

# Research on risk measurement of the multi-hierarchical herding behavior of the heterogeneous institutional investors

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## Abstract

Based on the modified LSV model, this paper measured the herding behavior of the 6 types of institutional investor via three aspects. We got some new findings: 1) The fund's herding behavior is the most serious in all kinds of institutional investors, and the fund shows no the professional ability in practice; 2) QFII, Trust and Broker did not do a good job as the social security fund, and even might be seen as the backward pointer of the market; 3) none of the industries owned the bigger or smaller measurement value of herding behavior for all of the institutional investors, which means all of the institutional investors will never buy or sell any industry simultaneously; 4) the social security fund invested the most in the growth enterprise market, which is quite different with our traditional conception on social security fund.

**Keywords:** *institutional investors; herding behavior; lsv model; heterogeneous*

## 1. Introduction

The market crash of A-share in 2015 has triggered a broad reflection of regulators and the financial industry, and its far-reaching impact is still continuing. The structure that retail investors accounting for the main part is often considered to be the main reason for the volatility and speculation. So the “*Opinions of the State Council on Promoting the Reform, Opening and Stable Development of Capital Market*” published in 2004 pointed out that they hoped to improve the investor structure of China's stock market with the intervention of institutional investors to promote the capital market stability. Over the past 10 years, the number and scale of institutional investors have been developing rapidly. Institutional investors have become the backbone of the Chinese stock market, so it is quite beneficial to study its investment behavior to understand the impact of the securities market and improve the relevant regulatory policy.

Nevertheless, as for opinions of the actual impact of Chinese institutional investors on the stock market, no unanimous conclusion can be drawn. Taking the "herding effect measurement, testing and behavior interpretation" as the core theme, there are a lot of empirical evidence that institutional investors not only do not stabilize market, but increase the market volatility. *Lao & Singh*<sup>1</sup> found that there was a clear herding behavior in the Chinese and Indian markets when the market was in shock. *Yao Juan et al.*<sup>2</sup> found there was a strong herding behavior in China's B-share market. *Xu Nianxing et al.*<sup>3</sup> revealed institutional investors' herd behavior contributed to the expansion of A-share market risk.

Previous researches are mainly limited to funds and QFII, while other institutional investors are rarely involved. In fact, China's institutional investors, has formed a fund-based, qualified foreign investors, trust, securities, social security funds, insurance companies, and other institutional investors combined diversification pattern now. Different types of institutional investors may have great differences in investment ideas and preferences, so that there is a big difference in herd behavior. Furthermore, few people distinguish the investment behavior differences among the bull and bear market, and discrepancies of the investment behavior of institutional investors have not been found studying at the industry or board level.

## **2. Literature review**

The popular method to measure herding behavior takes the shareholding data of the traders as the research target, like *Lakonishok et al.*<sup>4</sup> proposed that the significance of herding behavior could be measured by the indicator of the imbalance of trading volume between buyers and sellers, and studied the mutual fund of the US stock market. The results found that herding behavior is not significant. *Brown et al.*<sup>5</sup> found that institutional investors' herding effects could lead to overreacting stock prices. *Dazhi Zheng et al.*<sup>6</sup> find that industry herding generally exists in Asian stock markets.

As for the A-share market, *Xu Nianxing et al.*<sup>3</sup> found that institutional investors more played the "crash accelerator" than "market stabilizer" through the study of institutional investors' herd behavior. *Cheng Tianxiao et al.*<sup>7</sup> found that the intensity of herd behavior in QFII groups was significantly lower than that of domestic institutional investors represented by funds, showing that domestic institutions were the "bellwether" of the market volatility, and QFII was only in the position of "sheep". In summary, the current study on the herding effect of Chinese stock market is mainly limited to the fund and QFII. There is almost no comparative

study on herd behavior of other institutional investors such as social security, insurance, trust, etc. And this is exactly the starting point of this paper.

