The Influence of Diversification on Performance of State-owned Enterprises

An Empirical Study Based on Panel Threshold Model

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***Abstract*—The Panel Threshold auto-regression model has been used in this paper to study on Threshold Effect between diversification and performance of state-owned enterprises, and test whether there is an optimal threshold value of diversification index which cause more than two interval relationships of corporate performance that appear vertical asymmetric due to diversification effect. Empirical study shows that there is a double Threshold Effect between diversified index and corporate performance, in which, all interval influence coefficients are negative, that is, the promotion of diversification to corporate performance appears a gradually accelerating tendency.**

Keywords—threshold effect; diversification; performance

I. INTRODUCTION

Diversification is a series of business actives carried out by an enterprise beyond its original products and market. In order to make full use of resource and improve market share, many enterprises take diversification [1-4]. As shown in related data, in 1974, 86% of world top-500 companies operated more than one business [5]. Since then, more large enterprises developed diversification as a competitive strategy that has been continuously increasing. However, after a few time, some enterprises abandoned diversification and turned to specialized business, the diversified entropy averagely fell to 0.67 in 1990 from 1.00 in 1980, and the number of enterprises with specialized business has increased to 63.9% in 1989 from 36.2% in 1978 [6]. After 20 years of diversification popularization, specialized management became popular, why? What is the relationship between diversification and corporate performance? That is the research focus of economics and management.

According to existing literatures, most researches about diversification focus on advanced markets rather than emerging market and developing countries [7-12]. However, because of different national conditions and different development stage, in listing companies of China, especially, in state-owned companies with characteristics of profit making and public benefit which are different from developed countries in aspects of diversification characteristics, diversification business and enterprise value, what's the relationship between diversification and corporate performance, what's the degree of diversification can maximize to promote corporate performance? There are no answers yet in academic. Based on above, in this paper, 215 listed state-owned enterprises in Shenzhen prior to 2004 have been sampled; the data during 2004 to 2013 has been analyzed with Panel Threshold auto-regression model, in order to track out the degree and way of diversification to influence corporate performance.

II. LITERATURE REVIEW

In studies of relationship between diversification and corporate performance in developed market, there is a consistent view among most scholars that is an inverted U-shaped relationship. Since there are great different between developed countries and developing countries in market resources and cultural background, it is necessary to separately research the relationship in developing countries. Claessens[13] (2000), comparing the data of listed companies in United States, Japan and 8 East Asian countries, concluded that the listed companies in East Asian had more diversified degree, but less diversification discount in which the United States was 15%, Japan was 10%, but East Asian was about 5%. However, many studies of Chinese companies draw a non-consistent conclusion through linear analysis of diversification and corporate performance. Such as Zhangyi (2013) took empirical analysis diversification in logistics enterprises, which shows that diversification can generate overflow price effect, effectively promote corporate performance [14]. But Zhangchun (2010) studied economic consequences of diversification in theoretical analysis, which concluded that because of serious internal agency problems and weak corporate governance diversification may damage corporate performance [15]. Sun Gebing (2012) studied enterprises that have different growth opportunities, which shows that, when the enterprise is in the low growth period, there is no relationship between diversification and corporate performance; while in growing period, the relationship is significantly negatively correlated; while in high growth period, the relationship is significant positive correlation [16].

We believe that investing in different businesses or industries have different income risks can smooth annual revenue, reduce volatility of the cash flow, so as to reduce financial risk of enterprise and improve enterprise defensive

ability. But under the analysis framework of residual claim, shareholder value may decrease due to reduction of enterprise risk, because shareholder value depends upon financial leverage of company, to some extent, increasing of debt capacity will promote enterprise value (Mansi and David 2002) [17]. Taking a low degree diversification can effectively disperse enterprise risk, and urge resources transfer to high profit business. However an over-high diversification, to some extent, can improve resource utilization, but also lead to a higher agency cost and lower leverage. Based on above, the relationship between diversification and corporate performance is not a simple linear relationship, but a nonlinear relationship. Therefore, this paper aims to explore the effect of diversification on performance and how to affect corporate performance through Panel Threshold Model.

III. METHOD

According to Panel Threshold method developed by Hansen in 1999, take a Threshold Effect analysis of balanced panel data to study the effect of diversification on corporate performance.

