

# The Dynamic Impact of Diversification Strategy Based on Enterprise Scale Threshold on the Business Performance of Sports Enterprises

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## ABSTRACT

Using the panel data of 20 sports enterprises in China from 2018 to 2023 and using SYS-GMM model to overcome the endogenous problem of diversification, this paper discusses the dynamic impact of diversification strategy on the business performance of sports enterprises, constructs a dynamic threshold model, and analyzes the nonlinear relationship between diversification strategy and business performance of sports enterprises under different business sizes. It is found that under the condition of controlling the endogeneity of diversification, there is a premium effect on the impact of diversification strategy on business performance of sports enterprises; The interaction term between business size and business diversification index is included, and there is a trend from diversification discount effect to diversification premium effect; The regression results of the dynamic threshold model show that there is indeed a phenomenon that the diversification discount effect has changed into the diversification premium effect, and compared with sports service enterprises, sports goods enterprises need a larger business size to implement the diversification strategy.

## KEYWORDS

Diversification strategy; Sports enterprises; Business performance; Endogeneity; Size threshold

## 1. INTRODUCTION

Since the reform and opening up, after long-term deepening reform and continuous construction, China's sports industry has made considerable progress and development. Its significance in meeting social diversified consumption demand, optimizing industrial economic structure, increasing national (local) fiscal revenue, stimulating domestic consumption demand and building a harmonious socialist environment is beyond doubt. At the same time, it also undertakes the historical mission of realizing the transformation of China's economy from "industrial economy leading" to "service economy leading". The State Council's Opinions on Accelerating the Development of Sports Industry and Promoting Sports Consumption (GF [2014] No. 46) and the 13th Five-year Plan for Sports Development issued by the State Administration of Sports have raised the development of sports industry to the national strategy. The government proposed the top-level design of "raising national fitness as a national strategy and taking the sports industry as a green industry and a sunrise industry" to promote the sports industry to become an important driving force for economic transformation and upgrading under the new normal. As a market subject of sports industry, sports enterprises are also growing with the development of sports industry. Due to the national policies to promote the rapid

development of sports industry and under the market background of sports industry structure upgrading and sports industry integration, sports enterprises reconstruct the enterprise value chain through horizontal and vertical expansion of business, rapidly expand the enterprise size and market share, and make the diversification strategy one of the most important ones of today's sports enterprises. Whether sports enterprises can improve their performance by adopting diversification strategy will also be the focus of attention within the sports industry.

Using the methods of literature review, dynamic panel regression analysis and threshold regression analysis, this paper further studies the dynamic impact of sports enterprise diversification strategy on business performance from the following two aspects: First, the empirical research objects of diversification strategy and business performance are mainly listed companies in the whole industry and listed companies in specific industries such as tourism and agriculture. Factors such as industry characteristics, market environment and macro policies will lead to the differentiation of empirical structure, which cannot reflect the strategic choice of sports enterprises. Therefore, this paper selects the models that can solve the endogenous problems, makes a characteristic analysis of the samples of sports enterprises, analyzes whether there is a threshold effect of diversification on the productivity of sports enterprises through threshold regression, and makes a systematic analysis according to the relationship between them to ensure the accuracy of the research results. Second, after combing the literature, it is considered that it mainly focuses on qualitative research and case analysis, and the results are relatively subjective, while empirical research is more reasonable and can be further expanded on the basis of existing theories.

## **2. RESEARCH REVIEW AND HYPOTHESES**

### **2.1. Research Review**

Diversification strategy was first proposed by H.I. Ansoff. In his article *Strategies for Diversification* published in *Harvard Business Review* in 1957, he emphasized that diversification is "developing new markets with new products" [1]. Can diversification strategy improve enterprise performance? H. I. Ansoff did not give the answer, so scholars have carried out empirical research on diversification strategy and business performance. Early studies by western scholars mainly explored the impact of diversification strategy on business performance from an exogenous perspective. Most early empirical studies believed that diversification strategy would damage business performance, that is, there was diversification discount (Lang, Stulz, 1994; Bergerand Ofek, 1995) [2, 3]. Diversification discount is explained from the perspectives of agency cost increase (Jensen, 1986; Stulz, 1990) [4, 5] and internal capital market inefficiency (Shin, Stulz, 1998; ozbas, Scharfstein, 2010) [6, 7]. Although many early empirical studies verified the existence of diversification discount, some scholars still questioned the results. Campa and Kedia (2002) [8] and Villalonga (2004) [9] believe that there is a discount before enterprises implement diversification strategy, and the reason why enterprises adopt diversification strategy is that the enterprise performance is poor. They look for new profit points through diversification strategy, that is, there is the problem of diversification endogeneity. By overcoming the endogenous problem of diversification, they found that there was a premium in diversification. On the contrary, Lamont and Polk (2002) [10], Schmid and Walter (2009) [11] found that there is still a diversification discount on the basis of controlling endogeneity. At the same time, some scholars have analyzed the impact of diversification strategy on enterprise performance from the perspectives of related and unrelated diversification [12] and different performance levels [13]. Similar to the above research results, research results in China on the impact of diversification strategy on business performance are not consistent, from irrelevant relationship (Liu Li, 1997; Zhu Jiang, 1999) [14, 15], diversification discount phenomenon (Han Zhongxue, 2007; Yao Lijie, 2010) [16, 17], diversification premium (Su Dongwei, 2005) [18], to short-term premium and long-term discount (Li Jieyu, 2009; Qin bin, 2013) [19, 20].

