Stock Mispricing Differentiate the Motives for Mergers and Acquisitions：

Based on the Post-acquisition Market Evidence from China

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Abstract: This study uses a recently developed theory and technique to examine post-acquisition evidence as to the motives for mergers and acquisitions(M&As), and decomposed the M/B ratio into three components: firm-specific error, time-series sector error, and long-run value-to-book. We make a multidimensional grouping according to the frequency of M&As , payment method, proportion of shares acquired, M/B ratio before the merger and total assets of the acquirers before the merge. The results confirm that M&As involve multiple motives, such as market timing, industry and economic shocks, agency and hubris. Using a sample of 2,035 M&As in China, we find that 59% are related to market timing, 68% are related to agency and hubris, 21% are related to industry and economic shocks, 51% are related to multiple motives. Our empirical research finds that the main motives for M&As of listed companies in China are value-decreasing, which have negative impact on the acquirers' sustainable development.

1 Introduction

The motives for mergers and acquisitions(M&As) are not only the determinant of M&As methods and targets, but also the driving force that guides M&As activities towards the expected goals. Scholars at home and abroad have conducted extensive research on the causes of M&As using different methods. Some scholars use the content analysis method to study announcements and media disclosure of merger motivations, but the acquirer sometimes does not disclose motivations or conceal substantial motivations. Market data such as stock abnormal returns are used to evaluate merger motivations, but the conclusions of the event research method are often biased (Shleifer et al., 2003 [1] and Rhodes-Kropf et al., 2004 [2]). Therefore, this paper adopts the technical method developed by Rhodes-Kropf et al. (2005) [3] to overcome the incomparable problem of the methods commonly used in previous research to test the different motivations of M&As, and to provide evidence of Chinese capital market that the stock mispricing distinguishes multiple merger motivations.

2 Literature review and research hypothesis

Acquirer motivation can be classified as value-increasing and value-decreasing, and mixed motivation. There are many motivations for value-increasing M&As, including increasing market power, coping with industry shocks, pursuing economies of scale, financial

coordination, technical coordination and tax planning, etc. Value-increasing M&As can promote the sustainable development of enterprises and social economy. Eckbo (1985) find that competitors enjoy positive abnormal returns in the acquisition announcement [4]; Hayn (1989) find that depreciation related tax preferences is one of the motivations of M&As[5]; Healy et al. (1992) support the argument of operational coordination. They find that the acquirers have higher operating efficiency [6]; Ghosh and Jain (2000) support the financial synergy argument by proving that the financial leverage increases significantly after a merger [7]; Hoberg and Phillips (2010)[8], Jan and Kai (2014)[9] and other studies find that the pursuit of market and technology synergy of products are both important driving factors for M&As; Weston and Chung (1990) [10], Alexei (2013) [11] , Okoeguale and Loveland (2017) [12] confirm the argument that industry shock is the motivation of M&As.

There are three types of value-decreasing motives for M&As: agency, arrogance and market timing. Value-decreasing M&As hinder the sustainable development of enterprises and social economy. Agency problem refers to managers' consumption privileges at the expense of shareholders' interests. Shleifer et al. (1989) [13], morck et al. (1990) [14], Loughran et al. (1997) [15], RAU et al. (1998) [16], Andrade et al. (2001) [17] study that M&As are driven by management objectives. Even if M&As can reduce the long-run value of the company, the managers of the acquired company will still implement M&As for their own interests. Arrogance is the second motivation of impairment M&A. Roll (1986) [18] propose the hypothesis that managers' self-sufficiency lead to M&A. After that, Hayward and Hambrick (1997) [19], Barnes (1998) [20] and Moeller (2004) [21] and other research results show that many managers paid excessive merger costs because of arrogance. Market timing is also one of the causes of impairment M&As. Shleifer et al. (2003) introduce a model to study and find that acquirers with overvalued stocks use stocks to purchase relatively undervalued targets, and acquisition is basically driven by the stock market [1]. Rhodes Kropf et al. (2005) introduce a market timing model different from that of Shleifer et al. (2003) [1], which further provide empirical support for market time maneuver [3]. Dong et al. (2006) further support the theory of market timing. They find that the average market value of the acquisition company is higher than that of the target company; the overvalued acquisition company prefer to use stocks as the payment method for M&As; and the abnormal return of the high valuation acquirer decreases after a merger [22]. Alzahrani et al. (2014) find that firm-specific and Industry mispricing are the main driving factors of investment behavior [23].

