The Effect of Catching Up and Surpassing Industrial Policy on National Technology Development

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Abstract: Based on the principle of comparative advantage, developing labor-intensive industries in latecomer countries is conducive to their rapid integration into the international division of labor system. However, it is easy to lead the latecomer countries to fall into the capture type international division system dominated by the technology leading countries. By constructing a simplified game model of technological competition strategy between the two countries, this paper reveals the important role of industrial policy in technological catch-up of latecomer countries. With the increasing contribution of knowledge economy to economic growth, the latecomer countries must formulate industrial policies against comparative advantage, promote the growth of their own independent innovation ability, accelerate the pace of technological upgrading of traditional industries, and enhance their added value in the global value chain.

1. Introduction

Based on the understanding that developed countries have kicked off the ladder of economic growth, many economists have devoted themselves to studying the growth model suitable for developing countries to catch up with and surpass their own economy, which has led to different ideological trends and debates about industrial policies. Some scholars believe that the development of economy based on the principle of comparative advantage mainly focuses on the change of factor structure, especially the accumulation of capital, which leads to the industrial upgrading promoted by capital. [1] Professor Lin (2017) believes that a “promising” government needs to formulate industrial policies that “guide according to the situation” for specific industries [2]. The miracle of China's economic growth is a typical example of using comparative advantage to give priority to the development of foreign trade and quickly accumulate capital. With the continuous development of economy, the late developing countries can gradually narrow the technology gap by imitating and learning the technology of developed countries. However, the advanced countries gradually realize the threat of the diffusion of core technology to their leading position, so they take a series of measures to prevent the outflow of key technologies. If there is no independent innovation, China and other emerging markets are always difficult to catch up with and surpass technology. Therefore, another scholar thinks that we should pay more attention to the progress of technological level, and then pay more attention to the development and investment of scientific research, so as to guide the industrial upgrading direction driven by technology. [1] For example, Zhang(2010) pointed out that rich countries are trying to kick off the ladder that once made them climb to the present position [3], believing that if a country wants to achieve industrial upgrading, it must formulate industrial policies against comparative advantage. Yu (2013) believes that the theory of comparative advantage proves the benefits of international division of labor, but it can not be used as a guiding theory for industrial upgrading. [4] Because the specific technological progress mainly comes from the creativity of the grassroots and passes the competition test results, the government's intervention in technological innovation will not hinder the role of the market mechanism. Therefore, the government's formulation of industrial policy is an important path for the latecomer countries to quickly catch up with and surpass technology.

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2. The Role of Industrial Policy in Catching Up with and Surpassing Technology in Developing Countries

Science and technology are the primary productive forces. This part analyzes a game strategy of technology competition between the latecomer countries and the leading countries in a simplified two-state model, so as to reveal the important role of industrial policy in technology catching up of the latecomer countries. It is assumed that country A is a developed country And its technical level is in the leading position in the world. Developing country B is in a state of backward technology, but labor costs, natural resources and other prices are low. Therefore, we can build a game model of A-B two countries, and divide a country's industrial structure into low-tech production sector I (such as most labor-intensive industries) and high-tech production sector II (such as some high-tech capital intensive industries) according to the level of technology demand. In the initial state, the industrial economic structure of country A includes both low-tech production sector AI and high-tech production sector AII. However, because of the low level of technology, country B has only low-tech production sector BI. At this time, the economies of the two countries are in a closed state, and technology cannot be spread internationally. The two countries choose the strategy of cooperation or competition in technology, and the result of industrial structure equilibrium is shown in Table 1.

2.1 Both Countries Adopt Cooperation Strategy in Technology Competition Strategy

Cooperation means that both countries allocate resources to develop their economies according to their comparative advantages determined by their initial endowment. At this time, due to the existence of a large number of cheap labor and cheap raw materials, country A has obvious comparative advantages in labor-intensive industries, so it vigorously develops low-tech production sector I, and promotes its economic growth by exporting low-tech products.With the economic growth and the rising labor cost, country B gradually loses its comparative advantage in the low tech production sector. Country B can only allocate more resources to high-tech production sector II by withdrawing or transferring the industry overseas, thus bringing about economic globalization.At this time, for the two countries, because the allocation of resources is based on the principle of comparative advantage, the economic efficiency is higher, so the industrial structure of the two countries is in the equilibrium state of equation 1.