The research on the diversification strategy of sports enterprises mainly focuses on the following aspects: The first is the theoretical research on the business model and strategic transformation of sports enterprises, which includes the growth of sports enterprises (Zhao Yilong, 2018) [21], innovation ability (Zhou Wenjing, Wang Hengli, etc., 2018) [22], strategic choice (Mao Xuyan, 2015) [23], brand formation (Wang Jingyi, 2015) [24], resource allocation (Duan Yanling, 2018) [25], and competitive advantage (Zhang Xinying, Zhang Ruilin et al., 2014) [26], etc.. The second is the empirical research on the operating performance of sports enterprises, including (1) the evaluation and analysis of the operating performance of sports enterprises from the perspectives of financial indicators (Tan Hong, Cao Guohua, 2013) [27] and performance. In general, related research has carried out perfect theoretical and empirical analysis from different fields and perspectives, which has important guiding significance for the research of this paper.

## **2.2. Research Hypotheses**

### **2.2.1. The impact of diversification strategy on business performance of sports enterprises from the perspective of endogeneity.**

Analyzed from the perspective of exogeneity, diversification strategy is an exogenous variable that is not affected by other factors. From this point of view, diversification strategy will lead the enterprise to make excessive investment by using the capital of internal capital market, resulting in excessive capital allocation and a waste of capital; the expansion of business will cause internal organizational redundancy and the problem of information asymmetry between departments, which will further increase the agency cost of diversification strategy; cross subsidies for money-losing departments cause the enterprise's collapsing loss, so as to expand financial risks. Diversification has both negative and positive effects on business performance. From the viewpoint of endogeneity, before deciding to carry out diversification, the management will combine the enterprise's early operating performance and internal and external conditions to select the optimal business portfolio, mainly from the following aspects: When the enterprise moves from rapid growth to stability, it is unable to expand its business size due to the limitation of market scale. In this case, diversification strategy can raise business size of the enterprise quickly and form scale effect and economies of scope; When the enterprise is in the excessive allocation of resources, appropriate diversification can make effective use of the remaining resources, and make the resources flow freely among departments, so as to realize the optimal resource allocation within the enterprise. Diversification strategy can build the enterprise's internal capital market, reduce the enterprise's dependence on the external capital market and effectively reduce the operating cost. When the enterprise makes wrong business choices and a business market goes down, diversification can reduce the fluctuation of business revenue and share business risks. Based on the above analysis, this research poses the following hypothesis:

H1 Considering the endogeneity of diversification, diversification strategy has a significant positive effect on business performance of sports enterprises.

### **2.2.2. Nonlinear relationship between diversification strategy and business performance of sports enterprises.**

In fact, the performance of diversification varies according to the different development stages of the enterprise. Economic theory holds that under the action of the Law of Diminishing Marginal Returns, the gradual expansion of enterprise production scale will lead to the decline of marginal revenue rate. Meanwhile, in order to achieve the value-added goal, the enterprise, as a rational man, usually adopts diversification strategy to further release the marginal output capacity of factors. It can be seen that diversification strategy plays a certain role in promoting business performance of large enterprises. In addition, large enterprises in the mature stage already have the advantages of market pioneers and have a certain control over key resources and elements. They are more likely to reduce operating costs and risks through better portfolio under the promotion of diversification strategy and obtain greater economies of scale and scope (Du Jian, Ding Sasa, 2019) [34]. On the contrary, for small-

scale start-ups or growth enterprises, the implementation of diversification requires more resources to expand new business, resulting in the decentralization of limited resources and the reduction of capital utilization. This will affect the original main business of small enterprises with poor anti-risk ability, weaken their overall operation ability and damage their healthy development (Wang Min et al., 2018) [35]. Accordingly, this paper puts forward the following hypothesis:

H2: Diversification strategy has threshold effect on business performance. When the business size is small, diversification strategy shows discount effect; When the business size is large, the diversification strategy shows a premium effect.

