

Innovative Performance Promotion Effect of Free Trade Zone

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Abstract

On the basis of constructing a mechanism for innovating regional innovation capacity in free trade pilot zones, using Fujian Province as an object, and using the "counterfactual" analysis method of Hsiao et al., The actual values of variables before and after the establishment of the China (Fujian) free trade pilot zone The difference from the "counterfactual" value. The empirical measurement results show that the establishment of the Fujian Pilot Free Trade Zone significantly promoted the improvement of Guangdong's innovation capacity, and the policy effect reached 35%. The result is robust through a placebo test.

Keywords

Free Trade Zone; "counterfactual" analysis; regional innovation.

1. INTRODUCTION

At present, China's economy is at an important stage of transformation and upgrading. Under the situation of intensified international competition and the domestic economy entering a new normal, in order to actively respond to the pressures and challenges of the new rules of international trade and investment, it has a place in the future international economic and trade governance structure. The Chinese government has proposed an opening strategy for the establishment of China's Pilot Free Trade Zone. The free trade zone is an important engine for China's economic upgrading. Opening up promotes reform, innovation, and development, forms a replicable and popularizable experience, serves the development of the country, and restructures the opening-up pattern. It has become an important part of China's economic transformation and upgrading. Strategic content.

From September 2013 to August 2019, China has approved 18 pilot free trade zones in multiple batches, and has basically formed the basic pattern of "1+3+7+1+6" and formed the coordination of east, west, south, north, and middle. The openness of land and sea as a whole has promoted the formation of a new round of comprehensive opening up in China. China's Pilot Free Trade Zone strengthens the facilitation of foreign trade through institutional innovation and financial reform, promotes Chinese companies to "go global", and attracts foreign companies to "come in", which facilitates the financing and investment of enterprises, thereby promoting China's reform and opening up. Further deepen. So can a higher level of opening up to the outside world, a larger number of companies, and a better market environment improve the regional innovation capability? In response to this problem, this article uses the "counterfactual" analysis method to select data on the number of invention patents granted in each province to study whether the establishment of the free trade zone can promote regional innovation, with a view to providing useful reference and reference for the construction of the free trade zone.

2. LITERATURE REVIEW

As for the literature on the free trade zone, since the establishment of the Shanghai Free Trade Zone, many scholars have studied the economic impact of the free trade zone from a qualitative and quantitative perspective. In terms of qualitative analysis, Chen Qi and Liu Wei believe that the establishment of a free trade zone has both positive and negative effects on the economy. On the one hand, the agglomeration effect and "institutional dividend" effect produced by the Shanghai free trade zone have a "positive" effect on regional economic development. On the other hand, there is a crowding-out effect between the establishment of the free trade zone and other special economic zones, which is not conducive to the overall economic growth [1]. The research by Chen Aizhen and Liu Zhibiao pointed out that the establishment of the free trade zone will help China to transform from the opening of product markets to the opening of factor markets, and from the globalization of manufacturing to the globalization of service industries[2]. Yang Xiangdong proposed the "pre-admission national treatment" and "negative list" models established in the free trade zone, which will reduce taxes and domestic transaction costs, create a fair trading environment, and further promote economic development; at the same time, the government will be simplified and decentralized, and the system will be optimized. , Release policy dividends [3]. Sheng Bin evaluated four major free trade zones in China from investment, trade, finance, and supervision, and put forward suggestions for building an upgraded version of the free trade zone [4].