2.2 Country a Adopts Cooperation Strategy, While Country B Adopts Competition Strategy

Due to the cooperative strategy adopted by country A, there is no need for the government to intervene in the industry. The market will adjust the allocation of social resources according to the principle of comparative advantage, withdraw from the industries without comparative advantage, and strengthen the advantageous industries.Due to the competitive strategy adopted by country B, it is impossible to adjust its industrial structure only by the “invisible hand” of the market.Therefore, there is active government intervention in country B.If the government is “promising” at this time, then through the introduction of some targeted industrial policies, it will guide the redistribution of social resources in the high-tech production sector and low-tech production sector, which can promote the country's technological progress and finally form a complete industrial structure.The final equilibrium of the industrial structure of the two countries is shown in equation 2.

2.3 Country a Adopts Competition Strategy, While Country B Adopts Cooperation Strategy

For country A, if no measures are taken and resources are allocated according to comparative advantage, the globalization of production will make all low tech products of country A rely on imports. Most of the daily necessities are low-tech products, which will lead to the excessive dependence of people's life on foreign countries. Once there is a dispute between the two countries, or a war breaks out, it is difficult to re-establish a complete industrial chain of low-tech products in a short period of time to protect the basic life of the people, so it is in a passive state. Therefore, economic globalization strengthens the degree of interdependence of countries in a peaceful state, so as to keep the economic system of global division of labor stable. However, if country A intends

to reduce its dependence on the import of low technology products from country B, it will avoid the loss of retaliation from country B due to taking hostile actions first. Then, by reducing domestic labor costs, improving the degree of automation of low-tech production sectors, government subsidies, tax incentives and other measures to attract low-tech production sectors to return to country A, and finally form a balanced state of industrial structure in Formula 3.

2.4 Both Competitive Country a and Competitive Country B Adopt Strategy

If both countries adopt the competitive strategy of counter comparative advantage principle, countries a and B will try their best to take measures to improve their industrial structure, but the externality of technological progress will spread with the foreign trade of both countries, which makes the globalization of industrial structure inevitable. Therefore, the two countries will eventually form a state of technology lock, and the international trade will present a trend of anti globalization. At this time, the equilibrium state of the industrial structure of the two countries depends on whether country B achieves technological catch-up or not. If it does, it will be shown in equation 4, otherwise it will return to the initial equilibrium state (the structure is shown in equation 3).

Table 1 the Results Of the Game between the Two Countries

	country B		
country A		cooperation	compete
	cooperation	$\begin{pmatrix} 0 & B_{I} \\ A_{II} & 0 \end{pmatrix}$ (1)	$\begin{pmatrix} 0 & B_{I} \\ A_{II} & B_{II} \end{pmatrix}$ (2)
	compete	$\begin{pmatrix} A_{I} & B_{I} \\ A_{II} & 0 \end{pmatrix}$(3)	$\begin{pmatrix} A_{I} & B_{I} \\ A_{II} & B_{II} \end{pmatrix}$ (4)

There are two hypotheses implied in the above analysis: one is that technological progress will promote economic development, thus increasing the prices of labor and raw materials; the other is that cooperation strategy means that the principle of comparative advantage plays a role, and competition means that there is a “promising government” intervention against comparative advantage. As for country A, once country B catches up in the high-tech production sector, it will affect country A's leading position in technology and form a competitor in the high-tech field. Therefore, as long as formula 2 does not appear, other game equilibria will not affect the leading position of country A in the high-tech field. But for country B, it is very necessary to take appropriate industrial policies to enhance its competitiveness in the high-tech field.

