

The Opportunities and Challenges of Tesla's Entry into Chinese Market

Xinran Dai^{1, *,†}, Haoyang Zhang^{2, †}

¹ School of International Exchange, Inner Mongolia Normal University

² School of Economics and Management, Qingdao Institute of Technology

*Corresponding author. Email: 161842322@masu.edu.cn

[†]These authors contributed equally.

ABSTRACT

This article is based on the present situation of Tesla entering the Chinese market. It entails a detailed analysis of the similarities and differences between Tesla and other companies in China's new energy automotive industry, combining with the actual analysis of the opportunities and the difficulties faced by Tesla entering the Chinese market. By adopting the combination of theoretical and empirical methods, the operations of Tesla enterprise are analyzed. The research results show that the errors in infrastructure construction and customer audience decision-making are the objective and subjective reasons for enterprises to prevent Tesla from entering the Chinese market. At the same time, this paper takes the establishment of Tesla's experience shop in Beijing in 2013 as an opportunity to analyze the attitude of BYD on Tesla's entry by constructing three dynamic game models. Combining with the results, it is evident that with Tesla as the newcomer while BYD as the incumbent, under no circumstances would BYD show resistance to obscure the entry of Tesla. BYD does not spend abundant money to prevent Tesla from reaching the Chinese market.

Keywords: *New Energy Automotive; Tesla; Chinese Market; Opportunities; Challenges; Game Theory.*

1. INTRODUCTION

1.1. Research Background and Motivation

Tesla was founded on July 1, 2003 after realizing the contradiction between the production and use of fuel cars and the preservation of ecological environment. The idea of associating sports cars and new energy automotive came into being, targeting customers who are high-income groups with environmental awareness. Elon Musk became chairman of Tesla in February 2004 with a \$6.3 million investment. Thanks to Elon Musk's financial backing, Tesla's growth was gradually on track. The long-simmered technical problems finally flared up in 2007, when a new CEO Ze'ev Drori replaced Elon Musk with a new team that brought Tesla back to life. In February 2008, Tesla successfully delivered its first Roadster. In October 2008, the first batch of Tesla Motors was also sold successfully. However, due to the high price, consumers were dissatisfied. In order to solve the development difficulties, 10% of Tesla's shares were acquired by Daimler AG. Tesla then struck a deal to supply Toyota with battery packs and engines. In 2017,

Tesla entered into the Chinese market. In order to expand the market, Tesla gave up nationalization in 2018 and signed an agreement with the Shanghai government to take the 854,885 square meters of the 05 land in Shanghai as Tesla's Gigafactory 3 in Shanghai [1-2]. Nowadays, Tesla sales in Chinese market have accounted for 29.6% of the world's sales, but Tesla also has faced myriad of challenges and opportunities from entering the Chinese market to the present day. Based on the existing research results, according to the development of the Tesla and using the empirical model analysis of Tesla's difficulties in the process of entering the Chinese market, this paper tries to explore how Tesla successfully entered the marketing mode of China's new energy vehicle industry and provide experience for the operation of other enterprises in the new energy vehicle industry.

1.2. Literature Review

Most scholars believe that Tesla has great opportunities in the Chinese market, but according to the analysis of the current situation, there is also great risks. Tesla's macroeconomic expectations are not optimistic, and the industry growth rate is much less than expected.

Therefore, in order to further develop in the Chinese market, Tesla should reduce costs and control prices so as to improve the cost performance. Secondly, Tesla should also boost the coverage of charging facilities, charging services and battery supply. Finally, focus should be shifted to the appearance design and endurance of cars [3-5]. Some scholars argue that China's support policies for new energy vehicles, such as infrastructure, technological innovation and financial subsidy policies, will also bring various opportunities to Tesla [6,7]. Although Tesla has a great opportunity to enter the Chinese market, there are still many elements that prevents Tesla from entering the Chinese market. First of all, the price of Tesla in The Chinese market is 63% higher than that in the US due to tariffs and transportation costs, which is a major reason that prevents Tesla from entering the Chinese market. Second, the high performance of Tesla cars is limited by congested urban roads, and the simple design is inferior to other models of the same price, which also contributes to the resistance of Tesla cars from entering the Chinese market smoothly. In addition, the battery safety and brake failure problems of Tesla cars will also be challenges for Tesla to enter the Chinese market [8,9]. At present, there are many new energy vehicle industries in China, such as Xiaopeng, Ideal, BYD and so on. The cars of these industries are more suitable for Chinese traffic, and the appearance also meets the aesthetic taste of Chinese people. Moreover, these brands are all domestic brands, so they are favored by Chinese people. But Tesla is positioned to offer customers online procurement because all models are purchased online and custom-built, making it more attractive. Tesla is also targeting different demographics for other brands. Most of Tesla's competitors aim at the younger age group, while Tesla's target customers are the middle-aged group [10,11]. Tesla's own advantage will also be the opportunity to enter the Chinese market.

