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Government, MNEs and Industry Development: A Perspective of Game Theory

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Abstract

This study analyzed the roles of government and MNEs in industrial development through the perspective of game theory based on the case of Brazilian automobile industry. First, we have confirmed that government and FDI could have positive effects on industrial development through a dynamic game process. Second, we confirmed the roles of import-substitution for establishing and export-promotion policy for upgrading industry in the context of dynamic game. Furthermore, we stressed some policies such as further opening-up, which was always neglected in static analysis. Third, we found that the bargaining power of the government primarily came from the advantages of the local market. The conclusion we explored may have the policy implication for developing countries especially for those who have huge local markets.

Key words: business-government negotiation; inward FDI; MNEs; industrial development and growth; game theory

JEL classification: M16; M21

1. Introduction

Foreign Direct Investment (FDI) was often seen as a driver for industry development in developing countries as it may bring positive effects on industry development. These positive effects include both the direct effects such as bringing

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more capital, employment and exports, and the indirect effects named spillover effects so as to help the host country to establish or update the industry (OECD, 2002). However, sometimes, FDI may crowd out domestic investment and increase the exit rate of domestic firms from the market, which could reduce the social welfare of host developing countries (Aitken and Harrison, 1999). In fact, FDI may generate both positive and negative effects on industrial development.

Scholars argued that the positive impacts were not automatically generated and the government should intervene to maximize the benefits and minimize the cost of the FDI (OECD, 2002). According to the different phrase of industry, the government policies were divided into two categories: industry-establishing policies and industry-updating policies. The import substitution strategy was considered as the most important industry-establishing policies for the late-development country (Harris and Schmitt, 2000; Blanchard et al., 2010). Scholars claimed the importance of the government role in industry updating process and the main discussed policies focused on reducing the exit rate of domestic firms from the market, stimulating vertical linkages, and supporting domestic firms to catch up MNEs (Barrios et al., 2005; Bjorvatn and Coniglio, 2012; Gui-Diby and Renard, 2015). Thus, the role of government policy in maximizing the positive effects and minimizing the negative effects of FDI on industry development have gradually become a consensus (OECD, 2002).

Thus, as we saw, from the view of the Multinational Enterprises (MNEs), FDI can bring both positive and negative effect on industrial development. And then for host countries, aiming at maximizing the positive effects and minimizing the negative effects, the governments usually take the policies such as import substitution strategy, reducing the exit rate of domestic firms from the market, stimulating vertical linkages, and supporting domestic firms to catch up MNEs when building up or updating the industry, which may conflict with the profit maximization objection of the MNEs. However, even some scholars were aware that there existed some game relationships between MNEs and government when the policies were made, the important questions that how the government bargained with MNEs and chose the optimal strategy to promote industry development and what were the bargaining chips and optimal strategy policies have unfortunately not been investigated yet (Osland and Björkman, 1998; Chen, 2004; Zhang et al., 2013; Ott, 2013). Only very few literature such as Zhang and Rajagopalan (2002), Agmon (2003), Akkermans et al. (2010), used the Prisoner's Dilemma to analyze the MNEs' entry decision and cultural accommodation problem. Some scholars argued that the field of international business was considerably impaired by the way in which game theory had been marginalized within that field (Camerer, 1991; Ott, 2013).

Facing this research gap, this study will mainly use the Brazilian automobile industry's case to detect the interactions between government and MNEs from the perspective of the game theory. This paper is organized as follows: In section 2, we will thoroughly review the relevant studies including FDI's direct and indirect effects on industry development as well as the role of government for maximizing positive effects and minimizing negative effects of FDI on development. In section 3, we will

introduce the methodology including the case study design and the dynamic analysis framework in the perspective of game theory. In section 4, based on the Brazilian automobile industry's case, we will analyze the main game processes between government and MNEs in different industrial development periods with the above dynamic analysis framework. In section 5, according to the classic game theory and Brazilian automobile industry's practice background, we will discuss how the government made the decision and found out some effective optimal policy strategies in these dynamic game processes. In Section 6, we will make the conclusion and propose some limits and further research directions of this study.

2. Literature Review

2.1 FDI's Direct and Indirect Effects on Industrial Development

Many studies have been done in the field of FDI and industry development in developing countries. Two main channels were identified through which FDI can bring about industry development. The first channel is the direct effects of FDI on industry development by bringing more capital, employment and exports so as to help the host country to create or update the industry. The other channel is the indirect effects, which are also called spillover effects, by increasing the productivity of domestic firms so as to update the domestic industry (Hanousek et al., 2010). For both two channels, the existing studies found out both positive effects and negative effects of FDI on industry development.

Direct impacts of FDI inflows on development. The first direct impact of FDI inflows on development is investment effects of FDI. Since there was evidence that investment was a key ingredient to a sustained growth, FDI played a growing role in most developing countries' total investment (Borenzstein et al., 1995). As a result of the fact that transnational corporations typically have access to a wide variety of financing options, the risk-adjusted cost of capital is usually lower for them than the domestic firms from developing countries (Addison and Mavrotas, 2005). In such situations, the role of FDI in stimulating domestic investment and the total investment in the country is enhanced. Available empirical evidence lends support to such "crowding in" effects of FDI (Borensztein et al., 1995; Hecht et al., 2002; Bosworth and Collins,2003).

However, few scholars claimed that FDI may crowd out domestic investment or fail to contribute to capital formation, thus the benefits for host developing countries should be questioned. They revealed that crowding out effect dominated in Latin America while the crowding in effect was the norm for Asia (and weaker in Africa) between 1970 and 1996 (Agosin and Mayer, 2000).

The second direct impact of FDI inflows on development is employment effects of FDI. There are three ways in which employment is created. The first is direct employment for operations in the domestic economy. The second is through backward and forward linkages. Employment is created in enterprises that are suppliers, subcontractors or service providers. The third way in which employment is created is

through the growth of the economy that leads to further employment generation in the economy (Jenkins, 2006). Some studies provided the empirical evidence of the effects of FDI on the level of employment and claimed a significant positive impact. Iyanda (1999) obtained a estimate for Namibia: about 2 to 4 jobs are created for each worker that is employed by foreign affiliates. Similar job creation effects of FDI in the Chinese manufacturing sector was found by recent studies (Zhang, 2005; Karlsson et al., 2007). Blanas et al.(2019) find that foreign-owned firms offer more stable and secure jobs than domestic firms, as evidenced by their higher and lower shares of permanent full-time and temporary employment, respectively.

