

Research on Financing Prosperity Monitoring of Equipment Manufacturing Industry based on Industry 4.0

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Abstract

Industry 4.0 has brought opportunities and challenges to the development of China's equipment manufacturing industry. In order to boost the healthy development of equipment manufacturing industry, the paper select appropriate financing prosperity index and construct financing prosperity diffusion index and composite index in equipment manufacturing industry from the perspective of financing. Then we analysis the dynamic development trend toward financing prosperity of equipment manufacturing industry, and design the early warning signal lamp for it. In this paper, we take 2006-2015 quarterly data of the equipment manufacturing industry as a sample data, and wish to achieve the equipment manufacturing industry financing prosperity monitoring. Finally, the paper put forward to a series of corresponding improvement measures to address the problems related to financing problems in equipment manufacturing industry.

Keywords

Industry 4.0; Equipment Manufacturing Industry; Financing; Prosperity.

1. Introduction

China's equipment manufacturing industry is a pillar industry in the development of national economy. Under Industry 4.0, equipment manufacturing industry requires huge capital investment when it develops toward the direction of high-end. But China's equipment manufacturing industry has some financing problems which are imperfect financing structure system, single financing tool and other issues. Predecessors' researches mainly focus on the equipment manufacturing industry's sustainable development and competitiveness. However, fewer studies concerned about the equipment manufacturing industry financing prosperity monitoring.

In the study of the competitiveness of equipment manufacturing industry, Tao Lianghu (2005) used RCA method and PCA method to analysis the competitiveness of Hubei equipment manufacturing industry. In the prosperity monitoring, China has the authoritative economic prosperity indexes which include China Economic Prosperity Monitoring Center and Goldman Sachs (Asia) jointly developed the prosperity trend index, the economic index of China Economic Information Network, as well as China Consumer price index. Compared with the domestic economic index, foreign also has some influential prosperity indexes which include American Conference Committee prosperity indicator system, the US Economic Cycle Institute (ECRI) prosperity index and the Japanese prosperity trend index.

Because the equipment manufacturing industry is most concerned industry, its financing activity is related to the development of equipment manufacturing industry. Therefore, this paper will focus on financing prosperity monitoring of equipment manufacturing industry, and we hope to help the industry's financing risk monitoring.

2. The Characteristics of Equipment Manufacturing Industry Financing Activities

At the beginning of the 21th century, China put forward the goal of "vigorously developing equipment manufacturing industry" and introduced a series of policy to boost the development of equipment manufacturing industry. Under industry 4.0, equipment manufacturing industry actively responds to "Made in China 2025", and forces to promote industry to upgrade. Equipment manufacturing industry has developed into a pillar industry in the national economy. However, the financing of equipment manufacturing industry is difficult. According to statistics, equipment manufacturing industry financial expenses was 31.01 billion in 2016, of which interest expenses accounted for more than 90%. High financial expenses and interest expenses reflect that the financing environment of equipment manufacturing industry is not ideal. The reason contains the following three reasons: First, the lack of a good financing environment and a single financing channel in equipment manufacturing industry. Second, financing institution system is inadequate. Third, it lacks relevant professional to improve the financing environment.

Based on the characteristics of the financing environment of equipment manufacturing industry, this paper builds the financing prosperity index in order to monitor the financing environment of equipment manufacturing industry, and puts forward the corresponding improvement measures to address these problems.

3. Financing Prosperity Monitoring of Equipment Manufacturing Industry

3.1. Sample Selection and Source

In order to study the financing prosperity of the equipment manufacturing industry, this paper takes the listed companies from the equipment manufacturing industry as the sample, and uses the data from 2006 to 2015 as the sample data. The data is from the CSMAR.

