An empirical study on the relationship between industrial structure and economic growth in Guangdong Province

Jing Feng, Qiaowen Yang*, Yonghong Yao, Yuxin Cheng

Guangzhou Huashang College, Guangzhou 511300, China

*Corresponding author e-mail: yangqiaowen666@163.com

Abstract. According to the viewpoint of structuralism, if the optimization of resource allocation does not hold, this study focuses on considering the impact of economic structural changes on economic growth. There is an inherent relationship between industrial design and economic development, and timely adjustment of industrial systems is the binding force for sustained economic growth. Based on the data from Guangdong Province from 1979 to 2018, this paper uses econometric methods to establish a model for the contribution of industrial structure to economic growth. The research results reveal Guangdong Province's industrial design evolution and the relationship between industrial structure and economic development. Relevant policy recommendations.

Keywords: Industrial structure, economic growth, Guangdong Province.

1. Introduction

In modern economic theory, many economists have conducted in-depth research on the relationship between financial structure and economic growth. Kuznets believes that with the continuous development of the national economy, both the output value structure and the labor force structure will change. It is challenging to understand economic growth without understanding and measuring the changes in the financial system. On the other hand, Chenery believes that a series of changes in the interrelationship of the economic structure is necessary for economic growth. Stowe believes that modern economic growth is essentially changing industrial design. For many years, the rapid growth of China's GDP has always been the focus of worldwide attention. Many scholars have used various methods to conduct rich theoretical and practical research on the relationship between China's economic structure adjustment and economic growth. As an important province and city on the east coast of China, Guangdong Province has achieved rapid economic development since the reform and opening up. This paper aims to explore the relationship between the adjustment of industrial structure and economic growth in Guangdong Province and propose some countermeasures to promote the long-term and stable economic growth of Guangdong Province. This paper hopes to study the relationship between industrial structure change and economic development from an empirical point of view, quantitatively analyze the impact of industrial structure change on economic growth, and theoretically enrich the relationship between industrial structure and economic development.

2. Literature review

Since the reform and opening-up, China's economy has increased and achieved remarkable achievements. China's high-growth economic model does not conform to the conventional economic growth theory. This paper focuses on analyzing the influence of industrial structure on economic growth. The literature views on the relationship between industrial design and economic growth fall into three categories: Some viewpoints are that industrial structure optimization can promote economic growth; some ideas are that industrial structure optimization may not necessarily boost economic growth and may even have the opposite effect; in addition, there are still some viewpoints that industrial structure and economic growth do not Not a one-way linear relationship.

In the literature with China as the research object, many scholars believe that the industrial structure is one of the fundamental driving forces for rapid economic growth. Overseas scholar Sachs

(1994) found that the optimization of China's industrial design is the core driving force of China's rapid economic growth by comparing the development of China, Eastern Europe, and the former Soviet Union. Fan (2003) argues that with China's industrial restructuring, labor mobility between urban and rural areas and between sectors promotes China's economic growth. Domestic scholars Liu Wei and Zhang Hui (2008) and Gan Chunhui and Zheng Ruogu (2009) have proved that: China's industrial structure has a positive effect on economic growth, but this effect, as a reform dividend, is gradually increasing in recent years. Tan Shunfu (2007) believes that economic growth and industrial structure have a common change trend. Li Xiang et al. (2016) concluded through empirical analysis that before 2001, increasing the share of the tertiary industry could promote economic growth, that is, the structural dividend effect, but later, there was a stage of transition from "structural dividend" to "cost disease." Wen Rongguang and Wang Jiangbo's (2020) empirical research based on provincial data believes that the industrial structure can positively promote the economic growth of districts and cities. Sun Wei and Xu Shaojun (2021) combined China's actual data simulation and theoretical model analysis to show that the adjustment and transformation of the industrial structure in each region have contributed to the evolution of the economic gap in each area.