Some scholars have conducted quantitative research on the economic impact of the Shanghai Free Trade Zone through counter-factual analysis methods. For example, Tan Na and Zhou Xianbo selected monthly data on the growth rate of industrial added value and the growth rate of total imports and exports in 31 provinces and cities in China, and used counterfactual analysis to evaluate the economic growth effect of the Shanghai Free Trade Zone. Growth has a significant positive effect [5]. Xiang Houjun and He Kang used the propensity score matching method and synthetic control method and found that the free trade zone had a significant impact on Shanghai's capital flow, and its impact on foreign investment was far greater than the actual use of foreign capital [6]. Yin Hua and Gao Weihe used the panel data policy evaluation method to assess the system dividend effect of the Shanghai Free Trade Zone. Studies show that the Shanghai Free Trade Zone has significantly promoted the growth of Shanghai's GDP, import, export, and investment. The promotion effect on Shanghai's economy is more significant, and the reform is centered on institutional innovation, which has a significant long-term economic effect [7]. Liu Bingxian and Lu Cheng compared the difference between the actual value of the economic variables in various regions before and after the establishment of the free trade zone and the "counterfactuals" of the composite regional economic variables. Both have had different degrees of positive impacts on regional economic operations, and the effects of different free trade zones have significant differences [8]. Wang Lihui and Liu Zhihong used the "counterfactual" analysis method and synthetic control method to measure the economic effects of the Shanghai Free Trade Zone on the region. The research results show that they have a significant positive effect on the region's actual per capita GDP, fixed asset investment, and import and export volume Effect [9]. Liu Bingxian and Wang Ye analyzed the impact of the establishment of the Shanghai Free Trade Zone on regional innovation using synthetic control methods. The study found that the establishment of the Shanghai Free Trade Pilot Zone can significantly promote the improvement of Shanghai's innovation level [10]. Ye Linli used the counterfactual analysis method to calculate the economic effect of the establishment of the free trade pilot zone on Fujian Province. The results show that the construction of the Fujian Free Trade Pilot Zone has significantly promoted the growth of Fujian's real GDP, foreign investment, import and export trade, and innovation capabilities, and Has a significant long-term spillover effect on the Fujian economy [11].

The above studies have ignored the impact of the establishment of the free trade zone on regional innovation capabilities, but this effect is very important for the construction of innovative countries and the high-quality development of the national economy. The endogenous growth theory shows that innovation is the internal driving force that affects a country's economic growth, and the difference in innovation levels between regions is the deep force that forms the regional development gap. Based on this, this paper intends to focus on the perspective of technological innovation capabilities and use the "counterfactual analysis" method to scientifically assess the impact of the establishment of China's free trade zone on regional technological innovation capabilities and related factors that affect China's innovative production activities.

3. ANALYSIS OF THE MECHANISM OF FREE TRADE ZONE AFFECTING REGIONAL INNOVATION CAPABILITY

The main purpose of the establishment of the free trade zone is to strengthen the facilitation of foreign trade by institutional innovation and financial reform, increase the number of foreign-invested enterprises, promote the "going out" of Chinese-funded enterprises, and "bring in" foreign-funded enterprises, thereby promoting China's reform and opening Further deepening. The higher level of opening to the outside world, the larger number of companies, and the better market environment can explain the enhancement of regional innovation capabilities from the effects of competition, spillovers, and international trade.

3.1. Trade Effect

The trade effect is mainly divided into two aspects. The first is that it is upstream of the global value chain, which will increase investment in knowledge and technology, and increase in R & D investment will promote the improvement of regional innovation capabilities. The global value chain trade with intra-product division of labor as the core has become the main mode of economic globalization and international division of labor. Starting from the law of division of labor in the value chain of high-level elements and high returns, the free trade pilot zone actively plays a demonstration and leading role to increase knowledge and technology Capital investment achieves the rise of the position of the global value chain through the mastery and breakthrough of core knowledge and technology. The second is the promotion of FDI attracted by the establishment of free trade zones to promote regional innovation capabilities. After FDI investment enters the free trade zone, it faces fierce competition in the market in the zone. In order to achieve better development, multinational companies must increase investment in research and development. The increase in R & D investment of multi-national companies will affect the innovation capacity of the free trade zone through two aspects: First, multinational companies have advanced technology and successful management experience. The increase in R & D funds and R & D labor investment will directly promote and drive the host country. Technological advancement and innovation capabilities; secondly, in the process of localization of multinational company R & D activities, they will cooperate with host country enterprise R & D institutions, which will have spillover effects on local enterprise R & D institutions and enhance regional scientific research capabilities. Through these two paths, the innovation capacity of the free trade zone will be improved.

