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ASIAN ACADEMIC ACCOUNTING ASSOCIATION
18th annual conference
22-23 NOVEMBER 2017. BALI, INDONESIA

M&A Size, Technological Absorptive Ability and Post-Acquisition Innovation Performance: Evidence from Chinese High-Tech Firms

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Abstract

This study is an effort to reveal the effect of mergers and acquisitions (M&A) size on the post-acquisition innovation performance in the emerging Chinese market. Using the mergers and acquisitions data set of 277 high-tech firms over the period 2008-2015,we show that the M&A size have an inverted U-shaped effect on post-acquisition innovation performance of the acquirer. Further research indicated that the absorptive capacity significantly positively moderate the inverted U-shaped relationship between M&A size and post-acquisition innovation performance.

Keywords: Mergers and acquisitions (M&A) size; post-acquisition innovation performance; absorptive capacity

1. INTRODUCTION

In order to keep up with the fast-changing market, firms have to introduce technology or knowledge from external sources instead of creating knowledge and capabilities for survival and sustainable innovation solely within the organization (Leonard, 1995; Chesbrough 2003; Keil, 2004; Kang & Kang 2009; Kang, Jo& Kang 2015). As a result, M&A, as the most direct way to obtain external knowledge, become a first choice of most firms to realize technology breakthrough. According to the findings of the previous M& A literature, the decisions about whether or not M&A is conducted (Wagner 2011; Valentini 2012), the characteristics of the acquired and acquiring firms and the M&A deal itself (Desyllas & Hughes, 2010; Lin &Jang, 2010; Datta & Roumani, 2015), are the major factors affecting post-acquisition innovation performance. Undoubtedly, these findings contribute to discovering of the influential factors which have an influence on post-acquisition innovation performance, but it focusing only on the characteristics of one firm or the M&A deal itself, hence, fail to examine the relative characteristics between the acquiring and acquired firm (Jo, Park & Kang, 2016). According to the findings of Lane and Lubatkin (1998), the dyadic characteristics between the acquiring and acquired firm lead to the difference of the acquiring firm's learning between deals. Recent research has started to examine the dyadic factors between the acquiring and acquired firm (Bauer & Matzler, 2014; Sears & Hoetker, 2014).

Among the various dyadic aspects of M&A, we focus on the role of M&A size, measured by the relative value of acquired target to the acquirer. According to previous research, an effective integration process after M&A plays a decisive role for the success of a transaction (Haspeslagh & Jemison, 1991; Bauer, Matzler & Wolf, 2016). However, previous analyses, which used a dyadic perspective, focus on the important role of integration process (Teerikangas & Very, 2006; Gomes, Angwin, Weber, & Tarba, 2013), and neglected to examine factors affect this process. Thus, examining the factors which affects the post-acquisition integration process is required to better understand the performance differences between M&A deals. The variable in our study, M&A size, is a representative factor which affect the post-acquisition integration process (Kusewitt, 1985; Tichy, 2001). In

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addition, we examine the moderating role of technological absorptive capability on the relationship between the M&A size and the post-acquisition innovation performance. The acquirer with higher absorptive capacity tend to have a better ability to create knowledge, assimilate and interpret opportunities, and more effectively develop and apply explicit knowledge (Lane, Koka, & Pathak, 2006) and then strengthen the creation of innovation within the established size of M&A.

In order to examine the hypothesis developed in our study, we based our empirical research on the context of public trade high-tech firms in Chinese market, which is the most attractive emerging market in recent years. As the report of *CVSource*[1] database, both the M&A size and the number of M&A cases in Chinese M&A market achieved rapidly increase from 2011-2016.The increasing intensity of competition and the implantation of the strategy of innovation-driven development proposed in The 18th CPC National Congress in 2012 are the first two enablers for the high-tech firms in this emerging market to improve its innovative performance through some necessary strategies such as mergers and acquisitions. With the implementation of supply-side structural reform proposed in 2015, more and more company response to the government's requirement of improving national innovation ability by implementing large number of M&A at home and abroad, In brief, the significant active emerging Chinese market can provide a very good place to test the extant ambiguous M&A size and innovation relationship.

