 period. Furthermore, we explore herding behavior under extreme market conditions induced by COVID-19. We find that herding behavior is more pronounced for upside market movement, lower market trading volume, and lower market volatility caused by COVID-19. These results are important for investors and regulators to enhance their understanding of stock markets and the financial effects of the COVID-19 pandemic.

KEYWORDS

Herding behavior; Chinese stock markets; Covid-19

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G10; G14; G40

1. Introduction

Herding behavior in financial markets suggests that investors under conditions of uncertain information are affected by other investors and thus may imitate the others' decisions, or rely too much on public opinion (i.e., overwhelming majority concept), without considering their information (Banerjee 1992). Due to its significant impact on the stability and efficiency of financial markets and its close relation to the financial crisis (Choe, Kho, and Stulz 1999; Kaminsky and Schmukler 1999), herding behavior has attracted widespread attention in academia (Bikhchandani, Hirshleifer, and Welch 1992; Scharfstein and Stein 1990). COVID-19 has caused severe turbulence in global financial markets and imposed a significant impact on individual investment behavior; however, few studies explore the impact of COVID-19 on investment behavior in financial markets (Mnif, Jarboui, and Mouakhar 2020). Therefore, this paper investigates herding behavior in Chinese stock markets during the COVID-19 pandemic to understand the investment behavior in financial markets under these conditions.

Models of herding behavior include both theoretical and empirical models. The theoretical models of herding behavior mainly include the information cascade model (Bikhchandani, Hirshleifer, and Welch 1992), the information string model (Banerjee 1992), and the reputational herd behavior model (Scharfstein and Stein 1990). The existing empirical models of herding behavior can be roughly divided into stock trading behavior and return rates. Lakonishok, Shleifer, and Vishny (1991) propose using the imbalance of transaction volume between buyers and sellers to measure herding behavior. Christie and Huang (1995) propose adopting cross-sectional standard deviation of returns (CSSD) as a measurement indicator of herding behavior.

Many studies explore the economic and financial consequences of COVID-19. Scholars have discussed the impact of COVID-19 on financial markets and suggest that the pandemic induces a decrease in asset prices and an increase in market volatility (Ali, Alam, and Rizvi 2020; Apergis and Apergis 2020; Gil-Alana and Monge 2020; Narayan 2020; Salisu and Sikiru 2020). Dinh and Narayan (2020) explore the reaction of stock prices at different stages of COVID-19's evolution and argue that stock markets have over-reacted to any unexpected news and that they will correct themselves with

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more available information. Also, researchers investigate the influence of COVID-19 on energy markets and find increasing volatility in oil prices following the onset of COVID-19 and that the pandemic influences returns for the majority of the listed energy firms (Devpura and Narayan 2020; Huang and Zheng 2020; Polemis and Soursou 2020).

Several studies explore herding behavior in Chinese stock markets. Demirer and Kutan (2006) examine herding behavior in Chinese stock markets using both firm- and sector-level data and find that herding behavior does not exist in Chinese stock markets. Moreover, they find that herding behavior is significantly higher during downside market movement periods than the upside market movement. Tan et al. (2008) investigate herding behavior in dual-listed Chinese A-share and B-share stocks and find that herding behavior exists within both the Shenzhen A-share market and B-share market, and show that herding behavior occurs in both rising and falling market conditions.

Studies also investigate herding behavior under extreme market conditions induced by financial crises. Chiang and Zheng (2010) explore herding behavior during several financial crises and find that herding behavior is more pronounced during financial crises. Laih and Liau (2013) document significant evidence of herding behavior in Taiwan and China's stock markets during periods of financial turmoil, particularly for the latest subprime mortgage crisis. Ouarda, El Bouri, and Bernard (2013) show that herding behavior is significantly higher during the periods of the recent global financial crisis in 2007–2008.

This paper investigates herding behavior in two Chinese stock markets during COVID-19, the Shanghai A-share market, and the Shenzhen A-share market. We find that herding behavior is significantly lower than usual in the two Chinese stock markets during the COVID-19 period, although herding behavior exists in the two Chinese stock markets during the sample period, including COVID-19. Moreover, we show that herding behavior is more pronounced in upside market movement, lower market trading volume, and lower market volatility in the two Chinese stock markets under COVID-19.

