Analysis on the Influence Factors and Fluctuation of Iron Ore Price Based on Oligopoly Market

Wen-qi ZHU\textsuperscript{1,a}, De-yi XU\textsuperscript{2,b,*}

\textsuperscript{1,2}School of Economics and Management, China University of Geoscience, Wuhan, China

\textsuperscript{a}360423960@qq.com, \textsuperscript{b}xdy@cug.edu.cn

*Corresponding author

Keywords: Factor Analysis, Iron Ore Price, Influencing Factors, VAR Model.

Abstract. In this paper, we use factor analysis and VAR model, established the dynamic relationship between the price of iron ore and output, inventory, shipping cost, GDP. By using factor analysis, three common factors were extracted, and we discuss the common factor for iron ore price impact and the rule. The empirical analysis shows that the supply factors have a negative impact on the current prices; demand factors influences iron ore prices are relatively large which has a positive impact in the first phase of the price; Financial factors have a negative impact on the price of the current period, and the effects of the three factors are gradually disappearing.

Introduction

Iron and steel industry is the backbone of the national economy, iron ore is the main raw material for the iron and steel industry. In recent years, with the rapid development of China’s economy, the iron and steel industry is growing fast. Iron ore demand has increased year by year, and the contradiction between the shortages of iron ore resources in China is becoming more and more prominent. At present, China’s foreign dependence on iron ore reached 74%, Australia and Brazil accounted for 70% of the market share of the sea, which belongs to the typical oligopoly market. Since January 2014, the price of iron ore price from $128.1 per ton continued to decline. In October 2015, the price has dropped to $49.9 per ton, have an about 61% reduced. Currently the iron ore market is an oligopoly market and its prices continue to fall. Analysis the impact of iron ore prices on China is good to improve the international status of iron ore pricing.

Literature Review

The Indian government has started to restrict its exports of high-grade iron ore to the seaborne market, so that the country conserves its strategic resource within its boundary for future growth. So that the iron ore market will become more flexible, with most seaborne iron ore trade occurring at benchmark prices, but with a significant proportion taking place on the spot market (Sukagawa, 2010). The quantitative analysis uses monthly data between January 2003 and August 2012. The overall results show that when including transportation costs to the price series we do not find that iron ore prices are more volatile after the introduction of spot market pricing. Furthermore, the change in pricing regime does not have a significant impact on the iron ore price in the econometric model. Iron ore prices, GDP growth in China, and the freight rates are found to be cointegrated (when regressed with a market dummy variable), and the short run results indicates that GDP growth in China has the strongest impact on the iron ore price series for the period tested (Wårell, 2014). This article examines the scale of China’s demand shock and the supply-side reaction in established and fringe iron ore regions. It outlines the short-run constraints on supply expansion and explores the supply-side response to understand whether the long-run iron ore market adjustment has been competitive, or influenced by strategic supply and price interventions by incumbent producers (Hurst, 2015). Mineral products have some basic properties and characteristics, such as the separation of
supply and demand in space, the basic and strategic, non-renewable and financial properties etc. Mineral products supply, demand, emergency and international financial market impact on the world’s major commodity prices rise and fall (Zhen-hua Ge, 2014).

Analysis of Price Fluctuation and Influence Factors

Price Fluctuation Analysis. With the sharp rise in steel production in China, The iron and steel industry for iron ore demand is also increasing. It led the iron ore market prices have been high, and reaching a peak in March 2011, and then began a downward trend from 2014 to the present. (Fig. 1).

![Figure 1. 2009-2015 iron ore price trend.](image)

The strong rise in iron ore prices to stimulate the mineral investment, so that the supply of iron ore also rose sharply. China’s domestic iron ore investment also rose sharply, from less than 40 billion in 2006 has grown to 106.6 billion in 2010. The world’s three largest ore miners iron ore supply will continue to increase production. But since 2011, China’s economic reform to economic slowdown, the economy have transformed by stimulating investment. The import of iron ore demand by 17.5% annual growth slowed to 3.1%. Strong demand in emerging economies is not enough to compensate for the loss caused by the decline in market demand in china, therefore, the price of iron ore appeared sustained decline in the long-term. Since January 2014, the price of iron ore price from $128.1 per ton continued to decline. In October 2015, the price has dropped to $49.9 per ton, have an about 61% reduced.

Supply factors

Reserves: Overall, iron ore reserves are rich. By the end of 2014 the world’s iron ore reserves was 150 billion tons, the characteristics of iron ore resources in China is poor, less rich ore; Australia and Brazil have rich iron ore. In 2014, China’s 77.2% of the iron ore imports from the two countries.

