

A Study on the Impact of Sport Industry on Economic Growth: An Investigation from China

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Abstract

Prior literature has posited that the sport industry has been effective method to drive the economic growth. Given the rationale, this study sets China as a research object with a quarterly data from the first quarter of 2003 to the fourth quarter of 2017 to explore how the sport industry affects economic growth. This study employed Johansen cointegration test and dynamic ordinary least squares as methods for an empirical analysis. The input of sport industry, the labor input, the capital input, and the economic growth are used as research variables. The results show that there is a long-run relationship among them. Johansen cointegration test's estimation indicated that 1% increase in the input of sport industry will lead to 0.064% increase in economic growth. Dynamic ordinary least squares' estimation showed that whenever in the one lead, in the one lag and in the present period, the input of sport industry always poses a positive effect on economic growth. Labor input also has a positive effect on economic growth. The capital input has a negative effect on economic growth. Finally, even though the input of sport industry has a positive effect on economic growth, its impact on economic growth is relative weak.

Keywords: Sport Industry, Economic Growth, Production Function, Dynamic Ordinary Least Squares.

1. Introduction

The sport industry has two definitions. That is, the sport industry in the broad sense refers to all the operation activities related to sports, including the production & operation of sports material products and sports service products. The sport industry in the narrow sense refers to the part of sports service industry or sports enterprise that can enter the market and make profits. In other word, the sport industry refers to the collection of the same type of economic activities and the synthesis of similar economic sectors for the supply of sports products to the society. As a sector of the national economy, the sport industry has the same characteristics with other industries. That is, It pays attention to the market benefits and focuses on the economic benefits, while at the same time it has the characteristics different from other industries. The important function of its products also lies in improving the physical quality of residents, developing social production, inspiring national spirit, realizing the all-round development of individuals and the overall progress of social civilization. The sport products include both tangible sporting goods and intangible sporting services. The sport economic department includes not only market enterprises, but also various other institutions engaged in operational activities such as public institutions, social organizations and even individuals.

The sports industry is a veritable sunrise industry. The industrialization of China's sports market started in the 1980s. In the mid-1990s, China's sport industry has a relatively complete industrial pattern and a

relatively perfect sport industry system. After that, China's specific industries such as sports advertising, sports construction, sports gambling, sports tourism and sports supplies are fully developed during this period. In June 1995, the state general administration of sport promulgated “the outline for the development of the sports industry from 1995 to 2010”. It is pointed out that China's sports industry will take 15 years to gradually build a modern sport industry system suitable for the socialist market economy, in line with the laws of modern sports, complete categories, reasonable structure and standard development. Although the Chinese sport industry's asset stock, human resource condition and capital increment efficiency are increasing rapidly at present, there is no denying the fact that China's sport industry is still in the development stage, and the degree of marketization of each link is still low. Learning from western developed countries' experiences and models in sport industry management is a shortcut to the rapid growth of China's sport industry.

From the perspective of empirical analysis, this paper takes the quarterly time series data from 2003 to 2017 as the sample to analyze the impact of the sport industry on economic growth. In this paper, the input of sport industry is introduced to the production function as a driving factor to economic growth. In order to make the operating mechanism between sport industry and economic growth more clear, a menu of econometric approaches such as Johansen cointegration test and dynamic ordinary least squares will be taken to conduct an empirical analysis. Moreover, the input of sport industry, the labor input and the capital input are regarded as the independent variables, and the economic growth is regarded as a dependent variable. These variables will be used to perform an empirical analysis. The results show that there is a long-run relationship among them. According to results of Johansen cointegration test's estimation, 1% increase in the input of sport industry will lead to 0.064% increase in economic growth. According to results of dynamic ordinary least squares' estimation, whenever in the one lead, in the one lag and in the present period, the input of sport industry always poses a positive effect on economic growth. Meanwhile, the labor input also has a positive effect on economic growth. Conversely, the capital input has a negative effect on economic growth. All in all, even through the input of sport industry has a positive effect on economic growth, its impact on economic growth is relative weak.

To this end, the rest of this paper will be demonstrated as following. Part two shows the literature review. Part three exhibits the theoretical framework. Part four indicates the empirical analysis. Part five provides the conclusion.

