Study on the Influence of Enterprise Micro Behavior on the Safety of Iron and Steel Industry in China

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Based on the perspective of corporate governance, this paper establishes a fuzzy comprehensive evaluation model to empirically evaluate the impact of corporate behaviour on the safety of China's iron and steel industry, the results show that: From 2005 to 2011, the security situation of the iron and steel industry showed a trend of low to high, then decrease and then rise again; The competition degree of the upstream market is contrary to other indicators, and the effect on industrial safety is decreased.

Keywords: Corporate Behaviour, Corporate Governance, Iron and Steel Industry Safety

Introduction

The iron and steel industry is a pillar industry of the national economy, and it has played an important role in the construction of national economy and stable employment. In recent years, China's iron and steel industry faces a serious dilemma, and the research on its industrial security has certain practical significance. Currently, the discussion of industrial safety theories are based on industrial capacity resources and performance, and the research is biased from the central view or the macro level¹. But in fact, the industrial security concept based on industrial capacity resources and performance has a certain correlation with the micro system mechanism of enterprises. The capacity resources needed for the development of a country's industry are the ability resources for the development of enterprises and the performance of a country's industry is related to the micro-governance mechanism of enterprises. Therefore, the evaluation of the safety of industry should be further analyzed from the aspects of micro-governance².

Analysis on corporate behaviour in China's iron and steel industry

Research on the influence of Chinese iron and steel upstream industry on corporate behaviour

The iron and steel upstream industry mainly includes iron ore, water, coal, electricity and so on. Among them, the Chinese iron and steel industry is becoming more and more dependent on iron ore, the proportion of iron ore produced from imports rose from 44.73 percent in 2003 to 63 percent in 2012, which is a threat to the iron and steel industry. Australia and Brazil have been the biggest suppliers of iron ore in China, with high concentration and high risk. At the same time, the international iron ore market is highly monopolistic, with iron ore as a scarce resource, making the price of iron ore high and China lacking the control ability to import resources³. For procurement of raw materials, enterprises should unite to form foreign raw materials purchasing cartels, improving their market forces in the raw material market, and create better conditions for the merger and reorganization of enterprises⁴.

Research on the influence of Chinese iron and steel downstream industry on corporate behaviour

The downstream industries of iron and steel consumption include machinery, automobiles, ships, real estate construction and so on, among which construction is the main driving force of iron and steel consumption growth, accounting for 49.5% of the consumption of steel. The domestic market share of long material products is nearly 100%, board with pipe and other products, such as plate, hot plate, etc., is over 95%, only a few products is a bit low, which need to rely on imports, such as coating plate, electrical steel, etc. It can be seen that there are fewer high-end steel products in China, but there is a serious
excess of low-end production capacity, such as steel and wire, and it is difficult to quickly eliminate them.

**Analysis of the correlation between Chinese iron and steel industry and corporate behaviour**

**Concentration of iron and steel industry**

The iron and steel industry has a significant scale economy, and a clear positive relationship with the operating efficiency of the enterprise. China’s iron and steel industry presents a trend of reverse concentration, which weakens the competitiveness of iron and steel industry in China, showing that there is a big gap with the developed countries and it is too early to achieve economies of scale. At the same time, with the large number of domestic enterprises and low industrial concentration, China is in a passive position.

**Merger and reorganization in China’s iron and steel industry**

China’s iron and steel industry was rare in mergers and acquisitions before 2003, and it mainly started to merge and reorganize with the launch of Development Policy of Steel Industry in 2005. The merger and acquisition of China’s iron and steel industry has gradually shifted from regional m&a to interregional m&a. The iron and steel enterprises represented by BaoSteel have taken the step of merger and reorganization in the region. Regional mergers and acquisitions can generate regional synergies to form price competitive advantages. At present, the economic benefits of cross-regional mergers and acquisitions are not obvious, but it is the future development direction.