1.3. Research Contents and Framework

Based on the analysis of the literature that has been consulted, this paper describes the difficulties encountered by Tesla in entering the market from the three aspects including high pricing, limited charging services and low adaptability. Moreover, this paper also uses three game models to analyze the impact of BYD on Tesla in the Chinese market. Secondly, the opportunities encountered by Tesla in entering the Chinese market are analyzed from the perspective of China's introduction of relevant supportive policies and Tesla's higher level of new energy technology compared with other domestic new energy vehicle brands. The first part of this paper mainly analyzes the development status of Tesla, the development status of China's new energy vehicle market, and the opportunities encountered by Tesla in entering the Chinese market. The second part is about the difficulties Tesla encountered in entering China, and the game model decision analysis of different situations

between Tesla and BYD, which is the leader of China's new energy vehicle market at the time when Tesla just entered the Chinese market. In the last part, based on the challenges and opportunities analyzed above, suggestions are given for Tesla's further development in China's new energy vehicle market, as well as prospects for the future of this paper.

2. THE STATUS OF TESLA WITHIN CHINESE MARKET

2.1. Wide Distribution of Stores

Tesla opened its first store in Shanghai in 2013, and has since opened 139 experience stores in China as of 2021. All Tesla stores, including experience stores, currently cover 296 cities in 34 provinces in China, with a total number of 2111, mostly in first-tier cities (498) and new first-tier cities (584). Third, fourth and fifth tier cities accounted for less than 30 percent. It is worth pointing out that Tesla stores are mostly distributed in developed cities in China, where residents have high economic level and advanced consciousness and can have a higher recognition of China's emerging products. They are the demographic with a higher acceptance of new products. Such a strategy is planned to allow a smooth entry into the Chinese market.

2.2. Benefits of Chinese government policies on new energy automotive

With the promotion of the "Ten Cities, Thousands of New Energy Vehicles" campaign, new energy vehicles were initially launched. The event put forward clear requirements on the promotion methods and channels of new energy vehicles. In 2015, China began to implement the Environmental Protection Law to remedy China's environmental problems, which provided opportunities for the development of new energy vehicles. Thereafter, many new energy vehicle brands developed rapidly. From 2009 to 2016, China issued many corresponding supportive policies, such as infrastructure, technological innovation, fiscal subsidy policies, etc., including 21 policies directly related to new energy vehicles. In the same year, policies were also introduced stating that the investment projects of new energy vehicles are not subject to the minimum threshold of the industry of traditional cars. Moreover, new energy vehicles owners have the advantage of unlimited purchases, unlimited driving on weekdays and do not need to wait for a license plate in the lottery system. With the support of these policies, China has become the world's largest market for new energy vehicle sales for seven consecutive years.

2.3. Opportunities for Tesla in Chinese Market

According to the above analysis of Tesla and China's new energy vehicle market, China has introduced

numerous policies for environmental protection which demonstrates support for development of new energy vehicles and promote the spread of new energy vehicles. For example, financial policy support for new energy vehicle brands, the unlimited purchase right and a green license plate. However, these are not only opportunities for Tesla, but also for other New energy vehicle brands in China. There has to be intrinsic explanations for the tremendous growth of Tesla. First of all, the location of Tesla's stores in China is critical. Most of its stores are in China's developed cities. Secondly, Tesla's new energy technology is better developed than other domestic new energy vehicle brands, so many Chinese users choose Tesla vehicles having faith in the advanced technology.

3. ANALYSIS ON FACTORS THAT IMPEDE TESLA IN CHINESE MARKET

3.1. Overprice

In the United States, Tesla's new energy vehicles are highly sought after by the American people, but in China, many Chinese people have refrained from purchasing them. In 2014 and 2015, Tesla's sales volume in The Chinese market was only 2,499 and 3,692 respectively. After that, Tesla did not disclose its sales volume in China for a long time. Such a gap is mainly caused by Tesla's selling price in China, which is up to 63% higher than that in the US due to tariffs and transportation costs. This factor does impede Tesla from spreading among the working class in China as most citizens average income is relatively low when compared with western countries such as the USA. In addition, the high performance of the vehicle cannot be fully utilized. Tesla pricing is in accordance with the services provided such as real time assistance from the AI system. However, due to lack of network and congestion in urban regions, these services seem to redundant and therefore loses its appeal. Furthermore, consumers in China are able to purchase new energy vehicles with similar functions in from other domestic models such as such as NIO, Xiaopeng, Ideal, BYD and BAIC. These domestic companies supply only the necessary services that are popular among Chinese people, with relatively low prices, and can adapt to the congested road market in China.