Through these findings, this paper contributes to the literature in two ways. First, the finding that herding behavior is significantly lower during the COVID-19 period is novel compared with previous findings in the literature. As a result, this paper enriches the literature by exploring investment behavior during a worldwide crisis and shows different investment behavior during the pandemic. Second, this paper informs investors and policymakers about investment behavior under COVID-19. Based on findings shown in this paper, the two Chinese stock markets are more efficient during the periods of COVID-19 in terms of herding information. Therefore, policymakers have little need to worry about the inefficiency in the two stock markets during COVID-19. Also, individual investors should avoid pursuing extremely high returns caused by the pandemic to avoid any loss in the market condition due to more significant herding behavior.

The rest of the paper is organized as follows. Section 2 describes the data, Section 3 introduces the econometric models to analyze herding behavior, Section 4 investigates herding behavior during the COVID-19 period, Section 5 explores herding behavior under extreme market conditions caused by COVID-19, and Section 6 concludes.

2. Methodology

Following Christie and Huang (1995), we use the following formula to calculate the herding behavior index in stock markets,

$$H_t = \sqrt{\frac{\sum_{i=1}^{n}\left(r_{i,t} - r_{m,t}\right)^2}{n-1}} \tag{1}$$

where n is the number of stocks at a specific time in a stock market, $r_{i,t}$ is the return of an individual stock at a specific time in the stock market, and $r_{m,t}$is the average market return of individual stocks at a specific time in the stock market. According to Christie and Huang (1995), if the H index of a stock market is high, the return dispersions are also high, and thus herding behavior is less significant in the stock market, and vice versa. For a specific stock market, we can obtain each stock's return and calculate the average market return of individual stocks on a certain day in the stock market and thus obtain the H index for the stock market on a certain day. By repeating the procedure, we will obtain the time series of daily H indexes for a specific stock market during a specific period and investigate herding behavior in the stock market.

After obtaining the series of daily H index, following Chiang and Zheng (2010), we run the following regression to investigate herding behavior in Chinese stock markets during the COVID-19 period,

$$H_t = \gamma_0 + \gamma_1 R_{m,t} + \gamma_2 \left| R_{m,t} \right| + \gamma_3 R_{m,t}^2 + \gamma_4 R_{m,t}^2 * COVID_t + \varepsilon_t \tag{2}$$

where $R_{m,t}$ is the daily average market return, $\left| R_{m,t} \right|$ is the absolute value of $R_{m,t}$, and $COVID_t$ is a dummy variable indicating the periods of COIVD-19.[1] The beginning time of COVID-19 in China is 23 January 2020, when the Chinese central government officially announced the lockdown in Wuhan city. The end of the dummy period is hard to define since the spread of COVID-19 is ongoing. Therefore, we choose the most recent day, 12 October 2020, in which the data for related variables are available.

Moreover, we explore herding behavior under extreme market conditions caused by COIVD-19 in Chinese stock markets by adopting the method used in Christie and Huang (1995). Specifically, we run the following regression,

$$H_t = \alpha + \beta_1 C_t^H + \beta_2 C_t^L + \varepsilon_t \tag{3}$$

where $C_t^H = 1$, if the daily average market return (market trading volume, market volatility) lies in the upper tail of the distribution of daily average market return (market trading volume, market volatility) and zero otherwise; and $C_t^L = 1$, if the daily average market return (market trading volume, market volatility) lies in the lower tail of the distribution of the daily average market return (market trading volume, market volatility) and zero otherwise.[2] Following Demirer and Kutan (2006), we adopt a 5% upper (lower) tail of the distribution of daily average market return (market trading volume, market volatility) to examine herding behavior under extreme market conditions and 10% upper (lower) tail of the distribution of the daily average market return (market trading volume, market volatility) as robustness checks. The two dummies in Equation (3) aim to capture differences in return dispersions during the periods of extreme market conditions generated by COVID-19. The presence of β_1 and β_2 will indicate herd formation by market participants.

3. Data

The data used in this paper is from the Chinese Stock Market & Accounting Research (CSMAR) database. From CSMAR, we obtain individual stocks' daily returns and calculate the cross-sectional average stock of individual returns in a stock market to obtain an average market return. The daily trading volume of individual stocks is obtained from CSMAR. We add up the trading volume of individual stocks listed in a stock market to obtain market trading volume in the stock market. According to the method suggested by Martens and Van Dijk (2007), the daily market volatility is calculated by using cross-section returns.

