Analysis of the Life Cycle of China Shipbuilding Industry

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Abstract

The research of the article is based on the theory of industry life cycle. Empirical research on China annual shipbuilding output from 1983 to 2012 is made and life cycle stage of China shipbuilding industry is studied through using Compertz model. Combined with the current industry of our country shipping actual problems, puts forward some countermeasures and proposals.

Key words: Shipbuilding industry; Industry life cycle; Compertz model

INTRODUCTION

The shipbuilding industry is a modern comprehensive industry to provide technology and equipment for water transport, marine development and national defense construction, labor, capital, technology intensive industry, is an important part of advanced equipment manufacturing industry. Many factors will affect the global shipbuilding market in 2012 due to economic development, shipping, ship capacity and demand of shipbuilding capacity, the ship enterprises are facing enormous pressure. But China's shipbuilding industry three big indexes by DWT has remained still higher level rate in the world market.

Analysis of China's shipbuilding industry life cycle, recognize the shipbuilding industry life cycle stage is very important while China's shipbuilding industry have made the remarkable achievements. In view of China's shipbuilding industry life cycle stage of this problem, the domestic academic circles have two different points of view: First, that China's shipbuilding industry is still in the growth stage; second, that China's shipbuilding industry has entered the industry maturity (Dou & Lee, 2012, p.227). This research will use the Compertz model, analysis of China's shipbuilding industry life cycle stage, to discuss the existence of the problems and the solving methods.

1. ANALYSIS OF THE INDUSTRY LIFE CYCLE MODEL OF CHINA SHIPBUILDING INDUSTRY

1.1 The Theory of Industry Life Cycle

The industry life cycle is every industry has to undergo a process from growth to recession; it refers to from the industry to complete withdrawal from social and economic activities through time. The industry life cycle is generally divided into four stages: the initial stage, growth stage, mature stage and decline stage. Because of the industry life cycle constitutes an important factor in the external environment of enterprises, economics and management science researchers have great interest in the industry life cycle theory since the date of birth. Porter (1997) discussed the competitive strategy of the enterprise for new industries, mature industries and declining industry in the book "competitive strategy" (p.151). Liu and Ping (2009) analysis of the current development of fishing

industry of our country with the industry life cycle theory, and the industry life cycle characteristics are discussed in this paper, the dynamic model Chinese fishing industry development, and according to the dynamic model of fishing industry development strategy of innovation measures are put forward. Between the existing research results, from a strategic point of view, researches on industry life cycle are mainly concentrated in the phase change of industry life cycle impact on corporate strategy, and the different stages of the life cycle such as strategic decision introduction period, growing period, mature period for the enterprise to choose.

Therefore, application of the industry life cycle theory mainly includes: to study the industry life cycle curve from the empirical point of view of morphology; to determine the different stages of the industry life cycle, entry, exit and the characteristics of each stage; analysis of the industry life cycle evolution impetus; according to the industry life cycle and formulate corresponding policies.

1.2 Establish an Empirical Model

The Compertz model is proposed by the British statistician and mathematician B. Compertz, the overall shape of the S curve, is suitable for description of phenomenon during the development for the technical, economic, social and biological (Wang & Han, 2007, p.131). The curve can be divided into two stages when it reflect the relationship of some economic phenomena and time changing. The first stage is the growth stage, the general rule is: a certain economic variables (such as shipbuilding capacity) has a maximum or minimum limit value, with the passage of time, the economic variables in the initial stage just in the minimum limit values (industry survival the smallest scale) the slower growth, then enter a rapid growth stage, then entered a phase of slow growth, finally to the maximum limit (industry peak size), (see Figure 1). The second stage is the stage of decline, the general rule is: After the first stage, the economic variables decreased slowly below the maximum limit value, and then entered a rapid decline phase, and then enter the slow decline phase, tends to the minimum limit values, (see Figure 2) (Feng, Mao, & Zhou, 2005, p.150-151).
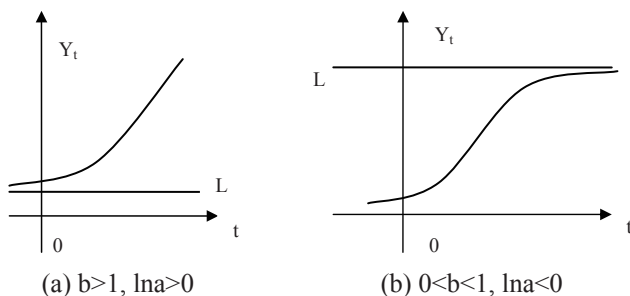