### 3. RESEARCH DESIGN

#### 3.1. Model Construction

##### 3.1.1. Dynamic Panel Model Considering Endogeneity.

This paper uses Cobb-Douglas production function (C-D production function) containing technological progress to analyze the impact of diversification strategy on business performance. The basic form of C-D production function is as follows:

$$Y = AK^\alpha L^\beta. \quad (1)$$

Wherein, Y represents total output, K and L represent capital factor input and labor factor input respectively, and A is the residual productivity after removing factor contribution, i.e., technological progress,  $\alpha$  and  $\beta$  are the elasticity coefficients of capital and labor inputs.

Considering the endogeneity of diversification, that is, diversification strategy is an endogenous variable affecting business performance, we add it to the C-D production function as a partial variable of A and obtain:

$$Y = Ah_i^\theta K^\alpha L^\beta e^\lambda \quad (2)$$

Wherein,  $h_i$  stands for the business diversification index and  $\theta$  for the elasticity coefficient of diversification strategy to enterprise performance. Let  $tfp = \frac{Y}{K^\alpha L^\beta}$  be the total factor productivity, and then find the logarithm on both sides to obtain:

$$\ln tfp = \lambda + \theta \ln h_i + \varepsilon. \quad (3)$$

Equation (3) is simplified to obtain:

$$tfp = \beta_0 + \beta_1 h_i + \beta_2 x + \varepsilon \quad (4)$$

Considering the endogenous problem of diversification and the impact of diversification strategy under different business scales, the lag of the explained variable and the interaction term between diversification strategy and business size are added to the empirical model to obtain the dynamic panel model:

$$tfp = \beta_0 + \beta_1 tfp_{i,t-1} + \beta_2 h_{i,t} + \beta_3 h_{i,t} \times \ln sales + \beta_4 x_{i,t} + \varepsilon_{i,t}. \quad (5)$$

Wherein, i and t represent the year and the individual enterprise respectively,  $\ln sales$  is the business size, and x represents the control variable,  $\varepsilon$  represents the random error term.

### 3.1.2. Threshold regression model.

The panel threshold regression model proposed by Hansen (1999) can not only accurately estimate the threshold value, but also test the significance of the threshold value, which avoids to a certain extent the statistical error and regression error caused by the subjective determination of the threshold value [36]. At the same time, considering the endogenous problem of diversification, this paper uses Hansen's research to test the dynamic panel threshold model, and sets  $\ln sales$  as the threshold variable to explore the impact of diversification strategy on business performance under different business sizes. The estimation model of dynamic panel threshold model is as follows:

$$tfp_{i,t} = \beta_0 + \beta_1 tfp_{i,t-1} + \beta_{21} hi_{i,t} I(\ln sales_{i,t} \leq \lambda_1) + \beta_{22} hi_{i,t} I(\lambda_1 < \ln sales_{i,t} \leq \lambda_2) + \dots + \beta_{2n} hi_{i,t} I(\lambda_{n-1} < \ln sales_{i,t} \leq \lambda_n) + \beta_{2n+1} hi_{i,t} I(\ln sales_{i,t} > \lambda_n) + \beta_3 x_{i,t} + \varepsilon_{i,t}. \quad (6)$$

Wherein,  $\lambda_1, \lambda_2, \dots, \lambda_{n-1}, \lambda_n$  are the threshold variables of business size.

## 3.2. Variable Selection

### 3.2.1. Explained variables.

By analyzing the relationship between some financial indicators and total factor productivity, Yuan Guiqiu and Hu Zuo (2009) proposed that total factor productivity can fully reflect the profitability and development capacity of enterprises and effectively avoid the impact of macro environment on enterprise output [37]. Therefore, this paper will select enterprise total factor productivity (TFP) to measure enterprise operating performance, and use the Olley-Pakes approach to estimate the total factor productivity of sports enterprises from 2018 to 2023. According to the basic idea of Olley and Pakes (1996) [36], the basic model is as follows:

$$\ln Y_{it} = \alpha_0 + \beta_k \ln K_{it} + \beta_l \ln L_{it} + \beta_a age_{it} + \beta_s state_{it} + \beta_e EX_{it} + \sum_m \delta_m year_m + \sum_n \lambda_n ind_n + \varepsilon_{it}. \quad (7)$$

