RESEARCH ARTICLE

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Determinants of diversification by listed firms in China

Abstract This paper empirically studies the determinants of diversification of Chinese listed companies from the perspectives of motivation and conditions. Results show that the traditionally believed motivations of economic rationality, organizational rationality and individual rationality have all exerted influences upon the choice of diversification models. By comparison, the choice of diversification mode for Chinese listed firms is largely based on organizational rationality motivation (to reduce company risks) and individual rationality motivation (in the self-serving interests of the top management). Meanwhile, such conditioning factors as company size, ownership structure, age of being listed, and the industry in which a company is all have significant effects on the choice and degree of diversification for Chinese listed firms.

Keywords diversification, determinants, economic rationality, organizational rationality, individual rationality

摘要 从主观动机和客观条件两个方面，对我国上市公司的多元化决定因素进行实证检验，结果表明，我国上市公司是否多元化以及多元化的程度受多种因素影响。就主观动机而言，传统理念的多元化经营的经济理性动机、组织理性动机以及个人理性动机，不同程度地影响着我国上市公司进行多元化经营模式的选择。但相比较而言，我国上市公司的多元化经营模式的选择，更多的是基于组织理性动机(降低公司风险)和个人理性动机(公司高管出于利己动机的考虑)。同时，在客观条件方面，公司规模、股权结构、公司上市的时间长短以及公司所处的行业等因素也对上市公司多元化及其程度产生显著影响。

关键词 多元化，决定因素，经济理性，组织理性，个人理性

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1 Introduction

Specialization or diversification? This has been an unresolved issue of great significance since Rumelt's seminal work (1974), which needs an urgent solution in practice (Jiang, Liu and Lu, 2005). It has been generally accepted that the diversification motivation originates from a firm's internal and external environment (Hoskisson and Hitt, 1990). There is not, however, a widely accepted theoretical framework to thoroughly analyze the diversification motivations. Researchers from different fields simply studied this problem from their own fields and propose various views or theories. For example, some proposed an efficiency hypothesis based on synergy effects. Others emphasized the effect of market-power on diversification. Still others argued for the financial synergy motivation behind diversification. However, as Ramanujam and Varadarajan (1989) argued that, these hypotheses may have neglected other more convincing motivations. Later, researchers shifted their focus to the study of economic consequences of diversification, attempting to explore the motivation from this view. However, this gave rise to another problem: economic consequences may be the outcome of various motivations and it is hard to find out which one is the determinant one. Hill and Hanson (1991) pointed out that it is not easy to understand the effect of diversification on a firm's value without taking the initial motivation of diversification into consideration.

We argue that whether the effect of diversification on firm value is positive or negative may vary from countries and the specific development stage of the same country. For Chinese listed companies, relevant studies have showed that diversification has a positive effect on firm value. Diversification negatively affects the fluctuation of firm performance. In other words, diversification decreases the degree of fluctuation of firm performance (Jiang, Liu and Lu, 2005). Though many Chinese listed companies operate cross industries, there are still a large proportion of single-segment companies. Our sample shows that from 2001 to 2004, the yearly ratios of single-segment listed companies to all listed companies are 35.93%, 34.93%, 31.59% and 30.59% respectively. Consequently, a question arises from this phenomenon: if diversification helps reduce the fluctuation of firm performance, decrease firm risks and enhance firm value, why there are still such a large proportion of listed companies prefer specialization to diversification? What are the determinants of Chinese listed companies' diversification strategy? This paper attempts to answer these questions.

The rest of this paper is organized as follows: Section 2 summarizes the present diversification situation of Chinese listed companies. Section 3 presents a brief review of literature of diversification, thus providing a theoretical foundation for our study and explaining the motivations of firm diversification.

Section 4 proposes a series of hypotheses and we test empirically these hypotheses in Section 5. A brief conclusion is presented in the last section.

2 Present diversification situation of Chinese listed companies

Chinese listed companies have been compulsorily required to disclose the segment information since 1998. Before that, it was up to the listed companies to decide whether to disclose the information or not. Based on the availability of data, we studied all non-financial listed companies in Shenzhen and Shanghai stock markets from 2001 to 2004. Up to December 31, 2000, there were 955 A-share listed companies in the two stock markets. After deleting the companies with incomplete data, we got a sample of 895 Chinese listed companies. Some of the data used in this paper are from the database of the Gild Data Analysis System of Huatai Securities, Co., Ltd. and the database of CCER Sinofin.

