Research on the Interaction of China’s Knowledge-Intensive Business Services and Manufacturing Upgrading

Hui FANG¹, Tian ZHAO¹,²,* and Yue-qian ZHANG³

¹College of International Trade and Economics, Shun'geng Campus, Shandong University of Finance and Economics, No.40, Shun'geng Road, Jinan City 250014, Shandong Province, P.R. China.

²Language and Literature Department, Shandong Agriculture and Engineering University, No.866, Nongganyuan Road, Jinan City 250100, Shandong Province, P.R. China.

³Shandong Experimental High School, No 73, Jingqi Road, Jinan City 250001, Shandong Province, P.R. China.

Email: 15805412568@163.com

*Corresponding author

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Abstract: KIBS is a kind of advanced production factor which could increase the added value and the productivity of manufacturing in the global value chain by industry association effect. This paper empirically tests the dynamic relationship between KIBS and manufacturing upgrading by VAR model. The results show that there is a long-term dynamic equilibrium and causal relationship between KIBS and manufacturing. The positive effect of the former on the latter is obvious and long-lasting.

Introduction

Since the reform and opening up, China has made considerable achievements in the manufacturing sector. The MVA (Manufacturing Value Added) in China is only 1.5% of the world in 1980, but the figure in 2010 is about 20%, the highest in the world. Due to lower labor cost, opening up and investment policy, the manufacturing industry of our country is developing at a high speed in an unprecedented situation. However, the model of China’s manufacturing industry is underdeveloped. From the perspective of international division of labor, China is confined in the lower links of GVC (Global Value Chain) As mentioned in the 13th Five-Year Plan, high input, high consumption and high emissions of extensive development is still the main mode of China's manufacturing industry. "Big but not strong", made China's manufacturing industry facing a dilemma, and it's high time for us carried on the transformation and upgrading manufacturing.

The global industry structure is showing a trend of transformation from “industrial economy” to “service economy” since the 1980s. The proportion of service industry is expanding in the national economy year by year, service industry accounts for nearly 50% of the GDP in recent years. The added value of KIBS (Knowledge-Intensive Business Services) has increased from 2010.24 billion yuan in 2004 to 11035.49 billion yuan in 2014. The proportion of KIBS within the service industry has increased from less than 30% by the early 2000s to nearly 40% nowadays, which shows that KIBS is playing an increasingly important role in the national economy and within the tertiary industry.

Literature Review

In the study of the interaction between services and manufacturing, service is often regarded as intermediate input of manufacturing. Krugman (1979) pointed out that imports of intermediate goods contain more advanced technology, which could replace domestic inputs and generate higher economic efficiency through technology spillover effect [1]. Broda, Greenfield and Weristein (2006)
studied the effect on TFP by imported intermediate products and named it as “horizontal effect” [2]. Grossman and Helpman (1993) studied the effect on input quality from new types of intermediates and named it as “vertical effects” [3].

In the empirical research, services have a significantly positive effect on manufacturing. The input-output analysis method is commonly used. Se-Hark Park (1989) analyzed the effect of services on manufacturing on the basis of input-output table [4]. Other research subjects include several European countries (Antonelli, 1998) [5], Japan and America (Carolina Casraldi, 1998) [6], Hong Kong (Yam et al., 2010) [7] and Spain (Mas-verdú, 2011) [8].

There has been a qualitative improvement on the research of KIBS from 1990s. The results show that the relationship between KIBS and manufacturing is very close. Ciriaci (2015) considered that strengthen the ties between KIBS and manufacturing can help enterprises to create new achievements, have more patents of higher quality [9]. Miozzo and Grimshaw (2006) pointed out KIBS has a strong ability of innovation and radiation in itself [10]. Knowledge spillovers may increase the production capacity of manufacturing technology. By studying the spatial spillover effects of manufacturing and services companies when they make location choices, Tur (2012) found that high-tech manufacturing enterprises are more affected by spatial spillover effects of services, compared to low-tech manufacturing enterprises [11].