3.2. Spillover Effect

The spillover effects are mainly technology spillovers and talent spillovers. In the free trade pilot zone, more favorable policies, free and open markets, and a better business environment will attract more domestic and foreign investment. On the one hand, the entry of foreign-funded enterprises has brought scarcity of capital, patented technologies, and management concepts. Compared with the local sales network, compared with local companies, foreign-funded

companies have a technology gap. In this case, knowledge and technology spillovers will occur, which will enhance the technological innovation capabilities of local companies to a certain extent [15]; on the other hand, A large number of “going out” domestic enterprises have settled in the free trade zone. These enterprises have mastered the latest technological research and development trends of the host country and promoted their own technological innovation capabilities through reverse knowledge spillovers [16]. The free trade zone generally has a good institutional environment, which can increase the attraction of talents. At the same time, cooperation and exchanges between enterprises in the zone also promote the flow of professional talents. Almeida and Kogut believe that the free flow of high-tech talents between regions can promote the exchange and interaction of knowledge, lead to the spillover of knowledge, and promote the improvement of innovation capacity in the region.

3.3. Competitive Effect

As the free market environment and preferential policies in the free trade zone will attract a large number of enterprises to settle in, leading to intensified competition among enterprises. Local enterprises must not only compete with domestic high-quality enterprises, but also with foreign-funded enterprises. In order to obtain higher profits To win more market shares, we will continue to improve production efficiency and innovation to enhance our competitiveness. Secondly, the preferential trade policies in the free trade zone increase the number of imported goods, and many companies in the zone will also produce more goods, resulting in a large variety of goods on the market, and more and more alternatives between the same goods. Only by constantly innovating products can we meet even more discerning consumers and stand out from the fierce competition. Therefore, the establishment of the free trade zone has an impact on innovative production activities through competition between industries and forced improvement of enterprises.

4. MODEL SETTINGS AND DATA DESCRIPTION

4.1. Model Setting

According to the policy evaluation theory, the operation of the Fujian Free Trade Zone after the implementation of the policy is used as the treatment group, and other domestic cities are used as the control group. The differences between the treatment group and the control group are compared to evaluate the impact of the establishment of the free trade area on regional innovation. . The commonly used method is the double difference method, but the use of the double difference method is limited by many assumptions: first, the processing allocation must be random (no selection bias); second, the processing and control areas must have the same underlying factors; third, Common potential factors must have the same amount of impact on each group. These assumptions are difficult to maintain in reality, because the establishment of free trade zones is obviously not random, and the innovation capabilities of different regions are affected by factors such as R & D investment, openness, and economic development level. Therefore, we draw on the "counterfactual" analysis method proposed by Hsiao et al. [14]. The method considers that there is a correlation between individuals in the cross section, and their development is affected by certain common factors. Therefore, the "counterfactual" value of the experimental group after the policy occurs can be determined by the correlation between the experimental group and the control group before the policy occurs. Relationship to estimate. This method overcomes the difficulties of the double difference randomness hypothesis, and at the same time reduces the interference of the variable selection and estimation method on the robustness of the empirical results to a certain extent.

Assume that at t , the innovation capacity of the first i area is y_{it} , y_{it}^1 represents the observation value of the free trade area established at time t in the i area, and y_{it}^0 represents

the observation value of the free trade area established at the time t at area i , so The establishment of a free trade zone in one region has no impact on other regions.

$$\begin{aligned} y_{it} &= y_{it}^0, & t &= 1, \dots, T_1 \\ y_{it} &= y_{it}^1, & t &= T_1 + 1, \dots, T \end{aligned} \quad (1)$$

The provinces without a free trade zone are $y_{it} = y_{it}^0$ ($i = 2, 3, \dots, N, t = 1, \dots, T$). so the effect of the establishment of a free trade zone on regional innovation can be expressed as

$$\Delta_{it} = y_{it}^1 - y_{it}^0 \quad (t = T_1 + 1, \dots, T) \quad (2)$$

However, for areas where the policy is implemented, a cannot be observed y_{it}^0 after, and Δ_{it} cannot be calculated directly. Hsiao et al. proposed that an optimal control group composed of provinces and cities without implemented policies can be used for prediction y_{it}^0 . Suppose y_{it} can be generated by the following factor model:

$$y_{it} = b_i f_t + \alpha_i + \varepsilon_{it} \quad (i = 1, 2, \dots, N; t = 1, 2, \dots, T) \quad (3)$$

