Impact of Industrial Hollowing on Regional Economic Growth Rate: An Empirical Analysis based on Shanghai's Data

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Abstract

The relation between industrial hollowing-out and Shanghai's economic growth rate was analyzed by using ordinary least squares and ECM regression model. Data used in the empirical test was a monthly time series data from January 2003 to February 2017. Empirical results show Industrial producer price index, and the total amount of imports has a positive relationship with economic growth rate. However, fixed asset investment, land use cost, and labor resources cost have a negative impact on economic growth rate.

Keywords: Industrial Hollowing-out, Region Economy, Shanghai, ECM Model

Introduction

With the development of the economy and society, industrial transfer is an inevitable phenomenon. It is an inevitable choice for a country or region to realize the optimization and the upgrading of the industrial structure. During the 90s of the last century, a large number of foreign countries' international industries transferred to the Yangtze River Delta area, making the Yangtze River Delta's economy to develop rapidly. However, for more than 10 years since the beginning of the twenty-first Century, the industry of the Yangtze River Delta has been forced to transfer to the central and western regions because of the rising cost of land resources and labor resources. On the one hand, the industrial transfer makes Shanghai, the leading city of the Yangtze River Delta, adjust the regional industrial structure, promote the division of labor and cooperation in the regional industry, and give full play to the comparative advantage resources. On the other hand, if the manufacturing industry in Shanghai is overly oppressed by the external environment, the speed of the outflow would be too fast. Therefore, this will lead to a large gap

in the industrial sector and to an obvious problem of industrial hollowing out. Historically, Japan, the United States, and other developed countries have experienced the crisis of Industrial Hollowing.

For Japan, the most important reason for its hollowing is the large-scale outward FDI. The reason is that the appreciation of the yen has greatly improved the purchasing power of the Japanese yen, and the other direct reason is that the domestic products made by Japanese enterprises have less cost advantages than products abroad. In addition, the rising prices of production factors such as labor and land also forces Japan to invest directly in overseas to avoid huge domestic costs. Such a large-scale foreign direct investment has made Japan suffer from the hollowing of domestic industry.

The crisis of Industrial Hollowing in America has appeared in several stages. The most recent stage is the high-speed expansion period of virtual economy. In the early twenty-first Century, the Internet bubble burst in the United States, resulting in a downturn in the information industry. This directly led to a large influx of funds to the financial and insurance services and the real estate industry, making these industries swollen too quickly. During this period, although the financial industry and the real estate industry can support the development of the US economy in a short time, it will not decline rapidly, but the indicators of its manufacturing industry are gradually deteriorating. The expansion of the virtual economy and the gradual shrinking of the real economy means that the Industrial Hollowing is becoming more and more serious.

At the present stage, the situation in Shanghai is similar to that in the United States and Japan. In recent years, Shanghai has turned out of the manufacturing industry dominated by labor-intensive and resource intensive industries, and gradually upgraded to capital intensive and technology intensive industries. Some production base has moved to other areas, such as the relocation of Baosteel and the relocation of the Unilever production base to Hefei. Therefore, these examples have proved that the manufacturing industry in Shanghai is losing a lot. Secondly, the growth of manufacturing investment in the eastern region, represented by Shanghai, has slowed down. The State Statistics Bureau issued a national investment in urban fixed assets from 06 to 10 years, showing that the growth rate of fixed assets investment in the eastern region has fallen behind the central and western regions in an all-round way. This situation is similar to Japan's massive investment abroad, which has led to a sharp drop in domestic investment.

The financial services industry in Shanghai has developed rapidly this year, and the coordination between the industrial structure and the proportion of the service industry has been unbalanced. Shanghai is likely to face the same problem in Japan that year, that is, the slowdown of economic growth caused by hollowing of the industry. Due to the excessive outflow of the

manufacturing industry, the growth of financial industry is not enough to make up for this gap, which leads to slower economic growth. Actual situation shows that Shanghai's economic growth rate is indeed slow. As a result, it is necessary to study the extent of the effect of hollowing on the economic growth rate. It can reflect the seriousness of the problem of hollowing in Shanghai, and the hollowing stage of Shanghai.