To investigate herding behavior during the periods of COVID-19 in Equation (2), we adopt a sample from 3 June 2019 to 12 October 2020, including 330 days after eliminating non-trading days.[3] During the sample period, COVID-19 suddenly broke out in Wuhan city and spread dramatically throughout China.[4] Therefore, we can analyze herding behavior in Chinese stock markets before and after the outbreak of COVID-19. The sample stocks are from two stock markets, the Shanghai A-share market and the Shenzhen A-share market. The number of listed stocks in the two

Table 1. Summary statistics of returns and herding information.

Variable	Obs	Mean	Std. Dev	Min	Max
r_{it}					
SH-A	467,670	0.0008318	0.0275735	−0.224935	0.441176
SZ-A	429,935	0.0008585	0.0288349	−0.167151	0.441767
H-index					
SH-A	330	0.0233596	0.0046584	0.0151465	0.0464454
SZ-A	330	0.0242728	0.0044997	0.015895	0.0487132

The data is from CSMAR. The sample period is from 3 June 2019 to 12 October 2020. SH-A denotes the Shanghai A-share market, and SZ-A denotes the Shenzhen A-share market.

Table 2. Summary statistics of market conditions under COVID-19.

Variable	Obs	Mean	Std. Dev.	Min	Max
r_{it}					
SH-A	242,184	0.0011836	0.0313211	−0.224935	0.44086
SZ-A	220,902	0.0011359	0.0324439	−0.167151	0.440419
H-index					
SH-A	170	0.026401	0.0039492	0.0192284	0.0464454
SZ-A	170	0.0269676	0.0042363	0.0194948	0.0487132
Trading volume					
SH-A	170	23.99567	0.3162639	23.35516	24.86108
SZ-A	170	24.05132	0.2947157	23.33955	24.73228
Volatility					
SH-A	170	0.0007225	0.0010244	2.26e-06	0.0068219
SZ-A	170	0.0007676	0.0008132	0.0000172	0.0040492

The data is from CSMAR. The sample period is from 23 January 2019 to 12 October 2020. SH-A denotes the Shanghai A-share market, and SZ-A denotes the Shenzhen A-share market.

markets during the sample periods is 2882 after deleting those stocks that had been delisted and terminated.

Table 1 shows the summary statistics of returns and the herding index for the two Chinese stock markets when performing the regression in Equation (2). From the table, we observe that the mean of the daily return of individual stocks in the Shanghai A-share market is lower than that in the Shenzhen A-share market. Besides, the mean of daily H indexes in the Shenzhen A-share market is higher than that in the Shanghai A-share market, suggesting that the return dispersions are higher in the Shenzhen A-share Market.

To investigate herding behavior under extreme market conditions induced by COVID-19 in Equation (3), we adopt a sample from 23 January 2020 to 12 October 2020, including 170 days after getting rid of non-trading days. The sample stocks are from two stock markets: The Shanghai A-share market and the Shenzhen A-share market. The number of listed stocks in the two markets during the sample period of COVID-19 is 2859 after deleting those stocks had been delisted and terminated.

Table 2 shows the summary statistics of market conditions for the two Chinese stock markets when running the regression in Equation (3). From the table, we observe that the mean of daily returns of individual stocks in the Shanghai A-share market is higher than that in the Shenzhen A-share market. However, the mean of daily H indexes in the Shenzhen A-share market is higher than that in the Shanghai A-share market, suggesting that herding behavior is lower in the Shenzhen A-share Market. Moreover, we find that average market fluctuations, including trading volume and volatility, in the Shanghai A-share market are lower than those in the Shenzhen A-share market, supporting that herding behavior is lower in the Shenzhen A-share Market.

