

The Allocation of Asset Structure Based on the Economies of Scale – Taking Listed Manufacturing Companies for Example

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Abstract. With economies of scale as the objectives and constraints, the optimal allocation of enterprises' asset structure was discussed. The main contributions of this paper are as follows: (1) Economic efficiency of scale from 2007 to 2011 in various sub-industries of manufacturing was obtained. (2) After empirical analysis and comparative study of the relationship between economic efficiency of scale and asset structure, we arrived at optimization direction of the enterprises which are at economies scale and diseconomies scale.

Introduction

In recent years, with the outbreak of global financial crisis, a large number of enterprises went bankrupt. Some of these enterprises broke their cash flow due to shortage of funds, and the others made bad investment decisions and invested large amount of money into assets with weak liquidity. In terms of asset structure, the reason of bankruptcy for above enterprises is that the number of current assets and long-term assets does not match. Nobel Prize in Economics awarded Alvin Roth and Lloyd Shapley in 2012 to commend their contribution on "Stable Matching Theory and Practice of Market Design". It is obvious that the problem of matching has an important value in economic development. Many scholars think that the allocation of asset should be arranged in advance rather than random outcome. But they have not yet given a clear optimization method of allocation. The reason is that the target of decision is difficult to definite. If the target is profitability, we should expand the proportion of long-term assets; if the target is liquidity, we should expand the proportion of liquid assets; if taking into account the profitability and liquidity, we should balance long-term assets and current assets, but it gets back to the problem itself.

There are various economic goals in business, while the goal of achieving economies of scale emphasizes rational allocation of production factors. But it is not subdivided to specific asset to consider the coordination between various assets. This paper used economies of scale as the objectives and constraints, and explored the allocation of asset structure. Our research makes contribution to adjust the directions of asset structure.

Research Review

The related research about economies of scale mainly includes the definition, measurement methods and influence factors [1-4]. Production function method, intra-industry trade method, market structure method and cost function method are used to measure the economies of scale. Particularly, production function method is the most commonly used, which includes CD method, transcendental

logarithmic function method, DEA method and ray homothetic function method. Economies of scale is affected by many factors, such as natural resources, special equipment, organizational factors, technical exchanges, business performance and so on.

The studies about asset structure are mostly concentrated on classification, measurement methods and economic consequences [5-6]. The proportion of various assets is used to measure asset structure. It can affect the competitiveness of enterprises and financial security and enterprise performance, forecast the financial crisis, and aid to make investment decisions.

Theoretical foundation and Research Hypothesis

Principal-agent theory, synergy theory, theory of constraint and modern portfolio theory put forward the optimal direction of asset structure from different perspectives.

Principal-agent theory explains the relationship between principal and agent. The separation of ownership and management rights makes it easier to gather large capital and implement enterprise-scale operation, generating economies of scale. But the agent tends to make use of assets inappropriately, especially cash. It leads to the change of the asset structure. The smaller the cash ratio is, the easier it is to achieve promotion of economic efficiency. Hypothesis 1 is put forward.

H1: For the enterprises which are in the economies of scale, the cash ratio is negatively related to the economic efficiency of scale.

Synergy is overall operating performance through technology transfer and business activities share generated by each separate component, whether an independent enterprise or a portion of the enterprise. In various aspects of a single enterprise, such as R & D, production and sales, the complementary of different resources will generate synergy and economies of scale. The large-scale production is also helpful for economies of scale in terms of fixed assets. Raw materials and finished goods are major components of inventories. Hypothesis 2 and hypothesis 3 are put forward.

H2: For the enterprises which are in the economies of scale, the inventory ratio is positively related to the economic efficiency of scale.

H3: For the enterprises which are in the economies of scale, the fixed assets ratio is positively related to the economic efficiency of scale.

Theory of constraint reveals the most unfavorable factor or weakest link of which can determine the effectiveness and efficiency of the system. In order to achieve economies of scale, firstly, enterprises need to know "short board" in the different phase of the life-cycle rather than simply expanding assets. In the early stage of expansion, a lot of special equipment, special materials and some other physical assets should be invested, physical assets at this time is the "short board". However, when the scale reaches a certain level and is more than the optimal scale, intangible assets becomes the "short board" which is urgent to be solved. Thus, hypothesis 4 is put forward.

H4a: For the enterprises which are in the economies of scale, the intangible assets ratio is negatively related to the economic efficiency of scale.

H4b: For the enterprises which are in the diseconomies of scale, the intangible assets ratio is positively related to the economic efficiency of scale, and the relationship between other assets and the economic efficiency of scale is not obvious.