In this paper, the monthly time series data of Shanghai from January 2003 to February 2017 are selected and a series of tests are carried out to avoid the distortion of the pseudo regression and regression results. Then the general least square method and ECM regression model are used, after the elimination of the heteroscedasticity and sequence correlation, to analyze the relationship between the factors of hollowing industry and the growth rate of Shanghai economy. The structure of this paper is as follows: the second part is literature review, the third part is variable selection and empirical analysis, the fourth part is conclusion and suggestion.

Literature Review

The definition of Industrial Hollowing is controversial. Zhimin Jiang (2006) thinks that the Industrial Hollowing is the concentrated expression of the conflict between the efficiency of the allocation of resource globalization and the development of a national industry, and gives a general definition: "Industrial Hollowing refers to the process of the decline of specific industries in a specific area resulting from the comparative disadvantage of production factors." Suhua and Ren Jing (2015) have similar view of industrial hollowing which states that Industrial Hollowing is a rapid decline in the proportion of the real economy represented by the traditional manufacturing industry and at the same time, the proportion of the virtual economy and the real estate industry, represented by the financial and insurance business. This, therefore, is rising rapidly, and the development of the new manufacturing industry in this region cannot make up for the manufacturing industry. The vacancy caused by the outflow leads to the decline of the economy in the region. Different from the above point of view, the interpretation of Industrial Hollowing in the Japanese economic white paper refers to the reduction of domestic production, investment, and employment caused by the increase of overseas direct investment, which essentially refers to the hollowing of the manufacturing industry.

Many scholars have discussed the reasons for the formation of Industrial Hollowing in Japan and the US. The cause of the formation of the Japanese Industrial Hollowing was discussed first. Some scholars believe that the main reason is the increase of foreign direct investment in domestic enterprises. Cowling and Tomlinson (2000) found that the average annual growth rate of Japanese enterprises' foreign direct investment is as high as 22%

by the study of the 1981-1995 years' data of foreign investment in Japan, which is significantly higher than it is in other similar countries. The large scale of foreign direct investment has greatly affected industrial production in Japan, thus leading to the hollowing of its industry. However, some scholars have studied through the method of empirical analysis, and finally found that foreign direct investment does not actually lead to hollowing. Through the analysis of a large number of empirical data, Ramstetter (2002) found that the activities of the overseas branches and the manufacturing export of the Japanese parent companies do not have a reverse relationship, which means that the foreign direct investment will not cause the hollowing of the industry. Cowling (2001), on the basis of a case study of the Japanese machinery sector, found that the high return on investment abroad has weakened the basic position of Japan's manufacturing industry, resulting in a decline in the international competitiveness of Japan and the decline of industry.

The reasons for the formation of Industrial Hollowing in the US are different from those in Japan. Xiao Zuting (2000) believes that the expansion of American foreign trade deficit is the inevitable result of the Industrial Hollowing up with the increasing industrial structure of the United States. Jing Tingting (2008) thought that the shift of the "sunset industry" in the United States after 80s aggravated the decline in labor productivity and the rise in the unemployment rate in the manufacturing industry of the United States, resulting in the hollowing of the manufacturing industry. Since the 90s, the manufacturing industry in the United States has been moving outward, but the United States has stabilized its global share of the manufacturing sector by its control over high-end manufacturing or high-end industries.

As for the measurement indexes of industrial hollowing, many foreign scholars measure it through the changes in the production, investment, employment, and export of the domestic manufacturing industry, and some scholars have studied the measurement indexes based on the impact factors based on the product level. Yang Zihan (2007) based on the revised import data, established the Product Turnover Index, then quantified the upgrading of the product, and judged whether the Industrial Hollowing was occurring by the difference of the data between these two. Domestic scholars choose indicators according to the specific performance and definition of Industrial Hollowing. Shi Liu and Zhang Jie (2013) use six indexes, such as scale hollowing, efficiency hollowing, employment growth rate, employment structure, TFP (total factor productivity), and export structure to measure the Industrial Hollowing. Chu Zhen (2013) selected the 1992-2011 year industry related data in Zhejiang Province, and used the analysis method of the coefficient of variation of industrial structure to analyze the industrial hollowing of manufacturing industries in Zhejiang province. Zhang Minli (2014) divided the industry hollowing into three two-level indicators:

departure, creation, virtualization and economic structure, and evaluated and measured them from these three angles.