The third direct impact of FDI inflows on development is export effects of FDI. In general, one may distinguish between direct and indirect effects of FDI on host exports. Direct effects refer to exports by foreign affiliates themselves. The impact of FDI on export activities of local firms makes up the indirect effects (Kneller and Pisu, 2007). Direct effects were usually referred as foreign affiliates in host countries may have better export potential than indigenous firms because of their business contacts abroad, marketing skills, superior technology, both in product and processes, and greater general know-how (Zhang and Song, 2001). Foreign affiliates can also affect host country's manufacturing exports in several indirect ways. For instance, local firms may increase their exports by observing the export activities of MNEs and by making use of the infrastructure of transport, communications, and financial services that develop to support those activities (Haddad and Harrison, 1993). Empirical research in this field mainly confirmed the export effect of FDI in developing countries (Zhang and Song, 2001; Kneller and Pisu, 2007; Sun, 2009).

Indirect impacts of FDI inflows on development. The indirect impacts of FDI inflows on development emanate from spillover effects. From the standpoint of multinational enterprises, indirect FDI spillovers are said to take place when the entry or presence of their affiliates lead to benefits for the host country's local firms, which the MNEs are not able to internalize at full value (Blomström and Kokko, 1998). From the standpoint of host countries, indirect FDI spillovers are associated to externalities generated by established foreign producers, through different mechanisms, thus affecting local producers' productivity and competitiveness. Indirect FDI spillovers (henceforth FDI spillovers otherwise explicitly informed) can be divided into horizontal and vertical (Meyer, 2004; Liu and Zou, 2008). Horizontal spillovers are externalities to domestic companies at the intra-industry level, while vertical spillovers occur at the inter-industry level, as in the case of technology transfers to domestic suppliers or customers in the production chain.

There are four channels of FDI spillover effects, which are demonstration or imitation effect, competition effect, movement of employees and linkage effect.

Demonstration effects. When foreign firms enter new markets, they demonstrate their advanced technologies, management skills and novel forms of organization, which local firms can imitate. The diffusion of information about technological innovations and new management techniques reduces uncertainty thus increasing imitation levels (Meyer, 2004*;* Blomström and Kokko, 1998).

Competition effects. Competition effects occurs if the entry of a MNES affiliate

leads to more severe competition in the host economy, thus forcing local firms to use technologies and resources more efficiently or, still, stimulates local firms to search for new, more efficient technologies. Competition effects are often intimately related to demonstration (Blomström and Kokko, 1998).

Movement of employees (training effects). MNEs build local human capital through training of local employees, yet these highly skilled individuals may move to locally owned firms or start their own businesses. (Blomström and Kokko, 1998; Meyer, 2004).

Linkage effects. Linkage effects refer to the FDI spillovers via the linkages between the MNES's foreign affiliate and its local suppliers and customers. The spillovers occur when local firms benefit from the MNES affiliate's superior knowledge of product or process technologies or marketing, without incurring a cost that exhausts the whole gain from the improvement. Backward linkages arise from the MNES affiliate's relationships with suppliers, while forward linkages stem from contacts with customers (Blomström and Kokko, 1998).

Intra-industry FDI spillovers may occur through demonstration and competition effects and employees' mobility (Liu and Zou, 2008). Inter-industry spillovers are likely to be observed through linkages (Javorcik, 2004) and also employees' movement at inter-industry level.

Some scholars pointed out that negative spillover effects of FDI may also exist. When competing with foreign entrants, domestic firms with lower productivity may be crowded out and lose their market share, what is termed market-stealing effect (Aitken and Harrison, 1999).

2.2 The Government Roles for Maximizing the Positive Effects and Minimizing the Negative Effects of FDI on Development

From the above literature, we can see that FDI can play a key role in industry development through bringing investment, job, export and technology, but FDI also may crowd out domestic investment, increase the exit rate of domestic firms from the market and reduce the social welfare of host developing countries. The positive impacts were not automatically generated and the government should intervene to maximize the benefits and minimize the cost of the FDI (OECD, 2002). According to the different phase of industry development, the government policies were divided into two categories: industry-establishing policies and industry-updating policies.

Industry-establishing policies. Several scholars have considered import substitution strategy as the most important industry-establishing policies for the late-development country. The principal concept underlying import substitution strategy can thus be described as an attempt to reduce foreign dependency of a country's economy through local production of industrialized products, whether through national or foreign investment, for domestic or foreign consumption (Waterbury, 1999). In fact, this import substitution strategy was adopted in most developing countries from the 1930s to the 1980s to establish new industrialization (Harris and Schmitt, 2000; Blanchard et al., 2010).

Industry-updating policies. Scholars claimed the importance of the government

role in industry updating process. The main discussed policies focused on reducing the exit rate of domestic firms from the market, stimulating vertical linkages, and supporting domestic firms to catch up MNEs. Considering reducing the exit rate of domestic firms from the market, several studies discussed the following policies, including infant industry protection, direct state ownership, tariff and nontariff protection, FDI targeting, government procurement for domestic firms, were usually implemented in the developing countries (Neven and Grossman, 1995; Bjorvatn and Coniglio, 2012). Stimulating vertical linkages, local content requirement, enhancing education and training were the most important policies in industry development (Noorbakhsh et al., 2001; Hansen et al., 2009). Besides, the policies aiming at supporting domestic firms to catch up MNEs usually concluded the promotion of large domestic firms, selective credit allocation, favorable tax treatment, pertaining to R&D activities and knowledge sharing (Barrios et al., 2005; Bjorvatn and Coniglio, 2012; Gui-Diby and Renard, 2015).

2.3 The Application of Game Theory to the Relationship between Government and MNEs

Based on the above literature, FDI can bring both positive and negative effect on industry development. And then for host countries, aiming at maximizing the positive effects and minimizing the negative effects, the government usually took the policy of import substitution strategy, reducing the exit rate of domestic firms from the market, stimulating vertical linkages, and supporting domestic firms to catch up MNEs when building up or updating the industry, which may conflict with the profit maximization objective of MNEs. Thus, the relationship between government and MNEs should be a dynamic bargaining process in the industrial development process (Ott, 2013), which needs the corresponding analysis perspective and method such as the game theory.