3.2. Lack of Charging Piles

Tesla's scheme of installing charging piles has not gone as planned. In 2014, construction of charging piles stagnated, customer satisfaction dropped to the lowest level in history. Customers who had previously ordered Tesla in cities other than Beijing and Shanghai were unable to pick up their vehicles. Since the charging piles of Tesla are incompatible with those of domestic new energy cars, Tesla must manufacture their own charging piles. However, limited production of the charging piles and its limited spread meant those Tesla vehicles sold in

China cannot charge in time. As a result, potential buyers therefore choose domestic vehicles rather than Tesla's new energy cars since their chances of charging when the battery is low is far high. The lack of charging piles is another barrier that Tesla needs to overcome.

3.3. Low Adaptability

The high performance of Tesla cars is limited by congested urban roads. Its powerful performance includes superior acceleration, steering, grip and handling performance. However, these capabilities are evident in long-distance driving, but are of little use on China's congested urban road networks. It is clear that the manufacture did not take into consideration the difference between Chinese urban and its counterpart in the west. Coupled with the high price of Tesla cars, many Chinese will opt to buy other brands of new energy vehicles, such as BYD, NIO, Xiaopeng and so on. Second, the appearance of Tesla cars is simple and far less fancy than that of Chinese new-energy vehicles. In China, the buyers of new energy vehicles are mostly young generations who are more adaptable to new technology in this emerging business but values appearance. It is obvious that the appearance of Tesla is not appreciated by young people, which is a big reason why new energy vehicles from Tesla not as welcomed in the Chinese market

3.4. Battery Safety and Brake Failure Issues

In addition to external factors, Tesla's entry into China was problematic due to issues within the vehicles. In 2013, a series of fires that occurred in Tesla vehicles wiped nearly 28% off its market value. While its battery has certain advantages over other electric vehicles, it is far from meeting public standards. This has resulted in further decline in the enthusiasm of Chinese consumers who held doubt in Tesla's quality control. In the years that followed, Tesla vehicles almost disappeared from the public view until 2020. In 2020, Tesla launched Model S and Model Semi in succession, which set off a buying spree among Chinese customers. However, the brake failure incidence immediately discouraged many potential customers from purchasing the new line of Tesla's production.

3.5. Game model analysis of BYD's impact on Tesla in the Chinese Market

In 2012, Tesla officially delivered its first Model S series of new energy vehicles, and at the same time launched corporate bonds for financing in China. In May of the following year, Tesla's new energy vehicles made profits in China for the first time, which boosted confidence for Tesla entrance into China. Six months later, Tesla opened its experience store in Beijing and its market expanded rapidly, which marked Tesla's official

entry into the Chinese market. Tesla's move galvanized BYD, which was then the leading brand of the automotive industry in new energy vehicles.

According to the game rules, both sides of the enterprise will choose the optimal strategy, that is, no matter what the other party chooses, they will choose the most advantageous strategy for themselves. If $\forall (s_i, s_{-i}) \in S, s_i \neq s_i^*, \text{ then } u_i(s_i^*, s_{-i}) > u_i(s_i, s_{-i})$ The test is performed with Tesela as the newcomer and BYD as the incumbent. At the same time, all the values shown below are based on the data assumptions of Tesla and BYD's sales profits at that time.