Our research paper makes some theoretical and empirical contributions to unravel the link between M&A and innovation performance. First, we link the influence factor of post-acquisition integration with post-acquisition innovative performance, and then contribute to make up and extend existing M&A literature. Moreover, the realization of our research provides a better understanding on the influence path of post-acquisition integration on post-innovation performance. Second, this paper shed lights on the important role of relative size of acquired target to the acquirer (the proxy variable of M&A size), which has been highlighted as a critical influence factor in the post-acquisition integration process (Cho & Chung, 2015), and further discovered the mechanism of integration activities in M&A, and open a black box exists in the relationship between integration process and M&A effects. Third, we tested our assumptions in the context of emerging market firms, with specific reference to China, Which has seen massive reforms unparalleled by any other emerging economy over the past decades, and provide a new evidence for the innovation-driven M&A. this is an important contribution to current literature, as most research is mainly concern that study of developed countries. Fourth, this research provides a decision reference for the managerial team. As we suggested in this paper, the decisions of M&A should be made based on fully consideration of the relative size of acquired targets and make sure that do not exceed the maximum absorption ability of the acquiring.

The rest of the paper is organized as follows, we overview the related literature and raised our research questions in section 2. Section 3 describe the sample and variables and the estimation model in the following empirical study. Section4 testing the influence of M&A size on post-acquisition innovation performance and the moderating effect of absorptive capacity. Section 5 are conclusions of our study.

2. THEORETICAL BACKGROUND AND HYPOTHESES

2.1 Prior research on M&A and innovation performance

In order to keep its innovative process, a firm has to try to upgrade its creative ability and knowledge stock by internal R&D and external M&A (Castellacci and Zheng, 2010; Herstad et al, 2014; Lodh, S. and M.R. Battaggion, 2015). The speed of technological change and the need for external technological knowledge that can complement internal R&D often motivate firms to extend their resources through M&As (Hagedoorn and Duysters, 2002). Some scholars has pointed out that with the increasing complexity of innovation, firms relying more and more on the external strategies such as M&A, therefore ,the number of technological M&A deals is constantly increasing(Rossi, Tarba & Raviv,2013). Against this background, more and more attention has paid to the possible existence of the link between M&A and innovation. Recent research on innovation through acquisitions has found that the firms which choose M&A as an external sourcing strategy can generate new innovation by combining its internal knowledge with the external new valuable knowledge or exploit the effect of economies of scale and scope in R&D (Ahuja & Katila, 2001; DeMan & Duysters, 2005; Cassiman et al., 2005). Colombo (2006) focused on technology-driven M&A, indicated that if the merger involves technological components and motivations such as technological renewal and diversity, and a larger knowledge base, it will be more likely to have a positive

[1] The CVSource is a professional financial product designed by China Venture group, it can provide the data, information and analysis tools of the market information, stock trading, corporate finance, and industry research results at all level for the investment managers, securities analysts, and help customers make efficient and accurate research, identify and evaluate investment opportunities.

impact on post-acquisition innovative performance. This streamline of research reflects the technology-driven innovation via M&A, revealing the path of resource integration through M&A to realize the technology breakthrough or innovation along the technological trajectories of the two firms (Dosi, 1982).

2.2 The influence of M&A size on post-acquisition innovation performance

Recently, more and more research focused on the influence effect of the determinants between M&A activities and innovation outcomes. In the point of Ahuja and Katila (2001), whether the innovation performance changes after the M&A or not based on the integration process of the knowledge bases, competences and capabilities they acquired with their own resources. That means the innovation effect of M&A needs a reasonable post-merger integration period (Haspeslagh & Jemison, 1991; Jansen, 2002), and tend to demand a minimum time span of 2-3 years (Cefis & Marsili, 2014). A recent research indicated that the size of M&A play an important role in this integration process, the larger M&A size will pose more difficult integration challenge for the acquirer (Ellis et al., 2011), therefore, the smaller M&A target may be easier and faster than the larger ones in the integration of M&A (Moeller, Schlingemann & Stulz, 2004). According to the research aforementioned, it is easy to understand that if the size of mergers and acquisitions within the firm's ability to digest, that will produce significantly positive influence on the improve of innovative performance. In this context, the acquiring firm could enhance the value added effect of M&A by increasing the M&A frequency which will bring a costly time cost and managerial effort. However, while the M&A size beyond the scope of the enterprise's ability to absorb, that will produce the resource slack of the acquiring, reduce the efficiency of R&D and then lead to poor innovative performance (Bourgeois, 1981; George, 2005).In sum, taking into account the absorptive ability of the acquiring firm, there exist a considerable M&A size, which will lead to the best innovative outputs. We therefore predict the following:

Hypothesis 1: The M&A size will have an inverted U-shaped effect on the post-acquisition innovation performance.