The starting point for the development of game theory was the publication of John von Neumann and Oscar Morgenstern's seminal work "The Theory of Games and Economic Behavior" in 1944. Subsequently, economics and political science have been the main fields in which game theory has been applied and developed. This method could illustrate the decision process and the key bargaining factors between the intelligent rational decision-makers, which is very suitable to detect the interaction between government and MNEs. By contrast, game theory has not been widely used in the field of international business. Only very few literature such as Zhang and Rajagopalan (2002), Agmon (2003), Akkermans et al. (2010), have used the Prisoner's Dilemma to analyze the MNEs entry decision and cultural accommodation problem. Luo (2004) analyzed a game theoretical application to International Business topics such as MNEs, their relationship with governments and general international alliance issues with a cooperation and competition perspective. Sanna-Randaccio and Veugelers (2002) used a game theoretical approach to analyze MNE knowledge spillovers from an industrial organization perspective with a mathematical treatment of strategic interactions. Most of these applications of game theory used the Prisoner's Dilemma to make the static analysis and mainly stood at the MNEs' perspective.

However, the dynamic analysis from the view of the host government, which was probably closer to the reality and further inspired the developing countries, remained a statement waiting for a proof.

2.4 Research Gap and Research Questions Proposing

As we can saw, the game theory contributed this suitable field of international business much few, and some scholars even argued that the field of international business was considerably impaired by the way in which game theory had been marginalized within that field (Camerer, 1991; Ott, 2013). Although very few scholars began to be aware of this game relationships between MNES and government (Sanna-Randaccio and Veugelers, 2002; Luo, 2004), the dynamic game process and the important questions what are the bargaining chips and what are the optimal strategy policies for host government have not been investigated adequately (Ott, 2013).

To fill this research gap, this study mainly uses the perspective of dynamic game theory to analyze the bargaining relationship between MNEs and government. The research questions of this study are mainly as following: what is the dynamic game process between the government and MNEs? What is the bargaining chips of the developing country government when gaming with the MNEs? And when facing this game process, what is the optimal strategy policies for host government to maximize the positive effects and minimize the negative effects of FDI on industry development?

3. Methodology

In this study, we combined the case study method with the game theory analysis. On the whole, we used the whole development process of Brazilian automobile industry as case study to discuss the above research question. And for each period of this case, by using the dynamic analysis framework in the game perspective we can preferably explore the dynamic game process between government and MNEs and the government's bargaining chips and strategy choice.

3.1 Case Study

We mainly adopted the case study methodology in this study, considering that it is more suitable for answering this "how" and "why" research questions which are not sufficiently addressed by alternative research strategies (Yin, 1994). The methodology's uniqueness is materialized from its ability to incorporate numerous types of evidence, including both qualitative and quantitative data, both historical and contemporary evidence (Yin, 1994; Dunning, 2007). Thus, this method is extremely suitable for our research design, even considering there were many qualitative data and historical evidence in process of industry development.

Brazil were selected for the case because of the following three characters: first, Brazil was as part of the BRIC and considered as one upper medium income emerging economy and late-industrializer; second, many research had confirmed that FDI indeed played the key role in the establishing and development progress of some

industries in Brazil (Daniel and Nistor, 2015); third, according to economic development history of Brazil, in the process of FDI entry and industry development, the Brazil government took a series of polices and dynamically bargaining with the MNEs. Besides, in different phase of the industry development, the policy tools and their effects were different, giving us some enlightenment on optimal government game strategy (Daniel and Nistor, 2015). In addition, to make our conclusion more general, we also make some comparison using the Chinese case in the discussion part.

The automobile industry was selected as the research field for its following characters: high value-added, long industry chain, high relativity of industries and high industrial spread factors. Due to this characters, on one hand, automobile industry was usually considered as a key industry for economic development, so that the government tended to attract FDI and take serial of policies to establish and promote its development. On the other hand, from the view of the MNEs, they had enough incentive to enter into the new market considering its high value-added. Thus, the automobile industry was suitable for being the analysis unit of this research.

The data was collected from primary and secondary sources. As the method requires historical information, archival data was searched for in printed and media vehicles, which allowed a first elaboration of the cases. Those documents were then discussed with representatives of some MNEs and local firms. The data was then organized by the following analysis framework in the perspective of game theory, and displayed in tables to facilitate further discussion.

To be specific, we interviewed four firms which were selected following the criterion of identifying cases which could best represent the evolution of the automobile industry in each country. The automakers are Chery and Gurgel. Chery is one of the successful Chinese carmakers having already captured a significant share of the Chinese market and moved to other countries, including Brazil. Gurgel, on the contrary, represents the failure of Brazil in regards to developing its indigenous auto industry. The two auto-parts suppliers are Yanfeng and Sabo, well-established firms with a global presence, the differences in their trajectories being associated with the evolution of their local institutional environments. As the method requires historical information, archival data was searched for in printed and media vehicles, what allowed a first elaboration of the cases. Those documents were then discussed with representatives of the focused firms, including members of their boards, with the exception of Gurgel, a firm that was closed down in 1993. On this basis, we also further looked up some automotive industry development history from the literature, such as Shapiro(1996), Göktas, (2013), Zhang et al.(2013) and so on, and further to the entire industry development history of supplementary.

3.2 The Dynamic Analysis Framework in the Perspective of Game Theory

Combining the classic dynamic game theory with the context of the game relationship between the MNEs and government, the following dynamic analysis framework was constructed.

The definition of essential elements. Combining the classic game theory with the specific context in our research question, we defined those essential elements as

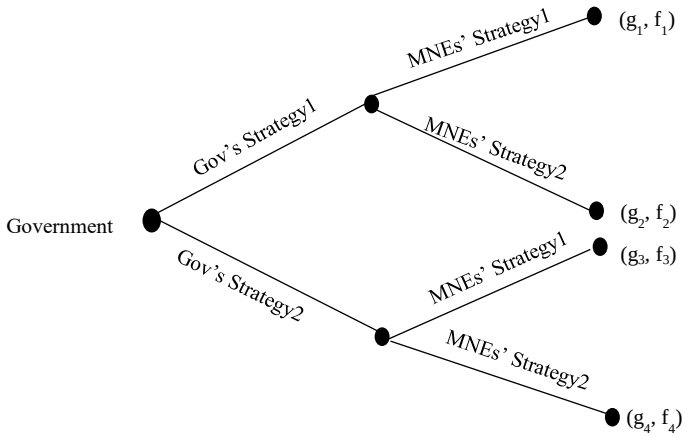
follows. First, player. It meant the independent decision makers in the games and there were two players, denoted government and MNEs in this study. Second, Preferences. It meant each players' preferences over outcomes and reflected the different utility levels for each players when different outcomes achieved. In our study, the preferences referred to the different objections of government or MNEs. Third, strategy set. In game theory, player's strategy was any of the options he or she can choose in a setting where the outcome depends not only on his own actions but on the action of others. And a player's strategy set defines what strategies were available for them to play. In the context of this study, the strategy set of government mainly concludes "start an import-substitution process or do nothing", "launch an export promotion program or do nothing", "introduce more competition or do nothing". And the strategy set of MNEs mainly concludes "enter Brazilian market through FDI or not enter", "make Brazil an export platform or not", "introduce new technology and car models or not". Fourth, the outcomes. In game theory, an outcome is a set of moves or strategies taken by the players, or it is their payoffs resulting from the actions or strategies taken by all players. In the context of this study, the outcomes conclude every combination of strategies of government and MNEs (see figure 1). Fifth, equilibrium. If each player has chosen a strategy and no player can benefit by changing strategies while the other players keep theirs unchanged, then the current set of strategy choices and the corresponding payoffs constituted an equilibrium. A primary purpose of game theory is to determine which outcomes are equilibrium according to the suitable solution method. According to our research question, specific solution method and game process are introduced as follows.

