Abstract

Purpose – The purpose of this paper is to analyze the market share of two competing enterprises from the perspective of consumer preferences on both of their products. For different industrial types, this paper discusses how domestic firms make decisions to compete with the multinational company based on consumer’s preferences on different types of products from different companies.

Design/methodology/approach – Considering the different types of equipment manufacturing industries, consumers’ differentiated preferences for Chinese domestic equipment manufacturers and multinational equipment manufacturers, as well as the uncertainty of technological level and dependence on production factor in reality, this paper introduces the interval grey number into the Stackelberg game model and analyzes the market share of two competing enterprises and the consumer preferences for both of their products based on different industrial types.

Findings – The results show that when both of the two competing firms are engaged in R&D activities, consumers prefer domestic products, and with the improvement of technological level, this preference grows stronger, but the market share of the multinational enterprise is higher than that of the local enterprises. When the two competing enterprises are engaged in manufacturing activities, consumers are more inclined to choose products of the multinational company, and with the increasing dependence on production factors, the preference becomes stronger. Meanwhile, the market share of the multinational company is higher than the local enterprise. Therefore, from the perspective of consumer preference, China’s domestic equipment manufacturing enterprises should choose technology-intensive or technology and labor-intensive industries (or dual-intensive industries).

Originality/value – In the context of international competition, from the perspective of consumer preference, the research on industrial selection is relatively rare, and does not take into account the influence of the uncertain influence brought by technological-level and production factor dependency. Therefore, this paper analyzes the influence of technological-level and production factor dependency on consumer preference among various types of industries. Based on the concept of consumer preference, and combining with the interval grey number, the improved grey game model is constructed to analyze the influence of the uncertainty of enterprise’s technological-level and production factor dependency on the market share of two competing companies, finally coming up with the direction into which the Chinese equipment manufacturing industries should develop.

Keywords Grey game model, Consumer preference, International competition, Industrial type

1. Introduction

The equipment manufacturing industry is a strategic basic industry to provide all kinds of technical equipment for the economic construction and national defense security. Because of its high requirement on the technological level and labor factor, the equipment manufacturing industry is both technology-intensive and labor-intensive industry. The development of China’s equipment manufacturing industry is inseparable from the global division network of labor dominated by the multinational corporations in developed countries. After the financial crisis, the developed countries return to the real economy, putting forward the “re-industrialization strategy.” Taking advantage of the dominant position in the global value chain, developed countries are transferring the processing and assembly segments to developing countries with lower cost of production, while they are
devoting substantial efforts into the development of their equipment manufacturing industry, accelerating the development of sophisticated equipment, key core components, equipment manufacturing services, and other high value-added core segments of the industrial chain. China’s equipment manufacturing industry has blended into the global value chain multi-dimensionally, and has become one of the world’s biggest manufacturing powerhouses. However, it is at the cost of a huge consumption of resources and energy and exploitation of its cheap labor. Therefore, China is locked in the embarrassing low-end position, which is hard to break through. In the present situation where global economy is undergoing major changes, the drawbacks of the current extensive blending model continue to emerge. It is necessary to conduct research and studies on the equipment manufacturing industry, in the context of intense international competition, focusing on industrial type selection issues. The study of the equipment manufacturing industry, as the national basic industry, is not only beneficial to promoting the industrial transformation and enhancing the international competitiveness of the industry, but also conducive to the development of other related industries in China.