3.5.1. Complete Information Static Model Analysis on BYD's Attitude Towards Tesla's Entry into the Chinese Market

Under ideal circumstances, and the market could be treated as a complete information static market model to conduct a complete information static model analysis. As shown in Fig.1, when Tesla choose to enter the Chinese market, BYD choose tolerance values for (40, 500). In order to maintain their status in the domestic sales, BYD will choose according to dominant strategy to prevent Tesla's entry. Hence the numerical value becomes (-10, 400). This change means that Tesla's entry will accompany a series of measures such as reduced price to increase sales. In that case, a price war between Tesla and BYD will be inevitable, especially when Tesla still insist to enter the Chinese market. Tesla is likely to suffer a loss in conducting business. At the same time, BYD, as local brands have a certain influence in China. The act of reduction in prices for BYD to impede the entry of Tesla will increase its sales. Given the assumption that the production cost remains constant, BYD's profit will be reduced. In the end, neither side will be able to reach the optimum. When Tesla chooses not to enter the Chinese Market, BYD chooses to tolerate that action as its profit will reach the maximum at a value of (0, 600). According to the dominant strategy, BYD will choose to impede Tesla regardless if it enters. So the numerical output will be (0, 500) when Tesla does not enter. In conclusion, in a static market with complete information, both Tesla and BYD will choose their dominant strategy according to the principle of equilibrium of dominant strategy. That is, BYD, as the incumbent, chooses to block Tesla from entering, while Tesla chooses to enter at the same time, and the final value is determined as (-10,400).

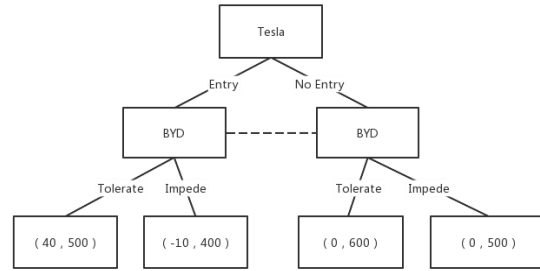


Figure 1 Game results under the static model

3.5.2. Complete Information Dynamic Model Analysis on BYD's Attitude Towards Tesla's Entry into the Chinese Market

When the market is dynamic, it is possible to refer to the first model as samples to model a practical market in reality and carry out the complete information dynamic market analysis by utilizing a complete information dynamic model, as shown in Fig. 2. The author decides to carry out a reverse induction analysis, Tesla as the newcomer may choose to enter or not enter. At the same time, as the incumbent, BYD can also choose to tolerate or to impede. So all the combination of decisions will lead to four different results. Since each decision is made independently without interfering the other, it is possible to achieve a perfect balance of the four types of sub-game. When Tesla chooses to enter, BYD can choose to tolerate or impede, analysis of data outputs that the maximum gain in tolerance is 500, while that of impeding is 400. Given the data, BYD will choose to tolerate the entry of Tesla into the Chinese Market. When Tesla chooses not to enter, BYD also has two options, namely to tolerate or to impede. The outcome of tolerance will return a gain of 600, while that of impeding is 500. Thereby, BYD will still choose to tolerate by comparison. To sum up, regardless of which option Tesla chooses, BYD will eventually choose to tolerate. In terms of Tesla, the return on Tesla's entry is 40 and the return on Tesla's non-entry is 0. So Tesla will choose to enter. In the complete information dynamic model, the final Nash equilibrium result would only be Tesla entering with BYD tolerating the entry.

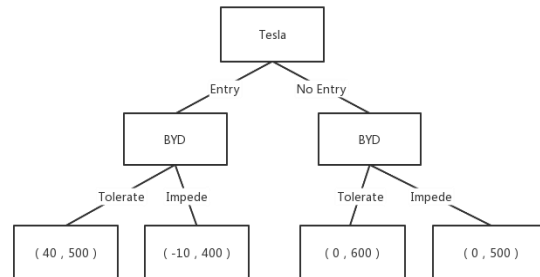


Figure 2 Game results under the dynamic model.

3.5.3. Incomplete information dynamic model analysis on BYD's attitude towards Tesla's entry into the Chinese market

The results of both complete information static model and the complete information dynamic model demonstrate that Tesla, as a newcomer, would choose to enter. But BYD as the incumbents in dominant strategies and Nash equilibrium result in varying results of tolerance and impeding. To model the market closer to reality regardless of the model, according to the incomplete information dynamic market analysis to conduct the incomplete information dynamic model, as shown in Fig. 3, Tesla, as the newcomer, is unaware whether BYD is an enterprise with high cost or low cost. So in this setting, a nature state is hypothesized as an insider with all the information. Tesla, though unaware whether BYD is high cost or not, can assign a probability p for BYD to be high cost hence the probability of BYD as a low cost enterprise can be deduced as $(1-p)$. Tesla chooses to enter while BYD chooses to tolerate under incomplete information, thus forming a sequential equilibrium of (enter, (tolerate, tolerate)), making

$$\begin{aligned}
 U_1(\text{entry}, (\text{tolerate}, \text{tolerate})) &\geq U_1(\text{no entry}, (\text{tolerate}, \text{tolerate})) \\
 &= p * 40 + (1 - p) * 30 \\
 &\geq p * 0 + (1 - p) * (-10)
 \end{aligned}$$