Some scholars hold the opposite view that KIBS has less impact on the manufacturing industry. Guerrieri (2005) found that KIBS has a significant effect on the technology-intensive manufacturing and little effect on labor-intensive ones [12]. Macpherson (2008) confirmed the above views by studying high knowledge and technology intensive services such as finance, communications, commerce, etc [13].

Currently, most foreign studies are from the perspective of industrial economics, with the background of industry association and input-output analysis as the main research method. Domestic studies are primarily theory analysis, empirical tests are limited. Most of the existing researches results are static, research on the specific effects of KIBS and manufacturing interaction is lacking of further discussion.

**Mechanism and Model**

Global value chain means to connect raw materials, products, sales, service and so on globally in order to realize the value of a commodity or service. From the GVC perspective, the competitiveness of the value chain determines the strength of the enterprises and the industry. In the case of production specialization and the deepening of intra-industry specialization, high knowledge-intensive services have a profound impact on the added value and competitiveness of the products. The move-up of manufacturing value chain mainly refers to the transformation from the low-end production process in the middle to the high-end on both sides. Lower end of the production process includes traditional manufacturing, assembly, etc. Higher end production links include design and development, logistics, transportation, brand marketing, etc. Manufacturing enterprises in our country participate in the international division mainly with low added value production, which lies in the low end of the value chain with low marginal rate of profit.

With the increased input of intermediate services in the manufacturing process, KIBS can promote the upgrading of manufacturing from two aspects—internal and external.

In the first place, from the perspective of endogenous factors, the promoting effect of KIBS to manufacturing is reflected in technology (both soft-technology and hard-technology) and human capital (both labor and knowledge).

In the second place, from the perspective of exogenous factors, the promoting effect of KIBS to manufacturing is reflected in FDI and international trade, which have technology spillover and trade creation effects to host country. Furthermore, government policy is also an important factor. Policy which is conductive to the development of services and manufacturing sectors plays a key role in the promotion of industrial upgrading in the long run.

In the third place, internal and external factors are also influencing each other. Customers, peers, universities and governments are all significant roles in the upgrading process. Customer demand
promotes the improvement of service quality. New technology and new development concept can be learned in the communication with the peers. Universities and research institutions undertake the important task of knowledge dissemination. Technological innovation and human capital accumulation in the process are the key influencing factors of manufacturing upgrading. Government and public policy organizations’ guiding role is also factor that cannot be ignored.

To sum up, under the action of endogenous and exogenous factors collectively, KIBS enterprises provide intermediate service input to the further production of the manufacturing enterprises. In that way, productivity increases, economies of scale effect is realized, the value of manufacturing industry can be increased rapidly, the pace of industrial upgrading is accelerated.

Empirical Analysis

Research Idea and Data Description

The research idea of this paper is to study whether there is a dynamic relationship between KIBS and manufacturing upgrading on the basis of analyzing their interactive mechanism through a VAR model, and to explore the reasons behind it. Manufacturing upgrading includes many things, but it will eventually be reflected in the manufacturing added value, profit, tax per capita and so on. Because indicators of profits and taxes are susceptible to the tax system, distribution system, method of depreciation and other factors, we choose MVA(manufacturing value added) to measure the results of manufacturing upgrading, KIBS to measure the development of knowledge-intensive business services sector. To logarithmic the existing time-series data will not change their character and relationship, it can eliminate the influence of different variance, making the data more smoothly. So we logarithmic the time-series data of MVA and KIBS, and record them as lnMVA and lnKIBS. The data we use is mainly derived from China Statistical Yearbook, China industrial economy statistical yearbook, China Statistics Yearbook on High Technology Industry (1992-2013).

Empirical Test. As there is no widely accepted economic theory about KIBS and manufacturing upgrading, and some variables are endogenous, it is necessary to further examine the dynamic relationship between them, although we have converted the relevant variables with 1992 as base year in order to eliminate the influence of time and price and other factors.

Stationary Test. Table 1 shows that both lnMVA and lnKIBS contain a unit root, they are non-reposeful time series, but their first difference reject the null hypothesis at 5% significance level, so we accept the conclusion there is no unit root. That is to say, lnMVA and lnKIBS are all I(1) variables, their linear combination is stable. Therefore, there may be cointegrating relationships present among them in the system. This is explored in the next section.