2.3 The influence of absorptive capacity on post-acquisition innovation performance

As analysed above, the influence of M&A size on post-acquisition innovation performance of the acquiring firm depends on the absorptive capacity of the acquiring firm. According to existing research, Absorptive capacity has been recognized as "a firms ability to recognize the value of new, external knowledge, assimilate it and apply it to commercial ends'' (Cohen & Levinthal 1990:128, 1989). This capacity develops from the knowledge stocks within the firms (Cohen & Levinthal 1989; Zahra and George 2002), and hence exhibit significant heterogeneity in different firms. It has been highlighted that the absorptive capacity can increase the firm's incentives to invest R&D (Cohen & Levinthal, 1989), and therefore, is gradually gaining recognition as a key driver of a firm's competitive advantage (Lichtenthaler, 2009). Previous research has indicated that the distinct absorptive capacity can lead to the better quality and timing of the outcome in their searches for external knowledge (Fabrizio 2009). As Fabrizio (2009) found that all other factors being equal, firms have stronger absorptive capacity will exhibit a better innovation performance. What's more, Cohen and Levinthal (1989, 1990) also pointed that a firm's absorptive capacity plays a dual role in improving innovative performance. On the basis of this line, Katrin (2012) fond a positive effect of absorptive capacity on post-acquisition inventor productivity.

Besides the direct effect on innovation performance, absorptive capacity can also intensify the relationship between M&A size and post-acquisition innovation performance. Firms with stronger absorptive capacity have stronger ability to recognize the value of new information, assimilate it, and apply it to commercial ends (Cohen & Levinthal, 1990: 128),and means they can realize a better post-acquisition integration process and then an ideal innovation outcomes. In another words, the stronger absorptive ability a firm have, the bigger size of M&A activities it can deal and the better innovation outputs it can obtain. Therefore:

Hypothesis 2: The absorptive capacity shows a significant moderating effect on the relationship between M&A size and post-acquisition innovation performance.

3. METHODS AND PROCEDURES

3.1 Data and Sources

Our intention is to offer an extensive perspective concerning the relationship between M&A size and its post-acquisition innovation, hence, our research object focused on the high-tech industry. This context was selected for the following two reasons. Firstly, firms in high-tech industries have been extensively engaged in mergers and

acquisitions (Cloodt et al., 2006), which means that mergers and acquisitions are an important means of strategy development and implementation in these high-tech industries. Secondly, these industries have observed rapid technological changes and have faced intensive technological competition. In such a technology intensive environment, innovation outcomes, such as patents, are key performance indicators (Dutta, Narasimhan, & Rajiv, 1999). Therefore, these high-tech industries provide an ideal context for examining innovation effective of M&A (Das & Kapil, 2016).

According to the definition of high-tech enterprises made by the OECD (Organization for Economic Cooperation and Development) as well as China-related provisions of the certification body, we choose the sample firms in 5 industries which include aerospace manufacturing, pharmaceutical manufacturing, electronic and communication equipment manufacturing, computers and office equipment, medical equipment and instrumentation manufacturing listed in Shanghai and Shenzhen stock markets.

In order to test our hypotheses, we constructed a database from several sources. First, we obtained mergers and acquisitions information of high-tech firms from Chinese merges and acquisitions database offered by Chinese Stock Market Research (CSMAR) database, which is the most authoritative M&A database, it includes the comprehensive information on the acquired and acquiring firms and the transaction and is widely used by scholars home and abroad to study the mergers and acquisitions questions. From this database, we identified acquisitions made by high-tech firms over 8-year period (2008-2015). Second, we collected the information of the acquiring firm's applied patents after M&A from the Patent database of Chinese Listed Companies. Finally, the related financial information of independent variables were collected from Chinese Stock Market Research (CSMAR) database.