### 3. Description of measurement method of herding effect

The LSV model proposed by *Lakonishok et al.*<sup>4</sup> is chosen in this paper, for it is the most widely used method and its economic meaning is very clear. First consideration is LSV method is able to identify herding effect sensitively and the data would be used are readily available. The second reason is that the model is widely used so that it can facilitate the comparison with previous studies. If  $HM_{i,t}^k$  is marked as the measure of the herding effect of institution  $k$  for stock  $i$  at period  $t$ , the measurement method is as follows:

$$HM_{i,t}^k = |p_{i,t}^k - E[p_{i,t}^k]| - AF_{i,t} \quad (1)$$

The purchase ratio  $p_{i,t}^k = b_{i,t}^k/n_{i,t}^k$ , and  $n_{i,t}^k = b_{i,t}^k + s_{i,t}^k$ , the variables are defined as follows:

1)  $b_{i,t}^k$  is the number of buyers in the institution  $k$  of the transaction  $i$  stock, that is, the number of institutions in the institution  $k$  of the net purchase of stock  $i$  at the end of the period  $t$ . Similarly,  $s_{i,t}^k$  is the number of institutions sold for net and it is clear that  $p_{i,t}^k$  can be calculated by  $b_{i,t}^k$  and  $s_{i,t}^k$ .

2)  $E[p_{i,t}^k]$  is the expected value of  $p_{i,t}^k$ .  $|p_{i,t}^k - E[p_{i,t}^k]|$  is the distance between  $p_{i,t}^k$  and  $E[p_{i,t}^k]$ , indicating that the distance between the current distance and the mean is the average difference of  $p_{i,t}^k$  in  $t$ , which represents the degree of dispersion of  $E[p_{i,t}^k]$ . Without considering the adjustment factor  $AF_{i,t}$ , the larger the value of  $HM_{i,t}^k$  in phase  $t$ , the greater the degree of dispersion of  $p_{i,t}^k$ .

3)  $AF_{i,t}$  is the adjustment factor. Obviously,  $|p_{i,t}^k - E[p_{i,t}^k]|$  will be greater than zero even if there is no herding effect in the market.  $AF$  overcomes the shortcomings of the initial measure  $HM$ . The specific performance for the value is too large, even if there is no herding effect,  $HM$  value will still be great. The specific measurement of the adjustment factor  $AF$  can be expressed as follows:

$$AF_{i,t} = E|p_{i,t}^k - E[p_{i,t}^k]| = \sum_{j=0}^{n_{i,t}^k} \left[ C_{n_{i,t}^k}^j (E[p_{i,t}^k])^j (1 - E[p_{i,t}^k])^{n_{i,t}^k - j} \times \left| \frac{j}{n_{i,t}^k} - E[p_{i,t}^k] \right| \right]$$

(2)

In order to distinguish the difference between the buyer's and the seller's herding effect, we adopt the method in Wermers (1999), which defines the buying sheep measure value  $BHM$  and the selling herding effect value  $SHM$ . Specific definitions are as follows:

$$BHM_{i,t}^k = HM_{i,t}^k | p_{i,t}^k > E[p_{i,t}^k] \quad (3)$$

$$SHM_{i,t}^k = HM_{i,t}^k | p_{i,t}^k < E[p_{i,t}^k] \quad (4)$$

The average of  $BHM_{i,t}^k$  and  $SHM_{i,t}^k$ , are set to  $\overline{BHM}$  and  $\overline{SHM}$ , representing the mean.

#### **4 Data selection and processing instructions**

##### ***4.1 Data collection and classification***

The data of institutions' holdings is from the WIND database, including top ten outstanding shares in annual reports of all listed companies, and funds & brokerage collection of financial assets management report. The sample period is 2005.Q4~2015.Q4 quarter. As the fund discloses complete holdings of information every six months, and brokers only disclose their complete portfolios at the end of some years, both of them disclose top ten shares of the shareholding portfolio quarterly, the rest of the type of institutions do not disclose their holdings. Therefore, this article mainly collects the institutional holding data according to the top ten outstanding shareholders of the listed company's statements.

This paper also studies the herding at the industry level. In accordance with the guidelines for the classification of listed companies revised by the SFC in 2012, the listed companies can be classified into 19 industries such as agriculture, forestry, animal husbandry and fishery, mining and manufacturing. Using the portion of the market value of each sector accounted for A-share market value as a reference, the number of listed companies in the three sectors of "services, education, health, and social work" is too scarce to support the robustness of the herding measure, so we have these industries removed.