**Evaluation on the impact of Chinese iron and steel enterprises on industrial safety**

**Evaluation process**

**Construction of fuzzy evaluation matrix**

According to the previous analysis, we need to study from 5 aspects-capital, skills, markets, suppliers and other stakeholders, the influence factors of concrete has six aspects: the common large shareholders in different enterprises, managers of the market competition degree, the condition of industry concentration, the downstream market competition degree, the upstream market competition degree, in the past two years the industry mergers and acquisitions with the efforts of government, the set of factors is $U = \{u_1, u_2, \ldots, u_6\}$; The positive effect of enterprise behaviour on the level of industrial security is divided into great, good, general, bad, and thus constitute the collection of comments: $V = \{\text{great, good, general, bad}\} = \{v_1, v_2, v_3, v_4\}$; Let's hypothesize that $R = \{r_{ij}\}, (i = 1, \ldots, 4; j = 1,2,\ldots, 6)$ is a fuzzy relationship from V to U, among them $r_{ij}$ represents the possible degree of the i-th comments in the j-th factor. We invite relevant experts in the iron and steel industry to evaluate the above 6 aspects and get the evaluation matrix of the effect of iron and steel enterprises’ behaviour on the safety of iron and steel industry in 2005, 2007, 2009, 2011:

\[
R_1 = \begin{bmatrix}
0.03 & 0.07 & 0.24 & 0.10 & 0.28 & 0.08 \\
0.10 & 0.10 & 0.24 & 0.20 & 0.24 & 0.12 \\
0.17 & 0.35 & 0.26 & 0.23 & 0.25 & 0.55 \\
0.70 & 0.48 & 0.26 & 0.47 & 0.25 & 0.55 \\
\end{bmatrix}
\]

\[
R_2 = \begin{bmatrix}
0.07 & 0.10 & 0.20 & 0.15 & 0.20 & 0.12 \\
0.12 & 0.17 & 0.22 & 0.23 & 0.27 & 0.14 \\
0.23 & 0.17 & 0.28 & 0.20 & 0.20 & 0.28 \\
0.58 & 0.56 & 0.30 & 0.42 & 0.33 & 0.46 \\
\end{bmatrix}
\]

\[
R_3 = \begin{bmatrix}
0.10 & 0.15 & 0.26 & 0.17 & 0.12 & 0.23 \\
0.14 & 0.16 & 0.26 & 0.22 & 0.20 & 0.13 \\
0.26 & 0.24 & 0.24 & 0.21 & 0.27 & 0.22 \\
0.50 & 0.45 & 0.24 & 0.40 & 0.41 & 0.42 \\
\end{bmatrix}
\]

\[
R_4 = \begin{bmatrix}
0.15 & 0.18 & 0.30 & 0.20 & 0.05 & 0.26 \\
0.13 & 0.18 & 0.28 & 0.24 & 0.10 & 0.13 \\
0.28 & 0.28 & 0.22 & 0.22 & 0.18 & 0.24 \\
0.44 & 0.36 & 0.20 & 0.34 & 0.67 & 0.37 \\
\end{bmatrix}
\]

**Fuzzy linear transformation**

Respectively assign four comments to 4, 3, 2 and 1, so the weight vectors of each rank in the evaluation set is: $A = (a_1, a_2, a_3, a_4) = (4,3,2,1)$, the fuzzy linear transformation $T_R$ is:

\[
B_1 = A \times R_1 = (0.146,0.176,0.246,0.193,0.255,0.173)
\]

\[
B_2 = A \times R_2 = (0.168,0.181,0.232,0.211,0.234,0.192)
\]

\[
B_3 = A \times R_3 = (0.184,0.201,0.254,0.216,0.203,0.217)
\]

\[
B_4 = A \times R_4 = (0.199,0.218,0.268,0.230,0.153,0.228)
\]

So the set of fuzzy linear transformations is:

\[
B = \begin{bmatrix}
0.146 & 0.168 & 0.184 & 0.199 \\
0.176 & 0.181 & 0.201 & 0.218 \\
0.246 & 0.232 & 0.254 & 0.268 \\
0.193 & 0.211 & 0.216 & 0.230 \\
0.255 & 0.234 & 0.203 & 0.153 \\
0.173 & 0.192 & 0.217 & 0.228 \\
\end{bmatrix}
\]
The steps of weight statistics are as follows: The weight of influencing factors is listed in Table 1. According to the questionnaire, the managers of the market survey table, they independently give the most appropriate weight which they think is the six factors organized. According to the weight distribution of the concentration. According to the questionnaire, the weight of influencing factors is listed in Table 1. The steps of weight statistics are as follows:

- Find the maximum and minimum weight of the factors \( u_1, u_2, \ldots, u_6 \), \( M_i = \max(a_{ij}) \); \( m_i = \min(a_{ij}); (i = 1, 2, \ldots, 6; j = 1, 2, \ldots, 50); \)
- Divide the weights into five groups, use the formula \( w = \frac{M_i - m_i}{5} \) to calculate class
- Calculate the frequency of the weights in each group.
- View the intermediate value of group in which the maximum frequency is grouped as the weight of factor \( u_1 \), thus get the weight vector \( w = \{w_1, w_2, \ldots, w_6\} \).