Where,  $i$  represents the enterprise,  $t$  stands for the year,  $Y$  represents the total output of the enterprise,  $K$  is the fixed assets of the enterprise,  $L$  represents the number of employees of the enterprise,  $year$  and  $ind$  are dummy variables of time and industry respectively,  $\varepsilon$  is the random interference item,  $age$  represents the age of the enterprise,  $state$  represents whether the enterprise is a state-owned enterprise, and  $EX$  represents whether the enterprise participates in export activities. In the estimation process of Olley-Pakes approach,  $\ln I$  is the proxy variable,  $state$  and  $EX$  are the control variables,  $\ln K$  and  $age$  are the state variables, free variables are  $year$  and  $ind$ , and the exit variable is  $exit$ .

### 3.2.2. Explanatory variable.

Business diversification index (hdi): The Herfindahl Index is used to calculate the degree of business diversification of the enterprise, and the calculation formula is:

$$hdi = 1 - \sum_{i=1}^n (p_i)^2$$

Where  $n$  is the total number of main businesses of the enterprise,  $i$  is the specific business, and  $p_i$  is the proportion of each main business income of the enterprise in the total revenue. The greater the  $hdi$ , the more diversified the enterprise's business.

### 3.2.3. Control variables.

Business size ( $sales$ ): measured by the total revenue of the enterprise's main business; human capital ( $alc$ ): measured by the ratio of annual employee compensation and benefits to the number of

employees at the end of the period; enterprise age: measured by the difference between the year of calculation and the year of establishment of the enterprise; asset liability ratio (dar): measured by the ratio of total liabilities to total assets at the end of the period; equity concentration (cr5): measured by the proportion of the shares held by the top five shareholders in the total shares of the enterprise.

### 3.3. Data Description

#### 3.3.1. Research sample.

By querying and selecting the annual financial reports of sports enterprises, excluding those with incomplete index data and too small proportion of sports business, 20 sports enterprises from 2018 to 2023 were finally selected as the research sample. The businesses of these 20 sports enterprises include the manufacturing of sports goods such as shoes and clothing, outdoor goods and fitness equipment, and sports services such as event operation, sports media, leisure fitness and the like, basically covering the 11 categories of sports industry. See Table 1 for the basic information of sample sports enterprises.

**Table 1.** Basic Information of Sample Sports Enterprises.

Name	Code	Main businesses	Security type
Toread	300005	Outdoor product manufacturing, sports industry fund establishment, outdoor tourism services, etc.	GEM
GuiRenNiao	603555	Sports shoes and clothing manufacturing and sales, sports brokerage, etc.	Shanghai A Share
Sanfo	002780	Outdoor shoes and clothing and equipment manufacturing, outdoor services, etc.	Shenzhen A Share
Beaume	833649	Sports shoes and clothing material processing, finished product production, etc.	New Third Board
CPT	833429	Sports nutrition production, monitoring instrument manufacturing, etc.	New Third Board
HL CORP	002105	Bicycle parts production, sports fitness equipment and material production, etc.	Shenzhen A Share
CHALLENGE	002486	Sports fabric and garment production	Shenzhen A Share
China Sports Industry Group	600158	Construction and sales of sports real estate, operation of stadiums and sports events, development of leisure and fitness activities, sports brokerage, sports lottery, etc.	Shanghai A Share
OCEANS	430617	Sports media, sports event resource management, event ticket agency, etc.	New Third Board
CW Group	835623	Leisure and fitness services, beauty services, sports commodity sales, sports training, etc.	New Third Board
Vango Sports	837629	Fencing Training and competition organizing, fencing equipment sales	New Third Board
Bestdo	834425	Sports service for companies, event organizing and sports training	New Third Board
GreatGate	835945	Sports media and event operation	New Third Board
EvergrandeTaobao	834338	Football club operation, sports advertising, player brokerage	New Third Board
Sportsexp	835182	Sports services for enterprises and individuals, including event broadcasting and operation, sports management and outsourcing, venue information system	New Third Board
Xinzhi Exploring	835073	Event organizing, sports training, sports tourism, etc.	New Third Board
Taishan Sports	837739	Production of sports facilities, sports products, etc	New Third Board
Pan-China Sports	836042	Planning, design and construction of sports facilities; investment in sports and health industry; operation of stadiums, events and clubs	New Third Board
Green World Sports	833910	Production of sports venues facilities	New Third Board
Cist Sports	830808	Sports venue services and venue system sales	New Third Board

### 3.3.2. Data sources.

The sports enterprises adopted in this paper are Shanghai and Shenzhen A-share, gem and new third board enterprises. The data are from Eastmoney and GTA CSMAR database. Considering the impact of macroeconomic trends on prices, all variables are deflated based on 2018, in which business size and human capital are deflated by the consumer price index, which is derived from the China Statistical Yearbook. The descriptive analysis of main variables is shown in Table 2.

