

Specialization Degree and Competitive Advantage of Automobile Enterprises

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Abstract: As an important carrier to realize "Made in China 2025", the automobile manufacturing industry plays an important role in national economic and social development. In the context of the deepening international division of labor in the automobile manufacturing industry, it is of great significance to study the impact of the degree of specialization on the competitive advantage of automobile manufacturing enterprises. This paper takes China's A-share listed automobile companies from 2010 to 2019 as a sample and finds that the improvement of the degree of specialization can significantly improve the company's technological and market competitive advantages. The research of this paper reveals the economic consequences brought about by the improvement of the specialization degree of automobile enterprises, and also provides micro evidence for enterprises to enhance their competitive advantages. The research conclusions have important implications for the choice of enterprise development direction and the policy formulation of government departments.

Keywords: Degree of specialization, Competitive advantage, Automobile manufacturing.

1. Introduction

Cars are one of the most important consumer goods for residents, and increasing residents' car consumption is of great significance to China's economic and social development. In 2021, the production and sales of China's auto industry will both break through the 26 million, reaching 26.08 million and 26.27 million respectively. In 2021, China's auto industry will achieve operating income of 8.16 trillion yuan, a year-on-year increase of 3.4%; total profit of 509.4 billion yuan, a year-on-year increase of 4.0%; completed fixed asset investment of 1.14 trillion yuan, accounting for 2.1% of the total fixed asset investment in the manufacturing industry; In terms of taxation, the tax revenue of enterprises related to the automobile industry chain accounts for more than 10% of the total national tax revenue; in terms of increasing employment, the automobile industry also provides jobs accounting for 1/6 of the total employment in the whole society. As an important part of China's manufacturing industry, the automobile manufacturing industry has obvious characteristics of industrial chain division of labor and a high degree of correlation among enterprises. Cultivating a higher level of automobile industry chain and value chain system plays an important role in stimulating economic growth.

At the beginning of the development of China's automobile industry, due to the imperfect market system construction and backward enterprise management model, the development of the automobile industry appeared in the situation of "big but not strong, many but not refined". Most car companies choose vertical mergers and acquisitions to develop the whole industry Chain mode for integration. However, since the 1990s, the volume of international trade has continued to expand. Based on their own comparative advantages, companies have increasingly specialized in division of labor. Many European and American vehicle manufacturers have begun to divest their existing parts manufacturing business and move towards A professional development model focusing on technology research and development, vehicle

design and assembly. At the same time, the economic effects of specialization have gradually attracted widespread attention in the academic circles. Jabbour (2005) believes that vertical specialization can promote the transfer of technology. This technology diffusion effect comes from the importing country's purchase of products from the exporting country. It will promote the technological progress of the exporting enterprises in the importing country, which in turn will benefit the importing enterprises in the original exporting country, and the improvement of production efficiency on both sides can bring benefits to both countries [1]. Based on the input-output table, Zhang Mingzhi and Li Min (2011) calculated the vertical specialization index of China's manufacturing sub-sectors. The research found that in the process of participating in the vertical specialization of various industries, labor-intensive industries participated in vertical specialization. The degree is lower than that of capital and technology-intensive industries, and through empirical data testing, it is concluded that participation in vertical specialization is more conducive to the optimization and upgrading of domestic industries [2].

In view of this, this paper adopts the Value Added to Sales (VAS) to measure the degree of specialization of listed automobile companies, and at the same time considers the input of R&D personnel and the output of patents, and uses R&D efficiency to measure the technological competitive advantage of companies. The impact of technological competitive advantage and market competitive advantage. The empirical study found that the degree of specialization has a significant role in promoting the competitive advantage of car companies. The test shows that the improvement of the specialization degree of automobile enterprises can enhance the competitive advantages of enterprises in both technology and market.