4. Herding Behavior during the Periods of COVID-19

Figure 1 shows the time series of daily H indexes in the two Chinese stock markets. From the Figure, we can observe that the two stock markets show more significantly higher H indexes during the

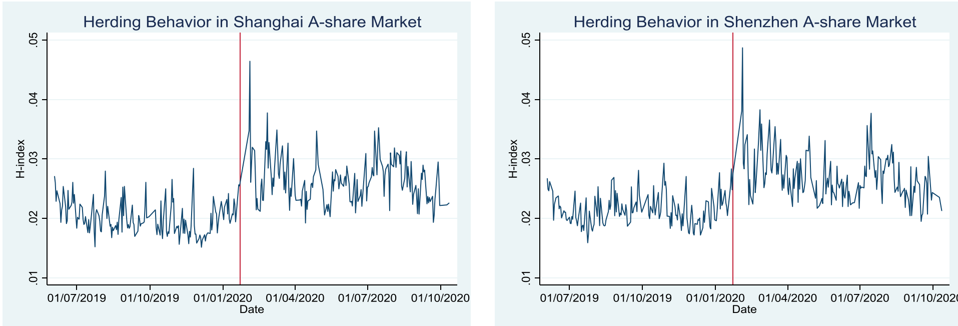


Figure 1. Herding behavior in Two Chinese Stock Markets. Notes: The data is from CSMAR. The sample period is from 3 June 2019 to 12 October 2020. The red line indicates 23 January 2020, the beginning of COVID-19 in China.

spreading of COVID-19. As a result, we conjecture that herding behavior is significantly lower than usual in the two Chinese stock markets during the COVID-19 period than before the spreading of COVID-19.

To formally address the significance of herding behavior in the two Chinese stock markets during the periods of COVID-19, we run the regression in Equation (2) and report the results in Table 3. According to Chiang and Zheng (2010), if the coefficient of $R^2_{m,t}$ in Equation (2) is significantly negative, it indicates the existence of herding behavior. Therefore, we find that herding behavior exists in the two Chinese stock markets during the sample period. However, we find that the interaction term's coefficient is significantly positive. As a result, herding behavior is significantly lower than usual during the periods of COVID-19.

To validate the above finding, we perform a robustness check by extending the sample period. We run the regression in Equation (2) using a sample from 13 October 2015 to 12 October 2020. The results are reported in Table 4. We find that the coefficient of $R^2_{m,t}$ is significantly negative, which implies that herding behavior exists during the extended sample period. Moreover, the interaction term's coefficient is significantly positive, which implies that herding behavior is significantly lower during the periods of COVID-19. Overall, our above finding is consistent under the augmented sample.

Individual investors' divergent judgment about the pandemic's persistence can explain the finding that herding behavior is significantly lower during the periods of COVID-19. Chinese stock markets include many individual investors, and their judgment about COVID-19 is divergent due to a lack of

Table 3. Herding behavior in Two Chinese Stock Markets.

Dependent:	(1)	(2)	(3)
H-index	Full Sample	SH-A	SZ-A
γ_1	−0.0887***	−0.0867***	−0.0905***
	(0.0106)	(0.0157)	(0.0144)
γ_2	0.2636***	0.2922***	0.2320***
	(0.0298)	(0.0407)	(0.0416)
γ_3	−12.0790***	−13.9836***	−10.5840***
	(1.4467)	(2.3014)	(1.8095)
γ_4	10.0232***	11.4770***	9.0058***
	(1.1480)	(1.9066)	(1.3880)
N	660	330	330
R^2	0.2359	0.2319	0.2462

The data is from CSMAR. The sample period is from 3 June 2019 to 12 October 2020. SH-A denotes the Shanghai A-share market, and SZ-A denotes the Shenzhen A-share market. The full sample indicates the mixed sample of SH-A and SZ-A. Newey–West heteroskedasticity and autocorrelation consistent standard errors are reported in the brackets. ***, ** and * denote significance at the 1%, 5% and 10%, respectively.

Table 4. Herding behavior in two Chinese stock markets (Robustness Check).