Some scholars believe that China's industrial structure evolution has no apparent positive effect on economic growth. Rodrik (2016) indicated that the early increase in the proportion of the service industry and deindustrialization in developing countries would hurt long-term economic growth. Through their research on China's manufacturing industry, Yuan Fuhua (2012) and Lu Tie (2002) believe that the industrial structure does not significantly affect economic growth. Li Xiaoping and Lu Xianxiang (2007) used the commonly used and extended shift-share method to analyze the impact of structural changes in China's manufacturing industry on labor productivity and total factor productivity growth. They found that structural changes in manufacturing did not significantly promote manufacturing productivity growth. The main reason is that the factors of production have not realized the process of transferring from industries with high productivity growth to sectors with low productivity growth. Through research, Yuan Jiang and Zhang Chengsi (2009) found that China's economic growth and industrial structure differentiation are linked, which indicates a negative correlation between the rationalization of industrial design and economic development. Han Yonghui (2016) stated that China is in a period of structural deceleration. Wang Wen and Huang Huiqun et al. (2017) showed that if there is too much focus on the development of the service industry, it is not conducive to China's economic growth, which will significantly increase the risk of the middle-income trap.

Some scholars believe that industrial structure and economic growth are not one-way linear correlations. Through research, Che Minghao et al. (2019) showed that the advanced industrial structure could promote economic growth, but it does not establish a linear positive and inverse relationship. The core variable between the two is the rationalization of industrial structure. Today, the focus of China should be to promote the rationalization of the industrial structure to promote the advancement of the industrial structure. Using the provincial panel data from 1993 to 2013 as the research sample, Lu Xuefa and Du Chuanzhong used the GMM method to analyze the causal relationship empirically. From the perspective of the whole China region, there is a two-way Granger causality between the adjustment of industrial structure and economic growth in a short period. There is a one-way causal relationship between economic growth and changes in industrial structure in the long run. However, the causal relationship will change if the consideration time is long, and only the one-way causal relationship of economic growth in the direction of industrial structure change exists.

The above literature has formed entirely different views on the relationship between China's industrial structure and economic growth. This paper believes that the following two factors are the main reasons for this result:

The first reason is that the definition standards for industrial structures are different, and the measurement value is high and low. For the measurement of industrial design, the macro-proportion and the degree of internal equilibrium are measured from two aspects: industrial advancement and industrial rationalization. Industrial sophistication is a measurement method commonly used by domestic scholars. The usual measurement method uses the ratio of agricultural and non-agricultural industries. The disadvantage of this method is that it ignores the industrial comparison within the non-agricultural sector and thus lacks proper research on the unreasonable structure of China's current secondary and tertiary industries. Industrial rationalization mainly measures the equilibrium degree of an economy's economic development by studying the degree of matching between the distribution of labor and the output value of various industries. This indicator is rarely used in the relevant literature, so in the existing research, most of them only focus on the macro overview of China's industrial structure and rarely involve the internal equilibrium of each industry. There is a lack of comprehensive and scientific research on measuring China's industrial design in the existing research. This article refers to the methods of Fu Linghui (2010) and Gan Chunhui (2011) to make a corresponding attempt to this problem.

The second reason is that in the research on the relationship between China's industrial structure and economic growth, China's overall macroeconomic data is generally used as a variable. The problem with this method is that there are significant differences in economic growth rate and structure among different regions in China. Ignoring such internal details and studying overall indicators cannot reflect the impact of other regional networks on the economy's overall performance. The research conclusions are highly contingent and cannot form a consistent point of view. For this problem, this paper selects the relevant data of Guangdong Province for empirical analysis, studies the relationship between the industrial structure and economic growth of a single province, and tries to explore the internal institutional factors.

3. Data description

Industrial structure refers to the organization and composition of various industries in the national economy and their proportions and interrelationships in the national economy. This paper's industry division and data are from the "China Economic Statistical Yearbook."Taking the economic growth of Guangdong Province after the reform and opening up as an example, Table 1 shows the data samples from 1979 to 2018. The letter Y represents the economic aggregate index, indicating the gross domestic product (GDP) value. The horizontal axis of the table is: use X_1 to represent the value of the output value of the primary industry, use X_2 to represent the value of the output value of the secondary sector, use X_3 to represent the value of the output value of the tertiary industry, use X_{21} to represent the value of the industrial output value, and use X_{22} to define the output value of the construction industry Use X_{31} to represent the value of the output value of the transportation, storage, and postal industry, and use X_{32} to represent the value of the output value of the wholesale and retail trade and catering industry. As shown in Table 1.