3.2. Financing Prosperity Monitoring Indicators Selection

3.2.1. Indicator Selection

Equipment manufacturing industry financing prosperity index is a composite index which reflects the industry trends in the financing activities. Based on the principle of representation, comprehensiveness and accessibility, this paper chooses 18 indicators: Equity multiplier, P / E Ratio, P / B Ratio, Equity Free Cash Recovery, Current Ratio, Quick ratio, Operating Cash Flow Liabilities Ratio, Working Capital and Loan Ratio, Shareholders' Equity Turnover Ratio, Working Capital Ratio, Easy Rate of Change, Borrowing Degree, Financial Asset Structure Ratio, Operating Gear Ratio, Financial Liability Ratio, Financial Leverage, Rate of Capital Accumulation and Net Growth Rate of Financing Activities.

3.2.2. Indicators Classification

According to the compilation principle of prosperity index, this paper regards equity multiplier as benchmark index. With the method of time difference correlation analysis, the paper uses the SPSS 19 software to calculate the time difference correlation coefficient between the candidate index and the benchmark index, and finally selects 14 indicators to be divided into leading, coincident and lagging indicators, as shown in Table 1.

Table 1. Equipment Manufacturing Industry Financing Prosperity Indicators System

Index Classification	Indicators	Time Difference Correlation Coefficient	Time Cycle(Negative for leading and positive for lagging)
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Leading Indicators	P/ E Ratio	0.430	-3
	P/ B ratio	0.671	-3
	Operating Cash Flow Liabilities Ratio	0.581	-2
	Easy Rate of Change	0.457	-6
	Rate of Capital Accumulation	0.394	-2
Consistent Indicators	equity multiplier	0.830	0
	Working Capital and Loan Ratio	0.175	1
	Borrowing Degree	0.536	-1
	Financial Asset Structure Ratio	0.393	1
	Net Growth Rate of Financing Activities	0.600	1
Lagging Indicators	Equity Free Cash Recovery	0.554	2
	Shareholders' Equity Turnover Ratio	0.326	3
	Working Capital Ratio	0.497	3
	Financial Leverage	0.302	7

3.3. Equipment Manufacturing Industry Financing Prosperity Index Preparation and Monitoring

3.3.1. Financing Prosperity Diffusion Index Preparation and Monitoring

The diffusion index reflects the proportion of the total number of expansion variables at a given point. Before calculating the diffusion index, it is necessary to determine the characteristics of each indicator in each period. First of all, we should calculate the sequence of the growth rate. If the growth rate is positive, then the sequence in this period as "expansion", and it can be denoted as "+". If the growth rate is negative, then the sequence is "contraction" in this period and it can be denoted as "-". Then we can calculate the percentage of indicators that is in the expansion. According to the calculation of the equipment manufacturing industry financing prosperity diffusion index, the equipment manufacturing industry financing diffusion index curve can be drawn. As shown in Figure 1.

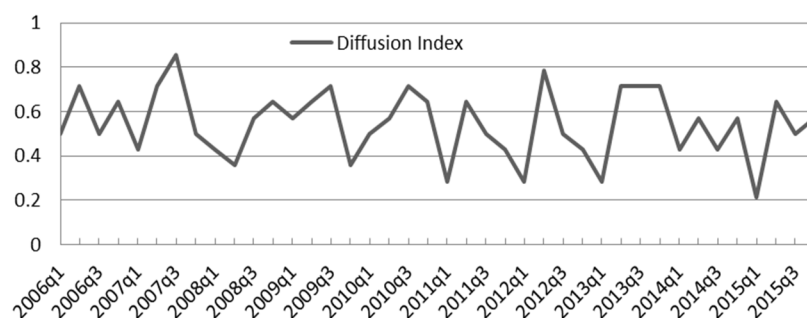


Figure 1. Equipment Manufacturing Financing Prosperity Diffusion Index

As can be seen from Figure 1, the equipment manufacturing industry prosperity diffusion index has 12 peaks and the valley of the 11 points. Equipment manufacturing industry financing prosperity diffusion index has been running around 50% fluctuations, which indicates that the degree of financial prosperity in the equipment manufacturing industry is in the prosperity - recession fluctuations.