Capacity: FMG, BHP, Rio and Vale are the world’s leading suppliers of iron ore, which greatly affects the supply of iron ore in the world. 2014, the four major mineral company increase the production capacity of 1 billion tons, compared with 2013, it increased 15.3%.

Inventory: Inventory to a certain extent can reflect the supply and demand situation of mineral products, and then affect the price. If inventory reduced, the demand for mineral products will be strong, supply becomes nervous, and ultimately lead to higher prices. Conversely, the increase of inventory results a decline on commodity prices. Since the beginning of 2011, the inventory of iron ore in China’s major ports remain high and continue to increase. The plentiful stocks of iron ore reduced China’s imports of demand.

Monopoly: Entering the 21st century, international iron ore industry entered the large-scale mergers and acquisitions phase. Vale, BHP and Rio control the iron ore production and trade volume by 70% to 75% of the world. In the supply of iron ore, it has been fully formed a typical oligopoly situation, resulting in a monopoly price.

Cost: The transportation cost of mineral products also directly affects the price of mineral products. Shipping costs accounted for 50% of the iron ore CFR, after 2008, the shipping market is rising,
shipping costs accounted for 51.8% of the proportion of the cost. Transport costs are higher than the value of the ore itself. The prices of iron ore in 2014 continued to fall, the sea freight also continued to reduce, the price of imported iron ore and the cost of sea freight determine the cost of China’s imports of iron ore.

**Demand Factors.** Consumption: In developed countries, iron ore consumption continues to decline steadily, the developing countries still have some potential for consumption growth. Up to September 2015, China’s per capita steel consumption is 560kg per person a year, compared to last year, it has a slight decline. The next few years China iron ore consumption will keep high, then gradually into the downstream channel.

**Economic Growth and External Dependence.** China’s economic had become slow since 2011, to the third quarter of 2015 growth rate of 6.9% which decreased by 2.8% compared with the first quarter of 2011. 2003-2013, China’s imports of iron ore increased by 6.7 tons, dependence on foreign imports increased from 45% to 74%, excluding iron and steel exports, China’s iron ore actual external dependence is 69%.

**Policy Factor.** Recently, the Chinese government puts forward strict control of the total amount of iron and steel, and accelerates the elimination of backward capacity, hope that the crude steel output to meet the level of national demand, inhibit excess capacity of steel production. In this context, the growth in demand for iron ore will be eased. Some unexpected events will also affect the price of iron ore in a period of time. Australia, for example, as one of the major suppliers of iron ore, his lack of labor resources, often appears to strike and other events. It will cause the tension of iron ore supply in a certain period of time, and become a factor in the price of iron ore negotiations.

**Financial Factor.** The rapid growth of economy and the increase of resource demand, to a certain extent, contributed to the appreciation of currency in countries. In turn, the appreciation of the currency affects both the domestic economy and the import and export of non-resource products. The international iron ore price and the dollar index are interrelated and mutually influenced.

**Factor Analysis and VAR Model**

**Data Selection.** Considering the quantifiable of the factors, in the empirical analysis we selected 9 factors, time span is the monthly data from January 2009 to June 2015. Supply factors selected China’s iron ore production, port inventory, comprehensive ocean freight, the Baltic Sea dry bulk index (BDI), Australia and Brazil iron ore exports accounted for the proportion of the world. Demand factors selected Chinese imports, China quarterly GDP, dependence on foreign. Financial factors selected dollar index.

**Factor Analysis.** Factor analysis’s basic idea is to group the original variables according to the relevance, makes the correlation between the variables in the same group is higher, and the correlation between variables in different groups was lower. Through factor analysis, 3 common factors were extracted from the 9 factors, which represented the supply factors, demand factors and financial factors.

<table>
<thead>
<tr>
<th>Null hypothesis</th>
<th>Method</th>
<th>Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit root (assumes common unit root process)</td>
<td>Levin, Lin &amp; Chu t*</td>
<td>-0.61019*</td>
</tr>
<tr>
<td>Unit root (assumes individual unit root process)</td>
<td>Im, Pesaran and Shin W-stat</td>
<td>-1.90429**</td>
</tr>
<tr>
<td></td>
<td>ADF - Fisher Chi-square</td>
<td>34.6138***</td>
</tr>
<tr>
<td></td>
<td>PP - Fisher Chi-square</td>
<td>34.8389***</td>
</tr>
</tbody>
</table>

Note: *, **, *** indicate that the value is significant under the 0.1, 0.05, 0.01 confidence level.
VAR Model. Stability test: We use the ADF method to test the stability of the time series of variables. It is found that the first order difference sequence of F1, F2, F3 and Y at a significant level of 0.1 in this paper is stable. Therefore, in the following analysis, all the 4 variables used to study (Table 1).