To sum up, on the one hand, monitoring the cooperation behavior of the other side will bring about greater transaction costs, on the other hand, the two sides' recognition of the other side's cooperation and competition is inconsistent, so the optimal strategy of country A is: the low-tech production sector adopts the cooperation strategy, and the high-tech sector adopts the competition strategy; the optimal strategy of country B is: the low-tech sector adopts the cooperation strategy, and the high-tech sector adopts the competition strategy Strategy. Therefore, the final game equilibrium result is that the two departments of the two countries will adopt the perfect competition strategy. The market itself will not allocate resources to the technical production sector with low profit margin and high risk. Therefore, the competitive strategy of “promising government” in country B to intervene in the economy shows obvious characteristics of adverse comparative advantage. Therefore, for the latecomer countries, if they want to catch up, they must develop high-tech industry against the comparative advantage.

3. The Necessity of Government Promoting Industrial Policy

The advantage of the market lies in the efficiency of resource allocation, and the advantage of the government lies in making up for the market failure. This is a widely accepted view since neoclassical economics. But in the view of Austrian School of economics, the so-called market failure of neoclassical economists is actually the failure of market theory, not the failure of market itself. Therefore, there is still a wide debate in the academic circles about who will promote the industrial policy.

Firstly, the definition of government's industrial policy can be divided into narrow sense and broad sense. Different economists have different understanding of industrial policy, which leads to some unnecessary misinterpretations and arguments.For example, Professor Zhang Weiying believes that industrial policy refers to the selective intervention and discriminatory treatment of the government in the production of private products for economic development or other purposes. Its means include market access restrictions, investment scale control, credit fund rationing, tax preferences and financial subsidies, import and export tariffs and non-tariff barriers, land price preferences, etc. [5]Another example is Professor Lin Yifu's view that all the policy measures consciously taken by the central or local government to promote the development of a certain industry in the country or place are industrial policies. [6] He said that as long as the specific industrial policy will further explain the impact of industrial development. Therefore, under the definition of broad industrial policy, it is easy to confuse the government's general service activities and special service activities, which directly leads to many scholars' unclear logic and different arguments.The paper holds that if the government's policy is applicable to all industries, it can be regarded as a conventional policy, and only the policy specifically aimed at some industries can be regarded as an industrial policy, that is, the industrial policy in this paper is a narrow industrial policy.

Secondly, there is no contradiction between the government and the market, which is the consensus of academia. The planned economy dominated by the government and the market economy under complete competition are two extreme situations under the economic system, which are not in line with the reality. Therefore, it is meaningless to discuss this extreme economic system out of the real economic situation. Modern economic society is a pattern of coexistence of multiple economies. There are not only government participation, but also market economy environment with monopolistic competition market and oligopoly competition market as the main pattern. The impact of government activities on the economy is not necessarily distorted. The government's intervention in economic activities is, to some extent, suspected of replacing the market. Here, the government activities can be further divided into the conventional supplementary role of the government to the market (such as providing some software and hardware security) and the unconventional active intervention (such as selective intervention and discriminatory treatment). The main purpose of the government's routine supplementary role is not to intervene in economic activities, but to improve the software and hardware facilities, reduce the transaction cost of the market, give full play to the efficiency of resource allocation of the market, and promote the formation of an effective market. The results of unconventional active intervention activities may be to promote economic efficiency, distort resource allocation, or even meaningless. Therefore, distorting the efficiency of economic operation is not the inevitable result of “promising” government intervention.

4. Summary

The market is characterized by decentralized experiment. The advantage of decentralized experiment is that it can avoid people's limited cognitive ability as much as possible, and spread the risk of trial and error to those enterprisers who dare to innovate. However, this view does not take into account the time factor of the experimental results. It takes a long time for the market to disperse and try and error, and arbitrage through entrepreneurs. In addition, from the perspective of modern economics, whether the government makes industrial policies depends on the expectation of innovation results rather than the probability. Because the government's industrial policy shows the characteristics of concentrated experiment, its expectation of innovation results is high. Therefore, market and government, as an indispensable institutional combination in the modern economic system, should play a joint role in the technological catching up strategy of the latecomer countries to ensure that the industrial policy plays a significant role in promoting technological innovation.

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