##### ***4.2 Data processing***

The shareholding changes are divided into the following two cases: First of all, assume that the institution  $m$  from  $k$  kinds of institutions in period  $t$  holds  $x$  shares of stock  $i$ , and the institution  $m$  from  $k$  kinds of institutions in period  $t-1$  holds  $y$  shares of stock  $i$ . If  $(x-y)>0$ , then it is recorded as net purchase, the value of  $b_{i,t}^k$  pluses 1. If  $(x-y) <0$ , then it is recorded as net selling, the value of  $s_{i,t}^k$  pluses 1. If  $(x-y) = 0$ , it indicates that the institution has no operation in the current period and does not count the statistics. Second, suppose that there is no stock  $i$  in the institution  $m$  of the  $k$  kinds of institutions in  $t$  period, and when the institution  $m$  in the  $t-1$  period of  $k$  class of institutions holds  $y$  shares of stock  $i$ , the value of pluses 1 (the equivalent of being sold out). Because LSV is very sensitive to the number of shares held by the organization, and because original intention of the herding effect is the bandwagon effect, the number of organizations is too small to explain the problem, so the samples whose sums of  $s_{i,t}^k$  and  $b_{i,t}^k$  are less than 3 are removed during the processing process. We use R language programming, and the results are summarized in Tables 1 to 3.

## **5. The empirical study on herding effectiveness of heterogeneous institutional investors**

### ***5.1 Market level—Herding effect in the ups and downs***

According to the actual trend of Shanghai Composite Index, the whole sample range of 2005.Q4~2015.Q4 is roughly divided into several rising or falling stages: 2005.Q4~2015.Q4 is the rising stage I of the market, 2008 for the whole year is falling stage I ; 2009.Q1~2009.Q3 is the rising stage II of the market, 2009.Q4~2014.Q3 is shrinkage down stage II ;2014.Q4 ~2015.Q2 is the rising stage III, the third and fourth quarters of 2015 is the falling stage III. Table 1 measures the behavior of different institutional investors in various rising / falling ranges. The sample value in parentheses refers to the number of shares traded by more than three institutions in the current period.

Table 1 shows that, in the case of QFII, both of buying and selling values of the herding effect are decreasing, i.e. the phenomenon of "buy with the sale" is weakening. The reason is that the proportion of QFII in China's professional organizations has been maintained at a certain level with little change. But its sample number included in the statistics of the stock - quarterly has been declining after peaking at 2006 and 2007. Although rebounded during the bull market in 2015, the overall trend was downward. It can be seen that the holdings of various institutions have been becoming increasingly different, which is undoubtedly beneficial to improve the institutional shareholding structure of China's capital market.

Compared with other institutional investors, regardless of the average buying ratio and the buying or selling value of herding, the herding behavior of the fund is the most prominent. It does not show professional ability. Similar to the retail investors, the fund tends to choose similar outstanding stocks in the bull and sell similar stocks in the bear. Since the change in the value of the herding effect is not significant at different stages, it indicates that the effect of the bull / bear market on the buying and selling the fund is not great, forming a contrast to QFII. As a result of the performance pressure, funds tend to buy and sell shares with other funds in the hope that their yield will be no less than other funds.

The average buying ratio, herding buying value and sheep selling value of insurance and social security funds maintain the lowest level in these 6 kinds of institutions in different periods, which shows that the insurance and social security investment philosophy is more rational, relatively independent decision-making and insurance and social security are relatively mature institutional investors. The entry to the market of the insurance and social security funds is mainly aiming on the protection of public money and the resistance of

inflation pressure. The funds have little incentive for short-term high returns and more concern with long-term stable returns. Besides, they have specialized teams as the technology support of the investment decision-making, so that their herding behavior is not obvious.

*Table1-* Herd behavior measurement of institutional investors in the rising and falling stages