In order to further analyze the dynamic relationship between the price fluctuation of iron ore and other variables, we construct Vector-Autoregressive (VAR) model. By calculating the AR Eigen polynomial of the model, find the reciprocal of the roots of characteristic polynomial all located inside the unit circle (Fig. 2). Indicates that the established VAR (2) model is stable. This shows that when a variable in the model changes, this can cause changes in other variables, but as time goes on, this change will gradually disappear.

[Figure 2. Stability Test of VAR Model.]

[Figure 3. Impulse Response Diagram.]

Impulse response analysis: in order to analyze the influence of various factors on the dynamic relationship of iron ore price, impulse response function is used to analyze. According to the established VAR (2) model, the impulse response function can be obtained.

Results and Discussion

(1) Supply factors have a negative impact on the price of the current period, starting from the second phase, the affect turned into positive and the highest amount was in the third period. Then it reduces gradually until close to zero.

The supply factor is mainly composed of China iron ore production, port inventory, comprehensive ocean freight, the Baltic Dry Index, Australia and Brazil iron ore exports accounted for the proportion of the world. According to the results of factor analysis, these factors were positively correlated with the price. When domestic supply increases, the price of iron ore will be reduced, the adequate inventory reduced the demand for imported iron ore China. But the domestic iron ore production share of China’s overall supply is not particularly high, therefore, the impact of price is relatively limited.

(2) Demand impact on prices is relatively large. When give DE a standard deviation of the change, it has a substantial influence in the first phase. From the beginning of the second period, the impact has been transformed into a negative direction, and the degree is gradually reduced until it disappears.

China’s iron ore consumption and economic growth significantly positive correlation. Economic growth or ultra-expected growth will affect the iron ore market prices rose. Strong growth in China, India, as the representative of developing countries also makes a sharp increase in demand for mineral products, leading to the world’s iron ore and other mineral products prices shock to high in the past 10 years. After China’s economic went down, China’s iron ore consumption became slowly which make the iron ore prices get down.

(3) Financial factors have a negative impact on the price of the current period, until the fourth phase only changed to positive, then gradually reduced until close to 0.

Between the dollar index and the ore price exists obvious negative correlation. The trading of iron ore is priced in dollars, so the price of iron ore is closely related to the price of the US dollar. When the
dollar appreciates, the price of iron ore in dollar terms will be reduced. For example, a few years ago, the price of iron ore and the sharp depreciation of the dollar are associated. By the impact of the 2008 financial crisis, the United States as the center of the financial crisis, the impact is great, the U.S. dollar continued to depreciate significantly, this directly leads to the rising prices of various resource commodities. Iron ore prices have continued to move higher because of the dollar’s decline. In addition, due to the depreciation of the dollar, a large number of dollars on resource based products and its manufactured goods of the spot and futures market. So there appeared speculative premium in the market, it further pushes iron ore prices.

Conclusions

In short, the relationship between supply and demand of iron ore is the fundamental reason for the price rise or fall, it is a long-term impact factor. In the short term, such as the sudden political events, exchange rate changes and other factors will cause the impact on the supply and demand of iron ore, or change the investor’s expectations of the relationship between supply and demand and the short-term price.

Comprehensive market from two aspects: prior to 2009, the iron ore market was in short supply, strong demand growth momentum boost ore prices increased rapidly. After 2009, the demand for iron ore became weak, and the capacity to maintain rapid growth, the relationship between supply and demand was inversion, the trend of the supply is still growing. Since 2011, as China’s economic slowdown and the gradual decline in demand for steel and overseas ore production capacity continues to release. Iron ore supply and demand pattern is a serious mismatch, further deterioration of the oversupply situation, iron ore port inventory backlog, iron ore prices into long-term decline. Iron ore supply and demand pattern came out serious mismatch, oversupply situation further deterioration, port iron ore inventory and iron ore prices into long-term decline.

In the supply factor, in different times, the impact of each factor on the price is also different. And at different times, the major impact factors also change. At the same time, there is no strict boundary between the supply, demand, the dollar exchange rate and other factors, and it can interact and transform from each other. That is, the influence factors of the international mineral product price are diversified and complicated.

Acknowledgement

This research was financially supported by the National Natural Science Foundation of China (41272362, 41572315).

References