The definition of the type of the game and the introduction of the solution method. First, we defined the type of the game between government and MNEs. According to the time order of deciding, the game was divided into simultaneous game and sequential game. Simultaneous games were games where both players move simultaneously, or if they do not move simultaneously, the later players were unaware of the earlier players' actions (making them effectively simultaneous). While sequential games (or dynamic games) were games where later players have some knowledge about earlier actions. According to understanding degree with each other, the game was divided into complete information and incomplete game. The former was a term used to describe an economic situation or game in which knowledge about other market participants or players was available to all participants. The utility functions, payoffs, strategies and "types" of players were thus common knowledge. Inversely, in a game with incomplete information, players may not possess full information about their opponents. In our research, the real game situation was that government made the policies first, and then the MNEs made the decisions in reality. Besides, the MNEs knew the host government's policies when they made the decisions and government can also communicated with the MNEs to know what they want. Thus, the type of the game was closer to a complete information dynamic game.

Then, the dynamic game process and the solution method for this type of game could be described as follows (see Figure 1). The government decided first and the two strategies would be chosen. Then the MNEs could observed and communicated

with the government of the host countries and choose their own strategies for each government's strategy. Thus, the total outcome were four situations (see Figure 1). If we wanted to know how the government made the decision, the solution method was the backward induction. In the game process, when the government made the decision, it always chose the optimal strategy to achieve its most preferred outcome (the largest one among the g_1, g_2, g_3, g_4). But this four payoffs were not only decided by its own strategy choice but also by the MNEs' strategy choice. Thus, the government made this decision before the MNEs made its own decision, the government should expected the MNEs' strategy choice rule in his brain, such as if the government chose strategy 1, MNEs chose its strategy 1 and if the government chose strategy 2, MNEs chose its strategy 2. Then, the government found that the final rational outcomes could only be those two situations (g_1, f_1) and (g_4, f_4) for him, and the government only needed to compare its own payoff g_1 and g_4 and chose the bigger one. For example, if $g_1 > g_4$ the government chose the strategy 1. Then, for the MNEs, they knew that the government have chosen the strategy 1, the MNEs naturally compare the f_1 and f_2 and chose the bigger one. For example, if $f_1 > f_2$, the MNEs also chose the strategy 1, and the equilibrium was (the government' strategy 1, the MNEs' strategy 1) under the condition of $g_1 > g_4$ and $f_1 > f_2$. In this study, we analyzed the game process between government and MNEs, and used this backward induction to discuss the optimal strategy for the government.

Figure 1. Extensive Form Representation of This Type of Games



4. Dynamic Game Process between Government and MNES in Brazilian Automobile Industry

4.1 The Evolution of the Brazilian Automobile Industry

First period (1950s to early 1960s): import-substitution and industry establish. Until the early 1950s, Brazil was thoroughly dependent on imports in regards to transportation vehicles, especially passenger cars. There were a few foreign firms assembling trucks and buses on a CKD basis and some auto part firms. The huge demand for private cars, high import costs, deficit in trade balance and scarcity of international currency prompted the government to start an import-substitution process. GEIA- the Brazilian Industry Executive Group drew up the plans for the automotive industry, which set the grounds for the vertical model (foreign assemblers and local suppliers) and high national content requirement, what was expected to lead automakers to subcontract local auto part firms and transfer technology on a cooperative basis. Three local auto producers emerged: Vemag (producing cars under license), Romi (producing a three-wheel small car, similar to the present Tata-Nano, under license) and Fabrica Nacional de Motores (a joint venture in which the local partner was a state-owned enterprise).

Regulatory measures initially restricted the import of auto-parts and forbade the import of assembled vehicles and CKD kits: the nationalization program imposed the alternative of either increasing local content (90 to 95% in five years). These measures encouraged foreign automakers to establish full-fledge subsidiaries and bring along their suppliers for the more complex parts. Thus, the local suppliers settled as suppliers of simpler parts.

During the second term of Getúlio Vargas (1951-1954), the federal government exerted strong pressure on the auto industry to pass on for producing locally. However, despite the auto companies see themselves as lucrative Brazilian market, considered him little to achieve the necessary economies of scale (Shapiro, 1996), since the average per capita GDP of the period (1960-1969) was U.S. $ 290 chains, while the U.S. was U.S. $ 3.600 chains(World Bank,2013). In 1956, Brazil produced 30 500 vehicles. The Vemag, which began operations in 1957 under license from German DKW, was acquired in 1967 by Volkswagen. Romi, which launched in the 50s the Isetta under license from Iso, now produces lathes, machines for processing plastics, cast iron parts and provides turning and machining services. The Gurgel Motors, which set up his factory in 1969, was declared bankrupt in 1994.

Second period (early 1960s to early 1990s): export-promotion. Between 1961 and 1967, the Brazilian economy underwent a long crisis, which reflected in the restructuring of the Brazilian automobile industry. There was a reduction in governmental intervention, the end of long-term contracts between automakers and auto-parts makers, suppliers was replaced and the vertical model started to crumble. Assemblers and auto-parts makers underwent a series of mergers leading to verticalization and market concentration. The government authorized auto-parts importation, and the relationship between automakers and auto-parts suppliers changed from cooperation to arm’s length and conflict. The Brazilian automakers

established in the previous period were crowded-out.