4. Model building

Neoclassical economic theory holds that financial growth results from the long-term combined effects of capital accumulation, labor force growth, and technological progress. Different industrial structures will lead to further economic growth efficiencies for a given capital, labor, and technology. Usually, we will assume that the production function is: Y= (X_1, X_2…, X_K, A). In the formula, Y represents the total output, xi represents the output of the ith (i=1, 2…, k) industry, and A represents the technical level. For the function Y= (X_1, X_2…, XK, A), Therefore, a multiple regression model between the economic aggregate index and various industries is obtained:

$$Y=\beta_0+\beta_1X_1+\beta_2X_2+\beta_KX_K+\beta_{k+1}\,A \tag{1}$$

This paper takes the logarithm of both sides respectively and expresses:

$$Log(Y)=\beta_0+\beta_1\log(X_1)+\beta_2\log(X_2)+\beta_K\log(X_K)+\beta_{k+1}\log(A) \tag{2}$$

Transform the model (2) to obtain the basic model of the impact of various industrial structures on economic growth:

$$Log(Y)=\beta_0+\beta_1Log(X_1)+\beta_2Log(X_2)+\beta_3Log(X_3)+\varepsilon \tag{3}$$

Table 1. GDP of Guangdong Province (100 million yuan)

Year	Y	X_1	X_2	X_3	X_{21}	X_{22}	X_{31}	X_{32}	X_{33}
1979	209.34	66.62	91.65	82.36	9.29	51.06	11.26	23.52	9.92
1980	249.65	82.97	102.53	89.87	12.66	64.14	13.72	29.53	12.66
1981	290.36	94.3	120.34	103.6	16.74	75.71	16.71	33.57	15.88
1982	339.92	118.17	135.37	113.13	22.24	86.39	18.34	38.07	18.61
1983	368.75	121.24	152.27	125.82	26.45	95.24	19.47	41.42	21.32
1984	458.74	145.25	187.55	154.33	33.22	125.93	25.68	54.41	29
1985	577.38	171.87	229.82	185.81	44.01	175.69	35.91	79.86	41.03
1986	667.53	188.37	255.88	208.46	47.42	223.28	40.18	89.78	60.79
1987	846.69	232.14	330.35	273.77	56.58	284.2	53.2	104.17	76.14
1988	1155.37	306.5	460.17	386.35	73.82	388.7	65.22	145.89	107.94
1989	1381.39	351.73	554.13	464.06	90.07	475.53	79.02	136.65	145.79
1990	1559.03	384.59	615.86	523.42	92.45	558.58	101.61	152.9	178.73
1991	1893.3	416	782.67	675.55	107.12	694.63	138.54	185.77	221.39
1992	2293.54	465.83	1100.32	899.28	201.04	881.39	174.28	236.59	266
1993	3225.3	558.7	1704.88	1386.83	318.05	1205.7	233.15	340.49	356.52
1994	4240.56	694.65	2139.89	1763.48	376.41	1406.02	272.27	486.46	479.15
1995	5381.72	864.49	2900.22	2448.82	451.4	2168.34	433.1	647.77	627.45
1996	6519.14	941.73	3269.35	2788.82	480.53	2308.06	497.68	798.55	738.98
1997	7315.51	986.82	3647.82	3158.74	489.08	2680.87	629.34	944.61	859.42
1998	7919.12	1004.92	3991.97	3463.12	528.85	2922.23	688.83	1073.36	963.72
1999	8464.31	1021.3	4264.32	3705.88	558.44	3178.69	745.15	1174.76	1104.22
2000	9662.23	1000.06	4868.75	4295.03	573.72	3793.42	908.45	1371.49	1375.4
2001	12039.25	1004.35	5341.60	4732.409	609.2	4301.752	1073.814	1543.83	1739.13
2002	13502.42	1032.8	5935.63	5288.53	647.1	4801.3	1157.75	1761.27	2113.66
2003	15844.64	1093.51	7307.08	6532.98	774.1	5225.267	1207.675	2009.33	2416.28
2004	18864.62	1245.42	8890.29	8011.15	879.14	5903.75	1351.62	1378.72	1886.95
2005	22557.37	1428.27	11339.93	10482.03	857.9	9598.34	990.53	2222.72	3734.67
2006	26587.76	1577.12	13431.82	12500.22	931.6	11195.53	1113.77	2542.45	4208.55
2007	31777.01	1695.57	15939.1	14910.03	1029.07	13449.73	1254.58	2805.16	4734.11
2008	36796.71	1970.23	18402.64	17254.04	1148.6	15323.59	1387.51	3306.97	5456.42
2009	39482.56	2010.27	19419.7	18091.56	1328.14	18052.59	1595.34	3907.43	6850.14
2010	46013.06	2286.98	23014.53	21462.72	1551.81	20711.55	1825.29	4647.76	7690.94
2011	53210.28	2665.2	26447.38	24649.6	1797.78	24097.7	2090.36	5681.17	8896.45
2012	57067.91	2847.26	27700.97	25810.07	1890.9	26519.69	2367.46	6333.62	9694.37
2013	62474.79	3047.51	29427.49	27426.26	2001.23	29688.97	2604.41	7039.2	10628.64
2014	67809.85	3166.82	31419.75	29144.15	2341.18	33223.28	2740.76	7778.82	12294.21
2015	72812.55	3345.54	32613.54	30259.49	2441.85	36853.47	2928.9	7625.98	13807.71
2016	80854.91	3694.37	35109.66	32650.89	2551.82	42050.88	3209.72	8382.48	16352.25
2017	89705.23	3611.44	38008.06	35291.83	2818.82	48085.73	3580.94	8976.59	19188.52
2018	97277.77	3831.44	40695.15	38432.76	3244.87	52751.18	3977.23	9577.68	19188.52