In order to ensure the accuracy of research, we impose the following restrictions on the initial examples:

a) Considering the different nature of assets and liabilities, the different financial reporting systems and the unique regulations, all firms that belong to the financial sectors, banks, life assurance companies, investment firms, insurance companies and real estate investment trusts are excluded from the sample.
b) We only retain the examples which has completed the asset acquisitions or technology acquisitions. The other types of M&A such as firm restructuring are not taken into account.
c) All the financial and innovative data of the examples must be available in the CSMAR database.
d) These restrictions led to the final usable samples of 277 Chinese high-tech firms.

3.2 Variables and measurement

To empirically test the stated hypotheses, we measured post-acquisition innovative performance with the number of patents applied by firms in our sample and M&A size will be measured by the relative value of the acquired target to the acquirer, Absorptive capacity was calculated by the value of R&D investment of the acquirer divided by applied patents. We also controlled the remaining factors that can also contribute to post-acquisition innovation performance.

3.2.1 Dependent variable

Innovation performance of the acquirer. We take the number of patents applied by the acquirer after M&A as a proxy valuable for innovation performance. As mentioned above, the innovation effect of M&A tends to need a reasonable post-merger integration period (Haspeslagh & Jemison, 1991; Jansen, 2002), which tends to demand a minimum time span of 2-3 years (Cefis &Marsili, 2014). So, in order to ensure the accuracy of results, we need to consider two-year lagged value of innovation performance variable.

3.2.2 Independent variables

M&A size. The main purpose in this paper is to explore the influence of M&A size on the innovative performance of the acquiring firms. As discussed before, there exist necessary relationship between the M&A size and post-acquisition innovation performance because of the critical role of M&A size in the post-acquisition integration (Cho & Chung, 2015). At this point, choose a proxy for M&A size that actually is a proxy of the difficulty that the integration of a firm implies. Previous research indicated that the relative value of the size of acquired target to the size of the acquiring firm reflects the degree of difficult to integrate the acquired targets (Moeller, Schlingemann & Stulz, 2004). Hence, in our empirical model, we used the turnover of the M&A divided by the total assets of the acquiring firm to calculate the value of M&A size.

Absorptive capacity. In this study, we tested the moderating effect of absorptive capacity of the acquirer on the relationship between M&A size and post-acquisition innovative performance. We use the method of Cohen & Levintha（1990）to measure the absorptive capacity of the acquiring firm, which take the ratio of R&D investment and the number of applied patents (Cohen & Levintha, 1990) as a proxy variable of absorptive capacity. This measurement can specifically reflect the consumption of R&D investment each patent.

3.2.3 Control variables

Several control variables often used in M&A research are included in this paper.

Firm size. Firm size has been highlighted as a significantly important influence aspect in previous innovation literatures (Cohen, 1995; Scherer, 1984; Ahuja, Lampert, & Tandon, 2008; Lee & Kim, 2016). In order to avoid the influence of firm size on our results, it will be controlled in our estimation

Firm growth. Previous studies have found that the growth of a firm shows a significantly influence on the firm's innovative performance (Corsino & Gabriele Roberto, 2011; OkeAdegoke, Walumbwa & Myers, 2012). Therefore, we controlled the growth variable, which is measured by the main business income growth ratio.

Debt to asset ratio. Part of research indicated that there exists a nonlinear relationship between the debt/assets ratio and the firm's R&D profile, the increase in R&D intensity is associated with a lower debt/assets ratio (Aghion, Bond, Klemm & Marinescu, 2004), and hence, it must have a significant impact on innovation performance. Therefore, we controlled this variable, which was measured by the total liabilities divided by the total assets.

ROE. The strong profitability can provide enough finance support for the firm's innovation activities and therefore pose a significant influence on the innovation output. We controlled this variable in our testing model. As the book value reported on company balance sheets, it can be collected from the CSMAR database.

R&D intensity. As an important input in the innovation process (Cohen, 1995) R&D intensity of the acquirer before M&A was controlled in our empirical model, which can be calculated by the R&D expenditure divided by the total assets (Lavie & Miller, 2008; Lee & Pennings, 2001).

Annual Number of M&A. Firms tend to engaged in multiple acquisitions in a year. We controlled for the annual number of acquisitions, which we measured by the number of acquisitions a firm conducted in a given year (Prabhu et al., 2005; Lee & Kim, 2016).