2.1 Diversification measures

People have gradually realized that one single variable can not precisely measure the degree of firm diversification. The four most commonly used variables are: the number of industries a firm engaged in (N), the Herfindahl-Hirschman Variable (HHI) of sales volume, the Entropy Income (EI), and the dummy variable for diversification (DIV). All these four variables were used in our study to measure the degree of diversification for Chinese listed companies.

(1) Number of industries (N). N refers to the number of industries providing the primary operating revenue for a listed company. The classification of industry is in accordance with the Industry Classification Standards of the China Securities Regulatory Commission.

(2) HHI. $HHI = \sum_{i=1}^{n} p_i^2$. p_i stands for the ratio of revenue from an industry to the total revenue of a firm. The higher the degree of diversification is, the lower the value of HHI. When a firm is single-segment, $HHI=1$. In comparison with the variable N, the variable HHI can measure the degree of diversification more precisely. For instance, if two firms both carry out cross-industrial operation, the income ratios of the two industries for the two firms are 90:10 and 50:50 respectively. The corresponding values of HHI for the two firms are 0.82 and 0.5 respectively, indicating that the latter has a higher degree of diversification than the former. Only one industry number variable can not reflect this difference.

(3) $EI = \sum_{i=1}^{n} p_i \ln(1/p_i)$. *EI* is the opposite of *HHI*. The higher the degree of the diversification is, the less prominent the main business of a company, the higher the value of *EI*. When a company is single-segment, *EI* equals 0. As *HHI*, *EI* is able to precisely measure the degree of diversification of a company too.

(4) *DIV.* If a company engages in diversification, *DIV* equals 1, otherwise it equals 0.

2.2 Diversification situation of Chinese listed companies

I first conducted a general survey on the diversification of Chinese listed companies. Table 1 provides the corresponding data from 2001 to 2004, as measured by the variables *N* and *HHI*.

Table 1 Diversification situation of Chinese listed companies

		1		2		3		4		≥5		Average
N	2001	321	35.93%	269	30.03%	190	21.25%	85	9.45%	30	3.34%	2.161
	2002	312	34.93%	296	33.04%	187	20.91%	70	7.79%	30	3.34%	2.119
	2003	282	31.59%	305	34.04%	186	20.80%	88	9.79%	34	3.78%	2.209
	2004	273	30.59%	330	36.82%	190	21.25%	77	8.57%	25	2.78%	2.168 0
		0.4		0.4–0.6		0.6–0.8		0.8–1		1		Average
	2001	88	9.79%	211	23.58%	159	17.69%	116	13.01%	321	35.93%	0.748
HHI	2002	84	9.34%	215	24.03%	160	17.80%	124	13.90%	312	34.93%	0.746
	2003	109	12.90%	233	25.92%	156	17.46%	115	12.90%	282	31.59%	0.724
	2004	98	10.90%	229	25.47%	163	18.24%	132	14.79%	273	30.59%	0.728

Sources: Collected by the author.

As shown in Table 1, 2/3 of Chinese listed companies engaging in diversification, and there is an increase tendency year by year. Among all the A-share companies, the number of companies operating cross two different industries simultaneously equals the number of single-segment companies, both occupying nearly 1/3 of the total sample. The difference is that the number of diversified companies constantly increases while the number of single-segment companies decreases. Companies operating cross three industries simultaneously account for 20% of the total sample and companies operating cross four or more industries account for 10%. Except the first two groups, the percentages of other groups in the total sample remain constant.

As measured by *HHI*, companies with *HHI* values smaller than 0.4 account for about 10% in the total sample, showing that the main business of a single-segment company is not prominent and different business units contribute more or less the

same to the company's prime operating revenues. Companies with *HHI* values bigger than 0.8 account for about 13% in the total sample, showing a company engaging in cross-industrial operations and the sales volume from one industry contributes more than 89% to the company's prime operating revenues. Companies with *HHI* values between 0.4–0.8 account for about 40% in the total sample, showing these companies have a high degree of diversification.

To better reveal the present diversification situation of Chinese listed companies, we carry out the following survey.

2.2.1   The industrial level

Different industries vary in development opportunities, risk levels and performance. Relevant studies have showed that firm's behaviors are in many ways connected with the industry the firm is in. As an important strategic decision of a company, diversification is influenced by the characteristics of the industry a company is in. The results of our survey on the present diversification situation of Chinese listed companies are shown as Table 2.