5. Empirical Research

5.1 Descriptive statistics

From Table 1 and Figure 1, After the 1990s, the economy of Guangdong Province has maintained a relatively rapid growth rate, and the annual GDP growth rate has consistently remained above double digits, especially from 1979 to 2018. The GDP increased from 20.934 billion yuan to 972.7777 billion yuan 100 million yuan, with an average annual growth rate of 17.3%, much higher than the national average. In the mid-1990s, the structure of the primary industry, the secondary sector, and the tertiary industry paid equal attention; by the mid-to-late 1990s, the secondary industry and the tertiary industry showed a trend of rapid development, and the development of the primary industry was stable and continuously shrinking. This change in the industrial structure was formed by a large amount of investment by state-owned enterprises and private enterprises. The difference in industrial design promoted the rapid development of related industries. With the rapid economic development and more and more sufficient funds, investment in various fields will inevitably increase. It is foreseeable that investment will continue to drive the rapid growth of China's economy.

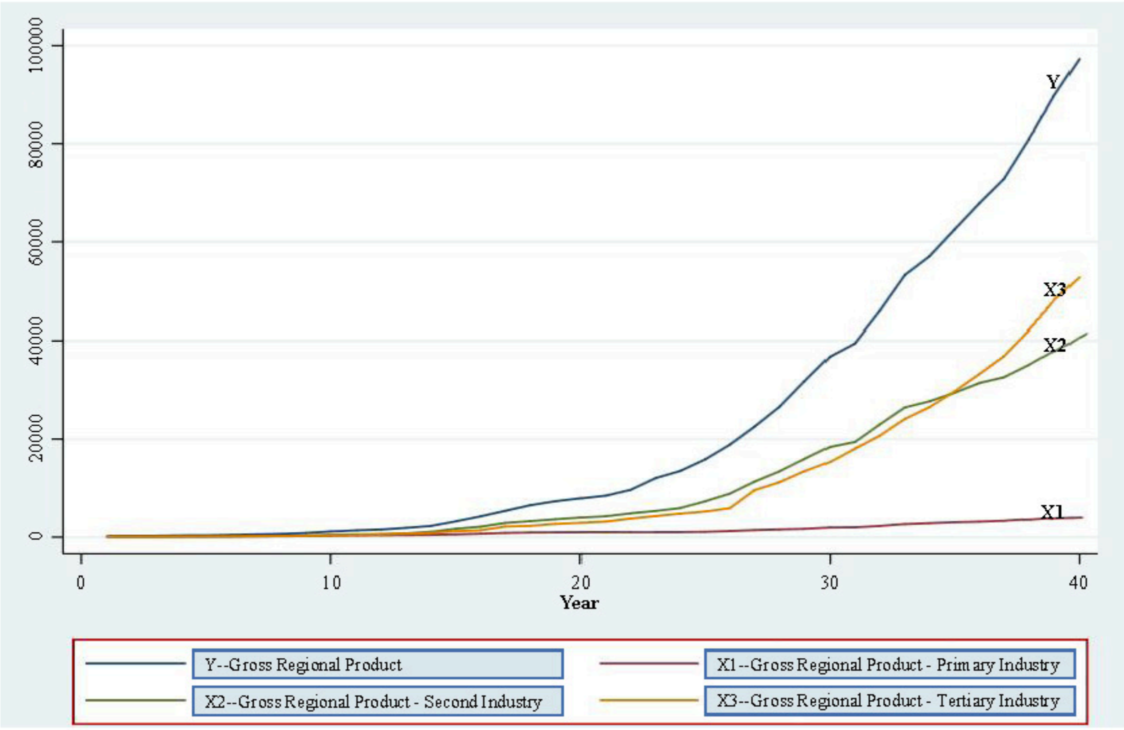

Fig. 1. Industrial output value and economic growth trend chart

As China began to open to the outside world, overseas markets also opened their doors to China, and China's exports increased. After China acceded to the WTO, exports continued to expand at an annual growth rate of over 20 percent. China has surpassed Germany as the world's largest exporter. The rapid growth of exports has created an enormous demand and stimulated the rapid development of China's economy. Consumption is the weakest of the "troika," but its contribution to economic growth cannot be ignored. With the increase in residents' income year by year, the consumer market is also becoming more prosperous. Although the expansion of domestic demand is slower than the economic growth rate, it also grows relatively fast, stimulating economic prosperity. Under the joint action of the "troika," China's economy has risen rapidly.