Market concentration. Market competition level pose some influence on the efficiency of using external outsources. To control for potential confounding effect of market competition condition, we specified market concentration as a control variable which was measured with Herfindahl–Hirschman Index (HHI) (Giroud & Mueller, 2010; Tirole, 1988). A higher value of HHI reflects lower competition in the market (Giroud & Mueller, 2010).

$$HHI_{jt} = \sum_{i=1}^{N_j} s^2_{ijt}$$

Where s_{ijt} represented the market share of firm i in industry j in year t. The market Share was measured by dividing firm's sales into the total sales by firms in industry j in year t.

Intangible asset. The intangible asset on behalf of the knowledge resources and reflected the inventory of corporate innovation, we take the natural logarithm of the firm's intangible asset.

Age. As shown in previous study, the relationship between the firm age and innovation is controversial. A number of studies did not find any effect of the firm age on innovation activities (e.g. Avermaete et al., 2003b; Laforet & Tann, 2006; Laforet, 2013; Baregheh, Rowley, & Hemsworth, 2016), other studies suggest a negative (e.g. Huergo & Jaumandreu, 2004; Rosenbusch et al., 2011) or a positive (e.g. Sørensen & Stuart, 2000) effects. In order to eliminate any possible influence of the firm age on our results, we controlled this variable, calculated by the difference value between the year of M&A and the year of a firm founded.

Year and industry dummies. We also included year dummies and industry dummies based on the latest industry classification code issued by China Securities Regulatory Commission (CSRC) in 2012 to capture unobserved heterogeneity across years and industries.

We included these control variables in the test models with the aim of deriving a more genuine measurement of the effect of M&A size on innovation performance.

3.3 Estimation model

Using zero-inflated negative binomial regression, we estimate the effects of M&A size on post-acquisition innovation and the moderation effect of absorptive capacity in the following function (1):

$$Innovation\ performance_{post-acquisition} = \alpha + \alpha_1 M\&A\ size + \alpha_2 M\&A\ size^2 + \alpha_3 Absorptive\ capacity \times M\&A\ size + \alpha_4 Absorptive\ capacity \times M\&A\ size^2 + \alpha_5 Growth + \alpha_5 Debt\ Asset\ ratio + \alpha_6 ROE + \alpha_7 R\&D\ intensity + \alpha_7 Annual\ number\ of\ acquisitions + \alpha_8 Market\ concentration + \alpha_9 Age + \alpha_{10} Intangible\ assets + \alpha_{11} Year + \alpha_{12} Industry + \gamma \quad (1)$$

The VIF (variance inflation factors) of all variables are below 5, confirming that there are no multicollinearity problems among the variables. In order to avoid the influence of individual heterogeneity on regressors, the RE model was chosen (Greene, 2003), which was tested based on Hausman test[2].

4. RESULTS

Table 1 and Table 2 present the descriptive statistics for the sample and correlations between the variables of interest respectively. Table 4 presents the regression results estimated by function (1). Model1 includes only control variables. Model 2 estimates the relationship between M&A size and post-acquisition innovation performance. Model 3 contains the interaction of M&A size with absorptive capacity. Model 4 is a full model that contains M&A size and its interaction with absorptive capacity.

The results presented for model 4 show that M&A size has an inverted U-shaped effect on post-acquisition innovation performance of the acquirer (β=3.61, $p<0.1$, and β= -1.02, $p<0.05$ for M&A size and its square respectively), in support of Hypothesis 1. The results further show that the absorptive capacity significantly interacts with M&A size for post-acquisition innovation performance of the acquirer. Absorptive capacity positively moderates the effect of M&A size (β=0.29, $p<0.01$) and positively moderates the effect of M&A size square (β=1.08, $p<0.01$). The results show that the positive effect of M&A size on post-acquisition innovation performance of the acquirer becomes more positive and the negative effect becomes less negative at a given level of M&A size for firms with higher absorptive capacity. That means, the invert U-shape is more convex for firms with higher absorptive capacity, in support of Hypothesis 2.