Dependent:	(1)	(2)	(3)
H-index	Full Sample	SH-A	SZ-A
γ_1	−0.1021***	−0.1118***	−0.0938***
	(0.0056)	(0.0079)	(0.0079)
γ_2	0.1619***	0.1703***	0.1533***
	(0.0215)	(0.0281)	(0.0325)
γ_3	−2.0093***	−2.2600***	−1.7916***
	(0.3465)	(0.4835)	(0.4963)
γ_4	1.4525***	1.3079**	1.5956***
	(0.3636)	(0.5179)	(0.4686)
N	2436	1218	1218
R^2	0.0860	0.1481	0.0597

The data is from CSMAR. The sample period is from 13 October 2015 to 12 October 2020. SH-A denotes the Shanghai A-share market, and SZ-A denotes the Shenzhen A-share market. The full sample indicates the mixed sample of SH-A and SZ-A. Newey–West heteroskedasticity and autocorrelation consistent standard errors are reported in the brackets. ***, ** and * denote significance at the 1%, 5% and 10%, respectively.

knowledge about the unprecedented pandemic, which implies that they will not easily reach a unified investment decision. However, individual investors may find it easy to agree during non-pandemic periods based on their common knowledge about the markets. As a result, herding behavior that measures the decision agreement will be significantly lower during the periods of COVID-19.

5. Herding Behavior under Extreme Market Conditions

In this section, we investigate herding behavior under the extreme market conditions generated by COVID-19. Specifically, we explore herding behavior under extreme average market return, market trading volume, and market volatility caused by COVID-19.

5.1. Herding Behavior under Higher and Lower Returns

Figure 2 shows that return dispersions are lower in the regime of positive average market returns while higher in the regime of negative average market returns in the two Chinese stock markets under COVID-19. Therefore, we conclude that herding behavior is more significant in the upside market movement than in the downside market movement in the two Chinese stock markets under COVID-19.

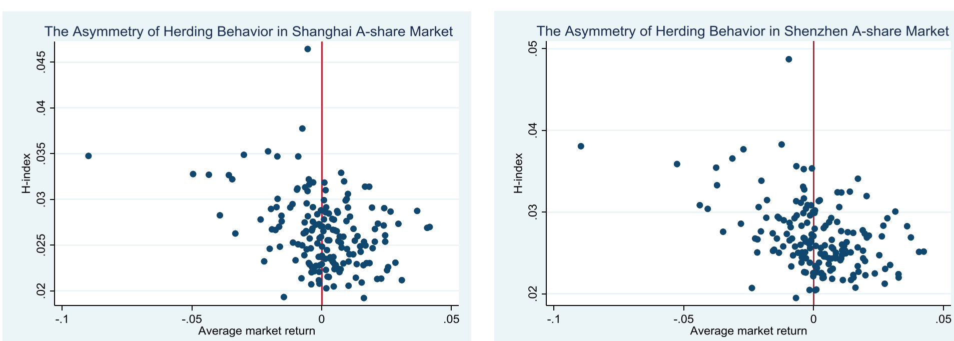


Figure 2. Herding Behavior in Different Returns Caused by COVID-19. The data is from CSMAR. The sample period is from 23 January 2020 to 12 October 2020. The red line indicates zero average market return, and the dots indicate the daily *H*-indexes.

Table 5. Herding Behavior under Extreme Market Conditions Caused by COVID-19.

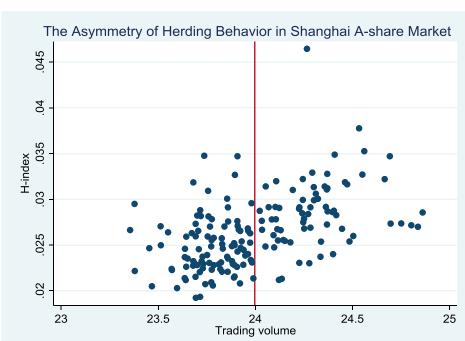
Dependent:	Returns		Trading Volume		Volatility	
H-index	SH-A (1)	SZ-A (2)	SH-A (3)	SZ-A (4)	SH-A (5)	SZ-A (6)
5% high and low tail						
β_1	−0.0009	−0.0008	0.0037***	0.0045***	−0.0000	0.0061**
	(0.0010)	(0.0010)	(0.0012)	(0.0016)	(0.0012)	(0.0024)
β_2	0.0052***	0.0063***	−0.0010	−0.0005	−0.0001	−0.0022***
	(0.0010)	(0.0012)	(0.0010)	(0.0018)	(0.0013)	(0.0008)
N	170	170	170	170	170	170
R^2	0.0915	0.1146	0.0432	0.0571	0.0000	0.1237
10% high and low tail						
β_1	−0.0006	−0.0011	0.0041***	0.0052***	0.0004	0.0038**
	(0.0007)	(0.0007)	(0.0010)	(0.0011)	(0.0010)	(0.0016)
β_2	0.0040***	0.0043***	−0.0023***	−0.0012	−0.0010	−0.0012*
	(0.0010)	(0.0012)	(0.0007)	(0.0011)	(0.0009)	(0.0006)
N	170	170	170	170	170	170
R^2	0.1003	0.1040	0.1394	0.1489	0.0075	0.0847