Table 2   Distribution of diversified companies in different industries

Industry	2001			2002			2003			2004		
	HHI	*EI*	*N*	*HHI*	*EI*	*N*	*HHI*	*EI*	*N*	*HHI*	*EI*	*N*
Agriculture	0.558	0.794	3.261	0.535	0.839	3.348	0.465	0.950	3.435	0.571	0.740	2.826
Mining	0.917	0.161	1.583	0.852	0.139	1.462	0.846	0.144	1.462	0.801	0.221	1.692
Beverage	0.806	0.340	2.051	0.740	0.453	2.333	0.710	0.492	2.231	0.713	0.488	2.231
Textile	0.775	0.367	1.905	0.709	0.474	2.119	0.669	0.530	2.310	0.674	0.551	2.333
Paper-making	0.779	0.384	2.077	0.786	0.387	2.077	0.773	0.404	2.231	0.778	0.372	2.000
Petroleum & chemistry	0.797	0.336	1.874	0.795	0.337	1.811	0.733	0.453	2.084	0.736	0.446	2.084
Electronics	0.794	0.406	2.333	0.841	0.303	1.944	0.844	0.254	1.611	0.834	0.274	1.778
Non-metal smelting	0.828	0.289	1.787	0.841	0.270	1.627	0.840	0.261	1.640	0.811	0.305	1.733
Equipment manufacturing	0.821	0.306	1.845	0.795	0.333	1.853	0.809	0.324	1.879	0.793	0.343	1.819
Biological pharmacy	0.743	0.412	1.911	0.750	0.413	1.893	0.687	0.500	2.125	0.690	0.492	2.071
Other manufacturing	0.632	0.493	2.333	0.651	0.478	2.333	0.635	0.503	2.250	0.628	0.492	2.083
Hydropower	0.784	0.323	1.850	0.774	0.343	1.900	0.773	0.360	1.975	0.784	0.336	1.875
Construction	0.642	0.587	2.800	0.694	0.557	2.533	0.657	0.590	2.667	0.680	0.561	2.600
Transportations	0.755	0.411	2.118	0.779	0.380	2.000	0.710	0.490	2.176	0.702	0.519	2.294

(*To be Continued*)

	2001			2002			2003			2004		
Communication equipment manufacturing	0.710	0.481	2.300	0.723	0.480	2.267	0.667	0.587	2.517	0.673	0.559	2.383
Wholesale and retailing trade	0.777	0.370	2.014	0.792	0.364	2.027	0.788	0.359	2.014	0.767	0.395	2.041
Real estate	0.730	0.444	2.189	0.752	0.441	2.135	0.755	0.429	2.154	0.768	0.406	2.096
Public service	0.597	0.691	2.806	0.606	0.681	2.694	0.617	0.673	2.667	0.678	0.565	2.528
Information service	0.611	0.501	2.182	0.686	0.544	2.400	0.654	0.602	2.600	0.716	0.497	2.300
Comprehensive industries	0.492	0.791	3.054	0.572	0.662	2.699	0.538	0.730	2.863	0.568	0.682	2.795

Sources: Collected by the author.

Table 2 indicates that there are big differences in the diversification degree as calculated by different measures. Specifically, the degree of diversification is the highest in agriculture, which may be explained by the limited needs of agriculture products. Construction, social service and other comprehensive industries also have quite high degree of diversification. By comparison, some monopolized industries (such as mining, hydropower, petroleum and chemistry, non-metal smelting, etc) and some new industries (such as electronic manufacturing, biological pharmacy, etc) have lower degree of diversification. Thus we can infer that the choice of diversification has something to do with the industry a company is in.

2.2.2 Ownership structure

When studying the behaviors of Chinese listed companies, we can not neglect their special ownership structures since different holding stockholders usually exert decisive influences on organizational behavior. In China, many listed companies are state owned. About 50% of listed companies in our sample have state government as their biggest stockholders as well as control stockholders/relative control stockholders (the number varies in different years). We classified diversified companies into five sub-groups in accordance with the nature of their biggest stockholders: Group 1 (state government has absolute control over the company), Group 2 (state government has relative control over the company), Group 3 (state government as the biggest stockholder, but the ownership ratio is less than 30%), Group 4 (legal person as the biggest stockholder) and Group 5 (other entities as the biggest stockholder). The distribution of diversification of Chinese listed companies with different ownership structures are shown in Table 3.

