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The Influence of Supply-Side Factors on the Upgrading of China's Industrial Structure

Juan Shang[1], Yao Tong[2]

[1, 2]Xidian University, School of Economics and Management, Xi Feng Road, Xinglong Section 266, Xi'an, Shaanxi Province, China

Abstract: ***With the decline of China's demographic dividends, the accumulation of "middle income trap" risk, marking China's economy began to enter a new stage. In the new economic normal, the focus of supply-side structure reform is how to solve the problem of excess capacity in China, low corporate profit margins, correct the mismatch of resources, in order to promote the upgrading of China's industrial structure. Based on the time series data from 1998 to 2015, this paper use unit root test and cointegration test to analyze the relationship between supply-side factors input and industrial structure upgrades, and on this basis, use Granger causality test for further study. The empirical results show that: There is a one-way and positive correlation between the supply-side structure and the upgrading of the industrial structure. Finally, according to the empirical results, put forward some suggestions and recommendations about supply-side structure reform and upgrading industrial structure.***

Keywords: Upgrading industrial structure; supply-side structure reform; element structure configuration; technical progress

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1. Introduction

In 2015, China's economy continues to decline, iron and steel, coal, cement, glass, petroleum, petrochemical, iron ore, nonferrous metals and other major industries have suffered serious losses. The problem of excess production capacity is serious, the process of productivity change is slow, and the profit margin of industry is increasing continuously. The economic structure of our country is faced with the imbalance of supply and demand. On the one hand, China's industries are faced with an embarrassing situation in which the supply of low-end products and services is too much, while the supply of high-end industries and services is insufficient. On the other hand, the traditional industry overcapacity has become China's economic restructuring and the burden of the optimization and upgrading of industrial structure, and the key technology of the competitiveness of some high-tech industries, strategic emerging industry is not strong, most rely on imports. Imbalances supply and demand structure has become a serious obstacle to China's economic growth in the process, Chinese adjustment of industrial structure is consistent with the pattern and the current trend, in order to promote the upgrading of China's industrial structure, industrial structure change is imperative.

2. Literature Review

Foreign scholars have little literature on the impact of factor inputs on industrial structure. Most of the research on industrial structure focuses on the correlation between industrial structure and national economic growth. In seventeenth Century, the British economist William Petty[1]are obtained by research because of the industrial structure of the world is different, leading to its national income differences, and in different stages of economic development. Based on the study of petty, Clark[2]studied that along with the economic development of a country, the labor force will turn to the second industry from the first industry, and then gradually turned to the third industry, elaborated the industrial structure evolution law. American economist Kuznets[3]on the basis of the per capita GDP share, examine the employment structure of a country's national income, reveals the influence on the industrial structure change, further proof of the petty - Clark law. In 1968, the American economist Chanari[4]were investigated in the process of economic development, changes in the structure of manufacturing industry within the industry, the development process and the manufacturing industry is divided into early, middle and late three stages, each stage of the leading industries are different, through the upgrading of the industrial structure can enter the development stage high.

Domestic scholars have carried out in-depth research on factor investment and upgrading of industrial structure. Yu Zipeng, Liu Yong[5]respectively analyzed the input structure of capital and labor force in the three industries, and thought that the change of production factor allocation structure would bring about the change of industrial structure. Yifu Lin[6]thinks that the upgrading of the structure of factor endowment will cause the upgrading of industrial structure. Therefore, when formulating the industrial policy, the country should develop its advantageous industries according to the structure of the factor endowment at that time. Ceng Guoping, Peng Yan[7]use 1979-2013 years of data analysis, put forward that there is a two-way causality between TFP and the adjustment of industrial structure, and total factor productivity can accelerate the adjustment of industrial structure in a short period of time. Yu Binbin[8]through the analysis of different development stages and different city scale industrial structure, raise the total factor productivity can promote China's economic growth will also ease the negative effect of the adjustment of industrial structure on economic growth.

Combing the relevant literature at home and abroad, we find that the research on factor investment to upgrading of industrial structure has been more mature. However, few

literatures have studied the supply side factor inputs that affect economic growth, and there is very little literature about the cause and effect relationship between the two parties, whether it is long-term or short-term fluctuation. Therefore, this paper mainly studies the supply side factors in time and the causal relationship between the industrial structure and the comprehensive score of and put forward to suggestions in the process of configuration elements of the upgrading of industrial structure in China.