The data is from CSMAR. The sample period is from 23 January 2019 to 30 June 2020. SH-A denotes the Shanghai A-share market, and SZ-A denotes the Shenzhen A-share market. Newey–West heteroskedasticity and autocorrelation consistent standard errors are reported in the brackets. ***, ** and * denote significance at the 1%, 5% and 10%, respectively.

To formally address this asymmetric herding behavior in the two Chinese stock markets under COVID-19, we run the regression in Equation (3) and report the results in Column (1) and (2) of Table 5. The regression results show that β_2 is statistically significant and positive in extremely lower average market returns, and β_1 is negative but not statistically significant in extremely higher average market returns. Moreover, the results of the robustness check at 10% tail of the distribution of daily average market returns show consistent findings. As a result, herding behavior is more significant in the upside market movement than in the downside market movement in the two Chinese stock markets under COVID-19.

5.2. Herding Behavior under Higher and Lower Trading Volume

Figure 3 shows herding behavior under the different market trading volume (logarithm unit) induced by COVID-19. We find that return dispersions are higher above the mean of the market trading volume while lower below the mean of the market trading volume. Therefore, we consider that herding behavior is high under extremely lower market trading volume while low under extremely higher market trading volume.



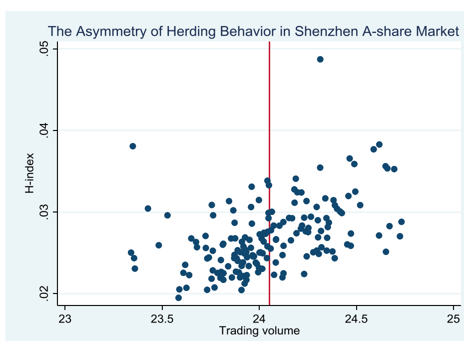


Figure 3. Herding behavior in different trading volume caused by COVID-19. The data is from CSMAR. The sample period is from 23 January 2020 to 12 October 2020. The red line indicates the mean of daily market trading volume (logarithm unit), and the dots indicate the daily *H*-indexes.

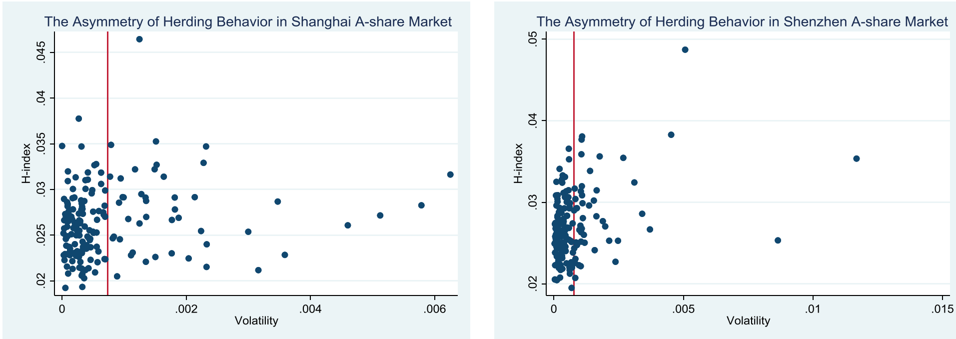


Figure 4. Herding behavior in different volatilities caused by COVID-19. The data is from CSMAR. The sample period is from 23 January 2020 to 12 October 2020. The red line indicates the mean of daily market volatility, and the dots indicate the daily *H*-indexes.

To address herding behavior under the extreme market trading volume caused by COVID-19 in Chinese stock markets, we run the regression in Equation (3) and report the results in Columns (3) and (4) of Table 5. From Columns (3) and (4), we find that β_1 is significantly positive, while β_2 is negative for the two Chinese stock markets. Moreover, the results of the robustness check at the 10% tail of the distribution of daily market trading volume show consistent findings, in which β_2 is significantly negative for the Shanghai A-share market. Therefore, we conclude that herding behavior is not significant under the extremely higher trading volume, while it is significant under the extremely lower trading volume caused by COVID-19.