The contributions of this paper are as follows: ① On the theoretical level, by collecting and sorting out the relevant data of China's auto manufacturing listed companies, empirically tested the impact of the degree of specialization on the competitive advantage of auto companies, and analyzed the degree of specialization of auto companies from

the perspectives of technology and market. The conclusions of this paper enrich the literature research on the competitive advantage of auto companies, and also provide new empirical evidence for the study of the economic consequences of the degree of enterprise specialization. ② On the practical level, with the continuous advancement of the process of economic globalization, the volume of international trade has also increased rapidly. In order to improve the efficiency of resource allocation, the level of specialized division of labor between countries and enterprises has been continuously improved. As an important pillar industry of the national economy, the automobile manufacturing industry is a subject of practical significance to study the impact of the degree of specialization of automobile enterprises on enterprise performance. This paper aims at listed automobile companies to explore whether their degree of specialization can enhance the competitive advantage of automobile companies, which provides a certain reference for the future development model selection of China's automobile industry.

2. Theoretical Analysis and Research Hypothesis

The automobile industry has the characteristics of long value chain and obvious division of labor in the production chain, and the input of production factors required for the production of different products is different. Based on the theory of comparative advantage, it is more beneficial for enterprises to sell products with comparative advantages and purchase products with relative disadvantages to increase the performance of enterprises. With the refinement of the division of labor in the automobile industry chain, each enterprise in the industry chain pays more attention to professional development. By making use of its own comparative advantages, it can improve the technical level on the one hand, and enhance the competitive advantage of the product market on the other hand.

The technological competitive advantages of enterprises are reflected in the input side related to R&D investment, R&D personnel, etc., and the output side related to patents, etc. Based on the technology spillover effect, the improvement of the degree of specialization of enterprises is more conducive to the improvement of their innovation capabilities [3]. Vertical specialization promotes the increase of enterprise or industry R&D investment mainly through the following channels: First, vertical specialization division of labor can make the input ratio of each enterprise's production factors more reasonable, thereby reducing the marginal cost of enterprise product production, thereby promoting enterprise innovation Increased capacity [4]. Second, vertical specialization is conducive to the enhancement of the core business capabilities of enterprises. Based on the "learning by doing" effect, the labor productivity and core competitiveness of enterprises can be continuously improved, thereby encouraging them to increase investment in innovation to obtain long-term competitive advantages [5]. Thirdly, the specialized division of labor in the specific production process of a product is conducive to improving product quality, thereby better meeting the needs of consumers, thereby promoting product R&D and innovation [6]. Fourth, the improvement of the degree of specialization of enterprises will increase the purchase of intermediate goods, and based on the technology spillover effect, it can promote the improvement of labor productivity of enterprises [7], and thus

increase the investment of enterprises in research and development [5]. Existing literature research mainly focuses on whether vertical specialization will affect the innovation input and output of enterprises. There are few literatures that combine the two and analyze the technological competitive advantage of enterprises from the value dimension, that is, the impact of specialization degree on R&D efficiency.

Product market competition is an important external governance mechanism for enterprises. Obtaining market competitive advantages can help enterprises increase market share in the industry, thereby improving enterprise performance. After China joined the WTO, the international trade volume of enterprises has increased year by year. With the increase of purchased intermediate products, the degree of vertical specialization has also been continuously improved, which has led to continuous development of domestic enterprises and industrial scales, and a significant increase in production efficiency [8]. Tang Dongbo (2013) believes that vertical specialization can maximize the input of enterprise production factors and give full play to their respective comparative advantages [9]. The continuous operation of the same process of products can also improve the proficiency of workers and thus increase labor productivity. Due to the existence of asset specificity, manufacturing companies outsource high fixed costs and low efficiency service links in the fierce market competition, which can more effectively leverage the comparative advantages of each company and improve production efficiency [10]. There are great differences in the input of production factors when car companies produce different products, and the improvement of production efficiency through specialization makes it easier for companies to form economies of scale, which in turn is more conducive to companies gaining market competitive advantages. Based on the above inferences, this paper proposes the following hypotheses:

H1a: The degree of specialization is significantly positively correlated with the technological competitive advantage of car companies.

