To What Extent Has Government Intervention Impacted The Manufacturing And Costs Of Private Space Launch Service Firms In The Oligopoly Market

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Abstract: In order to provide many special services to satellite operators and quickly occupy the market, foreign launch vehicle manufacturers have combined their own technical advantages to build low-cost commercial small rockets with obvious technical characteristics. Political connection originates from the government's intervention in macro and micro economy, and it also has two opposite economic effects: support and plunder. This kind of relationship affects all aspects of enterprise operation from various channels, such as loan tax incentives, corporate governance, hollowing out and plundering, and finally affects the value of the company. Therefore, this paper studies the extent to which government intervention affects the manufacturing and cost of private space launch service companies in oligopoly market, with a view to providing important reference and guiding significance for deepening integration of defense and civilian technologies and developing commercial space in China.

1. Introduction

In order to provide many special services to satellite operators and quickly occupy the market, foreign carrier rocket manufacturers have combined their own technical advantages to build low-cost commercial small rockets with obvious technical characteristics [1]. SpaceX has become a model for private space companies. Founded in 2002, the company aims to reduce the cost of entering space and improve the reliability of entering space. The company employs more than 1,800 people and is worth about $1.3 billion. In addition to signing a contract with NASA of the United States to implement the international space station commercial rail transport service, SpaceX also signed launch service contracts with private companies, non-US government agencies and the US military.

This paper is about how much help the U.S. government has for private listed companies according to the current market situation, and further analyzes what the U.S. government should do next.

2. Spacex's Lunar Orbit and Mars Landing Plan

At present, the fare for American astronauts to and from the International Space Station on the Russian Soyuz is about 557 million yuan, while NASA recently purchased five tickets in batches, which are slightly cheaper, and each ticket is about 514 million yuan. SpaceX said in a public statement that the two tourists' space travel is full of the hopes and dreams of all mankind. The flight will be completed by the spacecraft independently, without specially trained astronauts [2]. After the initial physical examination and physical fitness test, their names will be announced later, after which they will also receive relevant training.

This launch is a major milestone for SpaceX because it is the first time that the company has launched Falcon 9 rocket from Launch Complex 39A launch complex. Launch Complex 39A is a historic launching station of NASA Kennedy Space Center, which has carried out many Apollo moon missions and the first and last flight of the space shuttle program. Launching reusable rockets helps to reduce costs. The rocket launched this time carries a Luxembourg broadcasting satellite. SpaceX is committed to reducing the cost of launching rockets and speeding up the development of space travel. The successful launch of reusable rockets this time can be regarded as a big step

towards the above two goals.

At the 33rd Space Symposium held in Springs, Colorado, Gwynne Shotwell, president of SpaceX, told those who still have doubts that they would consider buying a ticket to Mars. The reusability of the rocket is of great significance. Compared with rebuilding a new rocket, the reusability of Falcon 9 can save nearly half of the cost.

If SpaceX's Mars program is successfully implemented in 2020, there will be many ways for humans to land on Mars. For example, the next generation Mars probe from NASA is also planned to be launched in 2020, and the ExoMars Mars Life Exploration Program jointly developed by Russian Space Agency and European Space Agency [4]. In addition, the United Arab Emirates also plans to send a satellite to Mars orbit in 2020, while China also indicated that it will realize its own Mars landing plan in the next ten years.

3. Government Intervention, Political Connection and Cost of Equity Capital

Capital cost is a key variable in corporate financing decision, an important factor affecting corporate value, and a core concept in the field of corporate finance research. As the main component of capital cost, the measurement of equity capital cost has always been an important research topic of corporate finance. In the transitional economy, officials' rent-seeking behavior and political corruption caused by government regulation and capitalization of power are important factors affecting economic efficiency, while the characteristics of "strong government" in China's economic transition to some extent provide a political hotbed for political rent-seeking and corruption. If a listed company undertakes the social functions of the government, it will inevitably make its activities deviate from the goal of maximizing value, and then damage its value.

As a characteristic of a company, political connection not only has a natural connection with government intervention, but also has an impact on company value. Investors will consider the political connection of enterprises when evaluating the value of listed companies [5]. In places where government intervention is strong, the local government experience of senior executives has a positive impact on the value of private listed companies. Moreover, the stronger the government intervention, the more the local government background of the executives can improve the company value.

From the perspective of enterprise risk, political association can influence investors' evaluation of risk from both protective effect and predictable effect. Political connection means the increase of government protection for enterprises, which will reduce investors' evaluation of enterprise risks. Political connection also means that the government may intervene in business operations, and the probability of rent-seeking and corruption increases.