According to the study of Threshold Effect by Hansen in 1999, if an enterprise has a single threshold, the model can be set up as follows.

$$v_{it} = \begin{cases} \mu_i + \theta' h_{it} + \alpha_1 d_{it} + \varepsilon_{it} & if \quad d_{it} \le \gamma \\ \mu_i + \theta' h_{it} + \alpha_2 d_{it} + \varepsilon_{it} & if \quad d_{it} > \gamma \end{cases} \tag{1}$$

$$\theta = (\theta_1, \theta_2, \theta_3, \theta_4)', \quad h_{it} = (s_{it}, m_{it}, g_{it}, c_{it})'$$

Hereinto, v_{it} represents proxy variable of corporate performance; d_{it} represents the degree of diversification in main business of compay, that is, the threshold variable in the model; γ is the conjectural specific threshold value; h_{it} represents control variable vector, respectively represent four control variables: s_{it} is flow rate, m_{it} is asset liability ratio, g_{it} represents total assets, c_{it} represents ownership concentration which is indicated by sum of shareholding proportion of top 10 shareholders in this paper; μ_i is a fixed effect, which is used to capture heterogeneity of different operating conditions in different companies; the expected value of error term ε_{it} is 0, variance is subject to the homogeneous distribution of independent ($\varepsilon_{it} \sim iid(0, \sigma^2)$). In addition, the subscript i in the model represents a different company, t represents specific period.

If above equation is replaced by a single equation, then a dummy variable $I(\gamma) = \{d_i \le \gamma\}$ is defined, in which I(.) is a indicator function, when $d_i \le \gamma$, then $I(\gamma) = 1$, otherwise $I(\gamma) = 0$. Now, the threshold model regression formula (1) can be expressed by the following regression formula (2).

$$v_{it} = \mu_i + \theta' h_{it} + \alpha_1 d_{it} I(d_{it} \le \gamma) + \alpha_2 d_{it} I(d_{it} > \gamma) + \varepsilon_{it} \tag{2}$$

Since above analysis assumed that there is only one threshold value in the model, but in actual situation there may be two or more than two threshold values, if there are double threshold values in the model, the regression formula (1) can be modified to.

$$v_{it} = \begin{cases} \mu_i + \theta' h_{it} + \alpha_1 d_{it} + \varepsilon_{it} & if \quad d_{it} \le \gamma_1 \\ \mu_i + \theta' h_{it} + \alpha_1 d_{it} + \varepsilon_{it} & if \quad \gamma_1 < d_{it} \le \gamma_2 \\ \mu_i + \theta' h_{it} + \alpha_3 d_{it} + \varepsilon_{it} & if \quad \gamma_2 \le d_{it} \end{cases} \tag{3}$$

Hereinto, Threshold value $\gamma_1 < \gamma_2$

Likewise, the model can be extended to multiple threshold values ($\gamma_1, \gamma_2, \gamma_3, \gamma_4 \cdots \gamma_n$).

IV. DATA SOURCE AND SAMPLING

In this paper, 671 companies listing in Shenzhen during 2004-2013 are selected, excluding 456 companies of missing data during this period, the companies of which main business are not determined in their annual reports, ST companies and non state-owned enterprises, finally there are 215 companies selected of which data comes from Wind database, CSMAR database and the annual company report disclosed.

A. Selection of Diversification Index

We find industry classification data of some enterprises' main business from Wind database, and look out one by one the main business of companies are not disclosed in their annual reports from Wind database, then refer to "guide for industry classification of listed company" issued by CSRC, regard the industry classification of listed companies as the fourth of industry code, and respectively calculate the ratio of every business income to total business income which is regarded as the base to calculate diversification index. In foreign countries, there are several parameters measuring diversification including the number of business units (Sturgeon et al., 2009) [18], diversification entropy (Chiung-Jung Chen et al, 2012) [19] and Herfindahl index (Hendricks et al.,2009)[20] based on assets and income. Because of the advantages of simple calculation, sensitive, Herfindahl index (H index) is used to measure diversification of enterprises in this paper. Calculation formula of Herfindahl index is as follows.

$$\text{Herfindahl index} = \sum S_i^2 \times 100\% \tag{4}$$

Hereinto, S_i represents the main business income ratio that one of industries accounts for all industries. As shown above, Herfindahl index is inversely proportional to the degree of diversification: the smaller the index, the higher the degree of diversification; the greater the index, the lower the degree of diversification.