H1b: The degree of specialization is significantly positively correlated with the market competitive advantage of car companies.

3. Econometric Model and Variable Setting

3.1. Sample Selection and Data Sources

In order to study the impact of the degree of specialization on the competitive advantage of auto companies, this paper selects the industry with a more significant industrial chain division of labor in the manufacturing industry—the auto industry as the research object. This paper takes the data of listed companies in the automobile manufacturing industry from 2010 to 2019 as the research sample, and screens out a total of 227 listed automobile companies. Missing data and abnormal samples were eliminated, and all micro-level continuous variables were tailed at the upper and lower 1% levels, so as to avoid large errors in estimation caused by extreme values. The financial data and patent data of listed companies come from the CSMAR database and the CNRDS database. Some missing data such as corporate R&D expenditures are manually collected and supplemented through annual reports, and finally 1074 observations are obtained.

3.2. Key variable measure

3.2.1. Explained variable

Technical Competitive Advantage (TCA): Referring to the research of Kong Dongmin (2017) [11], Quan Xiaofeng and Yin Hongying (2017) [12], Yang Wu et al. (2018) [13], the number of patent applications per unit of R&D personnel (TCA1) and the number of patents obtained per unit of R&D personnel are calculated (TCA2).

Market Competitive Advantage (MCA): Based on the research of Tan Duoqiao et al. (2010), it is measured by the growth rate of the main business income of listed companies in the total main business income of all sample companies in the industry [14].

3.2.2. Explanatory variables

Enterprise Specialization (VSI): Value Added to Sales

$$\begin{aligned}
 VAS &= \frac{\text{Added value} - \text{net profit after tax} + \text{normal profit}}{\text{Main business income} - \text{net profit after tax} + \text{normal profit}} \\
 &= \frac{\text{Added value} - \text{net profit after tax} + \text{net assets} * \text{average return on equity}}{\text{Main business income} - \text{net profit after tax} + \text{net assets} * \text{average return on equity}} \quad (1)
 \end{aligned}$$

Among them, the added value is expressed by the difference between the main business income of the enterprise and the purchase amount, the purchase amount is calculated according to the following formula, and the average return on net assets is measured by the average value of the industry (According to the Shenying & Wanguo secondary industry classification standard) in which the enterprise belongs.

Purchase amount = (cash paid for purchasing goods and accepting labor services + initial payment - end payment + Payables at the end of the period - payables at the beginning of the period + notes payable at the end of the period - notes payable at the beginning of the period) / (1 + VAT rate of purchased goods) + beginning inventory - ending inventory

VAS measures the proportion of the added value of the enterprise in the main business income. The larger the proportion, the higher the degree of vertical integration of the enterprise. Drawing on the research of Yuan Chun et al. (2021), the reverse index of VAS is used to measure the degree of enterprise specialization [18]. details as follows:

$$VSI = 1 - VAS \quad (2)$$

In order to ensure the validity of the measurement, referring to the research of Fan Ziyang and Peng Fei (2017) [17], this paper excludes the observations whose VSI deviates from the reasonable range [0, 1].

3.3. Empirical Model Construction

Build the model (1.1) (1.2) to test the hypotheses H1a and H1b:

$$TCA = \beta + \beta_1 VSI + \beta_2 Controls + Year + Area + \varepsilon \quad (1.1)$$

$$MCA = \beta + \beta_1 VSI + \beta_2 Controls + Year + Area + \varepsilon \quad (1.2)$$

(VAS) was first proposed by Adelman (1955), and then widely used to measure the degree of vertical integration [15]. The calculation of this indicator is mainly measured by the ratio of the added value of the enterprise's products to the overall income of the enterprise. The higher the ratio, the higher the degree of vertical integration of the enterprise. Based on previous studies on enterprise division of labor, vertical specialization and vertical integration are considered to be a set of opposite concepts, and the degree of enterprise specialization is measured with reference to this research conclusion. In order to avoid the influence of vertical integration measurement indicators by the profitability of enterprises, referring to the research of Buzzell (1983) [16], Fan Ziyang and Peng Fei (2017), this paper adopts the modified value-added method for measurement [17]. The specific calculation is as follows:

Among them, the explained variables TCA and MCA are technological competitive advantage and market competitive advantage respectively, the explanatory variable VSI is the degree of enterprise specialization, and Controls is a series of control variables, including company size (Size), asset-liability ratio (Lev), property right nature (SOE), enterprise age (Age), growth capability (Gro), R&D intensity (Rd) and ownership concentration (Fir). At the same time, the province and year where the enterprise is located are controlled, Year is a dummy variable for the year, and Area is a dummy variable for the area where the enterprise is located. If β_{jis} is significantly positive, the hypotheses H1a and H1b are verified.

4. Analysis of Empirical Results

4.1. Benchmark regression

In order to study the impact of the degree of specialization on the technological and market competitive advantages of enterprises, the following regression analysis is carried out, and the specific results are shown in Table 1: Columns (1) (2) (3) (4) are the explained variables Regression results of enterprise technological competitive advantage and explanatory variable specialization degree. Columns (5) and (6) are the regression results of the explained variable enterprise market competitive advantage and the explanatory variable specialization degree. The results of columns (1) and (3) show that after controlling the year and province, the estimated results of adding only the core explanatory variables show that the specialization degree VSI of car companies and the technological competitive advantages TCA1 and TCA2 are both significantly positive at the 10% level. The result shows that the higher the degree of specialization of the car company, the more patents the company's R&D personnel apply for, that is, the stronger the company's technological competitive advantage. On the one hand, the increase in the degree of specialization enables enterprises to invest more limited resources in the R&D and

production of major products, strengthens the collaboration ability of R&D personnel on related technological breakthroughs, and greatly improves the efficiency of product R&D of enterprises. On the other hand, the increase in the degree of specialization has also increased the investment of enterprises in outsourcing intermediate products. Based on the technological spillover effect of outsourcing intermediate products, enterprises can also better improve innovation efficiency. The results in columns (2) and (4) show that after the control variables are added, the regression coefficients before VSI of specialization degree are 0.165 and 0.124 respectively, and both are significantly positive at the 5% level, and the results have not changed significantly. The results support the hypothesis H2a of this paper. The results in column (5) show that after controlling the year and province, the estimated results of adding only the core explanatory variables show that the specialization degree VSI of car companies and the market competitive advantage MCA

are significantly positive at the 5% level, indicating that the professionalism of car companies The higher the degree of globalization, the more the company can occupy more product market share, that is, the stronger the company's competitive advantage in the market. On the one hand, the improvement of the specialization degree of enterprises can increase the production scale of main products, thereby generating scale effect and occupying a larger market share at a lower cost. On the other hand, the improvement of the degree of specialization can increase the differentiation from other similar products through the technical improvement of the main products, and then obtain a larger market share. The results in column (6) show that after the control variables are added, the regression coefficient before specialization degree VSI is 0.07, and it is significantly positive at the 5% level, and the result has not changed. This result supports the hypothesis H2b of this paper.