3.3.2. Financing Prosperity Composite Index Preparation and Monitoring

Generally speaking, diffusion index can only roughly determine the equipment manufacturing industry financing prosperity space, but it could not clearly show the intensity of the financial prosperity fluctuations of the equipment manufacturing industry. Composite index is "barometer" of financial situation, through the size of the composite index can determine the intensity of the equipment manufacturing industry financing prosperity fluctuations. Therefore, this paper calculates leading index, consistent index and lagging index, and further prepares the comprehensive composite index of financing prosperity.

Firstly, calculate the symmetric change rate of each indicator $C_{ij}(t)$:

$$C_{ij}(t) = 200 \times \frac{Y_{ij}(t) - Y_{ij}(t-1)}{Y_{ij}(t) + Y_{ij}(t-1)} \quad t = 2, 3, \dots T \quad (1)$$

In the Formula above: the index $Y_{ij}(t)$ is the first j indicators of the i index, j is represented the leading, consistent, lagging index, t represents the sample capacity.

Secondly, calculate the standardized rate of change $V_j(t)$. Before calculating it, we should obtain the comprehensive rate of change $R_j(t)$ at each time point of the leading, consistent and lagging indicator:

$$R_j(t) = \frac{\sum_{i=1}^{k_j} S_{ij}(t) \times w_{ij}}{\sum_{i=1}^{k_j} w_{ij}}, j = 1, 2, 3; t = 2, 3, \dots T \quad (2)$$

In the Formula above: the paper uses equal weights, $w_{ij} = 1$.

Then we calculate the normalization factor F_j :

$$F_j = \frac{\sum_{t=2}^n \frac{|R_j(t)|}{n-1}}{\sum_{t=2}^n \frac{|R_2(t)|}{n-1}}, j = 1, 2, 3 \quad (3)$$

Finally, calculate the standardized rate of change $V_j(t)$:

$$V_j(t) = \frac{R_j(t)}{F_j}, t = 2, 3, \dots T \quad (4)$$

Thirdly, calculate equipment manufacturing financing prosperity leading composite index, consistent composite index, and lagging composite index (I_j):

$$I_j(t) = I_j(t-1) \times \frac{200 + V_j(t)}{200 - V_j(t)}, x = 1, 2, 3; t = 2, 3, \dots T \quad (5)$$

Fourthly, the entropy weight method is used to determine the weight between leading composite index, consistent composite index and lagging composite index, and then calculate the financing prosperity comprehensive composite index.

Based on the above principle of financing prosperity index, leading composite index, consistent composite index, lagging composite index and financing prosperity comprehensive composite index are calculated. And the contrast diagram of equipment manufacturing financing prosperity leading composite index, consistent composite index, lagging composite index and comprehensive composite index can be drawn, as shown in Figure 2.

As can be seen from Figure 2, the financial boom of the equipment manufacturing industry leading composite index showed an overall upward trend from 2006 to 2015. From the beginning of the first quarter of 2006, the leading composite index rose slightly in the trend. From the beginning of the first quarter of 2013, the financial prosperity of the equipment manufacturing industry leading composite index rose. The leading composite index is up to

131.051 at the fourth quarter of 2015, compared with the same period last year rose by 4.728 points. Equipment manufacturing industry financing prosperity consistent composite index was first showed a small increase in microwave momentum, and then began to decline in the trend of fluctuations. And the financing prosperity lagging composite index showed a general downward trend from 2006 to 2015.