3. Empirical Analysis

3.1 Variable selection and data sources

The upgrading of the industrial structure means that China's economic growth mode change from the traditional mode of light industry gradually shift to heavy industry, from low value-added labor-intensive industries to gradually shift to high value-added and technology intensive and capital intensive industries, upgrading of the industrial structure is the inevitable result of transformation of industrial structure from quantitative to qualitative change. From the structure of the national economic structure, the upgrading of industrial structure means that more of the gross national product comes from the third industry, while the proportion of the primary industry and the second industry is gradually decreasing. Therefore, this paper uses the added value of third industries as the proportion of GDP to measure the extent of industrial structure upgrading.

The supply side factors that stimulate economic growth are mainly labor, capital, resources and innovation. We split the natural resources into energy resources inputs and land resources inputs. At the same time, the degree of technological progress can be regarded as the innovation size, Paul Romer that the research and Development Fund input can bring the improvement of technical efficiency, so as to bring technological progress. Therefore, this paper uses research and experiment development funds to describe the extent of technological progress. The method of calculating fixed capital stock is based on perpetual inventory method put forward by Goldsmith. In order to ensure the accessibility of data, the data is selected for 1998-2015 years. Data from the National Bureau of statistics, China Statistical Yearbook, China Energy Statistics Yearbook, Wind database.

Table 1: description of industrial structure upgrading and supply side factor variables

Variables	Indicator name
Industrial structure upgrading rate (Y)	the proportion of third industry added value to GDP (%)
Capital stock (K)	fixed capital stock (100 million yuan)
Natural resources (R)	land resources (R_L): crop sown area + built-up area (km^2) Energy resources (R_E): total energy consumption (10000 tons of standard coal)
Technological progress (A)	R&D (100 million yuan)
Number of labor force (L)	number of economically active people (10000 persons)

3.2 Measurement test and empirical analysis

(1) Principal component analysis

The processing method of the supply side factors data using principal component analysis method, in order to delete the redundant information, and carry out deeper research. The data in order to eliminate the effect of heteroscedasticity, upgrade the industrial structure of 1998-2015 (Y), the rate of fixed capital stock (K), land resources, energy resources (R_T) (R_E), technological progress (A), the amount of labor (L) time series of the number of treatment. Before the principal component analysis is carried out, in order to eliminate the influence of different dimensions between variables, Z-score normalization is needed to deal with the variables matrix. Principal component analysis using SPSS is as follows:

Table 2: tests for KMO and Bartlett

Kaiser-Meyer-Olkin metrics for sampling sufficiency		.737
The sphericity test of Bartlett	approximately chi square	266.350
	Df	10
	Sig.	.000

The KMO statistic describes the partial correlation between variables, the value of at least to be suitable for factor analysis of data on more than 0.6, if less than 0.6, indicating the correlation factor analysis is not strong, the effect is not very good, should reselect variables. The Bartlett sphericity test assumes that the original variables are uncorrelated, and that, obviously, only when the original hypothesis is rejected is the data fit for factor analysis. From the tests of KMO and Bartlett, it can be seen that the KMO value is 0.737, and the Sig value of Bartlett sphericity test is 0, so the sphericity test result is remarkable. That is, the two conditions are satisfied, and the degree of correlation between variables is large, which is suitable for the analysis of principal component.

Table 3: explains the total variance

Component	Initial eigenvalue		
	Total	Variance%	Cumulative%
1	4.935	98.704	98.704
2	.039	.786	99.490
3	.022	.443	99.933
4	.002	.046	99.979
5	.001	.021	100.000

As can be seen from table 3, first factors can explain the total variance degree is 98.704%, the other 4 factors accounted for only 1.296%, that most of the first factors can explain the total variance, namely by SPSS were extracted from a principal component. The score function is shown below:

$$FAC=0.202\ln L+0.2\ln R_E+0.201\ln R_L+0.202\ln A+0.20\ln K \quad (1)$$

From the formula 1, it can be concluded that the influence of each factor input on the aggregate score is a positive influence, so the increase of input can increase the comprehensive score. The aggregate score of the supply side factor is calculated according to the scoring function as shown in the following table:

Table 4: composite scores

Year	1998	1999	2000	2001	2002
FAC	-1.5956	-1.4031	-1.20173	-1.1061	-0.9113
Year	2003	2004	2005	2006	2007
FAC	-0.7223	-0.4669	-0.2190	-0.0265	0.1451
Year	2008	2009	2010	2011	2012
FAC	0.3124	0.50628	0.7331	0.9062	1.0506
Year	2013	2014	2015		
FAC	1.2034	1.3415	1.4539		

(2) ADF test

Figure 1 is a linear graph of the industrial structure upgrading rate and the supply side factor input comprehensive score. As can be seen from the figure, the industrial structure upgrading rate has shown a steady trend and a slight growth trend in the 1998-2015 years. The comprehensive score of supply side factor input showed a trend of continuous growth over time. To avoid spurious regression, ADF tests are needed for two sets of variable sequences.

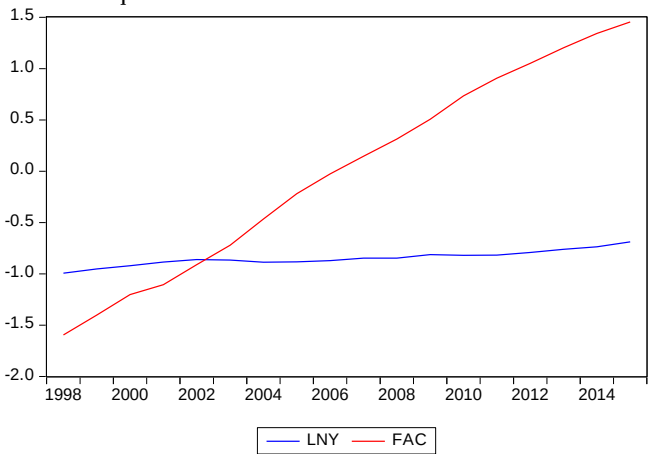

Figure 1: industrial structure upgrading and supply side factor input comprehensive score

As can be seen in Figure 1, the two sets of sequences show an increasing trend, and both contain intercept terms. Therefore, the test forms adopted in this ADF test are (C, N, K). Among them, C represents the time series containing intercept terms; n represents the time series containing the trend term; K represents the optimal lag order, in which the optimal lag order is determined by the AIC criterion.

Table 5: Results of ADF unit root test

variable	(c,n,k)	ADF	5% level	P	conclusion
FAC	(c,n,3)	1.062521	-3.7912	0.999	unstable
LnL	(c,n,0)	-1.407624	-3.7105	0.820	unstable

As can be seen from table 5, the original scores of the industrial structure upgrading rate and the supply side factor input are all unstable sequences, and the cointegration test is needed.

(3) Johansen cointegration test

Because the original sequence of comprehensive score of the upgrading of the industrial structure investment rate and the supply side elements of the two variables are unstable series, we need to examine a linear combination of the two variables is stationary, this paper uses Johansen cointegration test method.. Before the Johansen test is carried out, the lag order is determined. By establishing the VAR model, the optimal lag order is 5 by the AIC and SC criteria. The order of the cointegration test is 1 of the optimal lag order of the model, that is, the order of the cointegration test is 4.

Table 6: Results of cointegration test

Null hypothesis	Eigenvalue	statistic value	5% critical value	Prob.**
None *	0.876416	27.18083	14.26460	0.0003
At most 1	0.010226	0.133620	3.841466	0.7147

It can be seen from table 6, that means that there is no cointegration relationship, the probability of P statistic was calculated under the assumption of the value is 0.0003, can reject the hypothesis, that there is at least a cointegration relationship between the linear combination of the comprehensive score of the upgrading of the industrial structure investment rate and the supply side factors of two variables. The second hypothesis indicates that there is a cointegration relationship, the probability of P statistic under the assumption that the value is 0.7147, can not reject the hypothesis that, do not think that there is a cointegration relationship between the linear combination of the comprehensive score of the upgrading of the industrial structure investment rate and the supply side factors of two variables. Therefore, we can get the co integration equation between the upgrade rate of industrial structure and the input factor of supply side:

$$lnY=0.032394FAC \qquad (2)$$

We can conclude that there is a long-term equilibrium relationship between lnY and FAC, that is, the supply side factor input increases by 0.03%, and the upgrading rate of industrial structure increases by 1%.