**Table 2.** Descriptive Statistical Analysis of Main Variables.

Variable	Variable symbol	Mean value	Standard deviation	Minimum value	Maximum value
Business performance	tfp	8.3207	1.1554	3.5883	10.6779
Diversification	hi	0.4189	0.203	0.0016	0.8237
Business size	In sales	9.8645	1.5238	4.0368	12.7412
Human capital	alc	27.1225	75.1969	2.491	425.3421
Asset liability ratio	dar	0.5646	0.4352	0.0343	3.6596
Enterprise age	age	14.95	6.2075	3	31
Equity concentration	cr5	0.8105	0.2328	0.2739	1

## 4. EMPIRICAL ANALYSIS

Considering the heterogeneity of sports enterprises in different industries, that is, the diversification strategies of sports enterprises in different industries have different effects on business performance, this paper divides sports enterprises into sporting goods industry and sports service industry, so as to explore the impact of diversification strategies of sports enterprises in different industries on business performance. At the same time, all empirical results are obtained by using the measurement software Stata14.0.

### 4.1. Empirical Analysis of Dynamic Panel Model

To verify the impact of diversification strategy on the business performance of sports enterprises from the perspective of diversification endogeneity, this paper constructs a dynamic panel model including the lag of explained variables, and uses the system generalized method of moments (SYS-GMM) to estimate the dynamic panel model. SYS-GMM model can not only use instrumental variables outside the model, but also use those provided inside the model, which can effectively solve the endogenous problem of the model. Table 3 shows the test results of using SYS-GMM to estimate the dynamic relationship between diversification strategy and business performance of sports enterprises. Model 1 and model 2 are dynamic panel models comprising the business size and the interaction term between business size and business diversification index respectively. Model 3 and model 4 are dynamic panel models of sporting goods enterprises and sports service enterprises respectively. From the results of AR (1) and AR (2), it can be seen that there is no first-order autocorrelation and second-order autocorrelation in the difference of the perturbation terms of the four models. Therefore, the original assumption that the perturbation term in the estimation model has no autocorrelation is accepted. Meanwhile, the results of over identification of instrumental variables by Sargan test also show that under the significant level of 10%, the original assumption that all instrumental variables are valid cannot be rejected, which shows the rationality of the four model settings and the effectiveness of instrumental variables.

Model 1 does not include the interaction term between business size and business diversification index. The results show that under the control of the endogeneity of diversification, the impact of diversification strategy on the business performance of sports enterprises has a premium effect, which is consistent with the research results of Campa and Kedia (2002) [8], Villalonga (2004) [9], Su

Dongwei (2005) [18], and Hypothesis 1 proposed in this paper is tenable. Model 2 incorporates the interaction term between business size and business diversification index. The results show that the impact of diversification strategy on the business performance of sports enterprises has a discount effect, which is consistent with the research results of Lamont and Polk (2002) [10], Schmid and Walter (2009) [11], Li Jieyu (2009) [19]; but the regression coefficient of the interaction term is significantly positive, which indicates that the existing diversification discount effect will continue to weaken with the growth of business size, and the diversification discount effect will turn into diversification premium effect. Hypothesis 2 is supported. At the same time, model 3 and model 4 are the regression models of enterprise samples of sporting goods industry and sports service industry respectively. The regression results of the two models are consistent with those of model 2, which suggests that the regression of sub industry samples does not change the results reflected in model 2, and the regression results of model 2 are robust and scientific.

**Table 3.** Test Results of Dynamic Relationship between Diversification Strategy and Business Performance of Sports Enterprises (System GMM Estimation).