There are also some scholars who study M&As may involve a variety of motivations. Amihud and Lev (1981) suggest that corporate diversification enables companies to achieve more stable business performance while reducing the risk of human capital [24]. Shleifer et al. (1989) find that some M&As are conducive to the long-run growth of the acquiring company, as well as improving acquiring manager's job security [13]. Berkovitch and Narayanan (1993) make an empirical study of M&As in the UK and conclude that M&As may involve a variety of motivations, including synergy, hubris and agency [25]. Mrhrotra et al. (2011) conduct an

empirical study on Japanese M&As, and find that value-decreasing M&As involve a variety of conflicting motivations [26]. HIEN et al. (2012) empirically study M&As in the United States, and also confirm that value-increasing motives and value-decreasing motives for M&As coexist[27]. Rhodes Kropf and Viswanathan (2000 [28], 2004 [2], 2005 [3], henceforth RKRV) are the founders of the capital market driven M&As theory. Through mathematical derivation and empirical analysis, the impact of market value on the M&As wave is studied. It is found that the higher the stock is overvalued and the lower the M&As financing cost is, managers are more likely to implement M&As, and the wave of M&As will rise in bull market. RKRV method has also been widely used in the follow-up [28] [29] [30], but it mainly focuses on the correlation between the market to book(M/B) ratio and the wave of M&As, the payment method of M&As and the performance of M&As. Based on the research of RKRV, we study the M / B ratio of Chinese M&As, not only comparing the M/B ratio components of merger companies and non-merger companies, but also further testing the M / B ratio of the enterprises before and after the merger to infer the potential merger motivations.

According to RKRV, the M/B ratio can be decomposed into three components: the difference between the firm's market value(m_{it}) and the fundamental value implied by industry averages at time t($v(\theta_{it};\alpha_{jt})$), i.e. firm-specific error; the difference between the firm's fundamental value implied by industry averages at time t ($v(\theta_{it};\alpha_{jt})$ and fundamental value implied by long-run industry averages($v(\theta_{it};\alpha_j)$), i.e. time-series sector error; the difference between the firm's fundamental value implied by long-run industry averages ($v(\theta_{it};\alpha_j)$) and book value(b_{it}), i.e. the long-run value to book. The decomposition is written as model 1:

$$m_{it} - b_{it} = m_{it} - v(\theta_{it};\alpha_{jt}) + v(\theta_{it};\alpha_{jt}) - v(\theta_{it};\alpha_j) + v(\theta_{it};\alpha_j) - b_{it} \qquad (1)$$

The change of the firm-specific error after the merger is enough to indicate that the market has realized that the firm's common stock is overvalued or undervalued. Therefore, we believe that the change of the firm-specific error is suitable for tracking the market timing as a merger motivation. Based on the above capital market driven M&As theory, the following assumptions are put forward:

Hypothesis 1A: The firm-specific error of the acquiring firm will be significantly greater than that of the non-merger firm.

Hypothesis 1B: If market timing is the motive, the firm-specific error of the acquiring firm will experience positive or negative correction.

Hypothesis 1C: Compared with cash payment, the firm-specific error of the acquiring firm of stock payment will experience more positive or negative correction.

The second component of M/B in the RKRV model is time-series sector error, which means that frims are likely to take acquisitions to respond to industry and system shocks. Therefore,

the change of this part can be used to represent the merger motivation of industry or economic shock response. Therefore, the following assumptions are proposed:

Hypothesis 2A: The time-series sector error of the acquiring firm is significantly greater than that of the non-merger firm.