$$\begin{aligned}
 U_2(\text{entry}, (\text{tolerate}, \text{tolerate})) &\geq U_2(\text{entry}, (\text{tolerate}, \text{impede})) \\
 &= p * 40 + (1 - p) * 30 \\
 &\geq p * 40 + (1 - p) * 10
 \end{aligned}$$

$$\begin{aligned}
 U_3(\text{entry}, (\text{tolerate}, \text{tolerate})) &\geq U_3(\text{entry}, (\text{impede}, \text{impede})) \\
 &= p * 40 + (1 - p) * 30 \\
 &\geq p * (-10) + (1 - p) * 10
 \end{aligned}$$

$$\begin{aligned}
 U_4(\text{entry}, (\text{tolerate}, \text{tolerate})) &\geq U_4(\text{entry}, (\text{impede}, \text{tolerate})) \\
 &= p * 40 + (1 - p) * 30 \\
 &\geq p * (-10) + (1 - p) * 30
 \end{aligned}$$

When p is given, U_1, U_2, U_3, U_4 , can be solved and the final conclusion can be drawn. Therefore, it is assumed that the probability of p of BYD as a high cost enterprise is 30%, and the probability of pretending as a low cost enterprise is 70%. Then, by inserting the values p and $(1 - p)$, it is possible to can get:

$$\begin{aligned}
 U_1(\text{entry}, (\text{tolerate}, \text{tolerate})) &\geq U_1(\text{no entry}, (\text{tolerate}, \text{tolerate})) \\
 &= 30\% * 40 + (1 - 30\%) * 30 \\
 &\geq 30\% * 0 + (1 - 30\%) * (-10) \\
 33 &> -0.07
 \end{aligned}$$

$$\begin{aligned}
 U_2(\text{entry}, (\text{tolerate}, \text{tolerate})) &\geq U_2(\text{entry}, (\text{tolerate}, \text{impede})) \\
 &= 30\% * 40 + (1 - 30\%) * 30 \\
 &\geq 30\% * 40 + (1 - 30\%) * 10 \\
 33 &> 12.7
 \end{aligned}$$

$$\begin{aligned}
 U_3(\text{entry}, (\text{tolerate}, \text{tolerate})) &\geq U_3(\text{entry}, (\text{impede}, \text{impede})) \\
 &= 30\% * 40 + (1 - 30\%) * 30 \\
 &\geq 30\% * (-10) + (1 - 30\%) * 10
 \end{aligned}$$

$$33 > 0.67$$

$$\begin{aligned}
 U_4(\text{entry}, (\text{tolerate}, \text{tolerate})) &\geq U_4(\text{entry}, (\text{impede}, \text{tolerate})) \\
 &= 30\% * 40 + (1 - 30\%) * 30 \\
 &\geq 30\% * (-10) + (1 - 30\%) * 30
 \end{aligned}$$

$$33 > 20.97$$

Finally, it is concluded that selecting

$$\begin{aligned}
 U_1(\text{entry}, (\text{tolerate}, \text{tolerate})) &\geq U_1(\text{no entry}, (\text{tolerate}, \text{tolerate}))
 \end{aligned}$$

is the best option, and selecting $U_1(\text{entry}, (\text{tolerate}, \text{tolerate}))$ as sequential equilibrium. In other words, it is a good result for Tesla to choose entering as a newcomer under any conditions. BYD, as an incumbent, tolerates Tesla as a newcomer regardless of high or low cost.

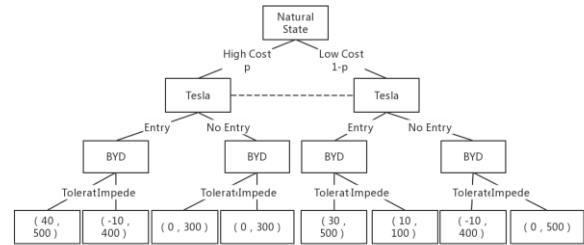


Figure 3 Incomplete information Dynamic Model.

3.5.4. Summary on the three game models on the attitude of BYD on Tesla's entry to Chinese Market

Finally, combined with the above three models can be seen that Tesla as a newcomer should choose to enter the Chinese market, while the best game theory decision for BYD, the incumbent is to tolerate Tesla's entry when faced with such a signal. In this way, the optimum gain can be achieved and both side can retain the optimum result. In retrospect, by reviewing the game results of BYD at the time of Tesla's entry into the Chinese market, BYD, the incumbent chose to tolerate Tesla's entry without too much financial or time cost in impeding the action. It is suitable to see Tesla's entry into the Chinese Market as introducing a catfish, believing that the introduction of Tesla will be able to trigger Catfish Effect that accelerates the development of Chinese new energy automotive market.