<table>
<thead>
<tr>
<th>Variable</th>
<th>ADF Value</th>
<th>5% Level Critical Value</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>lnMVA</td>
<td>-3.05</td>
<td>-3.88</td>
<td>unstable</td>
</tr>
<tr>
<td>lnKIBS</td>
<td>1.29</td>
<td>-3.05</td>
<td>unstable</td>
</tr>
<tr>
<td>ΔlnMVA</td>
<td>-3.92</td>
<td>-3.65</td>
<td>stable</td>
</tr>
<tr>
<td>ΔlnKIBS</td>
<td>-2.85</td>
<td>-2.67</td>
<td>stable</td>
</tr>
</tbody>
</table>

Cointegration Test. AIC and SC criterion all tend to set up a lag model of order 1, the cointegration test of lnMVA and lnKIBS in table 2 show that there is at least one cointegration function, the variables have stable equilibrium relationship in the long-run which ensured there won’t be “spurious regression” to the time series.

<table>
<thead>
<tr>
<th>H0</th>
<th>characteristic value</th>
<th>5% Level Critical Value</th>
<th>5% Level Critical Value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>None *</td>
<td>0.613202</td>
<td>15.49471</td>
<td>15.49471</td>
<td>0.0455</td>
</tr>
<tr>
<td>At most 1</td>
<td>0.034840</td>
<td>3.841466</td>
<td>3.841466</td>
<td>0.4513</td>
</tr>
</tbody>
</table>
**VAR Model.** We have got the parameter estimation of the VAR model with one-period lag, the dynamic feedback mechanism between the two variables can be presented with the following VAR model:

\[
\begin{bmatrix}
\ln\text{MV}\n
\ln\text{KIBS}
\end{bmatrix}_t =
\begin{bmatrix}
0.14 & 1.37 & -0.41
-0.30 & 0.40 & 0.60
\end{bmatrix}
\begin{bmatrix}
\ln\text{MV}\n
\ln\text{KIBS}
\end{bmatrix}_{t-1} +
\begin{bmatrix}
\xi_0
\xi_1
\end{bmatrix}
\]

(1)

Among them, the coefficient of determination reached 0.98. The reciprocal of the module of all roots are within the unit circle, demonstrating that the VAR model is stable, further analysis can be carried out.

**Granger Causality Test.** Table 3 shows that lnKIBS and lnMV A are cause and effect of each other, at least at a 5% significance level. That is to say, the development of KIBS is sure to cause the upgrading of the manufacturing industry, while the manufacturing upgrading will lead to the further development of KIBS. The relationship between the two is mutual promotion and coordinated development.

<table>
<thead>
<tr>
<th>Null hypothesis</th>
<th>No. of Observations</th>
<th>F-value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LN KIBS does not Granger Cause LNMVA</td>
<td>21</td>
<td>5.56948</td>
<td>0.0333</td>
</tr>
<tr>
<td>LNMVA does not Granger Cause LNKIBS</td>
<td>21</td>
<td>13.6943</td>
<td>0.0024</td>
</tr>
</tbody>
</table>

**Impulse response.** Figure 1 presents the estimates of the response of the KIBS and manufacturing respectively with a solid line, and the dashed lines are the corresponding two-thirds confidence intervals. A shock to KIBS in the first period will bring a rapid response to the manufacturing. The response will fall to a bottom after a slow rise in the 5th period. The influence gradually tends to be stable after that and will be zero after 23 periods. It indicates that the impact between KIBS and manufacturing is significant and long lasting.

![Figure 1. Generalized Impulse Responses of MVA to KIBS.](image)

**Conclusions**

To sum up, due to the above theoretical analysis and quantitative test, we can come to the conclusion that there does exist long-term equilibrium of the dynamic relationship between KIBS and manufacturing upgrading in China, the former has a significant impact on the latter and will continue to have a positive impact on the latter in a long time.
Acknowledgements

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References