The estimation results for some control variables are generally consistent with the previous findings. With regards to the firm size of acquirer, we observe that it shows a significantly positive influence on the post-acquisition innovation performance (α=0.06, $p<0.1$), consistent with previous findings (Ahuja & Katila, 2001; Prabhu et al., 2005; Lee & Kim, 2016). The significantly positive regression coefficient of Growth ($\alpha = 0.26$,$p<0.05$) and ROE （$\alpha = 1.00$,$p<0.01$） indicate that the good ability of growth and strong profitability can provide strong support for the positive post –acquisition innovative performance (Corsino & Gabriele Roberto, 2011; OkeAdegoke, Walumbwa & Myers, 2012). Consistent with previous findings (Aghion, Bond, Klemm & Marinescu, 2004), we find a negative but not significant relationship between the Debt to asset ratio and post-acquisition innovative performance ($\alpha = -0.22$). The R&D intensity of acquirer shows negative effect on the post-acquisition innovation performance (α=-5.05, $p<0.01$), which support the finding of Lee & Kim (2016). The annual number of acquisitions shows negative effect on the post-acquisition innovation performance (α=-0.03, $p<0.05$), it implies that when the company implemented a number of mergers and acquisitions in a year, it may face large challenge of integration, and therefore affect the firm's innovative outputs. Interestingly, the Market concentration positively affect the post-acquisition innovation performance of the acquirer (α=0.52, $p<0.01$), which is inconsistent with previous finding (Lee & Kim, 2016), that implies that in Chinese market, the high level of Market concentration means a high degree of market monopoly and thus forming centralized advantage to realize innovation. The Age shows a negative effect (α=-0.32, $p<0.05$) on post-acquisition innovation performance, which is consistent with

[2] The choose of RE (random effect) and FE（fixed effect）model always tested through Hausman test（Hausman & Taylor, 1981）. When the p-value of the test are significant, that means the FE model should be took in the regression, otherwise, the RE model should be chosen. In this paper, the P-value of Hausman was not significant, so, we chose the RE test in our model.

previous findings (Huergo & Jaumandreu, 2004; Rosenbusch et al., 2011). We find no significant effect of Intangible assets.

Table1. Descriptive statistics

Variables	**Obs.**	**Mean**	**S.D**	**Min**	**Max**
1. Post-acquisitioninnovative performance	277	6.97	21.68	0	208
2. M&A size	277	0.10	0.16	-0.01	1.39
3. Absorptive capacity	277	0.01	0.05	0	0.86
4. Firm size	277	22.06	1.11	19.73	28.00
5. Growth	277	0.38	0.78	-0.53	8.09
6. Debt Asset ratio	277	0.54	1.04	0.01	11.84
7. ROE	277	0.08	0.08	-0.70	0.34
8. R&D intensity	277	0.04	0.11	0	1.72
9. Annual number of acquisitions	277	1.42	1.17	0	15
10. Market concentration	277	0.13	0.11	0.01	0.62
11. Age	277	13.54	4.82	3	32
12. Intangible assets	277	18.84	1.33	12.88	25.12

Table 2 Correlations for innovative performance

	1	2	3	4	5	6	7	8	9	10	11	12
1. Innovative performance	1											
2. M&A size	-0.11**	1										
3. Absorptive capacity	0.02**	-0.05	1									
4. Firm size	0.24***	-0.06	-0.07	1								
5. Growth	0.06	0.24**	-0.02	0.08	1							
6. Debt Asset ratio	-0.01	-0.07	-0.02	0.02	-0.05	1						
7. ROE	0.02	-0.05	-0.00	0.05	0.13*	-0.03	1					
8. R&D intensity	0.10	-0.09	0.11*	0.60***	-0.08	-0.00	0.04	1				
9. Annual number of M&A	-0.05	0.07	0.03	-0.09	0.03	-0.03	-0.05	-0.05	1			
10. Market concentration	0.11	0.04	-0.04	0.24***	0.20**	-0.02	0.14**	0.24***	0.05	1		
11. Age	-0.02	0.02	-0.02	0.23***	-0.08	0.17**	-0.03	0.13**	-0.12*	-0.09	1	
12. Intangible assets	0.17***	-0.02	-0.05	0.79***	0.02	0.02	0.04	0.47***	-0.08	0.09	0.20	*1*

N=277. ***p < 0.01. **p < .0.05. *p < 0.1

5. CONCLUSION

In this paper, we focused on the relationship between the M&A size and the post-acquisition innovation performance with the samples of Chinese high-tech companies. As a result, an inverted U-shaped relationship between the M&A size and the post-acquisition innovation performance has been found, and the different absorptive capacity of the acquiring firms shows a significant moderating effect for the relationship. The relative value of the size of acquired targets to the size of the acquirer reflects the difficulty of post-acquisition integration, and therefore, this nonlinear relationship between M&A size and post-acquisition innovation performance reveals the influence path of post-acquisition integration process on the innovation changes to some extent, which provides a new empirical evidence for the previous research about the important role of post-acquisition integration process (Teerikangas & Very, 2006; Gomes, Angwin, Weber, & Tarba, 2013; Bauer, Matzler & Wolf, 2016).