Modern portfolio theory was first used in the area of financial assets investment, namely, the portfolio of financial assets with different risks can decrease the whole risk. Different assets have different risks and returns, so different asset portfolios make enterprises face different risks and benefits. From the perspective of weigh of risks and benefits, too many liquid assets or insufficient

investment in fixed assets will reduce the economic efficiency of scale, thus, the ratio of fixed assets and current assets is selected as a proxy variable of asset structure. Hypothesis 5 is put forward.

H5: For the enterprises which are in the economies of scale, the ratio of current assets and fixed assets is negatively related to the economic efficiency of scale.

The model (1) examined the relationship between internal structure of current assets and non-current assets and economies of scale. The model (2) examined the relationship between the ratio of current assets and fixed assets and the economies of scale.

$$Y_t = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + \alpha_4 X_4 + \alpha_5 ROE + \alpha_6 Te_{t-1} + \alpha_7 Year + \alpha_8 IND + \varepsilon \quad (1)$$

$$Y_t = \beta_0 + \beta_1 X_5 + \beta_2 ROE + \beta_3 Te_{t-1} + \beta_4 Year + \beta_5 IND + \varepsilon \quad (2)$$

Y_t was economic efficiency of scale (SE) which was output in VRS model. X_1, X_2, X_3, X_4, X_5 is Cash Ratio, Inventory Ratio, Fixed Assets Ratio, Intangible Assets Ratio, the Ratio of Current Assets and Fixed Assets. Four control variables are ROE, technical efficiency of the previous period, year and industry. The two measurement methods, on the one hand, help enterprises fully embody the connotation of asset structure. On the other hand, model (1) and model (2) can test each other.

Empirical Analysis

Table 1 Multiple regression results of the two models

Variable	Model (1)		Model (2)	
	Economies of Scale Group	Diseconomies of Scale Group	Economies of Scale Group	Diseconomies of Scale
X_1	-0.158*** (-6.696)	0.059 (1.327)		
X_2	0.110*** (5.369)	0.043 (1.039)		
X_3	0.073*** (3.168)	0.025 (0.468)		
X_4	-0.108*** (-5.925)	0.084** (2.391)		
X_5			-0.183*** (-10.239)	0.040 (0.998)
ROE	0.053*** (2.787)	0.033 (0.929)	0.056*** (2.932)	0.031 (0.871)
Te_{t-1}	0.267*** (13.103)	-0.144*** (-3.601)	0.235*** (11.913)	-0.151*** (-3.860)
Year	control	control	control	control
IND	control	control	control	control
Adjusted R^2	0.165	0.253	0.135	0.249
F Value	31.818***	14.504***	30.621***	17.075***
D-W Value	1.755	2.010	1.725	2.004

Note: ***, **, * respectively represents double-tailed significance under the 1%, 5%, 10% significance level, the values in brackets are sig. values, and other data are Pearson correlation coefficient.

This paper used the data of manufacturing listed companies in China from 2007 to 2011 as the object of study. We obtained data of 883 listed companies from the RESET database and CSMAR database and the internet. SPSS17.0 and Win4DEAP software were used to process data. Using the DEA method to calculate the economic efficiency of scale can avoid problems of too many assumptions, subjective weight setting, limitation of samples and difficulty in dividing the stage of economies of scale. And this paper used VRS model of DEA.

The mean values of SE of Chinese listed companies in each sub-industry were higher than 0.88, it indicated that Chinese manufacturing enterprises had higher economic efficiency of scale. The minimum standard deviation value appeared in C2 wood furniture in 2007, it was 0.0119. The maximum value emerged in C7 mechanical equipment instrument in 2011, it was 0.1194. In C7 machinery manufacturing, the mean value of economic efficiency of scale was 0.9084 in 2011, which was smaller than the value 0.9383 in 2010. It implied a poor development momentum in this industry and it occurred in 2012. C7 sub-industry almost had the largest standard deviation in each year and it reached a peak in 2009, it indicated that there is big difference in productivity.

The regression results of model (1) and model (2) was shown in Table 1. And the VIF value of each independent variable is approximately 2, far less than 10, and it's tolerance is far greater than 0.1. The adjusted R^2 of models respectively are 0.165, 0.253, 0.135, 0.249 and all F values are significant under the 1% significance level. It shows that the two models are reasonable by testing. The results show that hypothesis 1, 2, 3, 4a and 4b are true.

Conclusions

The main conclusions are as follows. (1)The average value of economic efficiency of scale is higher than 0.88, and the gap between each sub-industries is small. The overall manufacturing is in the economies of scale and the economic efficiency of scale is relatively high. (2) With the empirical test, the paper confirmed that the relationship between economies of scale and asset structure, and provided reasonable investment direction for the enterprises which were in different stage of economies of scale.

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