# Optimization of Industrial Structures in Hubei Province: A High-Tech Service Industry View

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***Abstract* — High-tech services, since it has the characteristics of low energy consumption, high output, and high service, it occupies a very important position in the overall services. In this paper we take the perspective of high-tech services, and carry out research on the effects of high-tech services in Hubei industrial structure optimization. We show that in the short term, high technology service industry plays important enough role to promote industrial structure optimization, but they are not the main reason of optimization, while the contribution of high tech service industry output value is significant.**

***Keywords - High-tech services, Industrial Structure, Hubei province***

## I. INTRODUCTION

Throughout the process of optimizing the economic structure of the world, we can find the status of service industry in the national economy gradually increased. In the service industry, high-tech industry since it has the characteristics of low energy consumption, high output; high service occupied the very important position in the overall services. As a central province of Hubei province, the lack of the eastern province of superior geographical location, cultural environment and investment policy, as well as lack of the western provinces' superior resource conditions and national policy support. Therefore, it can only according to their own educational resources and geographical advantages, vigorously developing high technology services, improving the single mode of industrial structure, to achieve the overall industrial structure optimization, striving to become a strategic point of rise of central China.

Since our country in the 1990s, for the first time put forward the concept of high technology service industry, on the high technology service industry since 2006, the domestic scholars researched gradually. But it mostly focused on the category on the high technology industry, evaluation of high technology service industry, and the importance of high technology service industry. And on the industrial upgrading research, it mainly focused on effects of services to manufacturing industrial upgrading.

From the point of view of the research literature abroad, mainly in the following points: (1) Think that manufacturing is the premise and basis for the development of service industry, service industry is a supplement to the manufacturing industry, like Cohen and Zysman(1987), Rowthorn and Ramaswamy(1999), Klodt(2000)，Guerrieri and Meliciani (2003). In Rowthorn and Ramaswamy's opinion, The development of manufacturing industry is the important guarantee of service industry development, Because manufacturing is an important demand of services sector, Left the manufacturing industry, social services without demand. (2) think that service industry ,such as producer services is the premise and foundation of productivity in the manufacturing industry. No well-developed service sector, the manufacturing sector is impossible to form a strong competitive edge. Pappaas and Sheehan(1998), Karaomerlio and Carlsson(1999), Eswaran and Kotwal(2001) point out that, Expansion of services can make the manufacturing sector benefits: Firstly, the expansion of the service sector reduced the cost of middle service in manufacturing sector. Secondly, the expansion of the service sector can be further increased specialization and division of labor, bringing power to raise labor productivity. (3) think that the manufacturing and services relationship is interaction, interdependence, mutual promotion and complementary relationship (Park,1989;Bathla,2003). They believe that the expansion of economies of scale, especially in the manufacturing sector is expanding rapidly generate large demand for services, and also will greatly increase production efficiency in manufacturing industry. And growth in the service sector is largely dependent on intermediate inputs. With economic development, interdependence between manufacturing and services, the degree of mutual promotion will gradually deepen. Mutual integration of services and manufacturing trends, Lundvall and Borras(1998) thought that, In recent years, while expanding economic scale, extensive application of science and technology and the continuous development of the Internet, on the other hand, gathering and convenient international exchanges of human resources, so that contact between services and manufacturing becomes increasingly more closely.

Documents from the domestic point of view, Scholars generally agree that, producer service promoting the role of the manufacturing sector. Guo Chongqing(2004) clearly that "the key of manufacturing development is outside manufacturing", We must further promote the development of China's manufacturing industry through the development of high-tech services. In addition, Chen Shouming, Han Xuebing and Kong Deyang (2007) collected a lot of data about the Shanghai high-tech service industry, they build

econometric empirical model and study the correlation between high-tech services and knowledge-intensive manufacturing, then, it proved they have a tendency to interactive development. Xu Qi (2007) studied the interaction between high-tech services and knowledge-intensive manufacturing industries, he found both in the process of interaction development, it formed a certain value system. Dong Wang Yang, Zhang, Feng Li (2009) thought that the high-tech services can contribute to the development of a national industries' transformation and upgrading, and become a new economic growth point. Li Xia, Chen Ningning (2012) found the industry linkage between advanced manufactory and high-tech services of Fujian Province. Hua Guangmin (2013) comparatively analyzed the efficiency of US high-tech services FDI to manufactory. Shi Yiming (2013) established coupling model to study high-tech services and equipment manufacturing industry, to analyze its operation mechanism.