In the 1970s Fiat and Volvo arrived in the Brazilian market, linked to the export of part of their local production. Due to Brazil's trade deficit, the government extended to the automobile sector the Program of Special Fiscal Benefits for Exports (BEFIEX). The government granted generous incentives, including tax exemptions on imported machinery, equipment and other parts, and waived federal and state value- added taxes on exports. In exchange, firms had to commit to long-term export contracts and comply with minimum domestic-content requirements (85% for vehicles sold in Brazil). Firms were also allowed to import a certain number of parts and components that had previously been banned because they were produced domestically. In the early 1970s, nearly 90% of Brazil's finished-vehicle exports went to other Latin American countries. By 1984, 40% of Brazil's vehicle exports were being shipped to the U.S. and Europe, and by 1989, this share had increased to 60%. Brazil's biggest success stories were the Volkswagen Fox in North America and the Fiat Duna in Europe (Shapiro, 1996).

Concurrently, the diffusion of the Japanese Production System provoked a dramatic reduction in the number of suppliers when arm's-length relationships were redefined as cooperative. Suppliers were selected according to their capacity to adopt and implement the JPS as well as standards like the ISO 9000 and standards specific to each individual assembler. With the creation of a new hierarchy in the sector - 1st tier or mega-suppliers (GM's Delphi, Ford's Visteon, FIAT's Marelli), most Brazilian companies were repositioned as second-tier suppliers.

The average annual GDP per capita between 1970 and 1989 was U.S. $ 1.550 chains, while the FDI was U.S. $ 26 billion.

Third period (early 1990s-): further opening up. In 1990, a policy of economic liberalization opened up domestic markets for international competition. At that point in time, the automobile industry had a competitive problem: very old products and low productive levels. In early 1990s, the Brazilian government promised to open the Brazilian market to imported cars for the first time since the late 1950s. Competition from imports was meant to jump-start the stagnating domestic auto industry by forcing firms to invest in new technologies and update locally produced models. The government also reduced domestic-content requirements from 90% to about 70%.

In 1993, the government established a new policy mechanism known as Sectoral Chamber, a tripartite arrangement among government, auto companies and labor. It defined a new set of strategic goals for the auto industry. A "popular car" regime was implemented in which companies were given major tax-breaks for producing 1,000cc-engine small cars.

In 1994, Brazil's institutional, political and macroeconomic conditions were stabilized. Due to the rise in purchasing power and the potential market that created, associated to the stagnation of markets in developed countries, the action of foreign multinationals speeded up and the relative share of the Brazilian economy in the hands of MNES subsidiaries increased significantly. In the automotive industry, virtually all the remaining global manufacturers set up subsidiaries, following the new globally distributed organizational model, where each activity is located in the country that

offers greater comparative advantages.

In the auto-parts industry, the presence of foreign subsidiaries increased, what was seen as the denationalization of the auto industry. In 1994, 52.4% of the total turnover was in the hands of Brazilian firms.

In the early 90s, there was the opening of the Brazilian market and inflation stabilization. Concomitantly, GDP per capita reached U.S. $ 5.100 chains (The World Bank, 2013) and there was an increase in demand Brazilian vehicle, which went from 914,000 in 1990 to 1.8 million in 1996 (Anfavea, 2012).The period (1990-2000), the average stock of FDI was U.S. $ 66 billion, from U.S. $ 37 billion in 1990 and reaching $ 120 billion in 2000 (The World Bank, 2013). According to Anfavea (2012), the Brazilian industry closed the year 2011 with an installed capacity of 4.3 million vehicles. The Brazilian automotive industrial park consists of 20 automotive, light commercial vehicles, buses and trucks, with 40 production units and 500 auto parts companies. Currently 17% of production is exported. In 2011, the trade openness index reached 24% (The World Bank, 2013). See the domestic production of vehicles in 2011 in Table 1.

Table 1. National Production Vehicles in 2011

	Cars	Light Commercial	Trucks	Bus	Total
Volkswagen	718,591	109,853			828,444
Fiat	576,029	186,152			762,181
General Motors	513,051	130,318			643,369
Ford	206,160	80,197	40,422		326,779
Renault	208,812	11,813			220,625
Peugeot Citroen	132,948	13,351			146,299
Honda	85,545				85,545
Man			69,275	13,831	83,106
Toyota	60,456				60,456
Mitsubishi		39,441			39,441
Hyundai CAOA		38,635			38,635
Nissan	17,797	14,843			32,640
Volvo			24,759	3,107	27,866
Scania			19,455	3,041	22,496
Agrale		357	1,036	5,332	6,725
Internacional			2,089	100	2,189
Mahindra Bramont		597			597
KG					-
Mercedes-Benz			n/a	n/a	
Iveco		n/a	n/a	n/a	
Total	2,519,389	632,363	225,751	55,113	3,432,616

Source: Brazilian Automotive Industry Yearbook (Anfavea, 2012).

4.2 The Game between Government and MNEs in Brazilian Auto industry's Case

Based on the description above, we could summarize the evolution process of the Brazilian auto industry into several games between the government and the MNEs. Table 2 shows the brief description of the games in different development periods.

Table 2. The Games in Different Development Periods

Period	Background	Player	Preferences	Strategy Set	Equilibrium	Realized Outcomes
1	In 1950s, the demand of private cars increased which caused the trade deficit problem	Governm ent	To reduce the trade deficit and develop the local auto industry	Start an import-substitution process/ do nothing	Start an import-substitution process	Many foreign companies set up their plants in Brazil; the local content reached 90% in 1961; the local automobile industry was built up
		MNEs	Valued the market potential of Brazil and wanted to sell their products there	Enter Brazilian market through FDI/ not enter	Enter Brazilian market through FDI	
2	The oil shock in 1973 led to the dramatic increase of imports and trade deficit	Governm ent	To increase exports of auto industry	launch an export promotion program/ do nothing	launch an export promotion program	Many MENs considered Brazil as an export platform; exports of automobiles increased; the local industry further developed
		MNEs	Profit maximization; Global market strategy optimization	Make Brazil an export platform/ not	Make Brazil an export platform	
3	In 1990s, lack of competition, old products and low productive level	Governm ent	To improve the productivity, the technology and the quality of Brazilian automobile industry	Introduce more competition/ do nothing	Introduce more competition	MNEs in Brazil invested in new technologies and update locally produced models; both quality and productivity were improved
		MNEs	Profit maximization; to maintain their market shares	Introduce new technology and car models/ not	Introduce new technology and car models	

The game process in first period. In 1950s, due to the increasing demand of private cars and the trade deficit, the strategic goal of Brazilian government was attracting FDI to build its own automobile industry at home. Because of the weak local foundations at that time, foreign companies only wanted to sell their products through export or CDK mode, but lacked motivation to transfer their production to Brazil.