Importance is attached to how to choose a suitable industrial type for China. Amy et al. (2008) evaluate the importance of the selected criteria and the performance of industry using fuzzy set theory. Hu et al. (2011) constructed the selection and evaluation index system of regional strategic emerging industries, and put forward the industrial selection model based on “AHP-IE-PCA” combination weighting method. Gao and Huang (2014) constructed the index system to evaluate the independent innovation ability of 36 industries, and then put forward the suggestions about the choice of industry type during the innovation transformation period in China. Weixian et al. (2016) construct an industry selection matrix combining the characteristics of high-tech industries based on the idea of matrix in Boston. As for the suitable industrial type for China, the opinions are different. Some researchers believe that China’s labor resources have the characteristics of “unlimited supply,” and enterprises can utilize large amount of cheap labor to replace expensive technology, which can not only enhance the international competitive advantage of these enterprises, but also promote the full employment of the labor force in China. Thus, China should pursue a labor-intensive strategy (Yang, 2007). However, more researchers point out technology-intensive industry could be a better choice for China today. According to Lee and Lim (2001), developing countries can rely on cheap labor to increase market share, but as technology advances and labor costs increase, firms need to innovate. In the grey incidence, the analysis of the industrial selection in China OFDI, the labor-intensive industry has the weakest effect on industrial upgrading (Li, 2013). Actually, technology-intensive industries are more inclined to launch product innovation activities and conducive to economic development (Pavitt, 1984), so China should enhance the market competitiveness of China’s equipment manufacturing industry through independent innovation (Chen, 2008), adopt a technology-intensive and innovation-led intensive economic development strategy (Yu, 2010), give full play to the spillover effect of technology-intensive industries, and enhance the international competitiveness of manufacturing industries through various means (Chen and Liu, 2011), and improve China’s independent innovation ability on the condition of opening up (Mahmood and Lee, 2004; Tang, 2012; Zhang and Zheng, 2013, He and Zeng, 2013).

In recent years, many scholars employ the game theory to analyze the competition among international enterprises. Tomaru (2007) studied how domestic firms can reduce marginal costs through R&D, and how foreign firms have an impact on social welfare when companies at home and abroad engage in Cournot competition. Matsumura et al. (2009) used a Stackelberg model for mixed oligopolies engaging a foreign firm and found the most optimal equilibrium for social welfare. Guo and An (2012) analyzed the two-stage game equilibrium of the market competition from the perspective of cost heterogeneity, with the background of local companies facing multinational enterprises’ competition.
(2016) constructed a mixed-oligopoly game model for companies with the production of differentiated products, considering the condition of foreign companies entering the market. Different from the research works above, this paper analyzes which industrial type choice of China’s equipment manufacturing industry from the perspective of consumer preference.

Because consumer preference is hard to change, companies can only meet changing consumer preferences by continuous innovation. Zakic et al. (2008) pointed out that enterprises maximizing their profits through providing products that match consumer preference is the principal motivation for enterprise product innovation. Wu and Qiu (2015) pointed out that the implementation of product innovation benefits the enterprises satisfying the consumer preference of the target market. Dewey Sword and Li (2015) analyzed the influence of consumer preference in the target market on the quality of the final product and the intermediate input product of domestic enterprises, and concluded that China should increase its exports to high-income countries so as to promote the technological upgrading of enterprises.

But so far, in the context of international competition, from the perspective of consumer preference, the research on industrial selection is relatively rare, and does not take into account the influence of the uncertain influence brought by technological-level and production factor dependency. Therefore, this paper analyzes the influence of technological-level and production factor dependency on consumer preference among various types of industries. Based on the concept of consumer preference, and combining with the interval grey number (Liu et al., 2010), the improved grey game model is constructed to analyze the influence of the uncertainty of enterprise’s technological-level and production factor dependency on the market share of two competing companies, finally coming up with the direction into which the Chinese equipment manufacturing industries should develop.