2. Literature Review

Sport industry is regarded as a sun-rising industry, especially, in the developed countries. It has played a critical part in the growth of gross domestic products. A great deal of scholars and experts have attempted to study the relationship between sport industry and economic growth. Their achievements will be exhibited as following.

Fang, Guo, Xiong, and Jin (2008) sets Heilongjiang province as an example to study the contribution of sport industry to economic growth. In fact, sports industry is not only a new subject for sports economics, but also a practical problem closely related to economic growth. They find that the sport industry impacts the economic growth via the low cost, quick start, high safety, permeability and wide area of strong radiation. Jie (2010) finds that the sport industry contributes greatly to economic growth. Developing sport industry can improve the quality of life and maintain social stability. It can also boost consumption, domestic demand and economic growth. Zeng (2010) uses the statistical and econometric methods to analyze the influencing factors of China's competitive sport industry. His results show that the development of China's competitive sport industry presents three gradient in east, middle and west. The level of regional economic development is the most important factor for the development of competitive sports industry. The development of competitive sport industry is seriously restricted by the backward technical level and the small input proportion. Yan, Gao, Zhang and Liu (2010) take Hebei province as the empirical object to study the relationship between leisure sport industry and economic growth. Based on the estimation of the cointegration test and vector error correction model, they find that there is a long-run relationship between leisure sport industry and economic growth. Manuel Luiz and Fadal (2011) attempt to explore the social economic determinants of sports performance in Africa, The previous researches have figured that the success of a country in sports has a direct relation with the economic

resources available for those sports. Via employing the cross-sectional data in African countries, their findings show that African performance in sports depends on an extent of social economic factors.

Austria (2012) sets European Union with the time span from the year of 2011 from 2012 to study the contribution of sport industry to economic growth. He collects all data from the twenty seven European Union member countries who treat the sport as economic activity. Via empirical analysis, he finds that in the narrow definition, the ratio of sport-related gross added value to the total European Union gross added value is 1.13%. In the broad definition, the ratio of sport-related gross added value to the total European Union gross added value is 1.76%. Wang, Zhang & Wang (2012) apply dynamic econometric methods such as co-integration test, error correction model and Granger causality test to conduct an empirical analysis on the relationship between sport industry and economic growth in China based on relevant time sequence data. They find that there is a long-term stable equilibrium relationship between sport industry and economic growth. Both of them are reciprocal causation and mutual promotion. Vigorously developing sport undertakings, especially the sport industry, will play an important role in the sustainable growth of national economy in China.

Zeng (2013) employs the time series data from the year of 1995 to 2011 to analyze the long-term and short-term relationship between input of sport industry and economic growth via the stationarity test, cointegration test and Granger causality test. He finds that there is a long-term relationship between both of them. Meanwhile, the input of sport industry is a Granger causality of economic growth. The one-way causal relationship between both of them exists. The mutual promotion and development effect between both of them is not significant in the short term. To a certain extent, the economic growth will be affected by the input of sport industry, that is, the input of sport industry will promote the economic growth. Tian & Guo (2013) construct an empirical study on the relationship between sports industry value-added and gross domestic product from 2006 to 2015 by using the econometrics research methods. Their results are shown as following. Firstly, there is a strong correlation between sport industry value-added and national economy. Secondly, 1% increase in the sport industry will lead to 0.677% increase in the economy in the long term. Meanwhile, the sports industry has no obvious effect on the short-term national economic growth. Thirdly, there is a one-way causal relationship between sport industry and national economy, and the change of sport industry growth is the cause of GDP growth. Fourthly, the impulse response function shows that the development of the national economy growth contributes to the sport industry, and the impact strength of the growth of the national economy to the sport industry is stronger than the sport industry to economic growth. Fifthly, the variance decomposition shows that the national economy is affected by its fluctuation and the sport industry, and the economic growth to the development of the sport industry's contribution rate is still insufficient.

