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An Analysis to Value-Added Export of China from the Perspective of Global Value Chain

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Abstract. In the global value chain, traditional export statistical method is hard to measure the real trade benefit. Using value-added export to calculate real export benefit, we find China has large scale in value-added export. But the concentration rate is so high, that is not conducive to disperse export risk. Industrial sector contributes far more than service sector.

Keywords: China; value-added export; global value chain.

1. Introduction

In the process of economic globalization, the production is characterized as fragmentation. A new pattern of international division of labor characterized by global value chains is strengthening. The production procedure is dispersed to different countries in the range of design, raw material purchase, parts manufacturing, processing and assembly, and sale. The value and profit are obtained by different firms from different countries. Traditional trade accounting method has problem of double accounting and overvalue, that is hard to measure the real trade benefit of a nation.

We can use indicator of "value-added export" to calculate export benefit. It reflects domestically added value from export, which contains direct value, and indirect value generated from relative industries. Traditional export statistical method does not filter away the repeated calculation [1].

Recently, it is popular to do empirical research with value-added export. There are two kinds of research. First, vertical specialization index method is used early, which is proposed by Hummels in 2001 [2]. Hummels used input and output data to make analysis to the imports volume involved in exports, and intermediate goods from direct export. Lawrence J. Lau (2007) use vertical specialization index and non-competitive input-output data to measure domestically added value from export [3]. However, the method has obvious flaws that do not refer to the added value arising from re-exports of third countries.

Using World Input-Output Database (WIOD) to do empirical research is becoming more and more popular. For example, Koopman (2012) apply Single-Region Input-Output (SRIO) model to analyze. But the method cannot reflect the economic relationship between countries. So, it is suitable to make analysis with Multi-Region Input-Output (MRIO) model. For example, Shuijun Peng (2015) use WIOD, MRIO and Structural Decomposition Analysis to calculate carbon emissions of consumption and production of China [4]. Ming Ge (2015) also apply it to analyze the volume of value-added export and import, and the determinants [5]. Yunfeng Yan (2016) also apply it to analyze trade competitiveness of APEC economies [6]. The paper mainly refers to the empirical research of Shuijun Peng and Ming Ge to make analysis.

2. Summary to Data and Model

The paper selects WIOD (2016 new release) as analytic sample from 2010-2014. The data cover 28 economies including China. According to International Standard Industrial Classification (ISIC 4.0 Rev), each country has 56 economic departments. Horizontally, WIOD give final demand of each country which is composed of final consumption expenditure by household, final consumption expenditure by non-profit organizations, final consumption expenditure by government, gross fixed capital formation, and changes in inventories and valuables. When calculating the direct consumption coefficient matrix of intermediate products, the elements in row vector of total input must not be zero.

For the data integrity, it is necessary to combine department according to the principle of ISIC 4.0 and ISIC 3.0. The outcome of combination is that amount of economic departments are compressed to 11.

As shown in MRIO, n (n=28) denotes the amount of country, and m(m=11) denotes the amount of departments of each country. X_{ij} denotes the output column vector of country i due to final demand of country j. X_{ii} denotes domestic output column vector due to domestic final demand. A_w is the direct consumption coefficients matrix of global intermediate goods, that represent the global production system. A_{ij} denotes the direct consumption coefficients matrix of country j and country i, which is also understood the input structure from country i to country j. A_{ii} denotes the domestic input structure of intermediate goods. Y_{ij} denotes the final demand column vector of country j and country i, which is also understood the final goods of country i exported to country j. So, the global production system can be modeled as:

$$\begin{bmatrix} X_{11} & X_{12} & \cdots & X_{1n} \\ X_{21} & X_{22} & \cdots & X_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ X_{n1} & X_{n2} & \cdots & X_{nn} \end{bmatrix} = \begin{bmatrix} A_{11} & A_{12} & \cdots & A_{1n} \\ A_{21} & A_{22} & \cdots & A_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ A_{n1} & A_{n2} & \cdots & A_{nn} \end{bmatrix} \begin{bmatrix} X_{11} & X_{12} & \cdots & X_{1n} \\ X_{21} & X_{22} & \cdots & X_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ X_{n1} & X_{n2} & \cdots & X_{nn} \end{bmatrix} + \begin{bmatrix} y_{11} & y_{12} & \cdots & y_{1n} \\ y_{21} & y_{22} & \cdots & y_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ y_{n1} & y_{n2} & \cdots & y_{nn} \end{bmatrix} \tag{1}$$

The equation can be further obtained:

$$X=(I-A_w)^{-1}Y=L_wY \tag{2}$$

L_w denotes the world Leontief inverse matrix. If we want to calculate the contribution of different countries to our nation's value-added export, we can use x_{is} denote output column vector due to the final demand of country s. It could be demonstrated the equation:

$$X_{is}=L_wY_{is}(i\neq s) \tag{3}$$

When analyzing the economic sector sources of value-added exports, we will use v represent the added value row vector of each country.

$$v=(v_1,v_2,\ldots,v_m) \tag{4}$$

Suppose that China is country 1. So, row vector of added value rate of China is v_1.

$$v_1=(v_1,0,\ldots,0) \tag{5}$$

It means added value rate of China only and none of other countries. So, the added value that country s create in China is V_{is}.