(a) b>1, lna>0   (b) 0<b<1, lna<0

Figure 1
Compertz Curve Under Rise Stage
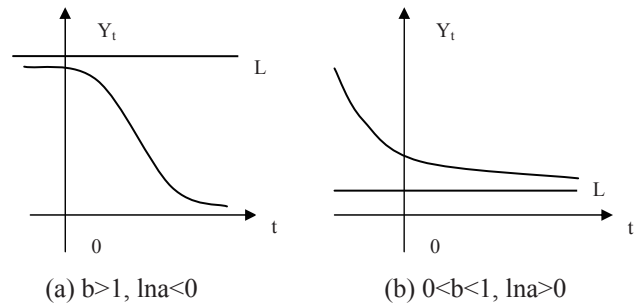

(a) b>1, lna<0   (b) 0<b<1, lna>0

Figure 2
Compertz Curve Under Decline Stage

Domestic scholars Liu (2009) used the curve model to our country shipbuilding industry life cycle, which can identify to our country of the world shipbuilding completions percentage as the research object. In addition, Li, Dai and Han (2005) also used the model to determine the Chinese steel industry life cycle. According to the knowledge of the industry life cycle theory and econometrics, combining research results and experience of previous scholars, this study chooses Compertz curve as the empirical model, as shown in equation: $Y_t = La^{b^t}$

Among them: It represents shipbuilding output of the phase t; t represents the time; L represents shipbuilding output limits; a, b represents estimated parameter of the curve parameters.

When L is fixed, and the model parameters in different stages of the industry life cycle has the following relationship (Yi, 2002, p.87), as shown in Table 1.

Table 1
Relationship Among L Values, Model Parameters and Industry Life Cycle Stage

Value of L	Range of parameters	Cycle stage
L for growth lower limit	b>1, lna>0	Enter the phase Grow up early
L for growth ceiling	0<b<1, lna<0	Growing up in the late The early stage of the mature
L for growth ceiling	b>1, lna<0	The late mature The early stage of the recession
L for recession floor	0<b<1, lna>0	Recession in the late

1.3 Collection and Analysis of Data

Due to the specific yield of Compertz curve model selecting industry as the object of study, in the research of shipbuilding industry life cycle stage, the shipbuilding capacity is as the object of study. Since 1982, China's shipbuilding industry realize the change from military to civilian, the establishment of Chinese Shipbuilding Industry Corporation realizes industry and trade, military and civilian, shipbuilding and ship repairing, scientific

research with production closely, become the domestic and foreign market economic entity. Comprehensive above factors, this article selects 1983-2012 China's shipbuilding completions as the research object, the data are shown in Table 2.

Table 2
Chinese Shipbuilding Completion from 1982 to 2008

(million DWT)

Year	Shipbuilding completions	Year	Shipbuilding completions
1983	130	1998	314
1984	165	1999	303
1985	221	2000	350
1986	176	2001	390
1987	178	2002	417
1988	160	2003	641
1989	142	2004	880
1990	141	2005	1310
1991	172	2006	1587
1992	238	2007	2164
1993	260	2008	2881
1994	385	2009	4243
1995	513	2010	6560
1996	442	2011	7665
1997	385	2012	6021

2. RESULTS AND ANALYSIS OF THE EMPIRICAL

2.1 Results of the Empirical Model

For the double exponential curve model, the empirical model can not completely linear processing, combined with the characteristics of time series data, this article analyzes the data in the method of nonlinear least square method by using Eviews 3.1.