In this situation, there was a sequential game between Brazilian government and foreign auto companies. First, the Brazilian government had two choices, to do nothing or to start an import-substitution process. If they chose to do nothing, foreign companies would not set up their plants in Brazil automatically, thus the strategic goal of government would not be achieved. If the government decided to start an import-substitution process, there would be two choices for foreign companies, to product locally or leave the Brazilian market. At that time, due to the intensive international competition between big auto companies, the strategic position of Brazilian market became more and more important. Thus, it would not be wise for most MNEs to choose to leave the Brazilian market.

Using the backward induction the Brazilian government could know that if they started an import-substitution process, foreign companies had no reason to leave the market, as their payoffs would suffer. As a result, the rational strategic decision of the government was to start an import-substitution process, which including restricted the

import of assembled vehicles and CKD kits, high local content requirement, financial incentives, etc. The outcome of this game was that many foreign companies set up their plants in Brazil, the local content reached 90% in 1961 and the local automobile industry was built up. The subgame perfect equilibria of this sequential game is that the government started an import-substitution process and MNEs chose to enter the market through FDI.

The game process in second period. In 1960s, due to the politic and economic instability there was a period of crisis in Brazilian automobile industry. At that time, the government mainly adapted a hand-off attitude. The relatively smaller and financial weaker native assembly companies were not able to survive during this period. Only few MNEs remained and monopolized the Brazilian automobile market. Thus, since then we may say that the Brazilian automobile industry became completely dependent on foreign companies.

The oil shock in 1973 had a significant impact on Brazil, which imported 80% of its oil needs. Concerning about the growing trade deficit, the government changed its strategic objective of the automobile industry mainly towards exports. As the Brazilian market itself lacked of productivity advantages, the motivation for FDI was only market-seeking. Once the Brazilian local market needs were met, the MNEs in Brazilian market didn't have self-motivation to export to other countries.

In this situation, another game between government and MNEs existed. The Brazilian government had to decide whether to launch an export promotion program or not. The launch of an export promotion program would be at the cost of tax reduction, fiscal support, import deregulation, etc. If the government chose to do nothing, the objective of export would not be achieved automatically. If the government decided to start an export promotion program, the MNEs would face two choices, to make Brazil a production site for export or not. The government could work backwards to know what the MNEs would do. When they decided to launch an export promotion program, the payoff function for MNEs would change, thus they chose to achieve the government's export expectations to maximize their payoffs in this given situation.

As a result, the rational strategic decision of the government should be to launch an export promotion program. The outcome of this game was that many MENs had considered Brazil as an export platform, the export of automobiles had increased, the technology had upgraded and the whole industry had further developed. For example, GMB wanted to introduce the J car, one of GM's "world cars" to Brazil. However, the size of the domestic market did not justify the investment needed to build the J car's new engine, which had to be made in Brazil in order to comply with domestic content requirements. GM decided to absorb the excess capacity while the domestic market grew by exporting the engine to the U.S. Pontiac division. In this case, the subgame perfect Nash equilibria was the government launched the export promotion program and the MNEs considered Brazil as a production site for export.

The game process in third period. In 1990s, after years of market protection, the Brazilian automobile industry faced a major competitive problem of old products and low productive level. The strategic objective of the government was to improve the

productivity, the technology and the quality of Brazilian automobile industry. In this situation, began another game between government and the MNEs. The government had to make a decision between continuing to protect the market or liberalization. If the government chose to continue protecting the market, the backward situation would be hard to improve due to lack of competition. While, if the government decided to introduce more competition, the MNEs had to make a choice between introducing new technologies and car models or not. If the MNEs chose to do nothing and remain the same, their market shares could be crowed out by import products. Since the Brazilian market was strategically important for international auto companies, they would spare no effort to maintain their market by improving their products.

As a result, the government decided to introduce more competition through reducing import tariffs. At the same time, because the government feared that the liberalization would shock the domestic production and lead to plant shutdowns, they established the "Sectoral Chamber" in order to improve the product competitiveness of the auto firms in Brazil. The outcome of this game was that the competition from imported cars forced MNEs in Brazil invest in new technologies and update locally produced models in an effort to improve both quality and productivity. And by the help of the Chamber, the auto firms in Brazil had successfully developed "popular cars", which met the local and regional market needs quite well. In this case, the subgame perfect Nash equilibria were that the government decided to introduce more competition and the MNEs improved their technologies and productivities.

5. Discussion

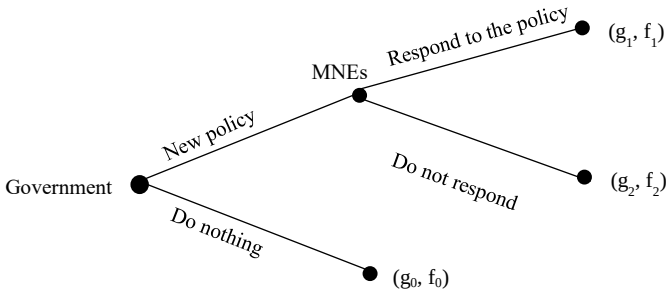
In this part, combining with the above game processes, we will mainly analyze the general game processes between government and MNEs, and discuss the government's optimal strategy when equilibrium was achieved for each phase.

5.1 The Decision Process of Government

The evolution of Brazilian automobile industry included several games between the Brazilian government and the foreign auto companies. In each phase, it was one complete information dynamic game. Thus, we used an extensive form representation to represent these sequential games as in Figure 2 and backward induction method to discuss its equilibrium:

Figure 2. Extensive Form Representation of the Games in Each Phase

The specific strategies in each phase could be described as follows:



New policy= {to start an important-substitution process; to launch an export-promotion program; to open up further}

Respond to the policy= {to enter; to introduce the advanced technology and product; to enter further}

According to the game theory, the benefits of each player was not only decided by its own strategies, but also related with the other players' strategies. That is:

g= g ("New policy"; "Do nothing"; "Respond to the policy"; "Do not respond")

f= f ("Respond to the policy"; "Do not respond"; "New policy"; "Do nothing")

According to the economic theory, we knew the profit was the function of price, sales and cost as follows.

$$f = f(p, s, c)$$

Although we didn't have the specific number to predict the accurate numerical of the profit, according to the above background and we knew that the MNEs would get more profits when they entered into the host countries considering the competition and new market. If the government's policy can attract the entry of MNEs, which meant that we had: $f_1 > f_2 = f_0$. If the government make the very harsh policy, MNEs would not like to enter in, then $f_0 > f_1 > f_2$, which in fact could be imposed on Pareto improvement by negotiation between the government and MNEs. Therefore, the final equilibrium decision process of government and MNEs could be illustrated as follows. Using backward induction method, the government decided first and knew that when they chose to introduce a new policy (to start an important-substitution process, to launch an export-promotion program, to open up further, etc.), the MNEs will rationally maximize their payoffs and reach the terminal node with payoffs (g_1, f_1). It is to say, in these sequential games the government can either choose "to introduce the new policy" and reach the terminal node with payoffs (g_1, f_1), or "do nothing" and reach the terminal node with payoffs (g_0, f_0). Besides, according to the above literature and practice background, combining with the suitable policies, FDI entry indeed could help to establish the industry or promote the development of the industry. Thus, in order to reach its strategic objective, the government's optimal choice is "to introduce

the new policy". Then, the MNEs naturally chose the "response to the policy" and backward induction tell us the optimal choice for each player was the strategy profile (new policy, respond), with payoffs (g_1, f_1). And from this process, we should keep in mind that the policy the government made should not be too harsh to attract the MNEs entry.