Zhang, Yang, and Zhao (2015) use the annual time series from 1995 to 2012 to construct a three dimensions (sports financial investment, sports business development and economic growth) vector auto regressive model to study their dynamic changes and interrelated characteristics so as to make up for the inadequacy of existing research. Their paper also provides some useful experience for the establishment of related policies for sports enterprise development. Their results show that the sports financial investment, the sports business development and the economic growth change synergistic-ally, and the model which includes only two variables is prone to be biased. There is a close linkage among them. The sports financial investment promotes economic growth through boosting the development of sports industry, and the sports development and the economic growth can promote mutually in both short and long-term. The sports development and economic growth do not drive into more sports financial investment in the long term.

Li (2017) studies the status and function of sport industry in national economy. Due to that the sport industry grows with the growth of the national economy. This kind of change which is brought by the economic aggregation with the dependency effect gives birth to the role and status of the sport industry in the national economy. He finds that at present, the consumption of sport industry plays an irreplaceable role in the whole industrial economic chain. His study examines the new money generated from Formula One Grand Prix and the economic impacts of this new money on the host economy using input–output analysis. He finds that the impact of the new money from non-local attendees or international attendees is more pronounced compared to that from local attendees. Also, F1 event appears to influence on sports-related industry as well as other industries such as manufacturing industry. His findings suggest that the host cities should focus on increasing the non-local and international attendees in order to enhance the

economic impacts of a sport event. Zheng and Wang (2017) explore the internal mechanism of the development of British sport industry and national economic growth from the theoretical point of view, the present research has, using econometric methods including cointegration test, error correction model estimation, granger causality test and so on, conducted an empirical analysis on the long-term equilibrium relation and short-term dynamic relationship of sport industry development and national economy in British. Their results show that: the level of time series of the British sport industry development and economic growth is stable in the sample period; there is a long-term equilibrium relationship between the British sport industry development and the national economy growth; 1% increase in British sport industry will drive the national economy total quantity levels increased by 0.8306%. The short pull effect of sport industry development on economic growth can not be belittled, while the good environment of social and economic development and also create the conditions for further improving the sports industry. There is a significant two-way causal relationship between the two sides, which means a mutually promote and restrictive drive mechanism has been formed between the British sport industry development and economic growth in a short period of time. Yao and Liu (2017) analyze the influence of China's sport industry cluster on regional economic growth by using static and dynamic panel models based on the provincial data from 2005 to 2015. Their empirical results show that both static and dynamic panel models support the hypothesis that China's sport industry cluster can significantly promote economic growth.

In short, compared with previous achievements listed above, the biggest innovation in this paper is that the input of sport industry is introduced to the production function as an element such as labor input and capital input. Then, the modern econometric approaches are employed to analyze the relationship among them.

3. Theoretical Framework

The sport industry is a market in which people, activities, business, and organizations involved in producing, facilitating, promoting, or organizing any activity, experience, or business enterprise focused on sports. It is the market in which the businesses are products offered to its buyers are sports related and may be goods, services, people, places, or ideas. In this paper, the sport industry which will be regarded as a factor to influence the economic growth will be introduced to the traditional production function. The general form of production function under the special economic structure gives:

$$Y = f(A, L, K, SI) \quad (1)$$

Where Y stands for the total output. A stands for the economic institution and the technology or something else (often treated as a constant). L stands for the labor input. K stands for the capital input. SI stands the input of sport industry. Meanwhile, conditions that should hold gives:

$$\frac{\partial Y}{\partial L} > 0, \frac{\partial^2 Y}{\partial L^2} < 0; \frac{\partial Y}{\partial K} > 0, \frac{\partial^2 Y}{\partial K^2} < 0; \frac{\partial Y}{\partial SI} > 0, \frac{\partial^2 Y}{\partial SI^2} < 0 \quad (2)$$

If equation (1) is set as the Cobb-Douglas production function, the total derivative of equation (1) gives:

$$dY = \frac{\partial Y}{\partial L} \cdot dL + \frac{\partial Y}{\partial K} \cdot dK + \frac{\partial Y}{\partial SI} \cdot dSI \quad (3)$$

Dividing Y on the both sides of equation (3) gives:

$$\frac{dY}{Y} = \frac{\partial Y}{\partial L} \cdot \frac{dL}{Y} + \frac{\partial Y}{\partial K} \cdot \frac{dK}{Y} + \frac{\partial Y}{\partial SI} \cdot \frac{dSI}{Y} \quad (4)$$

Where $\frac{\partial Y}{\partial L} \cdot \frac{dL}{Y}$ is the labor producing elasticity. $\frac{\partial Y}{\partial K} \cdot \frac{dK}{Y}$ is the capital producing elasticity.