5.2 Regression analysis

In model (3), the sample observations are the data of Guangdong Province's economic aggregate indicators and the output value of various industries from 1979 to 2018. The STATA15.0 method is used to quantitatively analyze the relationship between the evolution of industrial structure and economic growth in Guangdong Province and the regression values as shown in Table 2.

From the regression results, the determination coefficient R2 of the model is 0.9994, indicating that the model has a high degree of fit and good explanatory significance. The F statistic is 21057.70, which is significant at the 1% level, which indicates that the three the output value of the industry has a significant linear correlation with the GDP.

To further subdivide the contribution of each industry to the GDP, this paper uses X_1, X_{21}, X_{22}, X_{31}, X_{32}, and the output value of other drives in the tertiary sector except X_{31}andX_{32}, X_{33} as independent variables to establish the following regression equation:

$$LOG(Y)=\beta_0+\beta_1*LOG(X_1)+\beta_2*LOG(X_{21})+\beta_3*LOG(X_{22})+\beta_4*LOG(X_{31})+\beta_5*LOG(X_{32})+\beta_6*LOG(X_{33})+\varepsilon$$

From the regression model, Log (X_1), log(X_{22}), log(X_{31}) did not pass the t-test; the reason may be that the contribution of this variable to GDP is not apparent, delete the two sets of values, Log(X_1) and log(X_{22}), and re-regress to get the following results.

Table 2. The empirical results of the relationship between industrial structure and economic growth in Guangdong Province

Variable	Unstandardized coefficients	Sig.
β0	1.72 (11.21)	0.000
Log(X1)	-0.15 (-2.51)	0.017
Log(X2)	0.49 (8.48)	0.000
Log(X3)	0.53 (8.45)	0.005
F value	21057.70	0.000
R2	0.9994	
R2-Adjust	0.9994	

Table 3. The empirical results of the relationship between subdivided industrial structure and economic growth in Guangdong Province

Variable	Unstandardized coefficients	Sig.
β0	1.82 (5.67)	0.000
Log(X1)	0.06 (0.61)	0.548
Log(X21)	0.58 (10.5)	0.000
Log(X22)	-0.07 (-1.05)	0.303
Log(X31)	-0.04 (-0.82)	0.420
Log(X32)	0.12 (1.78)	0.085
Log(X33)	0.28 (4.52)	0.000
F value	9350.03	0.000
R2	0.9994	
R2-Adjust	0.9993	