The finding of this paper also implies that there exists a moderate M&A size at the point of the maximum absorptive ability of the acquirer can bring the biggest post-acquisition innovation outputs. The discovering of the positive moderating effect of absorptive capacity reveals that the acquirers with stronger absorptive capacity can obtain a bigger innovative performance peak value.

Besides the theoretical contribution presented in introduction parts, this study also possesses some positive practical implications. First, the inverted U-shaped influence of M&A size on post-acquisition innovative performance reminds the managerial team, which is the policy and development strategy makers, of that the decision of innovation-driven M&A transaction should be made based on a fully consideration of the difficulty of integration process, which can be measured by the relative size of the acquired target to its firm size. Second, the moderating effect of the absorptive capacity on the relationship between the M&A size and post-acquisition innovation performance reflects that some effective measures to improve the absorptive capacity is necessary in pursuit of the best innovation performance in given M&A size, such as further enhance the R&D investment after M&A (Cohen, 1990; Odagiri, 2003; Valentini, 2012).

As a limitation, however, our analysis which is based on the observation of the influence of M&A size on post-acquisition innovation outcomes does not account for the different innovation effect caused by specific acquisition styles and characteristics. Second, this study just focused on the high-tech companies which belongs to the innovation-driven industry, however the innovation-driven acquisitions activities widely exist in more industries,

the innovation performance and other economic consequences in these industries may be present distinctly different conclusions.

Table 3. Zero-inflated Negative Binomial regression results-the impact of M&A size on innovation performance and the moderating effects of firm size

Variable	Model1	Model 2	Model3	Model4
M&A size		7.04**		3.61*
		(7.13)		(9.74)
M&A size2		-7.51**		-1.02**
		(28.73)		(6.51)
M&A size × Absorptive capacity			-0.03***	0.29***
			(0.01)	(0.74)
M&A size2 × Absorptive capacity			0.02*	0.18***
			(0.01)	(0.33)
Firm size	0.55***	0.48**	0.00	0.06**
	(0.20)	(0.22)	(0.04)	(0.04)*
Growth	0.02*	0.24***	0.09	0.26**
	(0.21)	(0.28)	(0.07)	(0.13)
Debt Asset ratio	-0.43***	-0.54**	0.20*	-0.22
	(0.45)	(0.60)	(0.11)	(0.19)
ROE	3.53*	3.23	0.17	1.00***
	(2.10)	(2.38)	(0.44)	(0.77)
R&D intensity	-0.88*	-0.86***	-4.14***	-5.05***
	(0.86)	(0.90)	(0.86)	(1.51)
Annual number of acquisitions	-0.19*	-0.17	-0.03	-0.03**
	(0.11)	(0.16)	(0.02)	(0.03)
Market concentration	0.69**	1.08*	0.27	0.52***
	(1.45)	(1.59)	(0.24)	(0.43)
Age	-0.02**	-0.03**	-0.01***	-0.32**
	(0.03)	(0.03)	(0.00)	(0.01)
Intangible assets	0.09	0.18	-0.00	0.51
	(0.21)	(022)	(0.03)	(0.76)
Constant	-11.10***	-11.39**	-11.00***	-13.89***
	(3.30)	(3.41)	(0.54)	(1.17)
LR chi2	24.15 **	42.23***	25.37***	47.13***
observations	277	277	277	277

The results for year and industry dummies are not reported.
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

ACKNOWLEDGEMENTS

We sincerely thanks to the support of National Social Science Project found ('Research on the characteristics of mergers and acquisitions and industrial optimization effect under supply side structural reform'16AGL007) and the helpful job of my co-worker, Professor Xi Zhao and the anonymous reviewers of this conference.

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