$\frac{\partial Y}{\partial SI} \bullet \frac{dSI}{Y}$ is the sport industry producing elasticity.

Taking the general form of production function into the further consideration, as mentioned above, the introduction of sport industry can change the economic structure and the investment mode as well as the production mode. Therefore, due to the introduction of sport industry, the labor producing elasticity and the capital producing elasticity will also be changed.

Assuming the traditional production function gives:

$$Y = AL^\alpha K^\beta SI^\gamma \quad (5)$$

Due to the labor producing elasticity and the capital producing elasticity, the new production function gives:

$$Y = AL^{\alpha + \frac{\partial \alpha}{\partial \gamma} \bullet \gamma} K^{\beta + \frac{\partial \beta}{\partial \gamma} \bullet \gamma} SI^\gamma \quad (6)$$

Where $\frac{\partial \alpha}{\partial \gamma}$ and $\frac{\partial \beta}{\partial \gamma}$ are the influence elasticity, respectively. Furthermore, both of them are positive under the special period. Taking the logarithm on the both sides of equation (6) gives:

$$\log Y = \log A + \left(\alpha + \frac{\partial \alpha}{\partial \gamma} \bullet \gamma\right) \log L + \left(\beta + \frac{\partial \beta}{\partial \gamma} \bullet \gamma\right) \log K + \gamma \log SI \quad (7)$$

On equation (7), when taking derivative of γ , it can be found that $\frac{\partial Y}{\partial \gamma}$ is positive.

Rewriting equation (7) in more general form gives:

$$\log Y_t = C + \alpha_1 \log L_t + \alpha_2 \log K_t + \alpha_3 \log SI_t + \varepsilon_t \quad (8)$$

According to equation (7), it can be concluded that α_3 is greater than zero. Therefore, we can find that the sport industry has a positive effect on economic growth.

4. Empirical Analysis

4.1. Variable Description

The data used in this paper is sourced from the National Bureau of Statistics of China. The details of all datum will be listed as following exhibits.

GDP: It is a monetary measure of the market value of all the final goods and services produced in a period (quarterly or yearly) of time. In this paper, its growth rate will be used to stand for the economic growth.

Sport industry: It is a market in which people, activities, business, and organizations involved in producing, facilitating, promoting, or organizing any activity, experience, or business enterprise focused on sports. It is the market in which the businesses are products offered to its buyers are sports related and may be goods, services, people, places, or ideas. In this paper, the input of sport industry will be regards as an index to stand for the sport industry.

Labor input: It describes development in the cost of labour in the construction industry relative to a base year. It is monitored against average hourly earnings for regular working hours in the construction industry, indirect labour costs complying with collective agreements, and estimated development of earnings. In this paper, the employment figure will be used to stand for the labor input.

Capital input: it refers to the book value of all the capital invested by all investors in enterprise operation, including debt capital and equity capital. In this paper, the social total input will be used to stand for the capital input.

In this paper, except for the labor input, the GDP, the input of sport industry and the capital input are divided by consumer price index so as to obtain the real value of them.

4.2. Unit Root Test

Due to that some economic variables are not stationary, if these variables are directly used to carry out a regression analysis, the spurious regression will easily occur. Therefore, testing the stationarity of all variables is quite essential before conducting a regression analysis. Additionally, all variables are taken the logarithm so as to wipe out the outliers and diminish the heteroscedasticity. In this paper, the Augmented Dicky-Fuller test (ADF) will be utilized to testify the stationarity of all variables. The results of Augmented Dicky-Fuller test show in <Table 1>.

Table 1: Unit Root Test

Variable	t-Statistic	1% test critical value	5% test critical value	10% test critical value	Prob.	Result
$\log GDP$	-1.307	-3.568	-2.921	-2.599	0.619	Non-rejected
$\log L$	-1.393	-3.548	-2.912	-2.594	0.579	Non-rejected
$\log K$	-1.412	-3.568	-2.921	-2.599	0.569	Non-rejected
$\log CI$	-1.342	-3.568	-2.921	-2.599	0.603	Non-rejected
$\Delta \log GDP$	-3.015	-3.568	-2.921	-2.599	0.040	Rejected
$\Delta \log L$	-3.896	-3.548	-2.912	-2.594	0.004	Rejected
$\Delta \log K$	-5.534	-3.568	-2.921	-2.599	0.000	Rejected
$\Delta \log CI$	-6.276	-3.568	-2.921	-2.599	0.000	Rejected

Note: Δ denotes the first difference operator.