Hypothesis 2B: For M&As motivated by industry and economic shocks, the time-series sector error of the acquiring firm after the acquisition will experience positive or negative correction.

The last component of M/B ratio is the difference between the long-run value and the book value, reflecting the long-run growth opportunities, which is applicable to tracking the merger motivations related to agency, arrogance or synergy. As the long-run value of the acquiring firm decreases, the motivation of M&As tends to be arrogant and agency problem of the management; as the long-run value of the acquiring firm increases, the motivation of M&As may be related to synergy. Therefore, the following assumptions are proposed:

Hypothesis 3A: The difference between the long-run value and book value of the acquiring firm is significantly greater than that of the non-merger firm.

Hypothesis 3B: If the merger is driven by synergy (agency and arrogance), the difference between the long-run value and book value of the acquiring firm will increase (decrease) after the merger.

3 Sample selection and variable definition

3.1 Sample selection and data source

Considering that the share reform of listed companies in China has been completed by the end of 2006, the research window period is from three years before the merger to three years after the merger, therefore, this paper selects the A listed companies of Shanghai and Shenzhen Securities Exchange that announced and completed the merger plan from January 1, 2010 to December 31, 2014 as the study subject, and the research window period is from January 1, 2007 to December 31, 2017. The relevant information of M&As transactions and the financial data of listed companies over the years are all from GuoTai'an database. According to the condition screening, we get 2035 M&As transactions, involving 1111 acquiring companies, excluding the companies whose time from listing to M&As is less than 3 years, backdoor listing and data missing. In this paper, the listed companies with the most similar asset size in the same industry and no M&As in the research window are selected as the matched samples, and the profitability and solvency are also considered as the matched samples for the robustness test. Table 1 shows the frequency distribution of merger transactions by year and payment method. Of the 2035 merger transactions, 69.98% are cash payment acquisitions, 14.50% are stock payment acquisition, 13.66% are stock plus cash combination payment acquisition, the remaining 1.86% are asset payment and other payment

methods. It can be seen that cash payment is the main payment method of Chinese enterprise M&As. Python is used for data processing and analysis. In 2012, the number of merger transactions was the most and the average transaction value was the highest. In 2014, the number of merger transactions was the least, 4.38 times more than that in 2012; the total deal value is the highest, 4.14 times more than that in 2011.

Table 1

Frequency Distribution of Merger Transactions by Year and Payment Method

Year	All-cash	All-stock	Cash&Stock	Assets	Assets&Cash	Assets&Stock	Total	Total Deal value(million)	Average Deal value(million)
2014	525	84	161	3	3	3	779	7,642,501.02	9,810.66
2013	324	74	67	1	2	3	471	2,452,960.90	5,207.99
2012	115	44	13	4	1	1	178	2,053,095.98	11,534.25
2011	182	38	19	–	1	4	244	1,846,229.54	7,566.51
2010	278	55	18	10	1	1	363	3,472,827.70	9,567.02
合计	1,424	295	278	18	8	12	2,035	17,467,615.13	8,583.60

3.2 Research model and variable design

RKRV market value prediction model (model 2) considers market value influencing factors such as asset size, profitability and leverage, and conducts annual (i) cross-sectional regression analysis by industry (j) to obtain short-run and long-run regression coefficients(α) of each industry to estimate the industry short-run and long-run value of each company.

$$\ln(m_{it}) = \alpha_{0,jt} + \alpha_{1,jt}\ln(B_{it}) + \alpha_{2,jt}\ln(NI)_{it}^{+} + \alpha_{3,jt}I_{(<0)}\ln(NI)_{it}^{+} + \alpha_{4,jt}LEV_{it} + \varepsilon_{it} \tag{2}$$

The definitions and descriptions of each variable are shown in Table 2.