Table 3   Distribution of diversified Chinese listed companies with different ownership structures

Nature of the biggest shareholder	2001			2002			2003			2004		
	HHI	*EI*	*N*	*HHI*	*EI*	*N*	*HHI*	*EI*	*N*	*HHI*	*EI*	*N*
State government (>50%)	0.788	0.360	1.983	0.796	0.339	1.868	0.779	0.364	1.941	0.791	0.353	1.891
State government (30−50%)	0.757	0.406	2.064	0.820	0.399	2.059	0.747	0.430	2.089	0.737	0.451	2.185
State government (<30%)	0.691	0.530	2.426	0.722	0.493	2.232	0.694	0.535	2.423	0.654	0.593	2.484
Legal person	0.740	0.457	2.241	0.717	0.483	2.271	0.690	0.529	2.350	0.691	0.522	2.284
Others	0.698	0.508	2.259	0.710	0.484	2.174	0.749	0.408	1.957	0.765	0.400	2.041

Sources: Collected by the author.

Table 3 depicts listed companies with state government as the biggest stockholder (but not the control stockholder or relative control stockholder) have the highest degree of diversification. The second highest is those with legal-person-controlled. Companies with state government as absolute controller have the lowest degree of diversification. All these indicate that the ownership structure of a listed company, especially state-owned companies, has a certain effect on the choice of diversification mode.

2.2.3   Company size

It is generally believed that diversification is one of the inherent and important characteristics of big-sized companies. The empirical studies of Amey (1964) and Gollop and Monahan (1991) found that in the manufacturing industry, there is a positive relation between company size and diversification. To better survey the effect of company size on diversification, we classified isometrically Chinese listed companies into five groups in accordance with company size. "1" stands for smallest companies in the sample (20%) and "5" for biggest companies (20%), as exhibited in Table 4.

Table 4   Distribution of diversification of different sized Chinese listed companies

	2001			2002			2003			2004		
	HHI	*EI*	*N*	*HHI*	*EI*	*N*	*HHI*	*EI*	*N*	*HHI*	*EI*	*N*
1	0.760	0.416	2.061	0.793	0.435	2.061	0.734	0.448	2.133	0.718	0.461	2.078
2	0.734	0.456	2.211	0.729	0.462	2.161	0.718	0.486	2.233	0.712	0.493	2.217
3	0.722	0.462	2.228	0.742	0.431	2.094	0.690	0.522	2.289	0.716	0.484	2.228
4	0.748	0.442	2.256	0.738	0.437	2.172	0.722	0.479	2.244	0.717	0.489	2.261
5	0.778	0.384	2.050	0.782	0.393	2.112	0.756	0.420	2.145	0.777	0.384	2.056

Sources: Collected by the author.

Table 4 shows that the degrees of diversification of biggest and smallest companies are lower than the other three groups, while there is little difference among the middle three groups. Possible explanations might be that when a company is too small or too big, it tends to focus on one industry, while middle-sized companies prefer diversification. In other words, when a company is on the stage of development, it is more likely to adopt diversification strategy.

From the results above, we can see that diversification has been an important operation mode for Chinese listed companies. An increasing number of Chinese listed companies are adopting diversification strategy. Meanwhile, the choice of diversification mode and the level of diversification are influenced by some objective conditions.

3   Theoretical foundation for diversification

At present, there are three representing theories for diversification motivation, namely, economic rationality theory (maximum value hypothesis), individual rationality theory (non-maximum-value hypothesis) and organizational rationality theory. The classification of these three theories (or hypotheses) was first made by Larrson (1990) and mainly used in the field of merger and acquisition. Later, people found that these motivations can also be used to explain the choice of specific diversification strategies. Since then, these theories have been widely used in the study of firm diversification. Below is a brief review of these theories.

3.1   Economic rationality theory

It is also called maximum value hypothesis. The main idea of this theory is that the objective of diversification operation is to create value for stockholders. And the new value comes from the synergy effects accompanied with diversification. Since diversification can bring various synergy potentials, such as managerial, financial, operational synergies, an implementation of diversification strategy can create more value for a firm.

The economic rationality theory is the mostly widely used theory in the study of diversification motivation. There are a number of sub-theories, such as efficiency hypothesis, market power, and financial synergy potentials. We are not going to discuss these sub-theories in details due to the limited space.

3.2   Individual rationality theory

It is also called non-maximum-value hypothesis. It is proposed because people

have found that although the economic rationality theory has solid theoretical foundation and can explain reasonably the choice of diversification modes, many companies' endeavor of diversification fail to bring forth expected results. Meanwhile, people found that many cases of diversification bring diversification discounts rather than diversification premium. This sets some people seeking answers outside the maximum value hypothesis. The agency-theory-based hypothesis of individual rationality was then proposed.