B. Selection of Control Variable

Previous studies have indicated that the performances of companies listed in China are affected by many factors. The first factor is enterprise scale (toass); the larger the scale, the stronger the ability to operate; in this paper the total assets is taken as the proxy variable of enterprise scale. The second factor is financial leverage, if the company has strong profitability, often has a low level of debt, and a low financial leverage, so in this paper, asset-liability ratio (TDEBT) will be as the proxy variable of financial leverage. In addition, the company has higher current ratio (CUR), which shows that the company has stronger solvency, also shows that the company has better performance. At the same time, ownership concentration (OC) is also the factor that affects corporate performance. Therefore, four control variables are selected in this paper including enterprise scale, TDEBT, CUR, sum of square of top 10 shareholders holding.

C. Selection of Performance Index

Since ROA can measure net profit level produced by enterprise assets, most scholars (Ilknur tastan Boz (2013), etc.) take ROA as a index to measure performance. Therefore, ROA is as the proxy variable of performance in this paper.

As shown in the "Table I" above, there are great differences among 215 companies in diversification degree of which index value ranges account for 86% of the overall sample, in which the diversification index of the company with specific business is 1, and the diversification index of the company with higher diversification is only 0.14, but the overall average is 0.75. According to the classification standard of Wrigley (1970), the index shows that enterprises mainly rely on leading products, but only a small degree of diversification; the ownership concentration (OC) of the company is 0.181, which shows that the whole rights of the company is more dispersed, which provides a favorable space for the company's diversification. As shown above, diversification trends of Chinese enterprises are more obvious, which promote study to improve corporate performance.

TABLE I. DESCRIPTIVE STATISTICAL RESULTS OF SELECTED VARIABLES

	N	Range	Minimum	Maximum	Mean	Std. Deviation
ROA	2150	1.021	-0.528	0.493	0.029	0.063
DIVER	2150	0.860	0.140	1.000	0.750	0.253
CUR	2150	26.240	0.060	26.300	1.557	1.740
TDEBT	2150	1.082	0.012	1.094	0.518	0.187
TOASS	2150	8.035	9.65	17.685	12.681	1.225
OC	2150	0.709	0.013	0.722	0.181	0.124

V. EMPIRICAL RESULT

In the panel threshold regression, firstly we need to determine whether there is a Threshold Effect and calculate the number of Threshold. If there is not a significant Threshold Effect, the panel threshold model becomes ordinary linear panel regression model; if there is a significant Threshold Effect after testing, a nonlinear correlation between them is existence. In this paper, STATA software is used to gradually distribute F which are verified by bootstrap procedure, and finally get P-value to determine whether there is a Threshold Effect. The results of Threshold Effect testing are shown in "Table II".

TABLE II. THRESHOLD EFFECT TESTING

			Critical Value		
	F	*P*	*10%*	*5%*	*1%*
Single Threshold Testing	15.52***	0.000	10.43	5.88	4.28
Double Threshold Testing	12.57***	0.006	10.10	5.80	3.86
Tri-Threshold Testing	2.55	0.172	8.252	5.19	3.71

a. All the values of critical value and P are obtained after 500 times simulation using bootstrap method.

b. respectively represent remarkable under significance level of 10%, 5%, 1%.

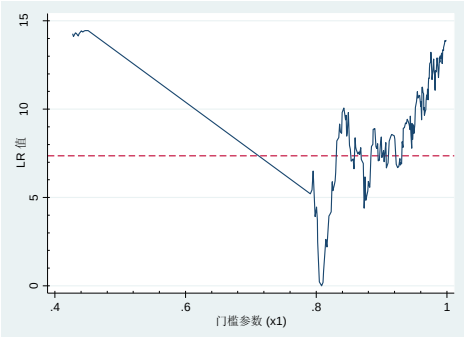

Fig. 1.