5.3. Herding Behavior under Higher and Lower Volatility

Figure 4 shows the herding behavior under different market volatilities induced by COVID-19. We observe that return dispersions are lower below the mean of market volatility, which implies that herding behavior is higher under extremely lower market volatility. On the contrary, we find that return dispersions are higher above the mean of market volatilities, which implies that herding behavior is lower under extremely higher market volatility.

To formally address this issue, we run the regression in Equation (3) and report the results in Column (5) and (6) of Table 5. For the low and high 5% of the distribution of daily market volatility, we find that all coefficients are not significant for the Shanghai A-share market in Column (5). However, we find that β_1 is significantly positive, while β_2 is significantly negative in the Shenzhen A-share market in Column (6). The results for low and high 10% of the distribution of daily market volatility confirm the findings. Therefore, we conclude that there is no significant herding behavior at extremely higher market volatility in the Shanghai A-share market while there is significant herding behavior at extremely lower market volatility in the Shenzhen A-share market.

6. Conclusion

This paper investigates herding behavior during COVID-19 in two Chinese stock markets, the Shanghai A-share market and the Shenzhen A-share market. We find that herding behavior is significantly lower than usual in Chinese stock markets during the pandemic. Moreover, we find that herding behavior is more significant in upside market movement, lower market trading volume, and lower market volatility under COVID-19.

The findings suggest that market participants are comparatively rational in Chinese stock markets and Chinese stock markets are more stable and efficient during periods of COVID-19 since herding behavior is significantly lower than usual in Chinese stock markets during the pandemic. As a result, Chinese policymakers do not have to be too concerned about potentially destabilizing effects. The results for both Shanghai and Shenzhen exchanges are consistent, suggesting that the information between the two stock markets flows smoothly during the COVID-19 period. Moreover, individual investors should not pursue extremely high returns caused by COVID-19 since herding behavior is significantly high during these periods.

Notes

1. A sample from 3 June 2019 to 12 October 2020 is adopted to perform the regression in Equation 2.
2. A sample from 23 January 2020 to 12 October 2020 is used to run the regression in Equation 3.
3. The sample period is selected to include as much data as possible around COVID-19 to compare herding behavior around COVID-19.
4. Currently, the spreading of COVID-19 is ongoing worldwide; however, the spreading of COVID-19 is under control in China.

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Appendix

We investigate whether herding behavior exits in Chinese stock markets by using the following regression:

$$H_t = \gamma_0 + \gamma_1 R_{m,t} + \gamma_2 \left|R_{m,t}\right| + \gamma_3 R_{m,t}^2 + \varepsilon_t \tag{4}$$

where $R_{m,t}$ is the daily average market return, $\left|R_{m,t}\right|$ is the absolute value of $R_{m,t}$.

Table A reports the results for the above regression adopting a sample from 13 October 2015 to 12 October 2020. From the table, we find that the square term's coefficient is significantly negative for both the full sample and Shanghai A-share market/Shenzhen A-share market. As a result, herding behavior does exist in the two Chinese stock markets during the sample period.

Table A Herding behavior in two Chinese stock markets (extended sample).

Dependent:	(1)	(2)	(3)
H-index	Full Sample	SH-A	SZ-A
γ_1	−0.1016***	−0.1112***	−0.0935***
	(0.0057)	(0.0080)	(0.0080)
γ_2	0.1624***	0.1693***	0.1554***
	(0.0221)	(0.0288)	(0.0335)
γ_3	−1.8203***	−2.0565***	−1.6192***
	(0.3701)	(0.5097)	(0.5356)
N	2436	1218	1218
R^2	0.0860	0.1481	0.0597

The data is from CSMAR. The sample period is from 13 October 2015 to 12 October 2020. SH-A denotes the Shanghai A-share market, and SZ-A denotes the Shenzhen A-share market. The full sample indicates the mixed sample of SH-A and SZ-A. Newey–West heteroskedasticity and autocorrelation consistent standard errors are reported in the brackets. ***, ** and * denote significance at the 1%, 5% and 10%, respectively.