Where b_i is the coefficient vector of the K -dimensional change with region, f_t is the common factor vector of the K -dimensional change with time, α_i is the regional fixed effect, and ε_{it} is a random disturbance term, which satisfies $E(\varepsilon_{it}) = 0$. Because the innovation capacity of each province and city is driven by common factors (such as R & D investment, openness, capital, etc.), although the degree of influence is different, there is a certain correlation between the cross-section data, so the provinces that have not established a free trade zone are selected. City as the control group, using $\tilde{y}_t^0 = (y_{2t}^0, y_{3t}^0, \dots, y_{Nt}^0)$ instead of f_t to fit the "counterfactual" value of y_{it}^0 . First, use the data of y_{it}^0 to get the fitted value

$$\hat{y}_{it}^0 = \hat{\alpha}_1 + \hat{\alpha}_2 y_{2t}^0 + \dots + \hat{\alpha}_n y_{Nt}^0 \quad (4)$$

at $t = 1, 2, \dots, T_1$, and predict y_{it}^0 at $t = T_1 + 1, \dots, T$ to get the "counterfactual" value \hat{y}_{it}^0 . The effect of the establishment of the free trade zone on regional innovation is:

$$\hat{\Delta}_{it} = y_{it} - \hat{y}_{it}^0, \quad t = T_1 + 1, \dots, T \quad (5)$$

Hsiao proved that under general conditions, $\hat{\Delta}_{it}$ is Δ_{it} consistent estimate.

Use the method of Hsiao to select the optimal control group:

The first step is to select j regions from the $N-1$ regions as the control group combination. There are a total of C_{N-1}^j results. $(y_{1t}^0, y_{2t}^0, \dots, y_{jt}^0)$ is constructed using the innovation indicators of j provinces and cities in each control group. Using AIC criterion to select the best control group. This process requires comparison of regression models, and the optimal control group obtained is recorded as $M^*(j)$.

In the second step, the optimal control group M^* is selected from $M^*(1), M^*(2), \dots, M^*(N-1)$ by using the AIC criterion.

The third step is to use the optimal control group M^* to predict the innovation indicators in the $t = T_1 + 1, \dots, T$ period, and obtain the "counterfactual" value of y_{it}^0 , and then further calculate $\hat{\Delta}_{it}$, which is the effect of the establishment of the free trade zone on regional innovation.

4.1. Data Description

There are three types of patents: invention patents, design patents, and utility model patents. Invention patents have the highest technological content, and are more stringent than other two types of examinations and approvals, which can better reflect the regional technological level and innovation capabilities. Since the number of patent applications does not accurately reflect the innovation situation in a region, this article uses the number of invention patents granted by each province as the proxy variable for the innovation index.

The original data comes from the wind database. From 2007 to 2016, we selected 28 provinces and cities nationwide (excluding Tibet, Qinghai, and Ningxia due to incomplete data) for several months of invention patent grants. To ensure data stability, we calculated the quarterly growth rates of invention patent grants for each province and city. When inspecting Fujian, 24 provinces and cities nationwide were selected as the control group (excluding Shanghai, Guangdong, and Tianjin), and the first quarter of 2007 to the first quarter of 2015 was taken as the period before the establishment of the Fujian Free Trade Zone policy. From the second quarter of 2015 to 2016 The period after the implementation of the policy in the fourth quarter of the year.

5. ANALYSIS OF EMPIRICAL RESULTS

5.1. Evaluation of the Effect of the Establishment of A Free Trade Zone on Regional Innovation

Table 1. Optimal control group weights for the Fujian Free Trade Zone

	Fujian		
	β	Standard error	T value
Constant term	0.2179	0.0369	5.8971***
Beijing	0.6025	0.1837	3.2806**
Shanxi	0.5865	0.1091	5.3753***
Neimenggu	0.2809	0.0739	3.8026***
Heilongjiang	0.3441	0.1222	2.8171**
Hubei	0.2919	0.1063	2.7449*
Guangxi	-0.2908	0.0907	-3.2050**
Chongqing	-0.4335	0.1144	-3.7881***
Guizhou	-0.4345	0.0866	-5.0161***
	R2=0.937		

Using the sample data of the quarterly invention patent grants of the 28 provinces and cities in the country from the first quarter of 2007 to the fourth quarter of 2016, using the model selection strategy proposed by Hsiao, and using the AIC information criterion as the model selection criteria, construct The "counterfactual" invention patents granted when Fujian did not

set up a free trade zone have been granted for several quarters of growth. Through the screening of AIC criteria, the provinces and cities of Fujian's optimal control group are Shanxi, Inner Mongolia, Heilongjiang, Beijing, Hubei, Guangxi, Chongqing, and Guizhou; Table 1 lists the weights of the optimal control group. It can be better predicted (R^2 reaches 0.937) the development path of the number of invention patents granted when Fujian does not establish a free trade zone.