Explained variable	Model 1	Model 2	Model 3	Model 4
tfp <sub>t-1</sub>	-0.0457* (0.0273)	0.3098*** (0.0882)	0.22* (0.123)	0.2835*** (0.0873)
hi	0.3846** (0.1602)	-6.4135*** (2.22)	-7.8127*** (1.4004)	-8.3432*** (2.1571)
lnsales	0.8864*** (0.0439)	—	—	—
lnsales×hi	—	0.7101*** (0.2473)	0.8304*** (0.1366)	0.9737*** (0.2391)
alc	0.000082 (0.00052)	0.00012 (0.0016)	0.0111 (0.0275)	0.00031 (0.00087)
dar	0.0268 (0.0578)	-0.2279** (0.1154)	0.1245 (0.4058)	-0.2409* (0.1367)
age	-0.0304*** (0.0076)	-0.0093 (0.0176)	-0.01 (0.0207)	-0.0427*** (0.0129)
cr	0.0763 (0.1174)	-0.1684 (0.3435)	-1.0545 (1.0626)	-0.2983 (0.3739)
cons	0.2302 (0.2938)	5.8973*** (0.5072)	7.191*** (1.6844)	6.3195*** (0.5887)
Annual dummy variable	Yes	Yes	Yes	Yes
Number of observations	120	120	54	66
AR (1)	0.1542	0.1632	0.6957	0.1904
AR (2)	0.4295	0.1967	0.1241	0.2739
Sargan test	0.2433	0.1428	0.1223	0.165

Note: the standard error is in brackets; \*, \*\* and \*\*\* mean passing the test at significance levels at 10%, 5% and 1% respectively

According to the real state of sample enterprises, the regression results of control variables are analyzed. The regression coefficients of human capital in model 3 and model 4 are positive, but they do not pass the 10% significance level test, indicating that the improvement of human capital has a weak positive effect on the business performance of sports enterprises. The regression coefficients of asset liability ratio in model 3 and model 4 are positive and negative respectively, and only model 4 has passed the 10% significance level test, suggesting that the liabilities of sporting goods enterprises are conducive to the improvement of business performance, while the liabilities of sports service enterprises inhibit the improvement of their performance. The reason is that the sample enterprises of

sporting goods industry have been listed for a long time and have large size, and the agency cost of equity is higher than that of debt. However, the sample enterprises of sports service industry are basically newly listed new third board enterprises and small in size. They expand business size through equity financing for the reason that the agency cost of equity is lower than that of debt. The regression coefficients of enterprise age and equity concentration in model 3 and model 4 are both negative, indicating that the greater the enterprise age and equity concentration, the more unfavorable for the improvement of performance. The reason is that the older the enterprise is, the more complex its organizational structure is, and its ineffective management results in the increase of management cost; moreover, equity concentration may lead to the wrong choice of business strategy and the decline of business performance.

## 4.2. Empirical Result Analysis of Threshold Regression Model

### 4.2.1. Threshold effect test and analysis.

The interactive regression in the dynamic panel model above tests that there is a business size threshold effect between diversification strategy and sports enterprise performance; but the relationship between diversification strategy and sports enterprise performance cannot be specified when the business size exceeds a certain level. Therefore, we choose business size as the threshold variable and establish a dynamic panel threshold model to further test the business size threshold effect of diversification strategy on the business performance of sports enterprises.

Before using the threshold panel model, it is necessary to test the threshold effect to determine whether the model setting is reasonable and further estimate the threshold value. It can be seen from table 4 that when the enterprise sample is a full sample and a sample of sporting goods enterprises, the single threshold effect is significant at the significance level of 1%, while the double threshold effect is not significant at the significance level of 10%, implying that there is only one threshold value in the full sample model and the sample model of sporting goods enterprises; the single threshold regression model should be selected, and threshold values of the two models are 9.0327 and 9.2671 respectively. When the sample enterprises are sports service enterprises, the single threshold effect and double threshold effect are both significant at the significance level of 1%, while the triple threshold effect is not significant at the significance level of 10%, indicating that there are two threshold values in the sample model of sports service enterprises; the double threshold regression model should be selected, and the threshold values are 7.3792 and 9.0327 respectively.

**Table 4.** Threshold Effect Test.

Threshold		Threshold estimate	F value	P value	BS times	Critical value		
						1%	5%	10%
Full sample	Single	9.0327	33.54***	$\leq 0.0001$	300	16.847	14.0547	12.3735
	Double	11.2434	6.56	0.5733	300	29.4604	17.8777	14.0022
Sporting goods industry	Single	9.2671	24.81***	$\leq 0.0001$	300	16.0931	13.6365	12.0618
	Double	9.9979	14.54	0.1533	300	28.8864	21.2591	17.6215
Sports service industry	Single	9.0327	31.42***	0.0033	300	22.2767	16.9369	13.2383
	Double	7.3792	49.49***	$\leq 0.0001$	300	20.7725	14.9889	12.3153
	Triple	10.1365	19.23	0.2533	300	79.6167	51.4538	36.7939