This chapter will mainly use multiple regression analysis to study the relationship among government intervention, political connection and cost of equity capital of listed companies in China. The basic form of the multiple regression model is as follows:

$$Cost\ of\ equity = \alpha_0 + \alpha_{1i} \times Political\ indicators_i + \alpha_{2j} \times Control\ variable_j + \varepsilon \quad (1)$$

The residual income model is used to estimate the cost of equity capital of listed companies in China, and the formula for calculating the cost of equity capital is derived as follows:

$$P_t = B_t + \frac{FROE_{t+1} - r_e}{(1+r_e)}B_t + \frac{FROE_{t+2} - r_e}{(1+r_e)^2}B_{t+1} + \frac{FROE_{t+3} - r_e}{(1+r_e)^3}B_{t+2} + TV \quad (2)$$

In which P_t is the share price; B_t is the initial net assets per share in the year of allotment. r_e is the cost of equity capital. $FROE_{t+i}$ is the predicted return on net assets of the first $t+i$ period.

TV is the final value. After replacing the indefinite period with the finite forecast period, the calculation formula is:

$$TV = \sum_{i=4}^{T-1} \frac{FROE_{t+i} - r_e}{(1+r_e)}B_{t+i-1} + \frac{FROE_{t+T} - r_e}{r_e(1+r_e)^{T-1}}B_{t+T-1} \quad (3)$$

T is the prediction interval of the model.

4. Influence of Government Intervention on Manufacturing and Cost of Private Space Launch Service Companies in Oligopoly Market

4.1 Oligopoly Market and Enterprise Profitability

Oligopoly refers to a kind of market structure, in which several large companies have high market power and dominate the industry. Oligopoly market usually has three characteristics: only a few large enterprises; High barriers to entry; This is interdependent. Due to the complexity of space technology and its various payloads, few companies can develop and assemble large spacecraft and launch services. That's why in most cases, leading companies like SpaceX and Boeing dominate the aerospace industry. NASA claims that the average cost of each launch is $152 million.

The cost of building new capabilities in the aerospace industry is usually in the millions of dollars. This level of start-up capital usually prevents many SMEs from entering this industry [6].

The launching industry is regarded as a non-collusive oligopoly, which means that companies act independently and will not collude with each other in order to fix or coordinate prices and restrict competition in any case. Various theories have been put forward to analyze the pricing decisions made by commercial launching companies. This concept of pricing theory points out that if a company lowers the price of its products to attract more customers, it can expect competitors to make similar reactions. This may cause the price of the whole industry to fall.

4.2 Maximizing the Profits of Oligarchs

Strategic behavior is to invest in the market environment and resources that can influence competitors' decision-making, so its emergence depends on the interdependence of enterprises in market decision-making. This dependence is most common in oligopoly market. On the one hand, because there are only a few suppliers in the market, the profit of each enterprise depends on the behavior of all enterprises. On the other hand, monopoly profits will tempt new potential entrants to consider entering, while the market behavior of incumbent firms will have an impact on the behavior of potential entrants. Therefore, oligopoly market structure constitutes the market basis of strategic behavior analysis.

Explicit cooperative strategic behavior refers to an behavior in which oligopolistic manufacturers coordinate their behaviors through open or secret agreements (written or secret talks) to maximize the profits of cooperative organizations. Theoretically speaking, when there is no information problem involved, it is of little significance to distinguish tacit cooperation strategic behavior from explicit cooperation strategic behavior. In the model that does not involve incomplete information, every enterprise knows the behavior with other enterprises, and can find out the betrayal in time and punish it. This means that enterprises can achieve the effect of cooperation only by tacit understanding without explicit collusion.

According to the financial situation of Rocket Lab, Astra Space and Virgin Galactic, Figure 1 shows the current situation of private space launch companies. The red area in Figure 1 refers to the minimum loss of oligopoly enterprises. When $MC = MR$, we determine the minimum level of output $Q_{equilibrium}$, and making an upward vertical line $Q_{equilibrium}$ can help us find the price ($P_{equilibrium}$) of this output level.