2. Model construction
2.1 Parameter setting and problem description
The traditional Stackelberg game model assumes that there are two firms in the industry with unequal status and producing alternative products. The two firms are faced with a common product market, whose market share and profit will be determined by their decisions about output under complete information. The inverse demand function for the product market is:

\[ p_1(Q) = \rho a - bQ = \rho a - b(q_1 + q_2) \] (1)

\[ p_2(Q) = (1-\rho a - bQ = (1-\rho a - b(q_1 + q_2) \] (2)

where \( a, b > 0, p_1, p_2 \) are the respective market prices of the products of multinational firm and local firm; \( q_1, q_2 \) are the respective product output quantity of the multinational firm and local firm; \( \rho \) is the consumer preference for multinational firm’s product and \( 1-\rho \) is the consumer preference for local firm’s product. This paper assumes that the marginal costs of the two products are fixed. However, the impacts of technological-level and production factor cost difference on the marginal costs of the two firms are considered. Therefore, the marginal cost assumptions of the two firms are modified with other assumptions remaining unchanged. Assuming that the main factors influencing the unit cost of products of multinational firm and local firm in China are twofold.

First, in terms of technical level, this paper posits that firm with advanced technology (multinational firm) can effectively reduce the unit product costs of its product, and for firm with inferior technological level (Chinese local firm), the unit product cost when introducing advanced technology is relatively higher. That is, there is a negative correlation between the level of technology and product unit cost.
Due to the uncertain impact of technological level on product cost, we only know the approximate range of technological level rather than its exact value. Thus this paper will set the technical level variable as interval grey number $\alpha_m(\otimes)(1 > \alpha_m(\otimes) > 0)$. So the game payment matrix of the two enterprises is grey matrix and they have a grey game going on. The technological level of the multinational firm as interval grey number is set as $\alpha_{1m}(\otimes)$, and the local firm as $\alpha_{2m}(\otimes)$. $\alpha_{1H}(\otimes)$ is the lowest technological level of the multinational firm while $\alpha_{1H}(\otimes)$ is the highest. Correspondingly, $\alpha_{2L}(\otimes)$ is the lowest technological level of the local firm and $\alpha_{2L}(\otimes)$ is the highest. So:

$$\alpha_m(\otimes) = \begin{cases} 
\alpha_{1m}(\otimes) \in [\alpha_{1L}, \alpha_{1H}], & \text{technology level of multinational firm} \\
\alpha_{2m}(\otimes) \in [\alpha_{2L}, \alpha_{2H}], & \text{technology level of local firm}
\end{cases}$$

(3)

Second, in terms of production factor dependence, the difference of factor endowment between multinational firm and Chinese local firm results in different unit costs of products of two firms. The local firm with comparative advantages can reduce the production cost effectively, and the multinational firm with inferior advantages has relatively higher unit cost, that is, the cost of production factors and the unit product cost are positively correlated.

This paper sets the production factor dependence level as interval grey number: $\beta_m(\otimes)$ ($1 > \beta_m(\otimes) > 0$), so the grey number $\beta_{1m}(\otimes)$ is the production factor dependence of the multinational firm, while $\beta_{2m}(\otimes)$ stands for the production factor dependence of the local firm. $\beta_{1L}(\otimes)$ is the lowest production factor dependence level of the multinational firm, while $\beta_{1H}(\otimes)$ is the highest. $\beta_{2L}(\otimes)$ is the lowest production factor dependence level of the local firm, while $\beta_{2H}(\otimes)$ is the highest:

$$\beta_m(\otimes) = \begin{cases} 
\beta_{1m}(\otimes) \in [\beta_{1L}, \beta_{1H}], & \text{production factor dependence level of multinational firm} \\
\beta_{2m}(\otimes) \in [\beta_{2L}, \beta_{2H}], & \text{production factor dependence level of local firm}
\end{cases}$$

(4)

