A Study of the Herding Effect of Chinese Open-End Funds at the Industry Level

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Abstract. In recent years there has been a growing perception among investors that there is a huddle of institutional investors in A-shares. To investigate this problem this paper applies a modification of the classical LSV model, which studies herd behaviour, to the industry level. By analyzing the data of open-end funds in various industries from March 2009 to December 2017, this paper investigates the extent and distribution characteristics of institutional investors' herding behavior at the industry level, and explores the driving forces of herding behavior at the industry level. It is found that Chinese open-end funds indeed have significant herding behavior at the industry level. As herding behaviour in the securities market may exacerbate stock market volatility, this phenomenon deserves the attention of regulators.

Keywords: finance · herding behavior · open-end funds · investment style

1 Introduction

Contrary to traditional finance's efficient market hypothesis, behavioural finance views institutional investors as imperfectly rational actors with principal-agent relationships. As a result of these investors' multi-layered agency conflicts, certain trading behaviours cause prices to deviate from rational levels and even increase unwarranted market volatility.

Herding behaviour relates to the notion that trading by institutional investors, such as mutual funds, generates information effects, and that the diffusion of these effects induces other institutional investors to behave as indicated above. For instance, the herding effect amplifies the trading effect. Herding conduct refers to copying or following the decisions of other investors while possessing private information but disregarding it [1]. Herding conduct in financial markets is typically viewed as a form of irrational blind investment behaviour following.

2 Literature Review

To investigate herding behaviour, Chinese scholars mostly employ the model and methodology developed by Lakonishok, Shlefer, and Vishny [2]. For instance, Shi Donghui [3] observed that from the first quarter of 1999 to the third quarter of 2000, Chinese funds exhibited a relatively severe herding behaviour. Wu and He [4] empirically

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tested the investment behaviour of open-end funds from the fourth quarter of 2001 to the first quarter of 2004. They found that China's open-end securities investment funds acted consistently in the stock market, and that this "herding" behaviour had clear industry characteristics, with a higher degree of herding behaviour in the real estate industry. Using data from 1998 to 2005, Qibin et al. [5] discovered that the herding behaviour of funds exhibited a "U"-shaped relationship with the outstanding share capital of listed companies. Furthermore, the herding behaviour characteristics of funds with different investment styles varied significantly, with growth funds exhibiting the highest level of herding behaviour, followed by hybrid funds, and value funds not existing. Li Qize et al. [6] analysed data from the first quarter of 2006 to the second quarter of 2012 and discovered that open-end funds have a board effect while closed-end funds have the smallest board effect. Meanwhile, the behaviour of China's funds demonstrates a cyclical pattern of herding. In contrast to traditional research on herding behaviour, which focuses on individual stocks, sectors, and investment styles, this paper will examine the extent and characteristics of herding behaviour among open-end funds from an industry perspective, with the hope of serving as a resource for investors.

3 Method and Data

This study examines a sample of equities and pari-mutuel funds of open-end mutual fund types from Q2 2009 to Q4 2017, excluding currency funds, QDII funds, ETF funds, LOF funds, FOF funds, and bond funds. All fund-related information is retrieved from the Guotaian CSMAR fund research database and filtered based on a set of criteria. In addition, fund position information is necessary for estimating the herding tendency of funds [7]. To simplify the research, the top ten longest positions of each fund, as reported in their quarterly reports, are chosen to examine herding behaviour at the sector level.

This study refers to the model indicators proposed by LSV [1], but modifies the application to the industry level. $HM_{k.t}$ denotes the degree of herding behavior of investment funds buying and selling stocks i in sector k in quarter t, with the following formula 1:

$$\mathrm{HM_{i.t}} = |\mathrm{P_{k.t}} - \mathrm{P_t}| - \mathrm{AF_{k.t}} \tag{1}$$

The definition of the LSV model's original measure HM would have been (2):

$$\mathrm{HM_{i.t}} = |\mathrm{P_{i.t}} - \mathrm{E(P_{i.t})}| - \mathrm{AF} \tag{2}$$

$P_{i.t}$ is the proportion of the amount of fund that buy stock i on a net basis in a given quarter t. In other words, this is the ratio of the number of stocks i bought to the number of stocks i sold. $\mathrm{E}(P_{i.t})$ is the expectation of $P_{i.t}$. Approximate substitution by the arithmetic mean $\overline{P_t}$ for a given quarter. $|P_{i.t} - E(P_{i.t})|$ is not zero. Unless the number of stocks traded by the fund tends to be unlimited, it follows that (3):

$$AF = E\left|P_{E(P_{i.t}())i.t}\right| \tag{3}$$

Similarly applying the sector level, N is the number of stocks in sector k held by fund j in that given quarter t. $holding\_chg_{i.j.t}$ represents the number of shares of stock i

in industry k that fund j changed during quarter t. The norm for industry classification is the SEC Industry Classification, 2012 Edition. $price_{i.t-1}$ is the price of stock i at the beginning of the quarter, and finally find the value of the change in share value of sector k held by fund j during quarter t (4).