<Table 1> indicates the results of unit root test. At 5% significant level, the t-Statistic value (absolute) is less than 5% test critical value(absolute). It means that all variables are not stationary at their own level. Whereas conducting the first difference, at 5% significant level, the t-Statistic value (absolute) is greater than 5% test critical value(absolute). It means that all variables are stationary at 5% significant level.

Because of that all variables are the process of $I(1)$, the long-run relationship among them needs to be examined.

4.3. Cointegration Test

There are a quantity of methods to inspect the long-run relationship among them. In this paper, the Johansen cointegration test will be used to detect the long-run relationship among them. Before that, the optimal lag should be confirmed. The results of unrestricted vector auto-regression lag order selection criteria show in <Table 2>

Table 2: Unrestricted Vector Auto-regression Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	1353.905	NA	3.16e-26	-47.365	-47.222	-47.309
1	1741.527	707.240	6.88e-32	-60.404	59.688	-60.126
2	1813.439	121.115*	9.76e-33*	-62.366*	-61.366*	-61.865*
3	1823.201	15.071	1.24e-32	-62.147	-60.284	-61.423

*indicates lag order selected by the criterion; LR: sequential modified LR test statistic (each test at 5% level); FPE: Final prediction error; AIC: Akaike information criterion; SC: Schwarz information criterion; HQ: Hannan-Quinn information criterion.

<Table 2> indicates that lag two is optimal according to the Akaike information criterion (AIC) and Schwarz information criterion (SC). In keeping with the results of unrestricted vector auto-regression lag order selection criteria, the Johansen cointegration test will be performed. The Johansen cointegration test results show in <Table 3> and <Table 4>.

Table 3: Unrestricted Cointegration Rank Test (Trance)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
$r = 0^*$	0.360	58.867	47.856	0.003
$r \leq 1^*$	0.299	32.955	29.797	0.021
$r \leq 2$	0.166	12.333	15.495	0.142
$r \leq 3$	0.031	1.806	3.841	0.179

Note: 1) Trace test indicates 2 cointegrating eqn(s) at the 0.05 level. 2) *denotes rejection of the hypothesis at the 0.05 level. 3) **Mackinnon-Haug-Michelis (1999) p-values.

Table 4: Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
$r = 0^*$	0.360	27.584	25.911	0.041
$r = 1$	0.299	20.623	21.132	0.059
$r = 2$	0.166	10.527	14.265	0.180
$r = 3$	0.031	1.806	3.841	0.179

Note: 1) Max-Eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level. 2) *denotes rejection of the hypothesis at the 0.05 level. 3) **Mackinnon-Haug-Michelis (1999) p-values.

The results of <Table 3> and <Table 4> show that there is a long-run relationship among them. The cointegrating equation gives:

$$\log GDP = 0.064 \log SI + 0.067 \log L - 0.921 \log K$$

$$\dots\dots\dots(0.029)\dots\dots\dots(0.009)\dots\dots\dots(0.029) \tag{9}$$

Where the value in the parenthesis is the standard error.

Equation (9) show the long-run relationship among them. We can find that the input of sport industry has a positive effect on economic growth. Namely, 1% increase in the input of short industry will lead to 0.064% increase in the economic growth. This result matches the methodology in part three. Meanwhile, the labor input has a positive effect on economic growth. That is, 1% increase in the labor input will lead to 0.067% increase in the economic growth. But the impact of labor input on economic growth is relative weak. It means that the structure of labor force is changing from labor intensive to high-tech intensive. Moreover, the capital input has a negative effect on economic growth. That is to say, 1% increase in the capital input will lead to 0.921% decrease in the economic growth. This result also in keeping with China’s real situation. With lots of excess domestic capital, China’s government has started to help other

countries to build infrastructure. In other word, this is also a reason why China carries out the One Belt One Road policy.