Table 2

Definition and Description of Variables

Variables	Description of Variables
m_{it}	Sum of total market value and total debt
B_{it}	Total assets
$(NI)_{it}^{+}$	Absolute value of net profit
$I_{(<0)}$	Dummy variable, when NI is less than 0, it is 1, otherwise 0

LEV_{it}	Asset liability ratio

We comprehensively consider the data non-stationary and prediction accuracy, and use the influence factors of RKRV model for reference, and apply the long short term memory network (LSTM) method (model 3) to predict the short-run and long-run basic industry value(h) of each company, wherein, the short-run basic value refers to the basic value implied by the industry average value in time t; the long-run basic value refers to the basic value implied by the industry average in the long-run(3 years in this paper).

$$z_t = \sigma(W_z \cdot [h_{t-1}, x_t])$$
$$r_t = \sigma(W_r \cdot [h_{t-1}, x_t])$$
$$\tilde{h}_t = \tanh(W \cdot [r_t * h_{t-1}, x_t])$$
$$h_t = (1 - z_t) * h_{t-1} + z_t * \tilde{h}_t \tag{3}$$

4 Empirical analysis results

Table 3 reports the average M/B ratio of acquirers three years before and up to three years after M&As. The average M/B ratio of one-time acquirers shows a downward and then upward trend of repeated volatility, and the average M/B ratio of active acquirers show a trend of fluctuating downward.

Table 3

Average Change of M/B Ratio Before and After M&As

Ln(M)-Ln(B)	All acquirers	One-time acquirers	Active acquirers
Num.	2035	626	1409
Three years before event	1.3577	1.3431	1.3643
Two years before event	0.9915	0.9213	1.0223
One year before event	1.0581	1.058	1.0581

M&As year	1.209	1.4373	1.1075
One year after event	1.2014	1.3315	1.1436
Two years after event	1.0985	1.1937	1.0562
Three years after event	1.123	1.4222	0.99

Table 4-1 and Table 4-2 show the three components and their changes of the M/B ratio in one year, two years and three years after the M&As, report the three components of the M/B ratio in the three event windows of the whole samples and their subsequent changes, and compare the merger group with the non-merger group. In addition, the samples are grouped according to the frequency of M&As, payment method, proportion of acquired shares and M/B ratio before M&As.

Table 4-1

The Three Components of M/B

Mispricing Error	Firm-specific Error				Time-series Sector Error				Long-run Value			
Event windows[year]	0	1	2	3	0	1	2	3	0	1	2	3
Panel a. Post M&As: All Acquirers												
Acquiring Firms' Mean	−0.0481**	0.1135***	0.1587***	0.1315***	0.4494***	0.4629***	0.3859***	0.3038***	0.8076***	0.6256***	0.5547***	0.6875***
Panel b. Post M&A: Acquiring Firms vs. Non-merger Firms												
Non-merger Firms' Mean	−0.1924***	−0.1936***	0.0646***	0.0937***	0.2666***	0.1792***	0.111**	0.0184	1.1195***	1.1281***	1.1141***	1.1448***
Difference	0.1443***	0.3071***	0.0941***	0.0378**	0.1828***	0.2837***	0.2749***	0.2854***	−0.3119***	−0.5025***	−0.5594***	−0.4573***