Note: \*, \*\* and \*\*\* mean passing the test at significance levels at 10%, 5% and 1% respectively

#### 4.2.2. Threshold model regression results.

**Table 5.** Regression Results of Threshold Model.

Explained variable	Full sample		Sporting goods industry		Sports service industry	
tfp <sub>t-1</sub>	0.4378*** (0.0684)		0.1924 (0.1267)		0.143* (0.0774)	
hi	Lnsales ≤ 9.0327	-0.6133** (0.2829)	Lnsales ≤ 9.2671	-1.6576** (0.7318)	Lnsales ≤ 7.3792	-5.8061*** (1.0747)
	Lnsales > 9.0327	0.4429* 0.2618	Lnsales > 9.2671	0.8158** (0.3254)	7.3792 < Lnsales ≤ 9.0327	0.2778*** (0.272)
					Lnsales > 9.0327	1.221*** (0.8874)
alc	0.0024 (0.0022)		0.0372** (0.0164)		0.0026 (0.0016)	
dar	0.2736* (0.1457)		0.9673** (0.3648)		0.0199 (0.1394)	
age	0.0414 (0.0318)		0.0129 (0.0318)		0.0413 (0.0339)	
cr	0.6347 (0.0114)		-0.0751 (0.8345)		-0.3726 (0.5695)	
cons	4.0734*** (0.9637)		5.9215*** (1.592)		6.0979*** (0.8874)	
Number of observations	120		54		66	
R <sup>2</sup>	0.6661		0.69		0.8981	
F statistics	15.1		6.36		27.54	

Note: the standard error is in brackets; \*, \*\* and \*\*\* mean passing the test at significance levels at 10%, 5% and 1% respectively

Table 5 shows the regression results of threshold model based on the above threshold effect test. According to the regression results of the threshold model of the full sample, when the business size does not exceed 9.0327, the regression coefficient of the business diversification index is significantly negative at the significance level of 5%, denoting that the impact of diversification strategy on the business performance of sports enterprises has a discount effect; but when the business size exceeds 9.0327, the regression coefficient of business diversification index changes significantly from negative to positive at the significance level of 10%, and the discount effect of diversification strategy changes to premium effect. The threshold model regression results of the samples of sporting goods enterprises are consistent with those of the full sample threshold model, but the threshold value of sporting goods enterprise samples is greater than that of the full sample threshold model. From the threshold model regression results of sports service enterprises, when the business size does not exceed 7.3792, the regression coefficient of business diversification index is significantly negative at the significance level of 1%, indicating that there is a discount effect on the impact of diversification strategy on the business performance of sports enterprises; When the business size is between 7.3792 and 9.0327, the regression coefficient of business diversification index changes from negative to positive at the significance level of 1%, indicating that the discount effect of diversification strategy changes into premium effect; When the business size exceeds 9.0327, the regression coefficient of business diversification index is significantly positive and larger at the significance level of 1%,

suggesting that the positive impact of diversification strategy on the business performance of sports service enterprises continues to increase with the expansion of business size. From the overall regression results, with the increase of business size, the regression coefficients of the business diversification indexes of the three threshold panel models change from negative to positive, showing that the diversification discount effect has changed into diversification premium effect in the three sports enterprise samples, which further supports hypothesis 2. Besides, the threshold value of the sample model of sporting goods enterprises is greater than that of the full sample model, while the threshold value of the sample model of sports service enterprises is less than that of the full sample model, which shows that compared with sports service enterprises, sporting goods enterprises need a larger business size to implement the diversification strategy.

#### 4.2.3. Robustness Test.

In order to ensure the robustness of the previous estimation results, this paper uses the substitution estimation method to test the robustness. Specifically, for hypothesis 1, this paper further uses the estimation method of differential GMM to re-estimate its model; For hypothesis 2, this paper uses the static panel threshold model to retest it. The estimation results are shown in tables 6 and 7. On the whole, the estimated coefficient symbols of the core explanatory variable  $hi$  in Table 6 are consistent with the above mentioned one, and the threshold range and corresponding coefficient symbols in Table 7 are basically consistent with the above mention one, indicating that the estimation results in this paper are robust.