Table 1. The Effect of Degree of Specialization on Competitive Advantage

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	TCA1	TCA1	TCA2	TCA2	MCA	MCA
VSI	0.113* (1.871)	0.165** (2.455)	0.103* (1.839)	0.124** (1.980)	0.089** (2.424)	0.070** (2.209)
Size		0.025** (2.432)		0.026*** (2.646)		0.009* (1.827)
Lev		-0.192*** (-2.744)		-0.165** (-2.511)		0.004 (0.108)
Soe		0.053* (1.777)		0.053* (1.895)		-0.015 (-1.069)
Age		-0.197*** (-4.760)		-0.167*** (-4.290)		-0.048** (-2.577)
Gro		0.063* (1.856)		0.059* (1.864)		0.468*** (26.625)
Rd		2.478*** (3.977)		2.126*** (3.640)		-1.153*** (-3.488)
Fir		-0.082 (-1.157)		-0.022 (-0.330)		-0.016 (-0.458)
Year	Control	Control	Control	Control	Control	Control
Area	Control	Control	Control	Control	Control	Control
Constant	0.260* (1.844)	0.104 (0.377)	0.323** (2.452)	0.080 (0.311)	-0.179*** (-3.296)	-0.368*** (-3.001)
Observations	682.000	682.000	682.000	682.000	1069.000	1069.000
R-squared	0.127	0.202	0.138	0.203	0.061	0.460

Note: t values are in brackets, ***p<0.01, **p<0.05, *p<0.1, the same below

4.2. Endogeneity issues

Considering the possible endogeneity issues in this study, enterprises with strong competitive advantages are more inclined to increase their own specialization, so this paper uses the propensity score matching method for robustness testing. According to the different degrees of specialization of the sample enterprises, first set the dummy variable VSI_D, and measure according to whether the VSI is greater than the sample median, if it is greater than the median, take 1, indicating that the enterprise has a high degree of

specialization, otherwise take 0. Taking VSI_D as the explained variable, and the control variable affecting VSI_D as the matching variable, Logit regression was used, and the nearest neighbor matching method was used to perform 1:1 matching with replacement between the two groups, and finally the matched samples were used for regression. Table 2 reports the regression results based on PSM paired samples. After controlling for potential endogenous problems, the relevant regression results are basically consistent with the previous ones, further confirming the previous conclusions.

Table 2. Robustness test: Regression results after PSM matching

VARIABLES	(1)	(2)	(3)
	TCA1	TCA2	MCA
VSI	0.299*** (4.249)	0.187*** (2.801)	0.062* (1.914)
Size	-0.008 (-0.684)	0.012 (1.052)	0.019*** (3.511)
Lev	-0.119 (-1.504)	-0.231*** (-3.055)	-0.000 (-0.001)
Soe	0.111*** (3.392)	0.142*** (4.574)	-0.074*** (-5.034)
Age	-0.162*** (-3.677)	-0.133*** (-3.174)	-0.048** (-2.341)
Gro	0.099*** (2.882)	0.113*** (3.463)	0.419*** (22.923)
Rd	-0.159 (-0.230)	0.257 (0.392)	-1.655*** (-4.703)
Fir	-0.068 (-0.904)	-0.038 (-0.525)	0.053 (1.428)
Year	Control	Control	Control
Area	Control	Control	Control
Constant	0.849*** (2.782)	0.417 (1.434)	-0.554*** (-3.999)
Observations	657.000	657.000	1052.000
R-squared	0.237	0.238	0.448

5. Summary

This paper analyzes the impact of the degree of specialization on the competitive advantage of listed automobile companies. According to the analysis and empirical research results of this paper, the following conclusions are drawn: the degree of specialization has a significant role in promoting the competitive advantage of automobile companies. In terms of enterprise technology research and development, the degree of specialization is significantly positively correlated with technological competitive advantage. The improvement of the degree of specialization enables enterprises to focus more on the R&D and production of major products, and more resources are tilted to improve the R&D capabilities of enterprise products. In addition, the improvement of the degree of specialization has increased the purchase of intermediate products by enterprises. Based on the "technology spillover effect" of purchased intermediate products, the improvement of specialization can improve the technological competitiveness of enterprises; in terms of market share, the degree of specialization significantly positive correlation with market competitive advantage. Market share is one of the important evaluation indicators of enterprise value. On the one hand, the improvement of the degree of specialization can expand the production scale of the company's main products, form a scale effect, and thereby reduce the unit production cost; Core business capabilities further form the differentiation among similar products and establish higher industry entry barriers, so as to better consolidate and develop market competitive advantages.

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