From Table 1, it is concluded that R^2 reaches 0.937, so the optimal control group composed of the provinces and cities in the non-free trade pilot zone can accurately fit the "counterfactual" value of Fujian's non-established free trade zone. Figure 1 depicts the real path and "counterfactual" path of the quarterly growth rate of Fujian invention patent grants before and after the implementation of the policy. It can be seen from the figure that before the establishment of the Fujian Free Trade Zone, the left half of each graph The growth path of the real invention patents granted in the three regions for several quarters is very close to the predicted path, indicating that the prediction effect is good. The right half of the dotted line in each graph depicts the predicted path and The real path shows that after the establishment of the free trade zone, the real development path of the number of invention patents granted in Fujian is above the "counterfactual" development path. Table 2 shows data from the quarters of real invention patents granted after the establishment of the Fujian Free Trade Zone and the "counterfactual" values when the free trade zone is not established. The difference between the true value and the "counterfactual" value reflects the free trade zone. Policy effect. After the establishment of these three free trade zones: The establishment of the Fujian Free Trade Zone has increased the quarterly growth rate of Fujian invention patents by an average of 35 percentage points per quarter.

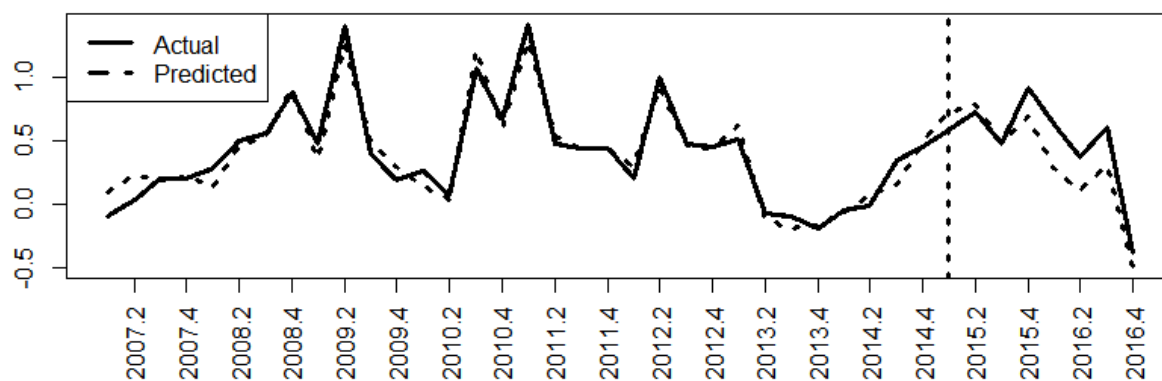


Figure 1. The real path and the "counterfactual" path for the growth of invention patents in the quarters before and after the establishment of the Fujian Free Trade Zone

According to the figure, it can be found that when the Pilot Free Trade Pilot Zone was first established, the impact on the quarterly growth rate of invention patents was not obvious, and even the "counterfactual" value exceeded the real value. Due to the lag in the implementation of the policy, the free trade zone It takes a certain time for the government's role, market entry thresholds, changes in regulatory methods, legal improvements and other companies' responses to this. Therefore, some time after the establishment of the free trade zone, policy effects began to appear.

Table 2. Policy effects of Fujian free trade zone

	Fujian		
	Actual value	Counterfactual value	Treatment effect
2013.4			
2014.1			
2014.2			
2014.3			
2014.4			
2015.1			
2015.2	0.72	0.78	-0.06
2015.3	0.47	0.49	-0.02
2015.4	0.91	0.68	0.23
2016.1	0.63	0.29	0.35
2016.2	0.37	0.10	0.27
2016.3	0.61	0.31	0.30
2016.4	-0.37	-0.50	0.13
Mean	0.48	0.31	0.35