$$V_{is}=V_{is}L_wY_{is}(i\neq s) \tag{6}$$

For the same reason, when analyzing the sectorial distribution of our country's value-added exports, we only need to retain the added value rate in sector j of China, and all the other country's sector zero. We use row vector V_{1j} to represent.

$$V_{1j}=(\underbrace{0\cdots,\ v_{1j},\cdots,0}_{China}\ \underbrace{0,\cdots,0,\cdots 0}_{country(2)}\cdots\underbrace{0,\cdots,0,\cdots 0}_{country(m)}) \tag{7}$$

3. Regional Sources of Value-Added Exports in China

As shown in Table 1, value-added exports in China fluctuated during 2011-2014, and reached the peak in 2011 to 275382.3 million dollars. From then on it declined to 241952.8 million dollars in

2014. It declined by 12.14%. It means that value-added exports are easily affected by global demand fluctuation.

Switzerland, Japan, USA, Korea also contributed more to our country's value-added exports. China has signed bilateral free trade agreements with Switzerland. The economy between China and Switzerland has greater complementarity. So, Switzerland accounted for 1/5 of total added-value exports. Japan and Korea are important trade partners with China. The three countries have formed a long-term division of labor pattern. The technology distance with Japan and Korea is gradually decreasing. It has contributed a lot to China's value-added exports. From a regional perspective, Asia-Pacific accounts for the highest proportion (34.1%). East Asia is following (25.0%). The contribution of emerging economies mainly composed of BRIMTI (Brazil, Russia, India, Mexico, Turkey, Indonesia.) is 9.9%. EU has taken up 10.8%.

Table 1. Regional Sources of Value-added exports in China

	2011		2012		2013		2014	
	million dollars	%	million dollars	%	million dollars	%	million dollars	%
Switzerland	60687.7	22.0	55509.0	21.0	68665.9	25.5	59876.3	24.8
Japan	41826.8	15.2	37321.2	14.1	33607.9	12.5	32741.7	13.5
Korea	12759.6	4.6	10071.7	3.8	9316.4	3.5	8745.5	3.6
TaiWan	7118.8	2.6	7383.9	2.8	6997.6	2.6	4644.1	1.9
USA	21552.9	7.8	20452.0	7.7	19994.0	7.4	18295.9	7.6
EU	29672.9	10.8	25329.6	9.6	25375.9	9.4	21491.4	8.9
East Asia	68816.9	25.0	61494.4	23.2	56107.7	20.8	51665.9	21.4
Asia-Pacific	93872.7	34.1	84979.6	32.1	79100.0	29.4	72655.8	30.0
BRIMTI	27385.8	9.9	29481.6	11.1	25612.6	9.5	19423.5	8.0
Total	275382.3		265003.0		269424.9		241952.8	

Table 2. Economic Sector Sources of Value-added exports in China

Economic Sector	2011		2012		2013		2014	
	million dollars	%	million dollars	%	million dollars	%	million dollars	%
Agroforestry	14542.1	5.3	14888.7	5.6	14476.7	5.4	12560.3	5.2
Mining and Quarrying	101137.7	36.7	85661.5	32.3	94374.7	35.0	78208.1	32.3
Manufacturing industry	37443.7	13.6	35824.1	13.5	34831.4	12.9	31460.6	13.0
Electricity/Gas/Steam/Air conditioning supply/Water supply/Waste disposal	5573.7	2.0	6088.5	2.3	6236.5	2.3	5250.0	2.2
Construction	5736.3	2.1	5372.2	2.0	5538.7	2.1	5698.6	2.4
Retail/Wolesale/Vehicle repair	20757.5	7.5	21796.3	8.2	21153.0	7.9	19906.6	8.2
Transportation/Storage/Post	16996.6	6.2	18311.9	6.9	17722.8	6.6	17351.7	7.2
Accommodation/Catering	4839.2	1.8	5294.6	2.0	5133.3	1.9	5217.3	2.2
Publishing/Communication/Information	7062.9	2.6	7258.1	2.7	6943.8	2.6	6497.6	2.7
Finance/Real estate/Business services	37781.7	13.7	39209.2	14.8	39169.3	14.5	37175.1	15.4
Other service industries	23510.9	8.5	25297.9	9.6	23844.9	8.9	22627.0	9.4

4. Economic Sector Sources of Value-Added Exports in China

As shown in Table 2,manufacturing sector contributed highly in added value to 13.6%. Mining and quarrying contributed most to 36.7%. This reflects that China still has an advantage in the supply of raw materials. In addition,financial,real estate and business services contributed to 13.7%. This also reflects the acceleration of the opening up process of our country's service sector. The competitiveness of financial,consulting and other service sectors are also rising accordingly. China has gained more export benefits.

5. Conclusion and Enlightment

First,China has a large scale of value-added exports,which reflects that our nation's position in the international division of labor has improved. This is due to technological progress and the advance of productivity. China will get more trade benefit in the future.

Second,The concentration ratio to value-added exports of our country is high. It is more dependent on Asia-Pacific countries and East Asia. This may not be conducive to disperse the risk of country's value-added exports in the long run. With the implementation of the one belt and one road initiative,there will be a decline for a certain degree in export market concentration ratio.

Third,The main source of value-added exports is from industrial sector. The proportion from service sector is low. It requires us to strengthen value-added exports in manufacturing sector,meanwhile increase the added value export of service sector.

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