$$\text{value\_chg}_{\text{j.k.t}} = \sum_{\text{i=1}}^{\text{N}} \text{price}_{\text{i.t}-1} * \text{holding\_chg}_{\text{i.j.t}} \tag{4}$$

Then each "fund-sector-quarter" sample is identified as a net buy B and a net sell S: if the value change of fund j's holdings under sector k in quarter t $value\_chg_{j.k.t} > 0$ Otherwise, the fund is marked as a net sell. The percentage of net fund purchases within sector k for each quarter t is then calculated as follows (5):

$$\text{p}_{\text{k.t}} = \frac{\text{B}_{\text{k.t}}}{\text{B}_{\text{k.t}} + \text{S}_{\text{k.t}}} \tag{5}$$

$B_{k.t}$ ($S_{k.t}$) is the number of funds net bought (sold) in industry k in period t. To ensure robustness, there must be at least five participating funds in the "sector-quarter." The aforementioned can be derived from the original measure $HM_{i.t}$, the bigger the value, the clear the fund's herding behaviour. $AF_{k.t}$ is the adjustment factor, and it is assumed that there is no herding behavior under each quarter t. The amount of net funds in the industry should follow the binomial distribution, so $AF_{k.t}$ is the same as the adjustment factor AF in the original LSV model. That is (6):

$$\text{AF}_{\text{k.t}} = \left|\text{p}_{\text{k.t}} - \text{E}\left(\text{p}_{\text{k.t}}\right)\right| \tag{6}$$

In this section, the LSV indicator from the last section is calculated using China's partial equity fund data from 2009–2017 and the "sector-quarter" sample. First, the mean values of the industry herd effect indicator (HM) for each period are assessed, then a t-test is conducted to determine whether the herd effect indicator is significant at 0, and finally, the strongest industries within each quarter are enumerated.

Temporarily, the industry herd behaviour of China's open-end equity funds exhibits a fluctuating downward trend, with a peak in the first half of 2009, followed by slight up-and-down fluctuations until the end of 2013, and HM indicators fluctuating significantly downward after a series of sharp fluctuations from the first quarter of 2014 to the fourth quarter of 2016 [9]. The flock behaviour markers for each quarter were likewise substantially different from zero at the 95% confidence level, as determined by the t-test.

The manufacturing industry (C) is the industry with the highest incidence of herding behaviour in China, with 20 of 35 quarters exhibiting the highest levels of herding behaviour. As the SEC industry division standard is split by industrial relevance, herding behaviour is more prevalent in the following industries: C17 textile industry, C18 garment industry, and C19 leather, and fur business. C30 is the industry for non-metallic mineral products, C31 is the industry for ferrous metal smelting and rolling, and C32 is the industry for non-ferrous metal smelting and rolling. Although not as frequently as the two primary categories of textiles and metals, several other manufacturing sub-sectors have also had a quarter with the highest degree of herd behaviour indicators [10]. These quarters, however, were not as common. The categories of L leasing and business services

as well as P education have the highest frequency in the non-manufacturing industry [Table 1].

Calculating further the descriptive analysis of herd behaviour inside each industry, this study finds that C41 Other Manufacturing, C33 Metal Manufacturing, and C35 Specialty Equipment Manufacturing are the three industries that have the lowest mean HM indicators within their respective sub-industries. More than five years of continuous data are available for all three industries, and the HM mean indicator is statistically significant

Table 1. China's partial equity fund data from 2009–2017 and the "sector-quarter" sample

Year	Test value	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
2009	HM mean value		0.107	0.021	0.024
	T-test		4.054	1.229	1.122
	Max(HM)		C30	C32	D
2010	HM mean value	0.022	0.055	0.032	0.03
	T-test	1.159	2.78	1.852	1.753
	Max(HM)	C25	C18	C19	E
2011	HM mean value	0.018	0.056	0.032	0.067
	T-test	1.007	3.781	2.342	3.358
	Max(HM)	A	C15	C18	C17
2012	HM mean value	0.044	0.049	0.018	0.057
	T-test	2.661	3.497	1.061	3.337
	Max(HM)	Q	I	D	S
2013	HM mean value	0.042	0.072	0.054	0.07
	T-test	2.572	3.379	3.282	4.341
	Max(HM)	C30	S	C28	G
2014	HM mean value	0.032	0.071	0.056	0.008
	T-test	2.375	4.618	3.499	0.653
	Max(HM)	C33	C36	C14	C39
2015	HM mean value	0.045	0.076	0.077	0.025
	T-test	2.297	4.251	4.103	1.724
	Max(HM)	B	L	C32	C23
2016	HM mean value	0.054	0.048	0.042	0.041
	T-test	3.328	4.223	2.76	2.755
	Max(HM)	S	L	C23	C31
2017	HM mean value	0.023	0.04	0.034	0.018
	T-test	1.765	3.295	2.56	1.654
	Max(HM)	H	P	P	C42

at the 5% level, making it worthy of reference. S General, D Electricity, Heat, Gas and Water Production and Supply, and G Transportation, Storage, and Postal Services had the three highest statistically significant HM mean values at the 5% significance level [Table 2].