Due to the limit parameter L is unknown, for accurate estimation of parameters by using nonlinear least squares, usually choose three-plus-value method to obtain the initial values of parameters. First, the model of logarithmic transformed into modified index curve model: $\ln Y_t = \ln L + b^t \ln a$, then is derived based on the knowledge of statistics, the calculation formula of parameter correction model (1)-(3) are as follows:

$$\ln a = (\sum_2 \ln Y_t - \sum_1 \ln Y_t) \frac{b-1}{(b^n-1)^2} \tag{1}$$

$$b = \sqrt[n]{(\sum_3 \ln Y_t - \sum_2 \ln Y_t)/(\sum_2 \ln Y_t - \sum_1 \ln Y_t)} \tag{2}$$

$$\ln L = \frac{1}{n}(\sum_1 \ln Y_t - \frac{b^n-1}{b-1}\ln a) \tag{3}$$

Type in: $\sum_1 \ln Y_t$ for the first time and the value of (1983-1992 years), $\sum_2 \ln Y_t$ for the second period and value (1993-2002 years), $\sum_3 \ln Y_t$ for the third period and value (2003 -2012 years).

Through the calculation, get the following data:

$$\sum_1 \ln Y_t = 51.32344$$

$$\sum_2 \ln Y_t = 59.11905$$

$$\sum_3 \ln Y_t = 78.22514$$

Then get the following data: lnL=4.595041, lna= 0.347315189, b=1.093785556

Then calculated: L=98.99219, a=1.41526273, b=1.093785556

Will the L, a and b three values as initial value, the nonlinear least squares method is used to estimate accurately, estimated the results as shown in Table 3.

Table 3
Estimation Results Under Non-Linear Least Squares

Variable	Coefficient	Std. Error	t-Statistic	Prob.
L	103.3793	32.94027	3.138386	0.0045
a	1.216564	0.122872	9.901026	0.0000
b	1.110763	0.017564	63.24184	0.0000

Note: R-squared=0.978071, Adjusted R-squared=0.976243

2.2 Analysis of the Results

Results by the model b=1.091163>1, lna=0.135539>0, combined with the value of L, the model parameters and the industry life cycle stage of a relational table the judgment standard, the China shipbuilding industry is entering period, growth period. According to the practical present development of Chinese shipbuilding industry, shipbuilding industry in the industry could be judged early growth period. The analysis results with the current some scholar's research conclusion is almost the same (Liu, 2009).

From the development of shipbuilding industry, From the point of shipbuilding power industry development, the shipbuilding industry of South Korea from the early 1970 s into the rapid development, the current industry into the mature period, growth period after almost 40 years; the shipbuilding industry of Japanese rapid development since the early 1950 s, until the 1990 s into the mature period, the current is close to recession, growth period lasted for nearly 40 years; And the shipbuilding industry of the United States and Britain growth duration is longer, about 50 years and 100 years respectively. The world shipbuilding powerful nations are generally to make shipbuilding output world first place in the industry growth period or mature period. Combined with the development of shipbuilding powers, the national shipbuilding industry life cycle is shown in Figure 3.
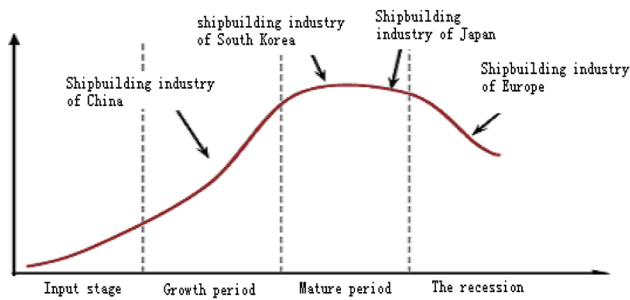
Figure 3
China, Japan, South Korea's and European Shipbuilding Industry Life Cycle

At present, our country shipbuilding industry will take a new road to industrialization, in order to improve and transform traditional shipbuilding industry policy, the advantage of lower labor costs will continue to maintain over a longer period of time (Li & Liu, 2006). Reference to the development cycle of Japan and South Korea, we can predict China shipbuilding industry growth sustainable until the middle of twenty-first Century.