From the research status at home and abroad, the study on high-tech services were sometimes about service which were the intersection of high-tech services, such as knowledge-intensive services, high-tech services, etc., But studies at home on relationship of high-tech service industry and other industries, especially the influence mechanism between it and the overall industrial structure optimization have no in-depth and systematic.

## II. The Definition and Characteristics of High-Tech Services

High-tech services is the concept proposed in recent years, It is closed to the modern service industry connotation, It is an important part and growth engine of the high-tech industry, It played an important role on promoting the upgrading of industrial structure and enhance industrial competitiveness. On high-tech services, it abbreviated as "HTC" (high technology services) abroad. They thought HTS refers to services with high-tech industry characteristics, by extending the connotation of high-tech manufacturing and the formation of new formats. It includes communications services, computer software, research and development and laboratory testing and related services. High-tech services is a relatively dynamic concept, based on network and information technology and other high-tech as the support, manifested as service, which was an emerging service to provide high technological content and high value-added services for manufacture and consumption. It has the basic characteristics of the service sector, but also has a technology-intensive and high-tech feature, is a product of the modern service industry and high-tech industrial development of mutual integration.

## III. Empirical Analyses

### *A. Data sources and variable description*

This paper based at services classification on GATS and Institute of Science and the National Bureau of Statistics in 2008, it selected information transmission, computer services and software industry as well as scientific research, technical services, intellectual property services, to have a coupled empirical test on high-tech services and industrial structure.

Due to limitations of available data, this paper select 1995 - 2014 a total of 17 years of data, data will be the removal of the traditional services, and the data was from the China statistical Yearbook of the tertiary industry.

Degree of development of high-tech services, we can use a variety of indicators. (1) Scale index. Such as industrial added value of high-tech services(x1); (2) proportion index. Considered that the high-tech service industry is relatively high-tech service industry parts, so we can use proportion of high-tech services in overall service industry to measure the degree of high-tech services' development., Such as the share of high-tech service's output value in service industry(x2); (3) Growth index. That is the growth rate of high-tech services(x3); (4) competitive index. High-tech talent is the basis of innovation and development of high-tech services and competitive, so we can use the number of tertiary and higher education to measure the competitiveness of high-tech services(x4).

In this paper, the index testing optimization and upgrading of industrial structure is as follows:

$$R = \partial_1 \times 1 + \partial_2 \times 2 + \partial_3 \times 3 \qquad (1 \le R \le 3)$$

$\partial_i (i = 1, 2, 3)$ was the proportion of I in overall service industry.

### *B. Variable Description*

In process of data analysis, we made each index logarithmic, data in the following table:

TABLE I

| | Scale(x1)(million) | proportion（X2）（%） | Growth rate(X3)（%） | Number of graduates（X4）（person） |
|---|---|---|---|---|
| 1995 | 387.72 | 52．2675 | 28．4394 | 41675 |
| 1996 | 469.92 | 51．6679 | 21．2009 | 48741 |
| 1997 | 558.08 | 51．898 | 18．7606 | 50420 |
| 1998 | 629.84 | 52．3523 | 12．8584 | 49632 |