One of the main characteristics of modern firms is the conflict of interest between managers and stockholders. Out of the consideration of dispersion of their specific investment risks and maximizing their own interests, managers are prone to adopt diversification strategies and to expand the company size dramatically within a short time. Generally speaking, diversified companies have stronger risk-resistance capabilities. More importantly, managers of big-sized companies have advantages (such as personal income, on-the-job consumption, self-awareness, and social status, etc.) over their counterparts in small or medium sized companies. Thus from the individual rationality view, managers have strong motivations for diversification—not for enhancing the interests of stockholders, but for maintaining or promoting interests of their own. When a firm has a dispersed ownership structure or lack of big stockholders or well-designed governance structure to supervise and restrict managers effectively, managers are more likely to adopt diversification strategy. The model of growth-maximizing (Marris, 1964), the Sales-Maximization Model (Bauml, 1958) and other models of non-maximum-value all reveal the typical characteristics of manager-controlling firms. People have gradually realized that the emergency of modern huge firm groups is an embodiment of managers seeking their own interests. As a result, although the agency theory has strong explanation power in explaining firm's motivation for diversification, the phenomena of over-diversification can not be simply explained by individual rationality alone.

3.3   Organizational rationality theory

Larsson (1990) believed that the motivation behind diversification is to control more resources and decrease environmental uncertainties. Both internalization transactions and hierarchical organizational structure can reduce effectively the uncertainty in key firm resources. Among the win-or-die competitions, expanding one's company quickly and dramatically through diversification can effectively prevent other rivals from hostilely takeover because the bigger a company is, the less likely it gets acquired. Thus it is easy to understand diversification from the view of organizational existence.

One may notice that organizational rationality is different from economic rationality for a firm is willing to control certain key resources at the expense of

suffering huge economic losses. Organizational rationality is also different from individual rationality for it may not consider the individual's self-interests. Specifically, organizational rationality theory believes the objective of diversification is to keep the organization existence, regardless that whether the diversification is beneficial to firm value or individual interest. The top priorities in the organizational rationality theory are always laid on reduction of the degree of uncertainty of key firm resources and the avoidance of being taken over by other organizations.

The three hypotheses above analyze only the subjective motivations for diversification. In practice, the choice of diversification mode depends not only on the subjective motivation of a company, but on certain objective conditions, such as company size, ownership structure, listed age, and the industry the company is in, etc. In the sections that followed, we explore the determinants of diversification of Chinese listed companies from the view of objective conditions.

4   Hypotheses

To begin with, we test in turn the traditionally-believed three motivations for diversification operation, namely economic rationality motivation, organizational rationality motivation and individual rationality motivation. Accordingly, we first propose the following hypotheses:

H1: The degree of diversification of a Chinese listed company is positively related to the company's value.

H2: The degree of diversification of a Chinese listed company is negatively related to the operating risks the company is facing.

H3: The degree of diversification of a Chinese listed company is positively related to the interests of top management in the company.

As discussed in Section 2, whether a company adopts diversification strategies and the degree of diversification is also influenced by a company's internal and external environment. More specifically:

Company behavior is affected by the industry it is in. First, development opportunities vary greatly in different industries. Generally speaking, newly-emerged industries provide more development opportunities and bigger market space. Thus the degree of diversification of firms in newly-emerged industries might be considerable lower. By comparison, firms in decline industries or mature industries have fewer development opportunities or less market space. Thus these firms are more likely to engage in new business to get strategy transformation. Besides, firms in mature industries tend to have better cash flow and firms in decline industries usually have more investable capital

due to fewer investment opportunities in these industries. Thus firms in both mature and decline industries have good foundations for diversification. In addition, firms with better cash flow, firms in industries with less development space, or firm with low profitability are more likely to enter new industries with higher profitability. As an example, many Chinese listed companies in the circulation industry have recently entered the real estate business. Finally, external operating risks vary with different industries. Some industries are characterized by economic- cycle-conformability, while others by economic-cycle-adverseness. Thus firms might choose to adopt diversification strategies in order to disperse operating risks. Drawing on the above rationale, we propose that:

H4: The diversification of a Chinese listed company has correlation with the industry it is in.