The regression results show that the model coefficients have passed the statistical test, and the R^2-Adjust is 0.9993, which has high goodness of fit. For every 1% increase in industrial output value, the GDP will increase by 0.57%; transportation, storage, and postal services will increase by 0.57%. For every 1% increase in the output value of the industry, the GDP value will decrease by 0.07%; for every 1% increase in the output value of the wholesale and retail trade and catering industry, the GDP value will increase by 0.12%. The output value of the tertiary industry excludes the two data sets of X_{31} and X_{32}. For every 1% increase in the output value of other sectors, the GDP value will increase by 0.29%. The empirical results show that industrial development has had great significance and a crucial contribution to the development of Guangdong Province in the past 40 years, while the development of the tertiary industry has a relatively small impact on the economic development of the whole of Guangdong Province.

Table 4. Empirical results of the relationship between subdivided industrial structure and economic growth in Guangdong Province

Variable	Unstandardized coefficients	Sig.
β_0	1.98 (19.02)	0.000
$Log(X_{21})$	0.57 (10.63)	0.000
$Log(X_{31})$	-0.07 (-2.20)	0.035
$Log(X_{32})$	0.12 (1.86)	0.071
$Log(X_{33})$	0.29 (5.73)	0.000
F value	14394.94	0.000
R^2	0.9994	
R^2-Adjust	0.9993	

5.3 Contribution of industrial structure to economic growth in Guangdong Province

Figure 2 reflects that industrial industries dominate the economy of Guangdong Province. The secondary industry in Guangdong Province has developed relatively steadily and is the backbone of Guangdong's economic growth. Promote the economic development of Guangdong together with the tertiary industry. The growth gap between the two sectors narrowed, but the growth rate of the tertiary industry was higher than that of the secondary industry. And through statistical analysis, it is found that Guangdong's tertiary industry has developed rapidly since the reform and opening up. From 1979 to 2003, the added value of the tertiary industry increased by 14.1%, which was 0.7 percentage points higher than that of GDP, 8.3 percentage points higher than that of the primary industry, and 1.7 percentage points lower than that of the secondary industry. The proportion of the three sectors in GDP has changed from 29.8:46.6:23.6 to 8:53.6:38.4. The tertiary industry has a prominent role in driving the growth of the national economy. For example, in 2003, it increased economic growth by 3.9 percentage points, and the growth contribution rate was close to 28%.

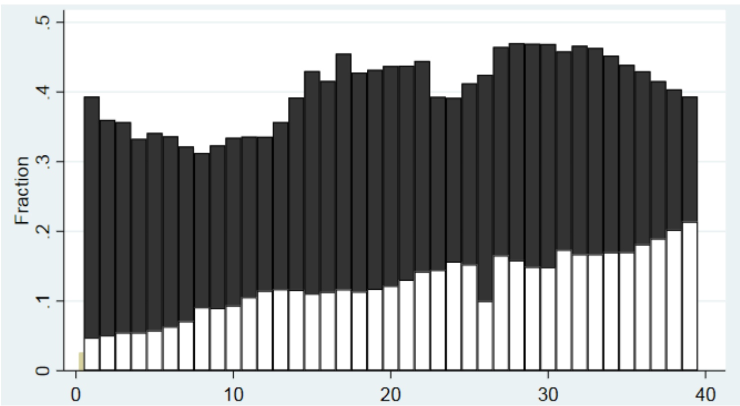

Fig. 2. Z represents the proportion of the tertiary industry excluding wholesale and retail trade and catering industry output value in GDP. X represents the proportion of industrial output value in GDP.