The unit loss is equal to the average cost minus the average price, so the total loss is calculated by multiplying the unit loss by the output. This is the red area. This figure means that the net losses of these three companies will gradually increase over time, and the lack of profits will last for several years. This is because these companies have spent a lot of money on spacecraft, testing, rent and technology.
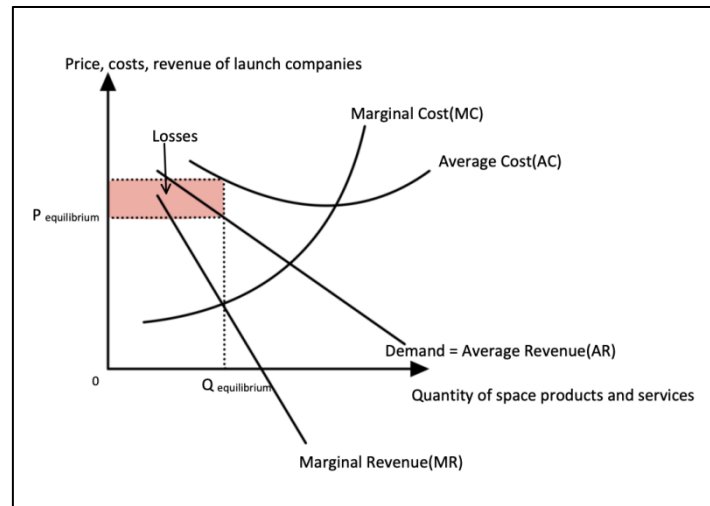
Fig.1 Present Situation of Private Space Launch Companies

Space launch companies mainly reduce costs by the following ways: driven by the market, aiming at profit and obtaining personal investment; Constantly innovate technologies to reduce costs with recyclable and reusable technologies; Introduce a large number of mature talents, streamline personnel, and greatly improve efficiency and time; Promote mass production, reduce labor cost and improve efficiency; Rent for construction and use old land for reconstruction.
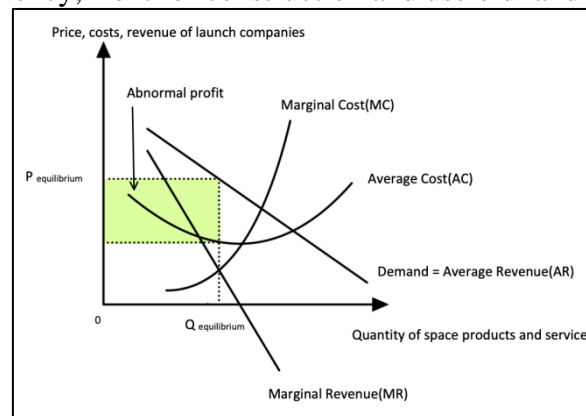

Fig.2 Profit Maximization

All private companies have at least one common goal-to maximize profits. In Figure 2, first find the place of $MC = MR$, and we can define the maximum output level ($Q_{equilibrium}$).

Just like how we think about Figure 1, making an upward vertical line $Q_{equilibrium}$ can help us find the price ($P_{equilibrium}$) of this output level. Then, the unit profit can be calculated by subtracting the average cost from the average price. Finally, the total profit is equal to the unit output multiplied by the unit profit, which is represented by the green area in the figure. Therefore, excess profit is one of the ultimate goals that private space launch companies want to achieve.

4.3 Impact Peak Analysis of Government Intervention

The government's support for private aerospace industry can bring many benefits to society: it can simulate local science education, which can also promote the training of high-tech labor force; Investment and support for space activities can promote national economic growth and gross domestic product; Aerospace is vital to national security and national defense. This industry brings a lot of employment opportunities to the states. Space exploration will also drive the development of new industries and create new employment opportunities. Over time, there are indirect benefits, including various intangible advantages, such as improving health, safety and economic prosperity.

The sudden reduction of government funds or the loss of contracts will bring huge losses to the

company. For immature companies, they may face the possibility of bankruptcy. Secondly, aerospace companies can encourage people to pursue science, technology, engineering and mathematics, and contribute to economic growth. Therefore, supporting private space launch companies can bring comprehensive and additional benefits to society and the country.

Under the business philosophy of "simplicity, low cost and high reliability", the cost, development cost and development time of small satellites entering low orbit are also greatly reduced. The state and the government have changed from the original service provider to the direct buyer of services, and the cooperation with private enterprises runs completely according to the commercial mode. This mode of commercial competition has effectively promoted the optimal allocation of resources and the transformation and development of commercial aerospace work. Although these private small satellite launching companies are not full-fledged, their development has narrowed the distance between aerospace industry and society, and their innovative management mode and technical mode have made this market more dynamic and competitive.

5. Conclusion

The technological development of launch vehicles has also undergone changes from small to large and then from large to small. Under the great situation that the country implements various reform measures and the economy is more open, we should actively jump out of the institutional constraints, embrace the free market, and temper a solid technical system and sound organizational structure with the power of the market. Flexible commercial companies to carry out space activities, can greatly reduce the cost of space launch. At present, the pursuit of the civil use of aerospace technology can't stay at the level of capital operation, and it needs "two tracks" in the system and industrial application, which requires the support of the government and state-owned military enterprises, as well as the active participation of private capital and private enterprises. The transformation of aerospace scientific and technological achievements needs diversified investment and incubation.

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