| | | | | |
|---|---|---|---|---|
| 1999 | 691.55 | 52．5466 | 09．7977 | 49362 |
| 2000 | 785.18 | 52．6853 | 13．5392 | 51932 |
| 2001 | 894.27 | 53．9871 | 13．8936 | 60443 |
| 2002 | 998.46 | 54．7828 | 11．6508 | 78430 |
| 2003 | 1119.38 | 55．3387 | 12．1107 | 119118 |
| 2004 | 1277.15 | 55．6454 | 14．0944 | 143246 |
| 2005 | 1531.47 | 58．2751 | 19．9131 | 187920 |
| 2006 | 1821.58 | 59．2224 | 18．9432 | 262591 |
| 2007 | 2435.2 | 62．666 | 33．6861 | 276005 |
| 2008 | 2831.52 | 61．7323 | 16．2746 | 351854 |
| 2009 | 3167.45 | 61．7783 | 11．8639 | 328202 |
| 2010 | 3622.97 | 59．8505 | 14．3813 | 331303 |
| 2011 | 4418.13 | 60．9648 | 21．9477 | 362991 |
| 2012 | 5074.08 | 61．8143 | 14．8468 | 353014 |
| 2013 | 6342.83 | 63．5878 | 25．0045 | 361572 |
| 2014 | 7389.82 | 65．1089 | 16．5067 | 390921 |

*C. Empirical Analysis*

*C1. ADF Unit Root Test*

To avoid heteroscedasticity, index used in this paper is to examine the number of variables, the test results shown in the following table:

TABLE Ⅱ

| variable | ADF statistic | 10% critical value | P value | form | stationarity |
|---|---|---|---|---|---|
| $LX_1$ | 1.040196 | -2.655194 | 0.9951 | (t,0，0) | no |
| $D(LX_1)$ | -3.303106 | -2.660551 | 0.0302 | (t,0，0) | yes |
| LX2 | -0.085207 | -2.673459 | 0.9356 | (t,0，0) | no |
| D(LX2) | -3.060915 | -2.673459 | 0.0504 | (t,0，0) | yes |
| LX3 | -3.231276 | -3.831511 | 0.9973 | (t,0，0) | no |
| D(LX3) | -5.467180 | -1.961409 | 0.0000 | (t,0，0) | yes |
| LX4 | 3.662324 | -1.607051 | 0.9996 | (t,0，0) | no |
| D(LX4) | -1.919181 | -1.606610 | 0.0545 | (t,0，0) | yes |
| LR | 2.392606 | -1.607051 | 0.9936 | (t,0，0) | no |
| D(LR) | -2.282598 | -1.606610 | 0.0254 | (t,0，0) | yes |
| conclusion | It is 1-order single whole sequence on the 10% threshold | | | | |

From the test results, At the 10% confidence level, the index LX1,LX2,LX3,LX4 and LR are integrated of order one time series, it referred that they were have co-integration relationship.

*C2. Co-Integration Test*

According to results of ADF unit root test, then we put LR, LX1, LX2, LX3, LX4 into co-integration test. We let e1 indicates the residual between LR and LX1, and then e2, e3 and e4.

TABLE Ⅲ

| variable | ADF statistic | 5% critical value | P value |
|---|---|---|---|
| $e_1$ | -2.426154 | -1.961409 | 0.0185 |
| $e_2$ | -3.811123 | -1.964418 | 0.0008 |
| $e_3$ | -1.807042 | -1.960171 | 0.0681 |
| $e_4$ | -2.287936 | -1.960171 | 0.0249 |

| variable | form | stationarity | |
|---|---|---|---|
| $e_1$ | (0,0,0) | yes | |
| $e_2$ | (0,0,0) | yes | |
| $e_3$ | (0,0,0) | no | |
| $e_4$ | (0,0,0) | yes | |

From the above table of co integration test result we can see that between LR and LX1, LR and LX2, LR and LX4,there are long-term stable equilibrium relationship. And between LR and LX3 there is no long-term stable equilibrium relationship.