5.2 The Role of FDI and Government in Industry Development

Based on the case of Brazilian automobile industry we had analyzed above, the evolution of Brazilian automobile industry is driven by several games between the government and the MNEs, which is a dynamic process. In this process, the FDI had indeed promoted the development of the Brazilian automobile industry greatly and the government indeed took lots of policies tools to maximize the positive influence and minimize the negative influence of FDI on industry development. This conclusion was consist with the existing literature and practice evidence in many developing countries. (Gui-Diby and Renard, 2015).

5.3 Role of Import-Substitution Strategy in Establishing the Industry

From this dynamic games of Brazil auto industry case, the role of import-substitution strategy for establishing the industry was significantly confirmed. From the process that the government chose the optimal policy strategy when establishing the industry, we knew that the MNEs played a very important role since there were scarcely any capital, technology and even market. At this time, the import-substitution strategy under the premise of attracting MNEs' entry was the dominating strategy to induce to establish the local industry.

5.4 Role of Export-Promotion and Further Opening Up Strategy in Updating the Industry

From this dynamic games of Brazil auto industry case, we further confirmed the effectiveness of export-promotion policy. And through the dynamic analysis, we have also confirmed the role of further opening up in updating the industry, which were usually omitted in the existing literature.

First, creating local advantages through export-promotion policy to guide foreign investment to promote industrial development. In 1970s, facing that the local market did not have the advantages of production efficiency, through tax relief, financial subsidies and other policies the government had created the competitive advantage of export at least within a certain period of time. Thus, the MNEs could have used local advantages to achieve the goal of export and industrial upgrading.

Second, another effective policy strategy found was that Brazil used the further opening up strategy to introduce external competition to force foreign companies to upgrade in the game process. It was noteworthy that the further opening up strategy was primarily used to overcome the insufficient updating incentive under the model of the local protection. In the 1990s, the government introduced more market competition through liberalization, which forced foreign capital to introduce new

products and technologies to maintain its position in the market. At the same time, in the process of opening up the government had still concerned about the protection of local production. For example, during this period the government and foreign companies jointly established the "Sectoral Chamber", with the government's tax incentives the foreign companies significantly reduced the price of products, and thereby the competitiveness of local production was enhanced.

5.5 The Market as the Bargaining Chip of Government

In the games between the Brazilian government and the MNEs, the key point of the government's decision lied on making one moderate policy to achieve the industry development goal considering the premise of MNEs' entry. Thus, the bargaining chip of government which was used to attract and guide the MNEs was very important. From the above game processes, we could see the bargaining power of the government primarily came from the advantages of the local market. The purpose of the foreign companies was to obtain the advantages of the local market, while the host government precisely, to a great extent, had the control of the local market.

For example, the Brazilian market was strategically important to the international auto firms, while the Brazilian government could decide whether the foreign firms could enter the market or not, through which mode could they enter the market, to which extent could they enter, etc. Therefore, the advantages of the local market often determined the bargaining power of the host government in the games between the government and the foreign firms. In the case of Brazilian automobile industry we could see that, to a large extent the government can make use of export-promotion, and through policy guidance to make foreign firms to meet the corresponding policy objectives.

5.6 Robust Check with the Chinese Case

From the above Brazilian automobile industry's case, we ensured the game relationship between the government and the MNEs as well as their roles in industry development. Moreover, we explored from the above game processes that the bargaining power of the government primarily came from the advantages of the local market and the government could draw lessons from the role of import-substitution strategy for establishing the industry and the role of further opening up in updating the industry. To make our conclusion more general and robust, we also studied the development of the Chinese automobile industry and made some comparative analysis, the similar conclusion was confirmed.

The evolution of Chinese automotive industry

From 1949 to 1978, China was under a planned economy, in which the government targeted commercial vehicles only. In 1953, under the technical assistance of the Soviet Union, China established the First Auto Works (FAW), which later became the source of technology to other plants. There were only a few passenger car models developed through reverse engineering, such as the "Hongqi (Red Flag)",

which was used as official car. The local market was not opened to FDI in this period, thus there was no FDI spillover.

China began its "Reform and Opening up" in 1978. The growing demand for passenger cars resulted in increasing importation due to the limited local technology and production capacity. To change the situation, the Chinese government opened up the domestic automobile market to FDI, controlling for the entry mode: MNEs could only enter Chinese market through joint ventures and the foreign holding was limited up to 50%. In 1984, the first automobile joint venture in China, Beijing Jeep Corporation, was established, followed by a joint ventures between Volkswagen and SAIC in 1985 and FAW in 1991. Through the joint venture model, the Chinese partners were able to learn about car manufacturing processes and modern management techniques.

Local content policies were also introduced. For example, the government required SAIC-VW to reach a local content rate to 40% within three years or close doors. Import tariff concessions were provided to those firms that met the local content requirement. Positive FDI spillover was generated in the auto parts industry through backward linkages. For instance, during the localization process of Santana, the capabilities of SAIC-VW suppliers increased dramatically due to VW's high quality standards. VW also sent experts to provide technical guidance and training to local workers (Xie and Wu, 1997). The localization rate of Santana production grew from 2.7% in 1987 to 92.9% in 1997(Lu and Feng, 2005).

Until the late 1990s, the Chinese car market was dominated by foreign brands. During that period, the Chinese automotive market was highly protected through high import tariffs. The number of assemblers was strictly controlled in order to achieve high market concentration ratios and economies of scale. However, the models in Chinese market were few, relatively outdated and expensive. Therefore, there was a large but unmet private demand, which was low-end and price-sensitive. In the late 1990s, indigenous firms like Geely and Chery were born to grasp that opportunity. Relying on price advantage, these new indigenous automobile firms achieved great success in the low-end market. During the period, the stock of FDI averaged U.S. $ 86 billion, from U.S. $ 4 billion in 1984 to $ 216 in 2002 (The World Bank, 2013).