6. Conclusion and suggestion

6.1 Related conclusions

The tertiary industry has low consumption, significant employment, less pollution, and high value. Practices at home and abroad have fully proved that the development of the tertiary sector is an essential indicator for measuring the degree of economic and social development of a country—an inevitable trend. Accelerating the development of the tertiary industry is a crucial goal of Guangdong's industrial and economic development and reform. It is also an inevitable trend of economic transformation under the new situation. Of course, in this new period, the development of the tertiary industry also has unique opportunities and possibilities:

6.1.1 The transfer of the international service industry brings new opportunities for developing Guangdong's tertiary sector

With the further development of economic globalization, large international multinational companies and groups have gradually turned their investment in the tertiary industry to emerging market countries. This specific background has brought Guangdong to undertake the transfer of the international service industry and improve the development level of the tertiary sector. Rare opportunity.

6.1.2 Manufacturing bottlenecks lead to the development of the tertiary industry

After years of development, Guangdong's economy has shown the characteristics of a block. While achieving significant economic benefits, it has also encountered enormous challenges due to the increasing production costs and severe environmental constraints. Due to the characteristics of the tertiary industry, shifting the focus of industrial development to the tertiary sector can significantly alleviate this pressure. The story of the tertiary sector has become an inevitable choice.

6.1.3 The increase in income has led to the rapid expansion of the tertiary industry

With the arrival of the development stage of Guangdong's per capita GDP of 5,000-10,000 US dollars, people's income will increase, and consumer spending will continue to grow. The consumer demand for services will continue to increase, including consumer services and products—in the sex service industry. In short, the increase in income will accelerate the development of the tertiary sector.

6.2 Policy Suggestions

6.2.1 Improve the ability of independent innovation and use high technology as the driving force for industrial upgrading

As the world's second-largest economic power, China's international competitiveness has always depended on low prices and strong production capacity, far from economic power requirements. In the three industries, technology constraints on development are the main reasons for industrial upgrading: China's agricultural production has a low degree of mechanization, low production efficiency, lack of agricultural technology innovation and application, and a large labor force in rural areas; in industrial production, the use of ancient science and technology has led to the emergence of the homogenized output, low value-added products, and production capacity. Industrial production lacks innovation ability and technology application, and the industry's competitiveness is low. The commerce and catering industry is the primary industry of the tertiary industry, and the technical content is low. The modern financial industry supported by high-tech information networks cannot meet the needs of other industries. The modern finance industry cannot meet the needs of different industries. The process of industrialization is essentially the continuous application of high and new technology to economic production. As a productive force, technology has always been a critical factor in promoting the industry from low to high and improving coordination between industries. In the future development, China should vigorously support higher education and research institutions and activate the source of scientific and technological innovation. In the development of agriculture, subsidies encourage the application of advanced technology and agricultural machinery to improve production efficiency and liberate more labor. The technology market is of great significance in future strategic development. Industrial construction should take the high-tech industry as the guide to drive the technological reform of existing backward enterprises. A slender network should support the development of the service industry, and the current finance should also be a priority project. With the help of the circular effect of the financial system, it can provide sufficient financial guarantee for other industries to improve the ability of inter-industry collaboration continuously.

6.2.2 Improve the macro-control system and establish a market-based industrial upgrading mechanism

Before the reform and opening up, China had long implemented a planned economic system that the government highly restricted, and its industrial policy focused on heavy industry. Lord's industrial policy. Under the influence of this policy, although China has achieved specific industrial upgrading results, it has paid the price of reduced industrial rationalization and a lack of inter-industry supporting cooperation mechanisms. After the reform and opening up, The planned economy has gradually given way to the market, and the government's influence on economic development is mainly based on regulation and planning. Under the leadership trend of worship, China is still on the wrong path of one-sided reliance on industry and the lack of reasonable development of the primary and tertiary sectors in its industrial development. From the historical experience of developed and emerging countries, follow economic laws and focus on different periods. The industry with the highest development efficiency can effectively realize the advanced industrial structure. At the same time, it can maintain a harmonious cooperation mechanism between sectors. The rationalization of industrial design can be held at a level that promotes economic growth. In the future development, China should try to change the government's function in economic development, revise the political achievement view of pursuing output value, and establish a long-term and sustainable development concept. The policy is based on preferential support for industries with a higher development value in different periods. We must support science and technology at the core of the backward and weak links in economic development. In financial planning, the government should be guided by the laws of industrial development, abandon the act of taking everything in the development strategy, give play to the role of the market in resource allocation, and gradually return to the part of the night watchman of economic development.

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