We have pointed out that Chinese listed companies have very unique ownership structures since state government is absolute controller or relative controller in a majority of Chinese listed companies. Relevant studies (e.g. Jiang, 2005) found that state-controlled listed companies lay greater emphasis on company performances, while other non-state-controlled companies highlight growth ability. Since diversification is a major approach of company fast development, we therefore propose that:

H5: The diversification and degree of diversification of Chinese listed companies are negatively related to the ratio of state-held shares in the company.

As a rule, newly-listed companies tend to conduct divestment of unrelated businesses to pursue better organizational performance as well as lay solid foundation for future financing. As the listing time increases, companies usually have more capital and motivations for diversification.[1] In an era of booming economy, Chinese listed companies are blessed with countless development opportunities. Meanwhile, as firms in a new economic entity, they are also vulnerable to the impacts of external risks (e.g. economic fluctuation). Under such circumstances, companies with abundant capital are more likely to enter industries with high profitability by means of conducting diversification activities so as to reduce operating risks and enhance their profitability. Therefore, we propose that:

H6: The diversification and degree of diversification of a Chinese listed company are positively related to the listed age.

A brief history review of company development in developed countries shows that most huge companies got diversification by means of merger and acquisition

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[1] Extant study has shown that Chinese listed companies have strong preference for equity financing. No matter has project worth investing or not, they always try to finance when possible.

and expanded dramatically within a short time. After gaining certain risk resistance capacities, many companies shifted from diversification mode to mode of focusing on the main businesses. For Chinese firms, the bigger the size of a company is, the more likely it gets supports and funds from the government. With China's entry into the WTO, in order to survive and develop in a far tougher environment, Chinese firms have to have strong incentives to expand size quickly through diversification. Thus, diversification is an inherent characteristic of a certain development stage in a company's life cycle. When companies have gained strong competitiveness in certain industry, they usually divest gradually to unrelated businesses so as to concentrate recourses to further develop the main business. In addition, since big-sized companies have strong risk-resistance capabilities, they do not need to disperse operating risks through diversification. Thus we develop the last hypothesis:

H7: The level of diversification of a Chinese listed company is negatively related to the size of the company.

5   Empirical tests and results

To test empirically the hypotheses above, we used all non-financial listed companies (data up to Dec 31, 2000) in Shanghai and Shenzhen stock markets as samples. After deleting companies with incomplete data, we had a sample size of 895 companies. The study interval is from 2001 to 2004.

5.1   Variables

Firm value. We used the natural logarithm of the value of Tobin's Q (lnq) as a substitute measure of firm value. The value of Tobin's Q came directly from the database of the Gild Data Analysis System of Huatai Securities, Co., Ltd.[2]

Firm operating risks. Generally speaking, the bigger the fluctuation of a company's earnings is, the higher the company's operating risk. Thus we adopted

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[2] In the Gild Data Analysis System, Q value= (total market capitalization + net debt)/ the carrying value of tangible assets. Total market capitalization = average price per share* number of shares. The carrying value of tangible assets = book value of the assets-intangible assets-deferred and prepaid expense-osses in suspense-debit of deferred tax. Net debt = total debt-salaries payable-welfarism payable-dividend payable-other payables-accrued expenses-housing circulating funds-deferred tax credit. Some scholars, when calculating Q value, distinguished between circulation shares and non-circulation shares. In these studies, the value of circulation shares equals share prices, while the value of non-circulation shares equals net assets value per share. Statistics show that the correlation coefficient is over 0.9 between our calculation method and the distinguished calculation method.

the earnings fluctuation range to measure the operating risks a company is facing. To precisely reflect the earnings fluctuation, we extended the range of values of earnings per share (after adjustment) back to 1999. Every three years was measured as an interval and we rollingly calculated out the standard variances of earnings fluctuation from 2001 to 2004. We believed that these rolling standard variances can better reflect the earnings fluctuation of Chinese listed companies in different fiscal years. We could thus find out the operating risks these companies were facing. The calculation equation used is as below:

$$Flu\_EPS = \sqrt{[EPS_t - (\sum_{t=1}^{3} EPS_t)/3]^2 + [EPS_{t-1} - (\sum_{t=1}^{3} EPS_t)/3]^2 + [EPS_{t-2} - (\sum_{t=1}^{3} EPS_t)/3]^2}$$

Top management's interests. At present, management does not have their company's stock options. Thus the interests of top management mainly embodied with the amount of salary. We used the natural logarithms of salary of the first three top managers (ln(*salary*)) in a Chinese listed company to stand for the interests of top management.

