Research on the Factors Influencing Overcapacity in Industrial Sectors

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Industrial overcapacity is caused by a combination of many factors. This paper selects the relevant indicators which have a great influence on overcapacity from the aspects of government, industry, and enterprises. The study builds a tobit model, quantitatively analyzes the factors influencing the overcapacity in China’s industrial sectors, and puts forward relevant policy suggestions to resolve this overcapacity.

Keywords: Overcapacity, Influencing Factors, Tobit Model

Introduction
Since the reform and opening up, China’s economic development has made remarkable achievements. However, through rapid growth and over-investment in previous years, industrial overcapacity has become increasingly prominent. In the existing study, Del Río et al. pointed out that a large volume of cheap debt affects the substantial increase in capacity1. Kou et al. pointed out that the benefit of expansion is greater when the competitor also expands, but this in turn leads to chronic oversupply2. Liu et al. pointed out that the assessment of official performance is a deeper reason for overcapacity3. Gan et al. discussed the effect of local officials’ tenure and performance appraisal on overcapacity4. Wang et al. and Zhang et al. thought that government’s improper intervention has an important impact on overcapacity5,6. Therefore, an in-depth quantitative analysis of the factors influencing overcapacity has important theoretical and practical significance.

Measuring model and data
Tobit model
Due to the data type being panel data, the value of capacity utilization as an explanatory variable has obvious truncation properties. To avoid the estimation results of the parameters being biased and inconsistent, in 1958 Tobit proposed the Censored Regression Model using the maximum likelihood method, also known as the tobit model, which is:

\[
Y^* = \begin{cases} 
\beta X + \mu & Y^* > 0 \\
0 & Y^* \leq 0
\end{cases}
\] (1)

Y is the dependent variable, Y* is the latent variable, X is the independent variable vector, \( \beta \) is the regression parameter vector, \( \mu \) is the error term, and \( \mu \sim (0, \sigma^2) \).

Construct model
In this paper, a tobit panel data model is constructed, and the relationship between the influencing factors and the capacity utilization is tested. The model is assumed as follows:

\[
CU_{i,t} = \beta_0 + \beta_1 Pe_{i,t} + \beta_2 Ctax_{i,t} + \beta_3 Ifa_{i,t} + \beta_4 Pso_{i,t} \\
+ \beta_5 Dic_{i,t} + \beta_6 Ditv_{i,t} + \beta_7 Rpia_{i,t} + \beta_8 Dmd_{i,t} \\
+ \beta_9 Fnd_{i,t} + \mu_{i,t} \] (2)

Where \( \beta_0 \) is a constant, \( \beta_i \) is the explanatory variable coefficient \( \mu \) is the random error term. The explained variable \( CU \) represents the capacity utilization. This paper uses the capacity utilization as an indicator to evaluate overcapacity and the improved Cobb–Douglas function to measure the capacity utilization. \( Pe \) represents performance evaluation index, and it is measured by the ratio of total industrial output value to national GDP. \( Ctax \) represents the comprehensive tax index, and it can be obtained by the ratio of tax and extra charges from principal business and value-added tax payable to revenue from principal business. \( Ifa \) represents investment in fixed assets, and it is measured by the fixed asset investment which is reduced by fixed asset investment price index. \( Pso \) represents the proportion of state-owned enterprises,

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and it is measured by the ratio of the total industrial output value of state-owned shares to the total industrial output value above the designated size. Diff is the degree of industry competition, and it is measured by the number of industrial enterprises above the designated size. It iv is the investment in industry technology innovation, and it is measured by the ratio of the internal expenditure on research and development to the total industrial output value. Rpia represents the investment expectations of enterprises, and it is measured by the ratio of profits, taxes and interests to average assets. China's industrial overcapacity is the result of a combination of overinvestment and demand reduction. Therefore, in addition to the main explanatory variables, this paper takes market demand as the control variable and measures it with the two variables of domestic demand, and foreign demand, respectively. Among them, Dmd represents the domestic market demand, and it is measured by the gross industrial products sales above designated size which is reduced by the producer price index. Fmd represents the foreign market demand, and it is measured by the export delivery value of industrial enterprises above designated size.

Data

In this paper, the industrial area of research refers to the field of industrial economic statistics released by the National Bureau of Statistics. According to the standards published by the National Economic Classification, and due to the value of small, short sequence, and statistical caliber in consistencies, and other issues, this paper selects 35 industrial sectors. The factors affecting the excess capacity of China's 35 industrial sectors were analyzed from 2000 to 2015. To reduce the heteroscedasticity and make the data smoother, this paper takes the natural logarithm processing of variables.