2.2 Model construction

On the basis of the above model assumptions, the unchanged product unit cost $c(a > c > 0)$ is introduced. For a multinational firm, it is advantageous in terms of technological level and disadvantageous in terms of factor cost; for Chinese local firm, it has comparative disadvantages technologically and advantages in the factor cost. The level of technology and production factor dependence are interval grey number, so the unit cost of multinational product is $C_1(\otimes) = [(1 + \alpha_{1H} + \beta_{1L})c, (1 + \alpha_{1L} + \beta_{1L})c]$, and the unit cost of domestic product is $C_2(\otimes) = [(1 + \alpha_{2L} - \beta_{2L})c, (1 + \alpha_{2H} - \beta_{2L})c]$. Hence the payment function of the two enterprises is:

$$\Pi_1(\otimes) = \begin{bmatrix} q_1(\rho a - b(q_1 + q_2) - (1 - \alpha_{1L} + \beta_{1L})c), \\
q_1(\rho a - b(q_1 + q_2) - (1 - \alpha_{1H} + \beta_{1H})c)
\end{bmatrix}$$

(5)

$$\Pi_2(\otimes) = \begin{bmatrix} q_2((1 - \rho)a - b(q_1 + q_2) - (1 + \alpha_{2L} - \beta_{2L})c), \\
q_2((1 - \rho)a - b(q_1 + q_2) - (1 + \alpha_{2H} - \beta_{2H})c)
\end{bmatrix}$$

(6)

Different from the traditional Stackelberg game model, this paper mainly assumes that the marginal cost of the two firms’ products is interval grey number and changes with the relative change of the grey value of the two related variables: $\alpha(\otimes)$, $\beta(\otimes)$. The grey variable $\alpha(\otimes)$ depends on the degree of influence of the technological level on the unit
product cost of the product, while the grey variable $\beta(\otimes)$ depends on the degree of influence of the production factor cost on the unit product cost. The interval value of $\alpha(\otimes)$, $\beta(\otimes)$ will undergo changes when studied on different levels of industrial types.

3. Model solving and analysis

3.1 Model solving

We use the inverse induction method to deduce the subgame perfect Nash equilibrium solution. The first-order optimization of (5) and (6) are:

$$q_1(\otimes) = [\min(q_1^*, q_1^{**}), \max(q_1^*, q_1^{**})]$$  \hspace{1cm} (7)

$$q_2(\otimes) = [\min(q_2^*, q_2^{**}), \max(q_2^*, q_2^{**})]$$  \hspace{1cm} (8)

$$q_1^* = \frac{(3\rho-1)a-c}{2b} + \frac{c}{2b}(x_{2H} - \beta_{2L}) + \frac{c}{b}(x_{1H} - \beta_{1L})$$  \hspace{1cm} (9)

$$q_1^{**} = \frac{(3\rho-1)a-c}{2b} + \frac{c}{2b}(x_{2L} - \beta_{2H}) + \frac{c}{b}(x_{1L} - \beta_{1H})$$  \hspace{1cm} (10)

$$q_2^* = \frac{(3-5\rho)a-c}{4b} - \frac{c}{4b}(x_{2L} - \beta_{2H}) + \frac{c}{2b}(x_{1L} - \beta_{1H}) - \frac{c}{2b}(x_{2H} - \beta_{2L})$$  \hspace{1cm} (11)

$$q_2^{**} = \frac{(3-5\rho)a-c}{4b} - \frac{c}{4b}(x_{2H} - \beta_{2L}) - \frac{c}{2b}(x_{1H} - \beta_{1L}) + \frac{c}{2b}(x_{2L} - \beta_{2H})$$  \hspace{1cm} (12)

Before analyzing the model, the model has two conditions to satisfy to get the optimal solution: the output value of each firm has to be non-negative; the profit of each firm has to be non-negative. The condition can be shown in the following expression:

$$q_1(\otimes), q_2(\otimes) \geq 0 \text{ and } \Pi_1(\otimes), \Pi_2(\otimes) \geq 0$$  \hspace{1cm} (13)

Corollary can be deduced on condition that the above constraints be satisfied:

Corollary 1. The model has an optimal solution if the preference of consumers for multinational products $\rho$ meets the following conditions:

$$\frac{1}{a}(1 - x_{1L} + \beta_{1H})c + \frac{b}{a}(\max(q_1^*, q_1^{**}) + \max(q_2^*, q_2^{**})) \leq \rho \leq \frac{1}{a}(1 + x_{2H} - \beta_{2L})c - \frac{b}{a}(\max(q_1^*, q_1^{**}) + \max(q_2^*, q_2^{**}))$$  \hspace{1cm} (14)