Table 4-2

The Three Components of M/B Correction

Mispricing Error Correction	Firm-specific Error Correction			Time-series Sector Error Correction			Long-run Value Correction		
Event windows[year]	[0,1]	[0,2]	[0,3]	[0,1]	[0,2]	[0,3]	[0,1]	[0,2]	[0,3]
Panel A. Post M&A Correction: All Acquirers									
Acquiring Firms' Mean	0.161***	0.2059***	0.1798***	0.0135	-0.077***	-0.0821***	-0.182***	-0.2529***	-0.1201
Panel B. Post M&A Correction: Acquiring Firms vs. Non-merger Firms									
Non-merger Firms' Mean	0.2566***	0.2855***	0.2516***	-0.0874***	-0.1556***	-0.2482***	0.0086***	-0.0054	0.0253
Difference	-0.0956***	-0.0796**	-0.0719*	0.1009***	0.0787**	0.1662***	-0.1906**	-0.2476*	-0.1454
Panel C. Post M&A Correction: One Time Acquirers vs. Active Acquirers									
One-time acquirers' Mean	0.1853***	0.2368***	0.1913***	0.0169	-0.0839**	-0.0506*	-0.308**	-0.4135**	-0.0888
Active acquirers' Mean	0.1502***	0.1922***	0.1746***	0.0119	-0.739***	-0.0961***	-0.1261*	-0.1816**	-0.1341
Difference	-0.0038	-0.0227	-0.0263	-0.0178	-0.0485	0.075	-0.1399	-0.3024*	-0.0878
Panel D. Post M&A Correction: Stock vs. Cash Payers									
Stock Payers	0.2201*	0.366***	0.3843***	0.1215	-0.2491**	-0.247***	-0.7335**	-0.9641***	-0.5444
Cash Payers	0.119***	0.152***	0.156***	-0.0417***	-0.0498**	-0.0203*	-0.1029*	-0.0821	-0.015
Mix Payers	0.3305***	0.3174*	0.0974*	0.1535	-0.0437	-0.232***	-0.246***	-0.3333***	-0.1564**
Difference (Stock-Cash)	0.1135	0.1981*	0.1697	0.1961*	-0.1905*	-0.2582***	-0.5558*	-0.7732**	-0.4232

Mispricing Error Correction	Firm-specific Error Correction			Time-series Sector Error Correction			Long-run Value Correction		
Event windows[year]	[0,1]	[0,2]	[0,3]	[0,1]	[0,2]	[0,3]	[0,1]	[0,2]	[0,3]
Difference (Stock-Mix)	-0.1115	0.0615	0.3079**	-0.0298	-0.2054*	-0.0308	-0.382	-0.556	-0.5742*
Difference (Cash-Mix)	-0.221***	-0.1493**	0.1232	-0.214**	-0.0103	0.24***	0.0303	0.0922	-0.0216
Panel E. Post M&A Correction: By Proportion of Shares Acquired									
⩽10%	0.1962***	0.1713***	0.103**	-0.0847	0.0012	-0.026	-0.0115	-0.0993	0.1769
(10%, 100%]	0.131***	0.1728***	0.1727***	-0.043*	-0.0785**	-0.0382***	-0.044	-0.0997	-0.0863
=100%	0.2047***	0.2685***	0.2066***	0.1278***	-0.0897**	-0.1669***	-0.4477***	-0.5407***	-0.2352
Group 3- Group 1	0.2531	0.3118*	0.3215*	0.3012	-0.06	-0.3621	-0.6104*	-0.7557*	-0.3904
Group 3- Group 2	-0.00241	0.028	0.0116	0.1576***	-0.0457	-0.0947*	-0.3905***	-0.4905***	-0.1621
Group 2- Group 1	-0.1132*	-0.0033	0.2066	0.084	-0.1114	-0.0189	-0.1029	0.0037	-0.3386
Panel F. Post M&A Correction: By the Pre-acquisition M/B Ratio of Acquirers									
Quintile 1	0.2487***	0.3493***	0.3276***	0.0531**	-0.0656**	-0.0165	-0.1164***	-0.1193***	0.0709*
Quintile 2	0.2137***	0.2619***	0.1786***	0.0166	-0.0212	-0.1072***	-0.0812**	-0.1196***	0.2114
Quintile 3	0.1979***	0.2623***	0.1924***	-0.0211	-0.0484**	-0.0414**	-0.0835	0.1483	-0.0231
Quintile 4	0.0918	0.1057*	0.1218	-0.0609	-0.2543***	-0.0697***	-0.1284	0.0008	-0.0229

Mispricing Error Correction	Firm-specific Error Correction			Time-series Sector Error Correction			Long-run Value Correction		
Event windows[year]	[0,1]	[0,2]	[0,3]	[0,1]	[0,2]	[0,3]	[0,1]	[0,2]	[0,3]
Quintile 5	0.0529	0.0503	0.0785	0.0798	0.0045	-0.1756**	-0.5007*	-1.1748***	-0.8370***
Difference (Q5-Q1)	-0.1958**	-0.2989***	-0.2491**	0.0267	0.0701	-0.1591*	-0.3843	-1.0555***	-0.9080***