Variable Selection and Empirical Analysis
1. Variable Selection

Explained variable is the economy of Shanghai. There are many indicators to measure the regional economy of Shanghai, such as the total GDP, GDP per capita, and the growth rate of industrial output. Considering that the monthly data is selected as the time series as a whole, and the economic index of GDP is based on the quarterly time unit, this paper chooses the growth rate of industrial total output value above the scale to measure regional economic. The growth rate of the industrial output value above Designated Size in Shanghai from January 2003 to February 2017 was found in the statistical yearbook issued by Shanghai Statistical Bureau.

Explanatory variable is the industrial hollowing, and the industrial producer purchase price index was selected as the measurement of industrial hollowing. It refers to the index of the purchase price of raw material, fuel, and power and reflects the relative number of industrial producer's price trend and degree of change. If this index is higher than the producer price index of industrial producers at the same period, the pressure of industrial enterprises is increasing and the profit space is further compressed. The phenomenon of Industrial Hollowing is due to the increase of enterprise management pressure caused by the shrinking of manufacturing industry in the region. As a result, this index is a quantified target for Industrial Hollowing.

Total import, land cost, human cost, and fixed asset investment are other indexes of Shanghai's industrial hollowing. The increase in total imports means the increase in the demand for outside industrial products, which is an indirect manifestation of the outflow of the manufacturing industry and the shrinkage of the industrial scale in Shanghai. Cao (2005) clearly pointed out that a rapid rise of business cost, which mainly refers to the land cost, are interacted with the emergence of industrial hollowing. Industrial hollowing leads to the rapid development of the virtual economy which pushed up the price level and business cost. In turn, the increase of land use cost has forced many industrial enterprises to move outside and accelerate the hollowing process. Averaged salary of virtual economy is very high which indirectly led to the overall wage level of Shanghai and causes the human capital intensive industries in the manufacturing industry to be unable to bear human cost and outflow. Virtual economy needs less fixed asset than manufacturing industry so that the hollowing will lead to the reduction of the investment in the fixed assets of the whole society. In turn, this indicator can also reflect the Industrial Hollowing.

2. Empirical Analysis

Stability of the data was tested first. In addition to the human cost, the ADF test found that the rest of the variables are the first order single sequence, and the human cost is stable under the two order difference, which is in line with the precondition of the further cointegration test. After checking the sequence correlation of the variables, the LM test found that the P value was less than 0.05, and the sequence correlation existed. The partial correlation coefficient intuitively determined that there existed three order sequence correlation and the correlation of the perturbation term sequence in the linear regression model will distort the regression estimation results of the model. In order to eliminate the sequence correlation, AR (1), AR (2), AR (3) are added to the regression equation, and then the Q statistic test shows that the sequence correlation was eliminated. Then, Breusch-Pagan-Godfrey (BPG) heteroscedasticity test found that the P value is less than 0.01, and there is heteroscedasticity. In order to satisfy the basic assumptions of the classical linear regression model, that is, random errors as random variables, all obey the normal distribution with zero mean, which needs to eliminate the heteroscedasticity. In this paper, logarithmic transformation is used to correct heteroscedasticity. After correction, BPG shows that there are no heteroscedasticity. Then the cointegration test was used to determine whether there is a long-term equilibrium relationship between variables. The cointegration test results show that there are cointegration relationships between the six variables.

After determining the long-term equilibrium relationship between the variables involved in this paper, OLS and ECM regression are made for growth rate of industry total output value above the scale respectively. The regression equation is as follows:

$$GROUTPUT = \alpha + \beta_1 PURCHASE + \beta_2 IMPORT + \beta_3 LAND + \beta_4 LABOR + \beta_5 FIXEDASSET + \varepsilon$$

where α is the intercept, β_i (i=1,2,3,4,5) is the coefficient, and ε is a random error term. Regression results are shown in Table 1.

Table 1. Regression Results of OLS Model and ECM Model		
Explanatory Variables	Growth Rate of Industrial Total Output Value Above the Scale	
	OLS Model Coefficient （Standard Error）	ECM Model Coefficient （Standard Error）
Industrial Producer Purchase Price Index	6.1210** (2.2502)	11.7771** (3.0715)
Import	0.5583* (0.4829)	0.4473* (0.4377)
Land Costs	-0.0858 (0.3219)	-0.3727 (0.3220)
Labor Costs	-0.8283* (1.1552)	—
Fixed Asset Investment	-0.0918** (0.3106)	0.1223** (0.2808)

Notes: ***,**, and * are respectively significant at 1%, 5%, and 10% levels. Labor cost is not a single order, which does not meet the requirements of establishing ECM model.