4.4. Estimation of Dynamic Ordinary Least Squares

Due to that the four variables used in this paper are the process of $I(1)$, the estimation of dynamic ordinary least squares employs the explained variable (GDP), other three explanatory variables (input of sport industry, labor input and capital input), first difference of explanatory variables and leads and lags of explanatory variable) to perform a regression. The purpose of introducing the difference term is to eliminate the possible simultaneous bias errors in the equation, the autocorrelation and the the non-normal residuals so as to obtain the consistent evaluation of cointegration coefficients.

The first lead and lag terms in this paper are used to conduct an empirical analysis via the estimation of dynamic ordinary least squares.

The model gives:

$$\log GDP_t = C + \alpha \log SI_t + \beta \log L_t + \gamma \log K_t + \sum_{k=1}^{k=1} \Phi_{1i} \Delta \log SI_{t+k} + \sum_{k=-1}^{k=-1} \Phi_{2i} \Delta \log SI_{t+k} + \mu_t \tag{10}$$

Based on equation (10), the estimation of dynamic ordinary least squares will be conducted. The results of dynamic ordinary least squares show in <Table 5>.

Equation (11) indicates the long-run relationship among them. We find that the input of sport industry has a positive effect on economic growth. Meanwhile, the labor input also has a positive effect on economic growth. Conversely, the capital input has a negative effect on economic growth. Moreover, one lead and one lag of input of sport industry has a positive effect on economic growth. This result also matches with the methodology in part three.

Table 5: Estimated Coefficient of Estimation of Dynamic Ordinary Least Squares

Variable	C	log SI_t	log L_t	log K_t	$\Delta \log SI_{t+1}$	$\Delta \log SI_{t-1}$
Coefficien t	0.409 [0.033]	0.011 [0.002]	0.082 [0.007]	-0.893 [0.016]	0.055 [0.005]	0.024 [0.003]

The estimation of dynamic ordinary least squares gives:

$$\log GDP_t = 0.409 + 0.011 \log SI_t + 0.082 \log L_t - 0.893 \log K_t + 0.055 \Delta \log SI_{t+1} + 0.024 \Delta \log SI_{t-1} + \mu_t \tag{11}$$

5. Conclusion

With the sport games prevalent, countries around the world are scrambling for the right to host sport events such as Olympic Games and Asian games. Of course, the success of sport events' holding also brings a lot of benefits to the economic growth of host country such as China who successfully holds the 2008 Beijing Summer Olympics. Consequently, this paper sets China as an example with a quarterly data sample from the first quarter of 2003 to the fourth quarter of 2017 to investigate the impact of sport industry on economic growth. In this paper, the input of sport industry, the labor input and the capital input are regarded as the independent variables, and the economic growth is regarded as a dependent

variable. These variables will be used to perform an empirical analysis under a menu of econometric approaches such as Johansen cointegration test and dynamic ordinary least squares. The findings of this paper indicate that the input of sport industry has a positive effect on economic growth, But its impact on economic growth is relative weak. Simultaneously, the findings of this paper also indicate that the labor input has a positive effect on economic growth. And the capital input has a negative effect on economic growth.

More precisely speaking, the coefficient of impact of the input of sport industry on economic growth is only 0.064 in the Johansen cointegration test's estimation and 0.011 (current period), 0.055 (one lead) and 0.024 (one lag) in the dynamic ordinary least squares' estimation. These values mean that the impact of the input of sport industry on economic growth is not fully realized. Therefore, China's government should increase the input of sport industry so as to enlarge it impact on economic growth. Moreover, the coefficient of the impact of labor input on economic growth is only 0.067 in the Johansen cointegration test's estimation and 0.082 in the dynamic ordinary least squares' estimation. Both of them indicate that the labor input has become weaker. It means that the traditional labor mode is no longer adapted to the current economic development. Therefore, the China's government needs to change the current employment structure (from the labor intensive to high-tech intensive). The coefficient of the impact of capital input on economic growth is -0.921 in the Johansen cointegration test's estimation and -0.893 in the dynamic ordinary least squares' estimation. These values mean that there is a lot of domestic excess capital. The China's government should make some policies such as One Belt One Road to take good use of the domestic excess capital.

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