Panel G. Post M&A Correction: By the Pre-acquisition Assets

	Firm-specific Error Correction			Time-series Sector Error Correction			Long-run Value Correction		
Quintile 1	0.2672***	0.3422***	0.3106***	0.2602***	-0.1855**	-0.2904***	-0.5355**	-0.9606***	-0.5574*
Quintile 2	0.2372***	0.2837***	0.1904***	-0.0047	-0.0782***	-0.0403*	-0.1788	-0.0083	-0.0934
Quintile 3	0.1224***	0.2146***	0.1641***	-0.0827*	-0.0179	-0.0481**	-0.0815	-0.0835	0.1638
Quintile 4	0.1326***	0.1629***	0.1616***	-0.0756***	-0.0746	-0.0027	-0.0454	-0.0735	0.0543
Quintile 5	0.0457**	0.0264	0.0722***	-0.0299	-0.0288*	-0.0289*	-0.0689*	-0.1385***	-0.1675***
Difference (Q5-Q1)	-0.2210**	-0.3150***	-0.2376**	-0.2901***	0.1567*	0.2615***	0.4667*	0.8224***	0.3903

Panel H. Number of Observations by the Type of Error Correction

	All mergers	Only firm-specific error correction	Only time-series sector error correction	Only long-run value correction	Both firm-specific error and time-series sector	Both firm-specific error and long-run value correction	Both time-series sector error and long-run	Mergers with all the three corrections

Mispricing Error Correction	Firm-specific Error Correction			Time-series Sector Error Correction			Long-run Value Correction		
Event windows[year]	[0,1]	[0,2]	[0,3]	[0,1]	[0,2]	[0,3]	[0,1]	[0,2]	[0,3]
					error correction		value correction		
Number of events	2035	306	45	411	54	649	124	200	
Percentage of total		15%	2%	20%	3%	32%	6%	10%	

4.1 Empirical Evidence of the Engine in the Market

The first groups(Panel a and Panel A) in Table 4-1 and Table 4-2 show that the `firm-specific error sustained` and significantly increases in the first and second year after the merger, and only decreases in the third year. Specifically, the firm-specific error increases by 0.161 and 0.0449 in the first and second year after the merger, and decreases by 0.027 in the third year after the merger.

The second group(Panel b and Panel B) of empirical results in Table 4-1 and Table 4-2 show that the acquirer's firm-specific error is significantly larger than that of the matched non-merger firms, and the positive correction of the acquirers' firm-specific error is significantly smaller than that of the matched non-merger firms. This finding shows that hypothesis 1 holds, acquirers have larger firm-specific error than non-merger firms, acquirers are less undervalued by the market than non-merger companies, and experience less positive correction after the merger, confirming that market timing is a motive for M&As, and hypothesis 1A and 1B are verified. At the same time, we get similar results by excluding the samples in the financial and utility industries.

The third group(Panel C) of Table 4-2 shows that the firm-specific error of one-time acquirers increases by 0.1853 in one year after the merger, increases by 0.2368 in two years after the merger, and increases by 0.1913 in three years after the merger, and all changes were significant at the level of 1%. The firm-specific error of active acquirers increased by 0.1502 in one year after the merger, by 0.1922 in two years after the merger, and by 0.1746 in three years after the merger. The correction of firm-specific error of each window in one-time acquirers is significantly higher than that of active acquirers. This means that once the market recognizes that the acquirer is undervalued, a one-off correction is sufficient, and further acquisitions by the same acquirer will not lead to further valuation correction in the market.

The fourth group(Panel D) of empirical results in Table 4-2 shows that the acquirers of stock payment and cash payment have experienced significant positive correction of firm-specific error in all three event windows, but there is no significant difference between the correction of firm-specific error of the two payment methods. Hypothesis 1C is not verified.