Institution		Rising I	Falling I	Rising II	Falling II	RisingIII	FallingIII
QFII (QF)	$\bar{p}$	0.64 (313)	0.39 (69)	0.61 (39)	0.56 (231)	0.43 (96)	0.47 (39)
	$\overline{BHM}$	8.45 (175)	5.78 (35)	6.57 (22)	5.07 (121)	4.54 (48)	-0.98 (17)
	$\overline{SHM}$	16.32 (138)	7.23 (34)	15.55 (17)	8.28 (110)	4.47 (48)	2.83 (22)
Social Security (SS)	$\bar{p}$	0.54 (164)	0.63 (23)	0.45 (30)	0.78 (387)	0.54 (227)	0.50 (133)
	$\overline{BHM}$	3.97 (72)	2.81 (12)	7.81 (13)	25.14 (210)	-0.61 (128)	2.80 (66)
	$\overline{SHM}$	-1.86 (92)	5.19 (11)	0.36 (17)	3.52 (177)	5.77 (99)	1.86 (67)
Insurance (IS)	$\bar{p}$	0.55 (186)	0.50 (88)	0.51 (86)	0.52 (1175)	0.55 (138)	0.54 (122)
	$\overline{BHM}$	6.01 (89)	-2.48 (44)	-0.41 (45)	1.73 (603)	6.75 (73)	0.98 (69)
	$\overline{SHM}$	4.16 (97)	-2.63 (44)	1.59 (41)	3.15 (572)	10.77 (65)	7.80 (53)
Trust (TR)	$\bar{p}$	0.56 (94)	0.35 (35)	0.54 (27)	0.54 (2002)	0.54 (1008)	0.35 (438)
	$\overline{BHM}$	1.78 (51)	11.49 (16)	7.07 (15)	4.43 (1027)	5.09 (514)	8.62 (211)
	$\overline{SHM}$	5.44 (43)	6.69 (19)	13.37 (12)	6.25 (975)	6.47 (494)	6.86 (227)
Broker (BR)	$\bar{p}$	0.52 (114)	0.45 (11)	0.11 (3)	0.53 (1995)	0.53 (209)	0.42 (128)
	$\overline{BHM}$	6.14 (54)	0.64 (6)	-2.62 (1)	2.37 (1096)	12.20 (105)	14.01 (55)
	$\overline{SHM}$	3.05 (60)	5.29 (5)	-1.31 (2)	7.59 (899)	11.55 (104)	5.47 (73)
Fund (FD)	$\bar{p}$	0.53 (3950)	0.50 (1762)	0.56 (936)	0.51 (17627)	0.56 (4848)	0.53 (2728)
	$\overline{BHM}$	12.24 (1974)	13.08 (897)	10.87 (459)	11.43 (8542)	11.82 (2224)	9.29 (1300)
	$\overline{SHM}$	10.37 (1976)	12.21 (865)	10.81 (477)	10.15 (9085)	11.11 (2624)	8.34 (1428)

## 5.2 Comparison of herding behavior at industry level

Table 2- Herding effect of heterogeneous institutional investors in different industries

Industry	QF	SS	IS	BR	TR	FD	Industry	QF	SS	IS	BR	TR	FD
<i>BHM</i>	14.4	0.4	5.1	4.9	5.8	13.2	Information	16.2	0.8	-2.9	-0.2	1.6	15.6
Agriculture,	6	6	22	19	22	215	technology,	6	24	25	60	65	725
<i>SHM</i>	5.4	2.4	2.0	6.4	6.4	13.1	Software	4.4	2.5	3.0	4.2	8.5	7.9
Forestry, etc	5	8	12	13	28	245	services	9	27	21	45	60	723
<i>BHM</i>	3.0	0.3	6.0	3.2	5.5	11.7		-2.7	-9.6	23.0	4.8	-0.2	15.7
	26	8	35	45	28	438	Finance	13	7	9	11	10	320
<i>SHM</i>	10.4	5.3	0.1	5.7	2.1	14.7		4.7	-	15.3	8.0	11.4	13.6
Mining	18	6	44	36	33	548		9	-	13	9	12	371
<i>BHM</i>	7.4	0.6	3.3	4.5	6.3	12.7		6.2	0.1	4.2	2.2	6.8	9.8
	278	299	538	782	1165	8731	Real Estate	30	17	33	86	106	837
<i>SHM</i>	10.9	4.0	3.0	6.2	5.5	10.6		6.6	2.1	2.4	6.2	7.9	10.9
Manufacture	228	221	566	739	1216	9664		20	10	23	80	109	977
<i>BHM</i>	0.8	4.0	-1.0	3.3	2.3	8.9		3.4	3.1	-3.4	18.1	-8.5	12.1
	21	25	31	32	64	632	Leasing and	7	7	11	14	11	155
<i>SHM</i>	5.9	-4.2	6.3	7.9	9.6	12.2	Business	13.5	1.7	-0.3	15.6	3.2	10.5
Electricity,	20	21	33	34	53	594	services	6	9	11	13	8	160
Heat, Gas and													
Water													
<i>BHM</i>	-3.8	-2.4	-1.1	2.4	1.0	13.0		-	-	14.8	0.6	-5.9	17.2
	15	10	17	26	39	347	Scientific	-	-	2	8	10	66
<i>SHM</i>	12.9	3.6	2.9	3.2	8.4	12.1	and Technical	-	-	24.3	8.4	5.5	8.3
Building	12	9	13	23	28	402	services	-	-	1	6	11	61
<i>BHM</i>	9.6	-0.7	2.7	1.6	4.5	11.0		-	-2.2	-	-	12.1	13.7
	21	22	50	78	83	896	Public	-	22	-	-	21	151
<i>SHM</i>	8.1	-1.4	0.6	7.5	3.6	10.0	Facilities	-	2.8	-	-	7.5	8.3
Wholesale	15	17	68	70	99	988	Management	-	11	-	-	20	158
and Retail													
<i>BHM</i>	4.3	1.7	3.9	1.4	1.6	7.6		-	-5.3	0.6	13.2	8.2	16.5
	49	19	34	49	46	611	Culture,	-	8	27	5	18	147
<i>SHM</i>	5.5	-0.8	1.1	9.0	7.2	12.9	Sports and	-	7.2	3.7	20.2	11.0	8.8
Transport,	41	21	40	40	43	638	Entertainment	-	6	28	8	19	178
warehousing,													
etc													
<i>BHM</i>	-	-	-4.9	2.6	15.6	9.3		-	-	-	5.2	2.0	6.7
	-	-	6	12	4	70	Synthesis	-	-	-	19	17	144
<i>SHM</i>	-	-	-8.0	6.2	-9.1	13.4		-	-	-	8.1	10.7	12.6
Accommo-	-	-	4	10	8	62		-	-	-	20	18	143
dation and													
Catering													