5.2. Placebo Test

We are not sure about the difference in the development path of the indicators caused by the Fuzhou Construction Pilot Free Trade Zone in March 2015. In order to rule out the contingency and human operation of the time point of the economic event, a robustness test was performed through a placebo test of changing time nodes. The specific operation is: randomly select a time point before the establishment of the Fujian Free Trade Pilot Area, and if similar conclusions are reached at this random time point, it indicates that the above analysis is not sufficient to support the economic effects of the Fujian Free Trade Pilot Area. For example, at the time of the year before the establishment of the Fujian Pilot Free Trade Zone, that is, the first quarter of 2014, the second quarter of 2014 to the fourth quarter of 2016 was the period after the implementation of the policy. It was found that even if the time point for policy implementation was changed, the optimal control group selected by the AIC guidelines could still accurately predict the growth rate of real invention patents granted in the Fujian Free Trade Zone for several quarters, with R² reaching 0.961. Figure 2 shows the growth rate path and "counterfactual" path of the real invention patents granted one year in advance of the establishment of the Fujian Free Trade Zone, one year in advance. Between the first quarter of 2014 and the first quarter of 2015, The growth rate path and the "counterfactual" path for the real invention patents granted for several quarters fluctuated. After the second quarter of 2015, the "counterfactual" path was lower than the real path. This shows that the FTZ has a significant positive treatment effect after its true establishment, and its policy effect is not another accidental or man-made phenomenon.

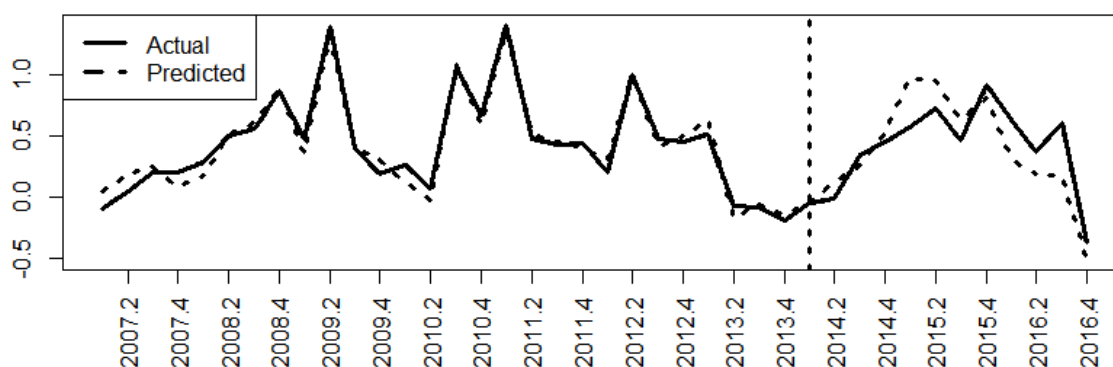


Figure 2. Quarterly growth rate of Fujian invention patents granted one year in advance

6. CONCLUSIONS AND RECOMMENDATIONS

On the basis of theoretical analysis of the establishment of the internal mechanism that affects regional innovation capabilities in the free trade zone, this article uses the "counterfactual" analysis method to assign appropriate weights to the reference group through data information to obtain a consistent trend with the economic movement of Fujian before the implementation of the policy. In the control group, the "counterfactual" phenomenon constructed by the synthetic control method was compared with the real situation of innovation in Fujian. The main research findings and inspirations are:

The establishment of Fujian Free Trade Zone affects Fujian's innovative production activities through competition effects, spillover effects, and international trade effects, and promotes the improvement of Fujian's innovation capacity. The result of the "counterfactual" analysis method also shows that the establishment of the Fujian Free Trade Zone has a significant positive impact on Fujian's innovative production activities. Positive gaps, and the average gap rate during the study period was about 35%. These results passed the placebo test.

In view of this, China needs to accelerate the establishment of a new open economic system, improve the construction of the free trade zone system and mechanism, realize the free flow of goods, services, capital and talents in the zone, and build a fair, competitive, efficient and internationally integrated Chinese economy. The free trade zone has increased the amount of knowledge in the free trade zone, enhanced the awareness of innovation, and facilitated the flow of information, thereby promoting the improvement of regional innovation capabilities. In addition, it is necessary to speed up the replication and promotion of the experience of the established free trade zone, and strengthen the linkages between the surrounding areas of the free trade zone, so as to achieve a more distinctive pattern of blossoming flowers across the country, promote the improvement of China's innovation level, and then increase China's international Competitiveness and international standing.

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