*C3. Vector Error Correction Model*

Error correction model (VEC) is a co integration constraints of VAR model, is applied to a co-integration relationship between non-stationary time series modeling, it

is an extension of the error correction model (ECM). The economic meaning of the error correction model is: Although the variables in the short term may deviate from the long-term equilibrium (co integration relationship), but the internal mechanism of the economic system will automatically to short-term fluctuations long-term equilibrium level adjustment. In order to investigate the short-term impact of high-tech services of the indicators of industrial structure optimization of time series of the above variables error correction model. Firstly, we establish the VAR model and determine the lag intervals.

TABLE Ⅳ

| Lag | LogL | LR | FPE |
|---|---|---|---|
| 0 | 73.74583 | NA | 3.21e-09 |
| 1 | 163.6454 | 126.9170 | 5.78e-13 |
| 2 | 188.7983 | 23.67337 | 2.96e-13 |
| 3 | 296.8387 | 50.84254* | 2.53e-17* |
| Lag | AIC | SC | HQ |
| 0 | -8.205392 | -8.009341 | -8.185904 |
| 1 | -16.89945 | -15.91920 | -16.80202 |
| 2 | -17.97627 | -16.21182 | -17.80088 |
| 3 | -28.80456* | -26.25590* | -28.55121* |

From the above results we learn that the optimal lag intervals is 3.

The results are as follows:

LR=0.442315042797*LR(-1)+0.0196859407506*LR(-2)
(0.47409) （0.41433）
+0.220402767166*LR(-3) + 0.0960486401525*LX1(-1)
（0.36808） （0.10270）
+0.104308202996*LX1(-2)-0.00031664232794*LX1(-3)
（0.11924） （0.11312）
+0.201595103596*LX2(-1) + 0.114924800626*LX2(-2) +
(4.440453) (3.44738)
0.417935200239*LX2(-3) -0.0342838468467*LX4(-1)
（2.23642） （0.2435）
+0.0104289909098*LX4(-2) + 0.0426546534445*LX4(-3)
(0.03291) （0.02207）
- 0.187690198706
（8.55204）

By the above equation, coefficients of LX1 (1) and LX1 (2), LX2 (1), LX2 (2), LX2 (3) are significant, and all are positive. It shows that in the short term, high technology service industry scale enough to promote the industrial structure optimization, But the error correction coefficient of LX1 (1) and LX1 (2) are not significantly. which shows the scale of the high technology service industry was not the reason of the industrial structure optimization, while the proportion of high tech service industry output value was significant.

## IV. PULSE RESPONSE ANALYSIS AND CONCLUSION

Combined with the above analysis results, using EVIEWS6.0 software, We have an pulse response analysis on coefficient of industrial structure upgrading in Hubei Province(R) and the share of high-tech service's output value in service industry(x2). The results of the analysis are shown below.

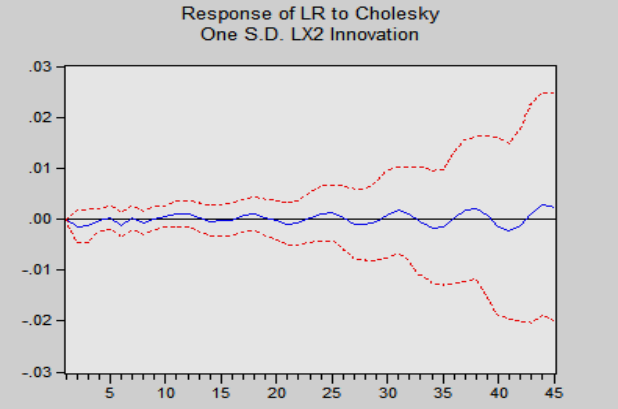


Figure 1. results of pulse response analysis

It can be seen from the results of figure1, When this issue is given a standard deviation of R, The response function curve of X2 is in a steady state, and the response function showed a significant increase from the twenty-fifth stage. This shows that in the short term X2 can promote the optimization of R, In the 25 period, with the increase of X2, it has a certain stimulating effect to the optimization of the industrial structure , And with the delay of time, the effect will be more obvious after the 25 period.

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