$\min(q_1^*, q_1^{**}) \geq 0, \min(q_2^*, q_2^{**}) \geq 0$

3.2 Model analysis

When analyzing different types of industries, the equilibrium output of the two firms will change as the interval relative values change. This paper unfolds its studies based on three types of industries: technology-intensive, technology and labor-intensive (dual-intensive) and labor-intensive, and analyzes the influence of technological level and production factor dependence level on consumer preference and market share:

1. Technology-intensive industry: this type of industry has a high dependence on technology and relatively low dependence on production factors. Therefore, the improvement and innovation of the technology can greatly reduce the unit product cost while the cost of production factor has a less influence on the unit product cost,
namely, $1 > \alpha_m(\otimes) > \beta_m(\otimes) > 0$. When the multinational firm and Chinese local firm engage in this type of industry, the Stackelberg game model equilibrium solution of the two firms is $q_1(\otimes) = [q_1^{**}, q_1^*]$, $q_2(\otimes) = [q_2^{**}, q_2^*]$.  

$P_1$. If $1 > \alpha_m(\otimes) > \beta_m(\otimes) > 0$, the output of the two firms meets the following inequality:

$$q_1^{**} > q_1^* > \frac{(3\rho-1)a-c}{2b} > 0, 0 < q_2^{**} < q_2^* < \frac{(3-5\rho)a-c}{4b}.$$  

The consumer preference $\rho$ for multinational product meets the inequality:

$$\frac{1}{3} + \frac{2c}{3a} \left[ \frac{1}{2} + \frac{1}{2}(x_{2L} - \beta_{2H}) - (x_{1L} - \beta_{1H}) - (x_{2L} - \beta_{2L}) \right] \leq \rho_1 \leq \frac{3}{5}$$

$$-\frac{2c}{5a} \left[ \frac{1}{2} + \frac{1}{2}(x_{2L} - \beta_{2H}) + (x_{1L} - \beta_{1H}) + (x_{2L} - \beta_{2L}) \right]$$

$P_1$ illustrates that when a multinational firm and a Chinese local firm compete in the same technology-intensive industry, the multinational firm has first-mover advantage, with its market share surpassing $(5\rho-2)a-c)/(1+\rho)a-3c)$, while the Chinese local firm’s market share is below $(3-5\rho)a-c)/(1+\rho)a-3c)$. Thus the market is gradually encroached by the multinational firm. As the preference for multinational firm $\rho$ increases, the market share of the local firm will become lower. When the industry’s requirements for technological level rise, that is, the value of interval grey variable $\alpha_m(\otimes) - \beta_m(\otimes)$ becomes larger, the gap between the market share of two companies $q_1(\otimes) q_2(\otimes)$ first widens and then narrows, which means the market share of the multinational firm keeps decreasing while that of the local firm keeps increasing. In this case, the consumer preference for multinational firm $\rho$ gradually declines. This demonstrates that if two firms all engage in R&D activities, the improvement of the technological level of the local firm may lead to the growing willingness of domestic consumers to purchase domestic products:

(2) Labor-intensive industry: this type of industry has a low dependence on technology where the unit product cost is more influenced by the cost of production factor, namely $1 > \beta_m(\otimes) > \alpha_m(\otimes) > 0$. When the multinational firm and Chinese local firm are in this type of industry, the Stackelberg game model equilibrium solution of the two companies is as follows: $q_1(\otimes) = [q_1^{**}, q_1^*]$, $q_2(\otimes) = [q_2^{**}, q_2^*]$.  