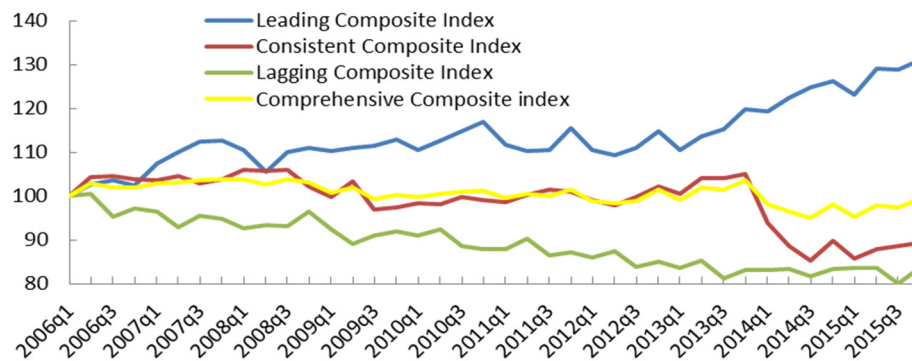


Figure 2. Contrast Diagram of Equipment Manufacturing Financing Prosperity Leading Composite Index, Consistent Composite Index, Lagging Composite Index and Comprehensive Composite Index

3.4. Equipment Manufacturing Industry Financing Prosperity Warning Signal Lamps

First of all, the equipment manufacturing industry financing prosperity comprehensive composite Index is standardized. The paper uses the statistical knowledge to design the warning interval. And the probability of the two interval operation of too cold and overheating is set to 6.5%. The probability of the two interval operation of micro cold and slightly hot is 9.5%. The probability of prosperity interval is 68%. On behalf the degree of signal lamp of equipment manufacturing industry financing prosperity, the "red lamp", "orange lamp", "green lamp" and "light blue lamp", "blue lamp" are represented "overheating" and "slightly hot", "heat", "micro-cold" and "too cold". Finally the equipment manufacturing industry financing prosperity warning signal light can be drawn, as shown in Table 2.

Table 2. 2006-2015 Equipment Manufacturing Industry Financing Prosperity Signal Lamps

Period	Signal Lamp	Period	Signal Lamp	Period	Signal Lamp	Period	Signal Lamp	Period	Signal Lamp
2006q1		2008q1		2010q1		2012q1		2014q1	
2006q2		2008q2		2010q2		2012q2		2014q2	
2006q3		2008q3		2010q3		2012q3		2014q3	
2006q4		2008q4		2010q4		2012q4		2014q4	
2007q1		2009q1		2011q1		2013q1		2015q1	
2007q2		2009q2		2011q2		2013q2		2015q2	
2007q3		2009q3		2011q3		2013q3		2015q3	
2007q4		2009q4		2011q4		2013q4		2015q4	

From the table 2, we can see that the equipment manufacturing industry financing prosperity signal lamps display slightly hot or overheating from 2006 to 2008. There are two reasons: First, the central government attaches great importance to the development of machinery industry enterprises. Second, the equipment manufacturing industry use domestic and international

market resources to promote the rapid development of their own. From 2009 to 2013, the financing activities of equipment manufacturing industry are in a state of prosperity. And under the regulation of government and market, equipment manufacturing industry financing is in good condition. However, from the beginning of 2014, the equipment manufacturing industry exposed some issues as other industries, such as blind investment. The equipment manufacturing industry also has excess capacity and weak ability to innovate. So the phase of the equipment manufacturing industry financing activities is not in good stage.

4. Conclusion

In this paper, According to the characteristics of equipment manufacturing industry financing activities and the principle of prosperity index, we construct financing prosperity diffusion index and composite index to reflect the extent of financing prosperity. Based on the analysis of the financing diffusion index and the composite index of the equipment manufacturing industry as well as the display result of the warning light, the paper finds that the financing environment of the equipment manufacturing industry is depressing and the situation is grim. In order to promote the development of the financing environment of the equipment manufacturing industry, this paper puts forward the following measures: First, we should effectively implement the supply side reform and enhance the financial support for the real economy. Second, a commercial bank-based financing institution system should be established. On the one hand, it can solve the financing channels and sources of equipment manufacturing industry. On the other hand, it can also improve the equipment manufacturing industry financing risk control system. Third, we can vigorously cultivate high-quality relevant professionals to enhance financing innovation and development capacity of the equipment manufacturing industry.

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