### The empirical results

In summary, the individual scores of enterprises' behavioural indicators affecting the safety of the iron and steel industry are shown in Table 2. The fuzzy comprehensive evaluation score vector of four years is as follows:

\[
W = \{W_1, W_2, W_3, W_4\} = w \times B = (0.193, 0.213, 0.209, 0.211)
\]

### Conclusions

Table 2 shows that the common large shareholders in different enterprises, managers of the market competition degree, the downstream market competition degree, in the past two years the industry mergers and acquisitions with the efforts of government present a wavy structures in four years, so we can conclude that: The iron and steel industry safety improved before the financial crisis gradually, started to fall in the wake of the financial crisis, and slightly improved in 2011, which is similar to the stock market's head and shoulders, high on the left and low on the right, also foreshadowed the likelihood of a decline after 2011; The competition degree of the upstream market is contrary to several other indicators, indicating that the upstream market forces of China's iron and steel industry chain are increasing, which threaten the cooperation between the iron and steel enterprises, and we also conclude that upstream suppliers of enterprises caused excessive competition and insufficient cooperation, thus the effect of industrial security impact is decreased and obvious.

### Acknowledgement

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### References


### Table 1 — List of weight of enterprise's behavioral indicators

<table>
<thead>
<tr>
<th>u_1</th>
<th>u_2</th>
<th>u_3</th>
<th>u_4</th>
<th>u_5</th>
<th>u_6</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>weight</td>
<td>0.26</td>
<td>0.12</td>
<td>0.15</td>
<td>0.07</td>
<td>0.18</td>
<td>0.22</td>
</tr>
</tbody>
</table>

### Table 2 — Steel industry safety evaluation score sheet from 2005 to 2011

<table>
<thead>
<tr>
<th>factor</th>
<th>u_1</th>
<th>u_2</th>
<th>u_3</th>
<th>u_4</th>
<th>u_5</th>
<th>u_6</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>weight</td>
<td>0.26</td>
<td>0.12</td>
<td>0.15</td>
<td>0.07</td>
<td>0.18</td>
<td>0.22</td>
<td>1.00</td>
</tr>
<tr>
<td>2005</td>
<td>0.038</td>
<td>0.021</td>
<td>0.037</td>
<td>0.014</td>
<td>0.046</td>
<td>0.038</td>
<td>0.193</td>
</tr>
<tr>
<td>2007</td>
<td>0.044</td>
<td>0.022</td>
<td>0.035</td>
<td>0.015</td>
<td>0.042</td>
<td>0.042</td>
<td>0.199</td>
</tr>
<tr>
<td>2009</td>
<td>0.048</td>
<td>0.024</td>
<td>0.038</td>
<td>0.015</td>
<td>0.037</td>
<td>0.048</td>
<td>0.209</td>
</tr>
<tr>
<td>2011</td>
<td>0.052</td>
<td>0.026</td>
<td>0.040</td>
<td>0.016</td>
<td>0.028</td>
<td>0.050</td>
<td>0.212</td>
</tr>
</tbody>
</table>

The frequency count of weights

In this paper, 50 experts familiar with the iron and steel industry and the enterprise behaviour are organized. According to the weight distribution survey table, they independently give the most appropriate weight which they think is the six factors of the concentration. According to the questionnaire, the weight of influencing factors is listed in Table 1. The steps of weight statistics are as follows:

- Find the maximum and minimum weight of the factors \( u_1, u_2, \ldots, u_6 \), \( M_i = \max(a_{ij}) \); \( m_i = \min(a_{ij}); (i = 1, 2, \ldots, 6; j = 1, 2, \ldots, 50); \)
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