4. DISCUSSION

In recent years, Tesla's development in China has been rapidly increasing, showing promising prospects, and its sales volume has accounted for 29.6% of the global total in new energy automotive. This is not only attributes to China's policies on new energy vehicles, such as unlimited license plate number, no lottery number and financial subsidies, but also to Tesla's store location

and its more developed new energy vehicle technology. These are all opportunities that Tesla has managed to grasp. In the process of development, it also encountered challenges and difficulties such as overprice, lack of charging piles and low adaptability. At present, Tesla's charging pile in China does not have comprehensive coverage, and is not compatible with the national standard charging pile, which is a major reason for the frustration of new energy vehicles in China. In many cities, charging piles are hard to locate, and owners of new energy automotive have to drive a long way to find charging piles. This creates inconvenience for refueling, which leads to the reluctance of people in many cities to buy new energy vehicles. Therefore, the author believes that in order to further develop new energy vehicles, it is necessary to increase the coverage of charging piles, so that people feel confident when stepping on the gas. Such a measure is beneficial to expanding the market of new energy automotive. Secondly, it is necessary to improve the battery endurance. The excellent battery endurance of Tesla's new energy vehicles is one of the key advantages conducive to the development of Tesla in the Chinese market. The current mileage of the new energy electric vehicles in the Chinese market is within 300 km, a number that is far below conventional fossil-fuel vehicles. Hence, consumers hesitate in purchasing a new energy vehicle. The author concludes that Tesla is able to maintain its market position and competitiveness by improving the battery life on Tesla's vehicles and assist the industry in raising the standard.

From previously mentioned section, Tesla has suffered from poor sales due to simple appearance design. As it is also one of the main reasons for Tesla's struggle in the Chinese market. Such designs failed to stand out in a multitude of new energy vehicles in China. In comparison with other new energy vehicles produced by domestic brands, Tesla's models fade in the background as other offer a variety of bright colors and fashionable appearance that aligns with the aesthetic of young demographic in China. Because they are the main category of the present consumer market, they are more able to accept those new type of product that matches their expectation. In contrast, Tesla models are more suitable for elder generations' aesthetic and cannot attract the massive potential buyers. Therefore, the author believes that Tesla should make changes to its vehicles that are in line with the aesthetics of young people. In this way, Tesla's new energy vehicles can be further developed in China.

5. CONCLUSION

In recent years, Tesla's development in China has been rapidly increasing, showing promising prospects, and its sales volume has accounted for 29.6% of the global total in new energy automotive. This is not only

attributes to China's policies on new energy vehicles, such as unlimited license plate number, no lottery number and financial subsidies, but also to Tesla's store location and its more developed new energy vehicle technology. These are all opportunities that Tesla has managed to grasp. In the process of development, it also encountered challenges and difficulties such as overprice, lack of charging piles and low adaptability.

This study describes the opportunities and challenges of Tesla's entry into Chinese market in the process of development, and puts forward the suggestion and insights to improve after analysis. To be more specific, this study focused on modeling game decisions and analysis of both Tesla, the newcomer and BYD, the incumbent at the time of Tesla's entry. Due to limitations of data, the three kinds of model used to examine the decision incumbent only consists of BYD. Therefore, there are still some shortcomings in the model. In the subsequent research, more incumbents in China's new energy vehicle market at that time should be introduced to make a more comprehensive analysis of uncertainties and to enhance the integrity of the model. In addition, in the process of constructing the model set, estimations of the results were gained by predicting numerical value derived from forecast sales data and research costs, leading to inaccuracy in model data. Despite the inference and decision was consistent with reality, when adding more models for other enterprises, these models may lead to subsequent deviation. As a result, the subsequent research should focus on collecting data and take into consideration additional uncertainties, which is bound to make the game model decision-making accurate and complete. In addition, with the development of Tesla and its relatively stable position, Tesla can act as an incumbent to devise new game decision model analysis for other brands that act as newcomers preparing or entering the new energy vehicle market. The subsequent research can enhance accuracy and timeliness in game model analysis according to the above three points. I believe that this research can assist and shed some light on the subsequent research on game model analysis as a reference study.

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