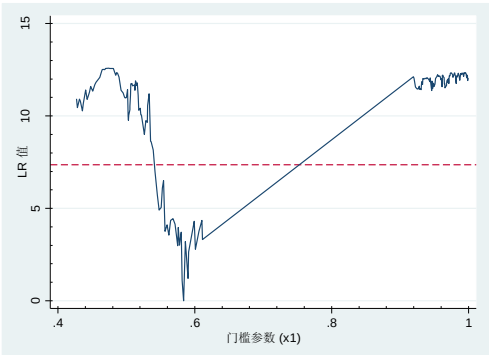

Fig. 2.

In testing, the first probable threshold value is 0.808 which will ensure the value of function LR(γ) minimum (equal to zero). In "Fig. 1" and "Fig. 2", when diversification index is taken as a threshold variable, the tendency of likelihood ratio LR(γ) which is a threshold value function is shown. The threshold value is located in the lowest point as shown in the figures above. At 95% confidence level, the confidence interval is [0.556, 0.873], the confidence value is 7.35 (denoted by the dotted line in the figures). As shown in the figures, all the points across the dotted line are located in the confidence interval, and taken bootstrap procedure repeatedly 500times, then P-value=0.006, F=15.52 which is more than the critical value under significance level of 10%、5% or 1%, which is mean that it has passed the single threshold testing. Then, fixing first threshold value, the second threshold value is

obtained by grid search which equals to 0.584, so P-value=0.006, F=12.57 which is more than the critical value under significance level of 10%、5% or 1%. In the same way, under significance level of 10%、5% or 1%, the assumption that there is only one threshold value is reject. Next, fixing the second threshold value, the first threshold value is reevaluated and equals to 0.808 in confidence interval [0.791, 0.931] that is same as the value of the first stage, which is shown that there are at least two threshold values between them. Finally, fixing the first and second threshold values, the third threshold value is obtained by searching that equals to 0.428 in confidence interval [0.427,0.999].However P-value=0.172,meaning be fail to pass significant testing. Therefore, there is a double Threshold Effect between diversification of business and performance, in which, the threshold value respectively is 0.584 or 0.808, as shown in "Table III".

TABLE III. THRESHOLD VALUE AND CONFIDENCE INTERVAL

	Threshold Value	95%Cconfidence Interval
Threshold value 1	0.808	[0.791,0.931]
Threshold value 2	0.584	[0.542,0.641]

Using endogenous data, the whole observed value is dived into three intervals, respectively is DIVER>0.808, 0.584 < DIVER < 0.808, DIVER<0.584. Specific threshold regression results are shown in "Table IV".

TABLE IV. THRESHOLD VARIABLE OF CORPORATE PERFORMANCE

Variable	Estimated Value	std	T
CUR	0.003***	0.001	2.72
TDEBT	-0.174***	0.012	-13.78
TOASS	0.017***	0.002	8.21
OC	-0.001	0.017	-0.06
DIVER-1(DIVER<0.584)	-0.080***	0.017	-4.73
DIVER-2(0.584≤DIVER≤0.808)	-0.050***	0.011	-4.27
DIVER-3(DIVER>0.808)	-0.031***	0.008	-3.47

c. Note: *, ** and *** respectively represent remarkable at significant level of 10%, 5%, 1%.

In the first interval: when diversification index d_{it} is less than 0.584, there is a negative correlation between diversification index and corporate performance of which the correlation coefficient is -0.080, namely when diversification index increases by 1%, the performance value declines by 0.080%. In the second interval: when 0.584≤DIVER≤0.808, the regression coefficient is -0.050, which shows that when the diversified index increases by 1%, performance value decreases by -0.050%.In the third interval: when the diversification index is more than 0.808, the corresponding regression coefficient is -0.031, which indicates that when the diversification index increases by 1%, the corporate performance declines by -0.031%. Above all, between diversification index and corporate performance, there is a double Threshold Effect of which the regression coefficient shows a rising tendency that gradually increases (0.031<0.050<0.808) when diversification index improving, that is, with improvement of diversification, there is a promotion of diversification to corporate performance which gradually accelerates.

In order to compare different companies, 2150 data samples of 215 companies are grouped, in which, the first interval have 1169 samples, the second interval have 333 samples, and the third interval have 648 samples. The features of each interval are analyzed as shown in "Table V".