Joint venture automakers became the main source of technology for indigenous firms, especially at their start-up phase. Positive FDI spillover effects were observed through demonstration, movement of employees and forward linkages. Besides, indigenous firms also benefited from the open auto parts supply system, which was built up by joint ventures. After the emergence of the indigenous auto firms, the government introduced several policies to support indigenous innovation and the nurturing of national brands. The market share of indigenous brand cars reached 26.1% in 2005 and 30.9% in 2010.

To increase competition, in the late 1990s, the government attracted more FDI, such as GM and Toyota. Later on, other MNEs were authorized, such as Ford, Kia, Hyundai and BMW. The auto parts industry has also attracted more FDI. At the same time, the import tariffs for automobiles were gradually reduced since China entered WTO in 2001. As competition increased, MNEs accelerated technological upgrading

and introduced more new car models. The average annual GDP per capita of China, between 1990 and 2011 was U.S. $ 1.590 chains, while the FDI was U.S. $ 231 billion In 2009, China became the first producer of the world market vehicles. In 2012, China's output reached 19.3 million units, 80.5% of production related to passenger cars, of which approximately 40% of local brands (Chu, 2001).

Robust analysis with the Chinese case

First, the FDI had indeed promoted the development of the Chinese automobile industry greatly and the government indeed played the key roles, which was consist with the existing literature and practice evidence in China. (Barrios et al., 2005; Bjorvatn and Coniglio, 2012). For example, the government bargaining with the Volkswagen and GE to establish the local industry and took serial policies to push the MNEs to transfer the technology and improve the abilities of domestic firms.

Second, the import-substitution strategy was also the optimal policy choice in the phase of establishing the industry. Before 1978, China didn't permit the MNEs' entry and tried to develop the auto industry by itself. Although the government did lots of efforts and even considered to introduce some technology from the Soviet Union, the development of auto industry was very low due to lack of FDI direct and indirect effects. After 1978, china had opened up to FDI and used the market chip to attract MNEs such as Volkswagen, Peugeot and so on. Besides, the government made the import-substitution strategy such as setting the high importing tax, encouraging to set up joint venture to produce locally, setting local content regulation, in order to establish the local industry. Under the successful implementation of this import-substitution strategy, the comprehensive Chinese auto industry had been established. The contrast results in China also further verified the role of import-substitution strategy for establishing the industry.

Third, this optimal game strategy of further opening up adopted by the Brazil government also used by Chinese government and both results implied that this strategy was usually effective when gaming with the MNEs. In 1990s, the whole passenger car industry was dominated by foreign-owned brands without almost any indigenous brands during this period. Besides, the Chinese automotive market was highly protected by high import tariffs and strict restriction of local entries in the car assembly industry. Under these protections, the joint ventures in China could price their cars higher than international levels and enjoy high profit rate and the MNEs had no incentive to introduce the new technology and product. Facing this problem, Chinese Government induced more competition in a timely manner by gradually reducing import tariffs and attracting more FDI. The moderate market competition benefited the generation of spillover effect and pushed the MNEs introduced more technology and new vehicle model. For example, the GM, Honda and other international auto makers entered into China in this period and GM introduced the Buick new century luxury cars, which was the most advanced car model for GM in that time. Finally, through this further opening up method for introducing more competition, the car industry in China benefited more direct and indirect effect of MNEs.

Fourth, the local market was used as the bargaining chip of government in the game process. At first, the Chinese government used the local market potential to attract Volkswagen to set up a joint venture with Shanghai Auto Industry Corporation (SAIC) in 1985 and another joint venture with FAW in 1991. As the economic development of China, the market scales of auto industry increased rapidly, many MNEs were attracted to enter into this huge market and the Chinese government made use of this bargaining chip to promote the industry development as well as the development of local firms.

6. Conclusion

This study mainly used the Brazilian automobile industry's case from the perspective of the game theory to detect the interaction between government and MNEs in different industrial development periods. We focused on analyzing the bargaining process between government and MNEs to investigate how the optimal strategic decisions were made and what was the bargaining chip of the government. First, we confirmed that FDI have indeed contribute a lot to the development of industry in developing host countries. And the government had played a crucial role in maximizing the positive influence and minimizing the negative influence of FDI on industry development. With the guidance of the government the FDI had built up the industry and led the industrial development and upgraded in different periods. This conclusion was consist with the existing literature and practice evidence in many developing countries. Furthermore, using the dynamic game analysis framework, we further found that the evolution of the Brazilian automobile industry was the consequence of several games between the Brazilian government and the MNEs. These games were mainly sequential games which the government moves first and the MNEs move in turn. As the first mover, the government could use backward induction to predict the choices of the MNEs and make its own optimal decision in order to achieve its strategic objectives. Second, there were many effective strategies which the government could use as powerful tools to guide the FDI in this dynamic game process. On one hand, the roles of import-substitution strategy for establishing the industry and export-promotion policy for upgrading the industry were confirmed in the game process, which was consistent with the existing static or non-game perspective literature. On the other hand, further opening policy, which were usually omitted in the existing literature, were explored by using this dynamic analysis. It was noteworthy that the further opening up strategy was primarily used to overcome the insufficient updating incentive under the model of the local protection. Third, by analyzing the dynamic games between the government and the foreign firms with Brazilian case, we explored that the advantages of the local market were the source of the government’s bargaining power, which the government could use as a bargaining chip to lead the FDI.

By using the dynamic game theory perspective, this study may contribute to several aspects in the field of international business. First, it illustrates the dynamic bargaining process between the government and MNEs when the government in

developing countries wants to establish or upgrade the industry. Second, it confirmed the roles of the FDI and government in industry development considering the context of dynamic game process. Third, it explores some new policy strategies such as opening up further at the suitable situation and using the local market as the bargaining chips, which may have policy implication for developing countries especially for those with the huge local market.

This study also have several limits. First, due to the limit of data, we could not predict the accurate profit of the MNEs in the process of the game, so that we solve this equilibrium by theory and case background but not by the function. Second, for lack of space, the whole case of Chinese auto industry is not demonstrated and we directly make some comparison analysis with Brazil case to make our conclusion more general. Therefore, our next research direction would be solving the equilibrium of the games by collecting more data and making more comparative case study in the context of other developing countries.

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