Company size. We used the natural logarithm of a company's total assets (ln(*asset*)) as a substitute measure for company size.

Industrial characteristics (*Ind*). This measure is a dummy variable. For identical industries, it equals 1, otherwise it equals 0.

Ratio of state-held shares (*Equity*). It is represented by the ratio of state-held shares to the total issued capital.

Listed age. It refers to the length of time from a company became listed to the time of our study.

5.2   Empirical tests and results

Based on the definitions of the measures above, we established an empirical model as below:

$$Div = \beta_0 + \beta_1 \ln q + \beta_2 \ln salary + \beta_3 \ln flu + \beta_4 equity + \beta_5 \ln asset$$
$$+ \beta_6 \ln age + \beta_7 industry + \varepsilon$$

Div is represented by *HHI*, *EI*, *N*, and the dummy variable for diversification (when a firm engages in diversification, it equals 1, otherwise it equals 0) respectively.

We mixed the traversal data with time serial data of all listed companies in the two stock markets, resulting in the so-called panel data. We then conducted regression analysis on the panel data to overcome the problem of multicollinearity among the variables. Considering that panel data usually have a

lot of data points, which gives rise to a pretty high degree of freedom, the combination of both traversal data and time serial data is able to improve the preciseness of a dynamic model within a short time. When using the panel data model, the model coefficients are usually held unchanged, while the intercept varies with the traversal data and time serial data. There are two solutions to the problem of a changeable intercept: one is to use a fixed effects model; the other is to use a random effects model. Hausman Test can be used to decide which model is more suitable for the study purpose. According to the Hausman test results, we chose the fixed effects model to estimate the sample data, as shown in Table 5.

Table 5   Regression results of the relation between diversification and its determinants

	EI		HHI		N		DIV	
Variables	C	P	C	P	C	P	C	P
C	0.692	0.000	0.546	0.000	2.341	0.000	0.986	0.000
LNFLU	−0.027	0.000	0.012	0.003	−0.064	0.000	−0.014	0.029
LNQ	0.001	0.993	−0.014	0.471	0.017	0.823	0.009	0.774
LNSALARY	0.010	0.243	−0.011	0.077	0.019	0.406	0.029	0.003
LNASSET	−0.015	0.118	0.012	0.069	0.009	0.722	−0.033	0.003
LNAGE	0.060	0.004	−0.028	0.063	0.142	0.011	0.089	0.000
EQUITY	−0.160	0.000	0.091	0.000	−0.427	0.000	−0.153	0.000
IND1	0.099	0.042	−0.048	0.161	0.213	0.098	0.056	0.313
IND2	−0.396	0.000	0.240	0.000	−0.940	0.000	−0.327	0.000
IND3	−0.189	0.000	0.108	0.000	−0.535	0.000	−0.136	0.003
IND4	−0.150	0.000	0.081	0.004	−0.470	0.000	−0.085	0.061
IND5	−0.585	0.000	0.351	0.001	−1.439	0.000	−0.573	0.001
IND6	−0.242	0.000	0.142	0.001	−0.616	0.000	−0.231	0.001
IND7	−0.240	0.000	0.152	0.000	−0.762	0.000	−0.241	0.000
IND8	−0.398	0.000	0.232	0.000	−1.003	0.000	−0.311	0.000
IND9	−0.364	0.000	0.206	0.000	−1.024	0.000	−0.323	0.000
IND10	−0.317	0.000	0.179	0.000	−0.869	0.000	−0.267	0.000
IND11	−0.240	0.000	0.124	0.000	−0.806	0.000	−0.134	0.001
IND12	−0.152	0.019	0.098	0.033	−0.359	0.038	−0.145	0.049
IND13	−0.284	0.000	0.164	0.000	−0.780	0.000	−0.262	0.000
IND14	−0.100	0.080	0.055	0.174	−0.192	0.206	−0.019	0.769
IND15	−0.207	0.000	0.118	0.000	−0.641	0.000	−0.183	0.000
IND16	−0.163	0.000	0.096	0.000	−0.484	0.000	−0.173	0.000
IND17	−0.283	0.000	0.158	0.000	−0.782	0.000	−0.200	0.000
IND18	−0.085	0.638	0.055	0.668	−0.111	0.816	−0.109	0.596
IND19	−0.234	0.000	0.151	0.000	−0.645	0.000	−0.259	0.000
IND20	−0.079	0.053	0.049	0.093	−0.273	0.012	−0.035	0.452
IND21	−0.157	0.020	0.092	0.054	−0.488	0.006	−0.175	0.022

(*To be Continued*)

(*Continued*)

Variables	EI		HHI		N		DIV	
	C	P	C	P	C	P	C	P
Sample	3 580		3 580		3 580		3 580	
R^2	0.098		0.063		0.096		0.072	
F	15.396		9.939		15.046		11.32	
P	0.000		0.000		0.000		0.000	
Hausman(*p*)	0.000		0.000		0.000		0.000	

Note: "*C*" stands for coefficient.