The regression results show that the industrial producer purchase price index is positively correlated with the growth rate of GDP. The greater the price index of the industrial producers, the greater the pressure of the industrial producers, to a great extent, forcing the industrial producers to seek the transformation and upgrade their products and also increase the added value of their own products to gain more profits. Thus, this could help the enterprises cope with the increasing pressure of business. In the long run, the pressure of business will restrict the development of industry, but it will also force the whole industry to become more efficient and competitive, and eventually play a positive role in economic growth.

There is a positive correlation between the total import volume and the growth rate of the industrial total output value above the scale. By importing, a region can profit from its comparative advantage and accelerate economic development. On the other hand, the increase in imports indicates a decrease in the demand for industrial products in the region, which reflects the shrinkage of industry. The results of this regression indicate to some extent that the advantages of comparative advantage are stronger than adverse effect caused by industrial atrophy.

There is a negative correlation between fixed assets investment and economic growth. A large portion of the investment in fixed assets flows out of the region, causing the manufacturing industry to shrink in the region, resulting in the slowdown of economic growth. The cost of land resources is negatively related to the cost of human resources and the economic growth. The increase of these two costs bankrupted many small and medium-sized enterprises, and the relocation of large manufacturing bases will naturally cause economic slowdown.

Conclusion

This paper collects monthly time series data of Shanghai's economy and industry between January 2003 and February 2017. Through the analysis of simple regression model, the relationship between the measurement factors of Industrial Hollowing and the economic growth of Shanghai was studied and the effect of the former on the latter was discussed by using the empirical analysis. The concrete conclusions of this paper are as follows: through the analysis of the time series data model, it was found that several index factors of Shanghai's Industrial Hollowing affect the economic growth of Shanghai, and there was a significant positive correlation between the purchasing price index of industrial producers and the regional economy. The cost of land resources and people are important reasons for the slowdown of regional economic growth in Shanghai.

Considering many scholars study of the industrial hollowing of developed countries, it can be summed up that for some developed countries, the outflow of the manufacturing industry is a normal means to adjust the industrial structure. They use their own advantages in international industrial division and transfer the low-tech manufacturing to foreign countries. It can reduce the waste of resources and time caused by the adjustment of industrial structure for a long time. Therefore, the industrial hollowing of the developed countries is a manifestation of economic globalization, not the essence of the hollow, because the developed countries can still grasp the dominant position of these foreign manufacturing industries, thus gaining more and more profits and a growing advantage. For developing countries, taking Shanghai as an example, a large number of manufacturing bases, which have attracted foreign investment and transferred from developed countries, are only the advantage of using labor costs. Now, when Shanghai is also facing a large number of manufacturing outflows, the disadvantage of manufacturing competitiveness must be solved. New manufacturing industry and high-tech industry should be actively developed to compete with the developed countries. Otherwise, there will be a real serious industrial hollowing and this would finally widen the gap between developing and developed countries.

Shanghai should take a strong manufacturing industry as an important basis for the optimization and stability of the industrial structure. The concrete practice is to actively promote the technological progress of the manufacturing industry and support the modern service industry. Through the continuous improvement of manufacturing technology, the manufacturing sector can gain continuous creativity and strong competitiveness, and compete for more market share of high value-added products to gain higher capital return. It could also assist the manufacturing industry to lead the upgrade of the whole manufacturing system and healthy development of the whole entity economy. Furthermore, supporting facilities of modern manufacturing industry needed

to be refined and reduce the phenomenon of self running of funds in the financial system separated from manufacturing. In addition, the development of modern manufacturing industry cannot only expand the output and scale of the original physical products, but also combine them with financial products.

For manufacturing enterprises, the government should give more preferential loan interest rates to encourage these enterprises to finish transformation and develop new technology. Shanghai has been in the middle and late industrialization of industrialization, the overall level of industrialization and manufacturing has been greatly improved, but it still has a big gap with the advanced manufacturing industry in developed countries, mainly in the aspects of product added value, scientific and technological innovation ability, and low profit rate. The new road of industrialization in Shanghai is the trend of the situation. The concrete practice is to strengthen the ability of creation and cultivate the talents of science and technology, pay attention to environmental protection, low energy consumption and high value added, give full play to the leading role of the government, and improve the position of the manufacturing industry in the national economy.

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