**Table 6.** Robustness Test Results (Differential GMM).

Explained variable	Model 1	Model 2	Model 3	Model 4
tft <sub>t-1</sub>	-0.0307	0.0859	-0.2611***	0.1734***
	(0.0233)	(0.0773)	(0.0958)	(0.0550)
hi	0.0870*	-7.6878***	-7.2936	-11.4846***
	(0.0528)	(0.9537)	(5.0127)	(1.8810)
lnsales	0.9374***	—	—	—
	(0.0324)	—	—	—
lnsales×hi	—	0.8667***	0.7243*	1.3105***
	—	(0.1023)	(0.4313)	(0.1923)
alc	0.0012***	0.0009	0.0298	0.0012
	(0.0004)	(0.0008)	(0.0355)	(0.0008)
dar	0.2102**	-0.3241**	-1.1823	-0.1437
	(0.0980)	(0.1420)	(1.1668)	(0.1112)
age	-0.0197	-0.0167	-0.0904	-0.0343
	(0.0141)	(0.0363)	(0.0817)	(0.1003)
cr5	-0.3362	-0.9896*	-2.9934	-1.5659
	(0.2053)	(0.5729)	(4.8259)	(2.3018)
Annual dummy variable	Yes	Yes	Yes	Yes
Number of observations	120	120	54	66
AR (1)	0.956	0.098	0.245	0.326
AR (2)	0.104	0.134	0.895	0.163

Note: the standard error is in brackets; \*, \*\* and \*\*\* mean passing the test at significance levels at 10%, 5% and 1% respectively

**Table 7. Robustness Test Results (Static Threshold Model).**

Explained variable	Full sample		Sporting goods industry		Sports service industry	
	hi	Lnsales ≤ 7.9671	-3.5106*** (0.5978)	Lnsales ≤ 9.2671	-1.5686* (0.8126)	Lnsales ≤ 7.3792
	—	—	—	—	7.3792 < Lnsales ≤ 8.5688	-0.1740 (0.3139)
	Lnsales > 7.9671	0.3914 (0.3676)	Lnsales > 9.2671	0.7381** (0.3393)	Lnsales > 8.5688	0.8952*** (0.2666)
alc	-0.0018 (0.0034)		0.0471*** (0.0167)		0.0031 (0.0020)	
dar	-0.0476 (0.1247)		0.7418** (0.3341)		0.2365*** (0.0777)	
age	0.0597 (0.0398)		0.0049 (0.0262)		0.0069 (0.0325)	
cr5	-0.7738 (0.9930)		-0.1466 (0.6642)		-1.1602 (0.8172)	
cons	8.0539*** (1.2746)		7.8859*** (0.8901)		8.3540*** (1.0056)	
N	100		45		55	
R <sup>2</sup>	0.4579		0.5841		0.9052	
F statistics	10.42		7.02		50.47	

Note: the standard error is in brackets; \*, \*\* and \*\*\* mean passing the test at significance levels at 10%,5% and 1% respectively

## 5. CONCLUSIONS AND DISCUSSIONS

Based on the panel data of 20 listed sports enterprises in China from 2018 to 2023, this paper selects enterprise total factor productivity as the measurement index of enterprise business performance, estimates the total factor productivity of sports enterprises by using Olley-Pakes method, and calculates the enterprise business diversification index by using the Herfindahl Index. The research samples are divided into sporting goods enterprises and sports service enterprises. The full sample model, sporting goods enterprise model and sports service enterprise model are established. The endogenous problem of diversification is overcome by using SYS-GMM model, and the dynamic impact of diversification strategy on the business performance of sports enterprises is discussed. The business size is selected as the threshold variable, a dynamic threshold model is constructed, and the nonlinear relationship between diversification strategy and business performance of sports enterprises under different business sizes is analyzed. The following conclusions are obtained: (1) Under the condition of controlling the endogeneity of diversification, the impact of diversification strategy on the business performance of sports enterprises has a premium effect; (2) The interaction term between business size and business diversification index is incorporated and the results show that the impact of diversification strategy on the business performance of sports enterprises has a discount effect, but the regression coefficient of the interaction term is significantly positive, indicating that the existing diversification discount effect will continue to weaken with the increase of business size, and there will be a transformation from diversification discount effect to diversification premium effect; meanwhile, the consistency of sub sample regression results shows that the above regression results are robust; (3) The liabilities of sports goods enterprises are conducive to the improvement of business performance, while the liabilities of sports service enterprises inhibit the improvement of business performance; (4) The regression results of the dynamic threshold model show that with the increase

of business size, the regression coefficients of the business diversification indexes of the three threshold panel models change from negative to positive, indicating that the diversification discount effect turns into diversification premium effect in all the three sports enterprise samples. Besides, through the comparison of the threshold values of the three threshold panel models, sporting goods enterprises need a larger business size to implement the diversification strategy.

## **DATA AVAILABILITY**

Data are available from the corresponding author upon request.

## **CONFLICTS OF INTEREST**

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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