First of all, we directly observe the differences of herding effect of different institutions in various industries, and the numbers in the second row of each block represent the number of stocks. Table 2 shows that industries having greater purchase herding effect of QFII are agriculture, forestry, animal husbandry and fishery valued 14.4, manufacturing(7.4), wholesale and retail(9.6), information transmission, software and information technology



services(16.2); industries with greater selling herding effect are mining(10.4), manufacturing (10.9), construction(12.9), leasing and business services(6), which reflect the industry trading preference of QFII. Similarly, the top three industries of buying herding effect with the fund's preference are scientific research, culture and finance. Insurance and social security funds have negative herd measure value in many industries, leading to a small overall herding effect. Water conservancy and public facilities management valued 12.1 has the greatest herding effect of the trust while finance has the greatest selling herding effect of the trust valued 11.4. As for the broker, leasing and business services has the highest buying herd measure value of 18.1, also with the highest selling herd measure value, which reflects the broker's preference on the speculation of leasing business services.

Secondly, observe the herd behavior differences from horizontal (Different institutions in a same industry) point of view. Firstly, we find which industries trades more frequently compared with all institutions. This can be reflected by the number of trading shares in brackets in Table 2. The sample sizes of QFII and social security are both around 840. The sample size of insurance is about 1700, two times as much as the QFII and social security's. Brokers' sample size 2400 is as about 3 times as QFII's. 3400 samples of the trust is about 4 times of QFII's. The number of traded shares involved in the fund is always the highest. For most industries like manufacturing, the sample size of different institutions is roughly in accord with the overall proportion above. The exception is that QFII has a total of 90 samples of the transport warehousing postal industry, which is the largest among all institutions except funds. For the financial industry, QFII has the same bias. Table 2 also shows that, for a particular industry, none of any industry is bought or sold at the same time by all institutions.

### ***5.3 Board Level***

The differences of characteristics on various boards are large, which will definitely have impacts on investment decision-making and investment preference of institutional investors. Table 3 shows that QFII, the social security, insurance, trust, broker and fund all have a significant herding effect on GEM (Growth Enterprise Market), SME (small and mid-size enterprise) and main-board. The herding measure values in both buying and selling herding behavior of all kinds of institutions on GEM are the highest. Meanwhile, the buying and selling herd measure values of institutions on the main-board of Shanghai and Shenzhen market are generally the lowest. The value of SME is between the main-board's and GEM's. This indicates that all institutions shows a phenomenon of "main-board's herding effect is



weaker than SME's and SME's herding effect is weaker than GEM's" in general, indicating that GEM is most likely to present the risk of skyrocketing and plummeting.

