Analysis of the Life Cycle of China Shipbuilding Industry

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Supported by Social Science Fund Project In Jiangsu Province (09EYA003), Research project of National Social Science Fund in Jiangsu University of science and technology (2011JG136).

Received 25 February 2014; accepted 12 April 2014

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.
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).

### 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

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**Figure 1**

**Compertz Curve Under Rise Stage**

**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: $Y_t = L a^b t$

Among them: $L$ 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>
<thead>
<tr>
<th>Value of $L$</th>
<th>Range of parameters</th>
<th>Cycle stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>L for growth lower limit b&gt;1, lna&gt;0</td>
<td>Grow up early</td>
<td></td>
</tr>
<tr>
<td>L for growth ceiling 0&lt;b&lt;1, lna&lt;0</td>
<td>The early stage of the mature</td>
<td></td>
</tr>
<tr>
<td>L for growth ceiling b&gt;1, lna&lt;0</td>
<td>The late mature</td>
<td></td>
</tr>
<tr>
<td>L for recession floor 0&lt;b&lt;1, lna&gt;0</td>
<td>Recession in the late</td>
<td></td>
</tr>
</tbody>
</table>

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**Table 1**

Relationship Among $L$ Values, Model Parameters and Industry Life Cycle Stage
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)

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

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: \( \ln Y_t = \ln L + b \ln a \), then is derived based on the knowledge of statistics, the calculation formula of parameter correction model (1)-(3) are as follows:

\[
\ln a = \frac{\sum \ln Y_t - \sum \ln Y_t}{(b^t - 1)^2} \tag{1}
\]

\[
b = \sqrt{\frac{\sum \ln Y_t - \sum \ln Y_t}{(\sum \ln Y_t - \sum \ln Y_t)}} \tag{2}
\]

\[
\ln L = \frac{1}{n} \sum \ln Y_t - \frac{b^t - \ln a}{b - 1} \tag{3}
\]

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

Through the calculation, get the following data:

\[
\sum \ln Y_t = 51.32344
\]

\[
\sum \ln Y_t = 59.11905
\]

\[
\sum \ln Y_t = 78.22514
\]

Then get the following data: \( \ln L=4.595041, \ln a=0.347315189, b=1.093785556 \)

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

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>103.3793</td>
<td>32.94027</td>
<td>3.138386</td>
<td>0.0045</td>
</tr>
<tr>
<td>a</td>
<td>1.216564</td>
<td>0.122872</td>
<td>9.901026</td>
<td>0.0000</td>
</tr>
<tr>
<td>b</td>
<td>1.110763</td>
<td>0.017564</td>
<td>63.24184</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

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

2.2 Analysis of the Results

Results by the model \( b=1.091163>1, \ln a=0.135539>0 \), 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.
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.

REFERENCES