TABLE V. STATISTICAL FEATURES OF SAMPLES IN DIFFERENT INTERVAL

	DIVER<0.584		0.584≤DIVER≤0.808		DIVER>0.808	
	Mean	*Std*	*Mean*	*Std*	*Mean*	*Std*
ROA	0.026	0.054	0.023	0.064	0.039	0.067
DIVER	0.411	0.128	0.702	0.067	0.951	0.565
CUR	1.472	1.147	1.348	1.237	1.664	2.092
TDEBT	0.516	0.178	0.555	0.175	0.509	0.193
TOASS	12.574	1.110	12.592	1.194	12.764	1.287
OC	0.170	0.122	0.173	0.128	0.188	0.123
N	648		333		1169	

In view of diversification degree of overall state-owned enterprises, the diversification indexes of most enterprises are in the third interval, which is caused that although diversification can promote corporate performance to some extent, due to different enterprises with different characteristics and operating environment, some enterprises are not able to engage in the greatest diversification; however in view of population standard deviation, the performance fluctuation range of enterprises within the third interval are largest, because when they begin to try diversifying, the performance has great instability.

In this paper, there are three intervals high, medium, and low interval that are divided according to the characteristics of diversification. After dividing, the samples become unbalance panel data, as shown in Hansman Testing random effect is stronger than fixed effect. Therefore, random effect regression method is used in this paper with performance index as the explanatory variable, the regression results of variable coefficient are shown in "Table VI" which indicates that in addition to negative correlation between moderate diversification and corporate performance, there is a significant negative correlation between over-high diversification or over-low diversification and firm performance, which is same as the regression conclusion of threshold effect and further verify the threshold regression results.

TABLE VI. ENTERPRISES PERFORMANCE REGRESSION ESTIMATION IN DIFFERENT INTERVALS

Variable	DIVER<0.584	0.584≤DIVER≤0.808	DIVER>0.808
DIVER	-0.051***	-0.051	-0.060**
	（-3.29）	（-1.05）	（-1.98）
CUR	-0.002	0.003	0.007***
	（-0.82）	（-1.07）	（7.37）
TDEBT	-0.127***	-0.125***	-0.142***
	（-8.21）	（-5.42）	（-12.64）
TOASS	0.015***	0.020***	0.017***
	（7.27）	（6.79）	（11.61）
OC	0.027***	-0.009**	-0.014
	（1.67）	（-0.35）	（-1.00）

VI. CONCLUSION

In this paper, the relationship between diversification and corporate performance is tested by samples of enterprises listing in Shenzhen. As shown in empirical study, there is a nonlinear relationship between diversification and corporate performance; with increasing of diversification, it takes a role of gradual promotion to corporate performance, which is different from the study of western scholars who have found that there is a inverted U shape between corporate performance and diversification (that is, with increasing of diversification, the corporate performance firstly increases, and then drops). The reason of this difference may be concluded into two aspects: firstly, because of the specific market environment of China, the data interval selected in this paper is a stage of Chinese market liberalization which is different from the high developed western market; secondly, the enterprises with diversification usually are large scale, complex structure, difficult to manage, and for most companies, when the diversification is low, the enterprise can not only meet the requirements of each business unit, but also disperse business risks and obtain diversification premium effect. However, with increasing of diversification, enterprises haven't enough energy and ability to operate each business unit, so that a discount effect will be present. But state-owned enterprises backed by government and banks, with advantages of capital and technology, have energy and ability to make full use of diversification to increase corporate performance. Additionally, a wide range diversification greatly exceeds original business industry, even involves in a new industry, and has good development, so as to be able to accelerate the process of diversification premium. Therefore, in western market the relationship between of diversification and corporate performance appears an inverted U conclusion, while in state-owned enterprises of China, it shows a continuous positive effect.

In general, with development of diversification in state-owned enterprises, it plays a role of promotion to corporate performance which is gradually increasing, namely the marginal benefit shows an increasing trend. Therefore, based on main business, the state-owned enterprises should make full use of the resources and potential to promote diversification in step by step, so that they will find new opportunity and improve profitability. This is not only conducive to development of enterprise itself, but also to improve the structure of capital market.

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