*Table3- Herding effect of heterogeneous institutional investors in different boards*

	Institution	Mainboard	SME	GEM	Institution	Mainboard	SME	GEM
BHM	QFII	5.53	9.47	0.35	Trust	5.67	6.55	8.61
		(417)	(44)	(4)		(939)	(542)	(230)
SHM	QFII	11.33	10.35	16.16	Trust	4.78	5.77	5.57
		(341)	(42)	(2)		(1077)	(578)	(247)
BHM	Social Security	0.54	-0.81	0.60	Broker	4.60	4.22	2.24
		(345)	(102)	(68)		(889)	(226)	(155)
SHM	Social Security	2.53	4.41	10.56	Broker	6.58	7.25	7.46
		(266)	(93)	(43)		(817)	(231)	(153)
BHM	Insurance	1.36	5.89	9.83	Fund	10.71	13.43	18.24
		(589)	(275)	(19)		(10008)	(3950)	(1742)
SHM	Insurance	1.91	4.99	14.84	Fund	9.85	9.63	7.38
		(643)	(259)	(10)		(11445)	(4369)	(1665)

As can be seen from the herd index of QFII in GME, QFII rarely holds GEM shares, and the volume of SME shares is also a little. In particular, the selling herd measure value of QFII on the three boards has always been high, the highest of all institutions, which illustrates that no matter in which A-share board, QFII did not play a role stabilizing the market. In addition, the investment proportion of social security on GEM is large, the greatest in six types of institutions. The social security has a very significant selling herding effect on GEM (Although its buying herd behavior is not obvious). This unexpected discovery is much different from the traditional idea that social security generally prefer the large blue chip in main-boards, helping us to re-understand the investment philosophy and behavior of social security. Insurance institutions and social security funds have a similar performance generally, and the difference is that the buying and selling herding effect of the insurance on SME is more significant than those on other boards.

Differing from the significant plate effect of QFII, social security and insurance, the board investment difference presenting by the buying and selling herd measure values of the trust and broker is much less. Even the trust selling herd measure value of the trust on SME is 5.77, larger than the GEM selling herd measure value 5.57. The buying herd value of the broker on SME is 4.22 which is also larger than 2.24 of the GEM. The fund has a severe plate effect in the buying direction of herding effect, the buying herd measure values in the main-board, SME and GEM are 10.71, 13.43 and 18.24. The increase is very obvious. However, the selling herd value is decreasing which shows that it could be a sign of "quitting the main-

board and SME and holding on GEM" of the fund. This can also be obtained from the fact that the buying herd value 18.24 is far larger than its selling herd value 7.38.

## **6. Conclusions**

This paper measures the herd behavior of different heterogeneous institutional investors from the market, industry, board three levels. The main discoveries at the market level are: 1) Herding behavior of the fund is the most prominent in all institutions and the fund does not reflect professional investment capacity. 2) Social security and insurance fund have kept relatively low herding behavior in different periods, and they are relatively mature institutional investors. 3) QFII, the trust and broker not only failed to buy before the surge and sell before the crash like social security funds, sometimes they even did the opposite and became a "reverse index" in the two transitions of the bull and bear.

At the level of industry, the study reveals the trading preference of heterogeneous institutional investors, providing an investment reference for other investors to follow specific investment institutions. And the empirical study has not found that for a particular industry, all institutions have a large or small herd measure value at the same time, which demonstrates that the investment preferences of different types of institutional investors are heterogeneous. It is not possible for all institutions being consistent with buying or selling in a same industry. And that is beneficial for the stability of A-share market.

At the level of board, the main findings are: 1) On the phenomena of QFII, social securities, trusts, brokers and funds all showing "main-board herding effect is weaker than SME's, SME's herding effect is weaker than the GEM's"; 2) The relative proportion of the social security fund on GEM is the largest among the 6 types of institutions, and the herding behavior on GEM is very prominent. This has considerable differences with the traditional concept that the social security usually prefers the big blue chip board. 3) Although the fund always has a strong buying herding effect, the extent of various boards are different. There may have signs of "quitting main-board and SME and buying GEM" existed.

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