(4) Granger causality test

Table 7: Results of Granger causality test under VAR model

Excluded	Chi-sq	Df	Prob.
D(FAC)	7.888689	3	0.0484
All	7.888689	3	0.0484
Dependent variable: D(FAC)			
Excluded	Chi-sq	Df	Prob.
D(LNY)	2.575800	3	0.4617
All	2.575800	3	0.4617

VAR model statistic significant results are given in Table 7, the first P value of 0.0484 is less than 0.05, so in 95% confidence level, we can think that the supply side factor input is the upgrading of the industrial structure Granger reason, and the explanation of industrial structure and supply side factor input lag period can significantly upgrade the rate of. Referring to the positive correlation, we can conclude that the increase of supply side factor can accelerate the upgrading of industrial structure.

Second P = 0.4617 > 0.05, in 95% confidence level, the upgrading of the industrial structure is not the supply side factor input rate of Granger reason, the lag can not explain the supply side factors caused by the change of. This paper argues that the supply side factor is more of a policy variable in China

and has a certain external nature. Secondly, there are many factors affecting the input of the supply side factors, such as reducing financing costs, tax cuts and so on, not limited to the upgrading of industrial structure. Therefore, the impact of industrial structure upgrading on the input of supply side factors is not significant.

4. Conclusions and Recommendations

4.1 Conclusions

In this paper, the supply side factors, including labor, land, energy, technology and capital, which influence economic growth are analyzed by principal component analysis to get a composite score on the supply side factor inputs. Based on the two factor time series of the supply side factors and the industrial structure upgrading rate in 1998-2015 years, the ADF unit root test, the Johansen co integration test and the Grainger causality test were conducted respectively, we put forward the following conclusions: ①The supply side factors into comprehensive score of the supply side factors are positive influence, and each element of the supply side investment impact on the size of the comprehensive score is basically the same, which increase the inputs can make the score increased. ②There is a positive correlation between the supply side factor input and the industrial structure upgrading rate, that is, the increase rate of industrial structure upgrading is 1%, and the input factor of supply side increases by 0.03%. Through vector error correction, it can be concluded that there is a positive correlation between the supply side factor input and the industrial structure upgrading rate. ③Between the upgrading of the industrial structure and between supply side factors, there is a one way Grainger causality. the increase in factor inputs will promote the upgrading of the industrial structure, the upgrading of the industrial structure but will not increase the rate of increase in supply side factors.

4.2 Recommendations

China's current industrial structure upgrading problems mainly in green low-carbon industries, strategic emerging industries, with international competitiveness of industry such as "high additional value", "high tech" industry occupies a small proportion, and the "high energy consumption, high pollution and high emissions" and other value-added low, backward production industry accounted too large proportion. In factor inputs, China's excessive reliance on land, capital, resources and other general factors of production inputs, and innovative elements, such as talent, technology, information, management and other elements of investment is low, resulting in China's excessive consumption of resources, labor intensive and other low-end industries accounted for a larger proportion, industrial upgrading slow structure. Based on the present situation of the industrial structure in China, the following suggestions and countermeasures are put forward in view of the current structural reform of the supply side:

(1) At the technical aspect, we should combine foreign advanced technology and independent research and development, and also should introduce foreign advanced technology selectively. At the same time, we cannot blind development the introduction of technology, take its essence and go to its dregs. We should transform foreign advanced technology into technological innovation that conforms to China's national conditions. Secondly, we should strengthen the capability of independent research and development and increase funding for scientific research. As for strategic emerging industries, we should not only enhance their key core technologies, but also enhance their original scientific and technological innovation capability, Promoting China's economic development with scientific and technological innovation, and promoting the optimization and transformation of industrial structure. Whether introducing foreign advanced technology or independent innovation, there are certain risks, which require government investment, correctly guide venture investment, and promote the development of high-tech industries. For the high added value and high technology industry, we should improve the fiscal support policies, encourage the construction of venture capital and equity investment fund, establish and develop high and new technology industry bases, promote high-tech and high value-added industries and traditional industries combined, gradually reduce the traditional mature industrial agglomeration can bring benefits, accelerate the optimization and upgrading of industrial structure in china.