By examining the aforementioned data, it is evident that the textile industry, the non-metallic and metal products industry, the electricity, heat, gas, and water production and supply industry, as well as the transportation and postal industries, exhibit more severe herding behaviour. And according to the official website of the National Bureau of Statistics, the three industries with the highest proportion of state-owned and state-controlled enterprises in 2010 were the production and supply of electricity and heat (18%), non-metallic mineral products (7%), and transportation equipment manufacturing (7%), all of which are among the industries with a higher proportion of herding behaviour, as

Table 2. Descriptive analysis of herd behaviour inside each industry

Industry	A	B	C13	C14	C15	C17	C18	C19
Sample size	30	35	35	35	35	14	29	7
mean value	0.058	0.0672	0.017	0.03	0.033	0.025	0.049	0.033
T-test	3.18	3.48	1.21	2.4	2.87	0.87	1.99	0.51
Industry	C20	C21	C22	C23	C24	C25	C26	C27
Sample size	8	18	13	9	14	8	35	35
mean value	0.019	0.039	0.029	0.079	0.035	0.134	0.04	0.031
T-test	0.61	1.35	0.99	1.27	1.38	2.41	4.15	4.58
Industry	C28	C29	C30	C31	C32	C33	C34	C35
Sample size	9	30	35	18	31	21	33	35
mean value	0.05	0.039	0.05	0.058	0.07	0.011	0.033	0.016
T-test	1.11	2.76	3.06	2.11	3.33	0.41	2.62	1.93
Industry	C36	C37	C38	C39	C40	C41	C42	D
Sample size	35	33	35	35	16	21	4	32
mean value	0.043	0.021	0.027	0.031	0.024	0.006	0.1	0.083
T-test	3.29	1.45	3.47	3.64	1.82	0.24	2.14	3.94
Industry	E	F	G	H	I	J	K	L
Sample size	35	35	35	6	35	35	35	34
mean value	0.036	0.02	0.077	0.138	0.041	0.063	0.047	0.05
T-test	2.94	1.94	4.27	1.65	3.43	6.16	5.11	3.08
Industry	M	N	P	Q	R	S		
Sample size	22	23	5	25	21	21		
mean value	0.027	0.033	0.201	0.075	0.05	0.084		
T-test	1.17	2.76	2.45	2.96	2.76	2.97		

indicated by the previous data. There appears to be a link between these two factors. It is possible to investigate the causes of herding behaviour. Regarding the study of the origins of sector-based herding behaviour in open-end equity funds, numerous ideas have been presented to explain the existence of stock-specific or sector-based herding behaviour by institutional investors. The majority of them include the following: first, managers follow highly correlated signal indicators to make decisions and the same information to make similar responses [11], which leads to research-based herding behaviour; second, managers simply imitate others and adopt the following strategy, resulting in an information flow model of following herding behaviour; and third, managers maintain reputation, which causes to reputation-based herding behaviour. The majority of these, however, are based on an investigation of the reasons of institutional investors at the level of individual stocks. According to Froot and Teo (2008), the driver of herding behaviour at the sector level may be the influence of investment style, as sectors are typically comprised of a series of companies with more distinctive characteristics, and these companies have a high degree of similarity in capitalization, book-to-market ratio, and other key indicators of interest. A group of funds may have invested in the same industry's equities due to a shared investment philosophy. While state-owned and state-controlled enterprises in China share certain similarities, many fund companies are more willing to invest in state-controlled enterprises, possibly due to their preference for similar key indicators and characteristics of state-owned enterprises, resulting in the obvious phenomenon of herding behaviour in industries with a higher concentration of state-owned enterprises [12].

4 Conclusion

This paper examines open-end funds traded in the Shanghai market from the second quarter of 2009 to the fourth quarter of 2017, classifies the top ten longest positions of fund companies by industry, analyses, compares, and tests the degree of herding behaviour among open-end fund companies at the industry level, and reaches the following conclusions: (1) According to LSV (1992)'s herding effectiveness score, China's industry-level open-end funds have low herding effectiveness. (2) In accordance with the LSV [1] herding efficiency indicator, there is herding behaviour in China's open-end funds at the industry level, with a declining trend in the degree. (3) Manufacturing industries, subdivided into non-metal and metal products, electricity, heat, gas, and water production and supply, transportation and postal services, and textile industries, account for the majority of industries with a high degree of herding behaviour. This trend may exist because Chinese open-end fund firms have a preference for the key metrics and corporate features of state-owned and state-controlled businesses. This preference, combined with a propensity for herding in certain markets, may explain the occurrence [8].

An increase in the share of institutional investors is thought to have contributed to market stability, given the LSV indicators of herding behaviour estimated in this research are generally lower than those determined by scholars before 2009. This article indicates that the SFC's "extraordinary leapfrogging" strategy has been successful in its intended purpose of sustaining the healthy growth of the stock market. The securities regulator

should keep working to increase the openness of stock market information to decrease herding behaviour induced by opaque information and to ensure that the growth of funds is steady and systematic relative to the size of the market.

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