The regression shows that all the four regression models are highly significant, thus the structure analysis is feasible.

Firstly, from the perspective of economic rationality, though we assume that a company's diversification and its degree of diversification are positively related to the company's value, the coefficients in all four models are not significant.

From the perspective of organizational rationality, the dummy variable for diversification is negatively related to the earnings fluctuation. In other words, diversification decreases the fluctuation margin, resulting in a reduction in operating risks. As for the three variables measuring the degree of diversification, *EI* is negatively related to the fluctuation of earnings. As discussed, the higher the value of *EI* is, the higher a company's degree of diversification. Thus earnings fluctuation is negatively related to the level of diversification measured by *EI*. *HHI* is positively related to the fluctuation of earnings. The smaller the value of *HHI* is, the smaller the margin of earnings fluctuation. As a small *HHI* value indicates a high level of diversification, we can infer that the fluctuation of earnings is negatively related to the level of diversification measured by *HHI*. Table 5 also shows that the fluctuation of earnings is negatively related to the number of industries a company engages in. Since all coefficients are highly significant in all four models, we can infer that diversification and the degree of diversification can reduce the operating risks a company is facing. Thus H2 is supported.

From the view of individual rationality, diversification has a positive relation with salary of top management. In addition, the coefficient and significance of individual rationality motivation variable are higher than the other two motivation variables. This indicates that the top management has strong incentives for diversification. As shown by the three variables for diversification, the signs of the diversification degree models measured by *EI* and *N* are as expected (though not significant). Besides, the degree of diversification measured by *HHI* is positively related to top management salary (significant at a 10% level). Thus H3 is partially supported－there is an individual rationality

motivation in the choice of diversification mode in Chinese listed companies.

Ownership structure strongly influences the choice of diversification mode: first, the ratio of state-held share is negatively related to diversification (significant at a 1% level), indicating that the higher the ratio of state-held share in a company, the less likely the company will adopt diversification strategy; second, as indicated by the three variables for diversification, the degree of diversification is significantly and negatively related to the ratio of state-held share in a company. In other words, the higher the ratio of state-held shares in a company, the lower the degree of diversification in the company. Thus H5 is supported.

The listed age also exerts effects on the choice of diversification mode. Our results showed that the longer a company becomes listed, the more likely the company adopts diversification strategy. In addition, all the three variables for diversification are positively related to the length of listing time. Thus H6 is supported.

Table 5 also shows that for a majority of industries, the choice of diversification and the degree of diversification are significantly and positively related to the specific industry a company is in. Thus H4 is supported.

Company size is negatively related to the diversification and degree of diversification. Except for the diversification degree mode measured by the number of industries, the variables of company size are significant in all other three models, indicating that the bigger a company is, the less likely the company engages in diversification. Besides, for diversified companies, the bigger a company is, the lower the degree of diversification. Thus H7 is supported.

6   Conclusion

Whether a company diversifies or not, it depends on the internal and external environment it is facing. In other words, there are many factors that affect a company's diversification. From the views of subjective motivation and objective conditions, we empirically tested the determinants of diversification for Chinese listed companies and find that such traditionally believed determinants as economic rationality, organizational rationality, and individual rationality affect the choice of diversification modes to some degree. By comparison, however, when deciding whether to diversify or not, the motivations of organizational rationality and individual rationality are stronger than the economic rationality motivation. In other words, Chinese listed companies diversify aiming at either reducing operating risks or enhancing the top management's interests. We also find that a firm's mode of operation (i.e specialization or diversification) and the degree of diversification are affected by a series of factors, such as company size,

ownership structure, listed age, and the industry variable. What is more, it is also found that whether a company diversifies or the degree of diversification are affected by a series of factors, namely, company size, ownership structure, listed age, and the industry a company is in. Specifically, the bigger a company is, the higher the ratio of state-held shares in total issued capital and the shorter the listing time, the more likely the company engages in specialization. Otherwise, a company is more likely to choose diversification.

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