(2) In the aspect of capital factor input, the human capital structure and material capital structure matching with industrial structure are actively cultivated, which are matched with the industrial structure. As far as the total amount of human capital is concerned, the total amount of human capital in China is the largest except for the United states, however, from the point of view of human capital per capita, China is still in a relatively backward position. The reason is that our country is a big country with population, so the total amount of human capital is relatively high, however, the low per capita human capital shows that China is not a powerful country of human capital. Therefore, the government should increase the investment of human capital, improve the incentive and restraint mechanisms, building covering urban and rural residents and improve the public education system, strengthen human capital investment, the comprehensive construction of a learning society of lifelong learning, lifelong learning, the realization of human capital by the "quantity" to "quality". In terms of material capital, we should improve the universality of material capital accumulation, pay attention to national savings and direct investment, and form a good interaction between capital accumulation and economic growth. Gradually relax the threshold limit of private capital, guide the flow of funds to small and medium-sized enterprises, increase investment in urban infrastructure construction, improve the efficiency of the allocation of funds in the real economy. The focus of investment will be shifted from heavy industry to basic industries, such as energy, transportation and service industries, so as to improve the existing industrial structure.

(3) From the resource level, we should improve the efficiency of the use of resources, save resources, and achieve recycling of resources. First of all, the government should establish a clear land property right system to ensure that the ownership of land property rights is not disputed, and to improve the liquidity of the land market. Strictly control land use and strengthen the effective linkage between land use planning and

industrial planning, Limiting the land size of backward production capacity industries, and providing strategic scale industrial planning land for strategic emerging industries. According to the development cycle of different industries and the characteristics of the production mode, different land supply patterns are explored and different land leasing and land leasing policies are formulated. According to the development cycle of different industries and the characteristics of the production mode, different land supply patterns should be explored and different land leasing and land leasing policies should be formulated. At the same time, vigorously promote the development of water-saving industries, rational use of water resources, the establishment of efficient wastewater treatment plants to achieve recycling of wastewater. Secondly, for enterprises with excess capacity, the government can give certain policy support, and encourage them to use technology innovation to effectively upgrade excess capacity. At the same time, we should also do an orderly elimination of extensive industries, realize the transformation to a low-carbon economy model, and accelerate the upgrading of industrial structure. Finally, the government should vigorously develop a variety of renewable energy sources, accelerate the development of natural gas, wind energy, solar energy and other clean energy, broaden the supply of energy in China, speed up the adjustment of China's energy structure, establish a perfect carbon emissions trading market, improve the rate of return on green investment, and accelerate the development of China's green financial industry, set up corresponding energy saving incentive measures and regulations to upgrade the high energy consuming industries such as chemical industry, steel, cement and electric power.

(4) From the point of view of labor force, the effective allocation between labor resources and industrial structure can be achieved. Gradually transfer the labor force from the low-end industry to the high value-added industries, and arrange the employment structure according to the characteristics of the industrial structure in different regions. For the less developed regions, the government should establish appropriate industrial zones, attract more surplus labor and the re-employment of laid-off workers, and to strengthen the technical training, which has the corresponding work quality. In developed areas, it should gradually transfer the investment focus from the first and the second industry to the third industry, broaden the field of development of the third industry, the establishment of social security system and preferential policies to attract more talents with high quality and high level. According to their own advantages and disadvantages, different regions should adopt corresponding industrial policies to solve the problem of excessive surplus labor force, alleviate employment pressure and speed up the upgrading of industrial structure.

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Author Profile

Juan Shang works as an associate professor in school of Economics and Management, XIDIAN University. Her specialization lies in regional economics

Yao Tong is now pursuing Master degree since 2016 under the guidance of Prof. Yang. Her specialization area is Finance.