In addition, in order to further evaluate the market timing, we divide it into five parts according to the size of M/B ratio and the size of total assets before the merger, and compare the correction of firm-specific error between the first fifth and the last fifth. In the sixth and seventh groups(Panel F and Panel G) of Table 4-2, the acquirers with large M/B ratio or total assets experience less positive correction than those with small M/B ratio or total assets. That is to say, the market thinks that there are less cases of low valuation acquirers with large M/B ratio and large total assets, and more serious cases of low valuation acquirers with small M/B ratio and small total assets. Therefore, the positive correction of acquirers with small M/B ratio

or small total assets is more intense.

4.2 Empirical Evidence for the Motivation to Respond to Industrial / Economic Shocks

The first group(Panel A) of results in Table 4-2 shows that the `time-series sector error` of all the samples increases significantly in the first year after the merger, and then decreases significantly in the second and third years after the merger, while the matched non-merger firms decreases significantly in the first to the third year after the merger, which shows that in order to cope with the industrial / economic impact, the acquirers' time-series sector error will first experience upward correction and then downward correction, rather than non-merger firms continue downward correction. The second groups(Panel b and Panel B) in Table 4-1 and Table 4-2 show that the time-series sector error of the acquirers is significantly larger than that of the matched non-merger firms, and there is also a significant difference in the time-series sector error correction between the acquirers and the matched non-merger firms, further confirming that the industrial / economic impact is an important cause of M&As, and confirming hypothesis 3.

In Table 4-2, there are significant differences in the correction of time-series sector error among groups sorted by the frequency of M&As (Panel C), payment method (Panel D), proportion of shares acquired(Panel E), M/B ratio before the merger (Panel F) and total assets of the acquirers before the merger(Panel G). This shows that many M&As are impacted by industry/economy. When we tested the correction of time-series sector error, we find that about 15% of the industries show significant decreases in time-series sector error after the merger. These industries included electric power industry, thermal power production and supply industry, automobile manufacturing industry and pharmaceutical manufacturing industry. These industries experience more price and regulatory shocks over the sample period. Our results are consistent with the observation of many researchers that mergers often occur in industries experiencing input prices and deregulation shocks (mulherin and Boone, 2000 [28]). The above fully shows that industry/economic shock is a common motive for M&As.

4.3 Empirical Evidence of Synergy, Agency and Arrogance Motivation

The long-run value component of the M/B ratio is likely to be affected by motivations related to synergy, agency and arrogance. In Table 4-2, the result of the first group(Panel A) shows that the difference between long-run value and book value in one year and two years after the merger is continuously downward corrected and significant at the 1% confidence level, indicating that agency and arrogance are the motives for M&As. In Table 4-1 and Table 4-2, the second groups(Panel b and Panel B) show the differences between the long-run value and book value of the acquriers and that of the non-merger firms in the first and second years after the merger are significant , ae well as their differences between long-run value and book value correction, which further confirms the existence of Hypothesis 4, agency and arrogance motivation of M&As.

The results of the third group(Panel C) in Table 4-2 show that the long-run value has undergone significant negative correction, no matter whether it is an one-time acquirer or an active acquirer, which is significant in one year and two years after the merger, but not significant in three years, and the difference of the long-run value and book value correction between an one-time acquirer and an active acquirer is not significant. This further shows that agency and arrogance are the motives for M&As, and that multiple acquisitions by the same acquirer will not lead to further correction of long-run value.

In Table 4-2, the results of the fourth group(Panel D) show that in the three event windows, the reduction of the long-run value of acquirers paid by stock is significantly greater than that of the merger firms paid by cash. This shows that acquirers with stock payment are more likely to be associated with value-decreased acquisitions, while acquirers with cash payment are more likely to be associated with value-added acquisitions. That is to say, the merger paid by stock is more affected by the motives related to agency and arrogance.

The fifth group(Panel E) of Table 4-2 shows that the decline of long-run value of acquirers with acquisition ratio of 100% is significantly higher than that of acquirers with acquisition ratio of 10% or less. This shows that the rapid expansion of M&As significantly reduces the long-run value.