$P_2$. If $1 > \beta_m(\otimes) - \alpha_m(\otimes) > 0$, the output of the two companies meet the following conditions: $0 < q_1^{**} < q_1^* < (3\rho-1)a-c/2b, q_2^{**} > q_2^* > (3-5\rho)a-c/4b > 0$.  

The consumer preference for the multinational product $\rho$ meets the following inequality:

$$\frac{1}{3} + \frac{c}{3a} \left[ 1 + (x_{2L} - \beta_{2L}) + 2(x_{1H} - \beta_{1L}) - 2(x_{2L} - \beta_{2H}) - 4(x_{1L} - \beta_{1H}) \right] \leq \rho_2 \leq \frac{3}{5}$$

$$-\frac{c}{10a} \left[ 1 + 5(x_{2L} - \beta_{2L}) + 4(x_{1H} - \beta_{1L}) + 4(x_{2L} - \beta_{2H}) \right]$$

$P_2$ shows that when the multinational firm and Chinese local firm both compete in the labor-intensive industry where cost of production factor, compared to technological level, exerts a bigger influence on the unit product cost, resulting in
the augmentation of the interval grey variable $\beta_m(\otimes) - \alpha_m(\otimes)$. Hence, the local firm gives play to their first-mover advantage, with its market share exceeding $(3-5\rho)a-c)/(1+\rho)a-3c)$, while the multinational firm’ market share drops below $((6\rho-2)a-2c)/(1+\rho)a-3c)$, losing their advantages. In this scenario, the growing dependence of both companies on production factor, namely the increase in value $\beta_m(\otimes)$ will gradually enhance the consumers’ preference for multinational product $\rho$, which means that when both companies are engaged in production activities, consumers tend to have a higher preference for multinational product. The high dependence on production factor of two companies causes the narrowness of the gap between multinational and domestic market share.

(3) Technology and labor-intensive industry (dual-intensive industry): this dual-intensive industry is a type of industry where the production process requires both advanced science and technology and a large number of production factors. The influence of technological level and cost of production factor on unit product cost is nearly the same, which is shown as $1 > \beta_m(\otimes) \approx \alpha_m(\otimes) > 0$.

$P.3$. If interval grey variables $\alpha_m(\otimes)$, $\beta_m(\otimes)$ satisfy the condition $\beta_m(\otimes) - \alpha_m(\otimes) \approx 0$, the output of two companies satisfy the following condition:

$$q_1^{**} \approx q_1^* \approx \frac{(3\rho-1)a-c}{2b} > 0, q_2^{**} \approx q_2^* \approx \frac{(3-5\rho)a-c}{4b} > 0.$$

The consumer preference for multinational product $\rho$ satisfies: $1/(3) + (c)/(3a) \leq \rho \leq (3)/(5) - (c)/(5a)$.

$P3$ indicates that when two companies are both in the technology labor-intensive industry, the influence of technology and cost of production factor on unit product cost is alike, with each market share reaching $((6\rho-2)a-2c)/(3-5\rho)c)$. In this scenario, the technological level and production factor dependence have a little influence on the consumer preference for multinational product $\rho$.

Based on the analysis of the above three types of industries, we come to the conclusion that a multinational firm occupies the largest market share in the technology-intensive industry, then in the dual-intensive industry and the smallest in labor-intensive industries; while for Chinese local firm, the market share in the labor-intensive industry is the largest, the market share in technology labor industry comes second, followed by the least market share in technology-intensive industry. Hence, the selection preference for three types of industries between multinational firm and Chinese local firm is opposite.

Under the setting where multinational firm and Chinese local firm cooperate, they can realize the advantage complementation in technology and labor, and maximize their overall profit. Hence, the payment function can be written as follows according to Equations (1) and (5):

$$\Pi(\otimes) = [Q(\rho a-bQ-(1+z-\beta)c), Q(\rho a-bQ-(1-z+\beta)c)]$$

where $a \in \max\{\alpha_{1H}, \alpha_{2H}, \alpha_{1L}, \alpha_{2L}\}, \beta \in \min\{\beta_{1H}, \beta_{2H}, \beta_{1L}, \beta_{2L}\}$.