3. CURRENT PROBLEMS AND COUNTERMEASURE ANALYSIS OF SHIPBUILDING INDUSTRY DEVELOPMENT IN OUR COUNTRY

3.1 Main Problems

(1) Delivery is difficult, most owner's delay in delivery of the vessel.

Weakness of the current world economic recovery, the shipping market and the shipbuilding market is facing serious excess capacity contradictions, owner of a few years ago order the ship delivery enthusiasm is not high, to improve the ship construction requirements, modify the shipping contract means such as delay in delivery of the vessel, disrupted the shipbuilding enterprise production plan, make the management of the enterprise cost, financing difficulties, economic benefit is badly damaged.

(2) In terms of profitability, profits continue to fall, the ship company losses increase.

Since the outbreak of the financial crisis, the ship price is low for a long time, and rising labor costs, the RMB exchange rate appreciation, ship owner's delay, the first advance payment declined, and avoided in severe cases. These external factors increase the financial costs of shipping enterprise loans, shipyard spare capacity, ability, shipping enterprise's economic benefit is getting worse, the loss of enterprises are gradually increasing.

(3) The financing pressure increases, corporate liquidity.

Although financial institutions to give financial support on the part of state owned enterprises and key enterprises, but for the majority of enterprises within the industry,

especially the small and medium-sized enterprises, financing difficulties, shortage of funds is a serious problem to the production and operation of troubled companies in recent years. Because of funding problems unresolved, some enterprises holding the ship can not according to plan to start, affect the delivery schedule; some enterprises because of not implement loan funds, lost orders, underemployment problems become more prominent; some enterprises even face the danger of collapse.

3.2 Countermeasures to Solve the Problem

(1) Promoting enterprise integration restructuring, accelerate the transformation and upgrading of structure adjustment.

Part of the shipbuilding enterprises in our country in the first half of 2013 to start construction in the situation of insufficient, some small and medium-sized enterprises even have stop production, converting part of the phenomenon, caused by excess capacity and excess capacity utilization is insufficient will accelerate industry consolidation. Shipbuilding enterprise backbone production of larger scale, strong technical force, has obvious advantages compared with a number of small and medium-sized enterprises. Strengthen the joint between the enterprise restructuring, to enhance the competitiveness of shipbuilding enterprise itself, the enhancement enterprise in the fierce market competition continued to undertake orders, to become bigger and stronger shipping industry in our country.

(2) To strengthen cost management, improve the quality of the products.

The quality requirements of the owner of the ship is more and more high because of shipping market depression, ship enterprise delivery pressure is more and more big. In the face of difficult delivery, shipping enterprises must find a way to find problem from their own. In order to solve this problem, first of all, ship enterprises to strengthen cost control in our country, implements the comprehensive budget management, enhance the capacity of target cost control, and reduce unnecessary spending. Next, should attach great importance to the quality risk and improve the quality management mechanism, to ensure product quality stability and improvement. At the same time, actively explore the reform of enterprise labor employment way, strengthen the quality of the product from the management system.

(3) Carry out the diversification; alleviate the pressure of the market.

The ship market in the doldrums, orders difficult, makes many enterprises ability of idle. Carry out diversified management, optimize the business structure is to reduce market risk, the important measures to alleviate the pressure of the production. Shipping enterprises should actively carry out market research, to realize the change of from a single product to related diversification, adjust their industrial and product structure.

CONCLUSIONS

This paper analyzed the shipbuilding industry life cycle in China based on the Compertz model, it pointed out that now China's shipbuilding industry is in the growth period of the life cycle, and this phase will last until the middle of twenty-first Century. The determination of the industry life cycle can be provided a reference for the direction of future development of shipbuilding industry in China. Next, the paper analyzed some problems that shipbuilding enterprises facing now in China, then point out that those shipbuilding enterprises could these methods to solve current difficulties，such as strengthening cooperation between enterprises, improving product quality, reducing costs, carrying out diversified management modes, and so on.

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