The sixth group(Panel F) of Table 4-2 not only provides further evidence of agent and arrogant motivation of M&As, but also shows the existence of cooperative motivation. The long-run value sector of the M/B ratio of highly valued acquirers with decreased significantly in one year, two years and three years after the merger, and the difference between the long-run value and book value of highly valued acquirers companies decreased significantly than that of low-valued companies in two years and three years after the merger, but the difference between them was not significant in one year after the merger. In other words, the acquirer may have a certain cooperative motivation at first, but it will suffer from impairment later because of the dominant agency and arrogance motivation. In addition, long-run value sector of M/B ratio of highly valued acquirers decreased significantly more than that of low-valued acquirer.

The seventh group(Paneld G) of Table 4-2 shows that the difference between the long-run value and book value of acquirers in the top fifth of total assets and those in the bottom fifth of total assets has decreased significantly, but the downward correction of the long-run value of large acquirers is significantly smaller than that of small companies. This further shows the existence of agent and arrogant motivation of merger, the management is more likely to implement impact on small companies, and the long-run value of small companies is significantly decreased greater than that of large companies.

4.4 Summary of evidence of M/B ratio decomposition

Table 4-1 and Table 4-2 show that undervalued and small acquirers have more significant

market opportunity; sample companies in industries with significant changes have more significant response motivation to industry/economic shocks; stock payment and rapidly expanding companies are more related to agency and arrogance motivation, and their long-run value will decline; overvalued and small companies will experience a more significant decline in long-run value.

Table 4-2 in group 8(Panel H), we divide the whole samples into 7 groups according to the types of mispricing correction: (1) M&As with only correction of firm-specific error; (2) M&As with only correction of time-series sector error; (3) M&As with only correction of long-run value; (4) M&As with only correction of firm-specific error and time-series sector error; (5) M&As with only correction of firm-specific error and long-run value; (6) M&As with only correction of time-series ector error and long-run value; (7) M&As with all three types of mispricing correction.

In 2035 samples, 306 acquirers (15%) only experienced the correction of firm-specific error; 45 acquirers (2%) only experienced the correction of time-series sector error; 411 acquirers (20%) only experienced the correction of long-run value. Among the M&As with various types of mispricing correction, 849 acquirers (42%) have firm-specific error correction and long-run value corrections. This means that there are many acquisition managers who use M&A to achieve their personal goals. Specifically, 1209 (59%) of acquirers are motivated by market timing; 423 (21%) are motivated by responding to industrial and economic shocks; 1384 (68%) are motivated by management agency and arrogance. There are 1027 acquirers with multiple motives (51%) and 762 acquirers with single motives (37%). The results show that multiple motives dominate. This is consistent with the research conclusions of Amihud and lev (1981) [24], Shleifer and Vishny (1989) [13], berkovitch and Narayanan (1993) [25] and Gao (2010) [29]. There are multiple motives for M&As, sometimes conflicting motives.

From the above empirical research results, we find that most of the merger motivations of Chinese listed companies are value-decreasing, such as arrogance and agency, which have a negative impact on the sustainability of enterprises and social economy.

5 Conclusion

We decompose the M/B ratio of acquirers into firm-specific error, time-series sector error, difference between long-run value and book value, and observe how they change in a period of time after a merger to decipher motivation of M&As. We find that motives for M&As include market timing, response to industry/economic shocks, agency and arrogance. Our results show that multiple motives dominate, and about 51% of 2035 acquirers have multiple motives. Many acquisition managers promote personal goals through M&As. Our research methods allow us to draw conclusions based on post market evidence. Because we use the same method to evaluate the motivation of M&As, we overcome the comparability problem of different methods in the existing literature, and we use long short term memory neural

network (LSTM) as the data modeling and analysis method, which can provide more accurate data measurement and analysis. To sum up, our study provides new empirical evidence in China for the study of merger motivations, and expands the research on motivation of merger, and finds a way to overcome the previous research shortcomings.

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