Then we obtain the output of the cooperative enterprise as:

$$Q(\otimes) = \left[\frac{\rho a-(1+z-\beta)c}{2b}, \frac{\rho a-(1-z+\beta)c}{2b}\right]$$

4. Analysis of examples
The analysis of the Stackelberg game model equilibrium solution indicates that in R&D stage which demands higher level of technology, the multinational equipment
manufacturers with the advantage of technology occupy a larger market share while the local Chinese firms with disadvantages occupy a smaller market share. In the process of manufacturing, the demand for production factors is larger, thus local equipment manufacturers in China with comparative advantages in factor cost occupy relatively larger market share compared to the R&D stage where multinationals have the edge. Combining with the comparison between the present situation of multinational and China’s equipment manufacturing industry, we come up with the interval grey value of technological-level and production factor dependence (see Table I). Then we obtain the consumer preference in Table II and the grey market share of two competing enterprises in Table III (when \( a = 200, b = 4, c = 30 \)).

As can be seen from Tables II and III, when the two firms all engage in the R&D and their technological level is alike, consumers have a higher preference for the local product but the market share of the local firm is smaller compared to that of the multinational firm. This might be due to the reason that the high cost of R&D of the Chinese local firm leads to the higher price of its product, which reduces the market share. In the case of the two enterprises all taking part in manufacturing with the same dependence on production factors, consumers have a higher preference for multinational products and the multinational enterprise has a higher market share. When both companies choose the dual-intensive industry, it turns out that consumers have a similar preference for both products and their market share is basically the same, with the market share of the local firm slightly higher. Therefore, from the perspective of consumer preference, the local Chinese equipment manufacturing enterprises should select technology-intensive or dual-intensive industry.

From Figure 1 and the relationship between \( \rho \) and \( q \), when two competing companies are engaged in R&D, with the upgrading of technology, the market share of the local equipment
manufacturers gradually increase; when the two competing companies are engaged in manufacturing, with the increasing dependence on factors of production, multinational equipment manufacturers will increase its market share.

Under the setting of parameters in Table I, if multinational firm and Chinese local firm transfer from competition to cooperation, the market share of cooperative enterprise increases to [19, 23.5], which is higher than that of two competitive firms according to the Equation (16).

5. Conclusions
In this paper, the internal grey number is introduced into the Stackelberg game model in consideration of the uncertainty of the technical level and the production factors and we analyze the market shares of two competing firms and the preference of consumers to the market shares from different industrial levels. In the field of international competition, with dominant advantages in technology, multinational equipment manufacturers are playing a leading role in the R&D of new products and meanwhile, in order to leverage low-cost factors of production in China, multinational equipment manufacturing enterprises continuously transfer manufacturing segment into China through foreign direct investment or other methods. Unfortunately, due to the restrictions of relatively lower technological level, China’s domestic equipment manufacturing enterprises have to depend on its advantages in the low cost of production factors, and are forced to focus on the manufacturing segment, whose market is dramatically squeezed by multinational corporations. On the other hand, in the field of international cooperation, the cooperative profits are higher than that in the competitive environment.

From the perspective of consumer preference, we made the conclusion that, if the two companies are both technology-intensive companies with the same level of technology, as the improvement of technological level, domestic consumers have a higher preference for their own local firm; if the two companies are both labor-intensive companies with the same level of dependence on production factors, with the increasing reliance of the companies on production factors, consumer have a higher preference for multinational firm. Therefore, based on consumer preference, Chinese equipment manufacturers should actively engage in the R&D activities of new products, enhance the technological level, and occupy the leading position in R&D, so as to promote the international competitiveness of China’s equipment manufacturing industry, and increase the market share of local enterprises.

Figure 1. Influence of technological-level and production factor dependence on consumer preference.
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**Further reading**


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