Empirical Results and Analysis

Based on the above analysis, the tobit model is used to estimate the factors influencing the capacity utilization (shown in Table 1). Industrial overcapacity is formed under the joint action of local governments, industrial characteristics, the investment expectations of industrial enterprises, and market demand levels. According to Models 1–3 and Models 5–7, performance evaluation index has a significant negative impact on capacity utilization. From Model 2 and Models 5–7, we can see that the comprehensive tax burden level has a significant negative impact on capacity utilization, and the coefficients are -0.0695, -0.2356, -0.2524, and -0.2740, respectively. As shown in Models 4–7, investment in fixed assets has a significant negative impact on capacity utilization. The social consensus on the good prospect of the industry and the existing official performance

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
<th>Model 6</th>
<th>Model 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pe</td>
<td>-0.1389*** (0.000)</td>
<td>-0.1375*** (0.000)</td>
<td>-0.1229*** (0.001)</td>
<td>-0.0465 (0.371)</td>
<td>-0.1109 ** (0.026)</td>
<td>-0.1898*** (0.003)</td>
<td>-0.1934*** (0.002)</td>
</tr>
<tr>
<td>Ctax</td>
<td>-0.0695* (0.088)</td>
<td>-0.0640 (0.101)</td>
<td>0.0225 (0.338)</td>
<td>-0.0707* (0.052)</td>
<td>-0.0976*** (0.003)</td>
<td>-0.1199*** (0.000)</td>
<td>-0.1358*** (0.000)</td>
</tr>
<tr>
<td>Ifa</td>
<td>-0.1640*** (0.000)</td>
<td>-0.1258*** (0.000)</td>
<td>-0.1139*** (0.007)</td>
<td>0.2167*** (0.004)</td>
<td>0.2389*** (0.000)</td>
<td>0.2596*** (0.000)</td>
<td>0.1132*** (0.006)</td>
</tr>
<tr>
<td>Pso</td>
<td>-0.1412*** (0.000)</td>
<td>-0.1421*** (0.000)</td>
<td>0.1068** (0.014)</td>
<td>-0.1229*** (0.007)</td>
<td>0.1334*** (0.003)</td>
<td>0.1538*** (0.001)</td>
<td>0.1763*** (0.000)</td>
</tr>
<tr>
<td>Rpia</td>
<td>0.0997** (0.038)</td>
<td>0.0907*** (0.000)</td>
<td>0.1057*** (0.027)</td>
<td>0.0374 (0.137)</td>
<td>0.0374 (0.137)</td>
<td>0.0374 (0.137)</td>
<td>0.0374 (0.137)</td>
</tr>
<tr>
<td>Itiv</td>
<td>0.0620*** (0.000)</td>
<td>0.0541*** (0.004)</td>
<td>0.0524*** (0.003)</td>
<td>0.0843*** (0.000)</td>
<td>0.0682*** (0.000)</td>
<td>0.0684*** (0.000)</td>
<td>0.0636*** (0.000)</td>
</tr>
<tr>
<td>Dmd</td>
<td>-1.7968*** (0.000)</td>
<td>-1.6540*** (0.000)</td>
<td>-1.5069*** (0.000)</td>
<td>-0.7919*** (0.018)</td>
<td>-0.9841*** (0.003)</td>
<td>-1.8580*** (0.000)</td>
<td>-1.9665*** (0.000)</td>
</tr>
<tr>
<td>N</td>
<td>560</td>
<td>560</td>
<td>560</td>
<td>560</td>
<td>560</td>
<td>560</td>
<td>560</td>
</tr>
</tbody>
</table>

Note: ***, **, and * are the significance level of 1%, 5%, and 10%. 
appraisal system, lead to over-investment in fixed assets and, in turn, a sharp expansion of capacity. The proportion of state-owned enterprises is significantly and negatively correlated with capacity utilization at 1% confidence level. The degree of industry competition is positively correlated with capacity utilization in Model 6 and Model 7, and the coefficients are 0.0997 and 0.1057, respectively. It shows that moderate competition improves the allocation of resource efficiency and the level of production technology, and, to a certain extent, improves the capacity utilization. As shown in model 7, although the coefficient of industrial technology innovation investment is positive, it is not significant. On the one hand, innovation investment affects industry performance and market competitiveness, and improves product quality to increase demand, thereby reducing excess capacity. On the other hand, increased investment in innovation will increase production efficiency, further expand production capacity. The ratio of profits, taxes and interests to average assets has a significant positive effect on capacity utilization. Though companies have good expectations for the future, but considering the cost of investment and the complexity in technology and equipment, tend not to increase investment to boost volume, with the result that the excess production capacity eases to a certain extent. In terms of control variables, from the results of model 1-7 in Table 1, the domestic market demand and foreign market demand are significantly and positively correlated with the capacity utilization, indicating that the increase of market demand can reduce excess capacity to a certain extent.

Conclusions and Recommendations

This paper selects relevant indicators form the perspectives of government, industry, and enterprises, uses tobit model to analyze the factors influencing industrial overcapacity from 2000 to 2015. The main results are as follows: firstly, performance evaluation and intervention behaviors, such as comprehensive tax, macro-control through state-owned enterprises, have important influence on the overcapacity. Secondly, the increase of competition intensity in the industry optimizes the allocation efficiency of factors of production, and, to a certain extent, helps improve technical efficiency and ease overcapacity. Increasing input in technological innovation in industries can improve product quality and increase demand for products to ease overcapacity, but it will also increase capital supply and product supply in production, thereby exacerbating excess capacity. The overall impact is uncertain. Thirdly, the increase in the ratio of profits, taxes and interests to average assets will increase capacity utilization. In addition, increasing market demand can digest the supply of products in the local market and have a positive impact on easing overcapacity. According to the conclusions, this study puts forward the following suggestions to promote the capacity utilization: firstly, the state should reform the assessment mechanism of local governments and scientifically regulate the government's macro-control behaviors. Secondly, the state should speed up the adjustment of industrial structure and actively provide a benign market competition environment to ease overcapacity. Thirdly, the enterprises should rationally allocate production factors according to the investment expectation, and actively exploit the overseas market to increase the capacity utilization.

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