Print ISSN: 2288-4637 / Online ISSN 2288-4645 doi:10.13106/jafeb.2020.vol7.no6.157

Analysis of Bilateral Input-Output Trading between Vietnam and China*

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Received: April 09, 2020 Revised: April 17, 2020 Accepted: May 01, 2020

Abstract

This study attempts to analyze trade flows between Vietnam and China in order to understand the mutual influence of bilateral trade relations. China is a country with the world's leading economic potential. China and Vietnam are neighboring countries sharing a border of 1,281 km. Trade relations between the two countries are a necessity and, with a right policy, are beneficial to both. Vietnam has a trade deficit with China. This situation is exacerbated by the continuing rise in the gap. Vietnam trade deficit from China was USD12.5 billion in 2010, increasing to USD24 billion in 2018. Data are extracted from the 2015 national input-output tables of Vietnam and China as well as Vietnam Household Living Standard Survey statistics. The research identified 36 sectors of bilateral input-output trade between Vietnam and China. A bilateral output-input model is applied to analyze how final demand and use of input in the production of this country induces output and value added of the other country. The results show that China benefits more from Vietnam's production and consumption than Vietnam does. Vietnam's inter-sector structure does not stimulate domestic production due to the absence of supporting products as inputs in the production process.

Keywords : Bilateral Trade, China, Input and Output Model, Vietnam

JEL Classification Code: P33, P45, R15

1. Introduction

China is a country with the world's leading economic potential. China and Vietnam are two neighboring countries sharing a border of 1,281 km. Trade relations between the two countries are a necessity, and if there is a right policy, it is beneficial for the development of both Vietnam and China in their trade relationship. Vietnam has always a trade balance deficit with China. This situation is exacerbated by the fact that Vietnam trade deficit with China increases – from USD12.5 billion in 2010 to USD24 billion in 2018, and during the first nine months of 2019, the trade deficit was already USD24 billion (Figure 1).

This study attempts to analyze trade flows between Vietnam and China in order to examine the mutual influence in bilateral trade relations. The study uses a bilateral outputinput model to analyze how final demand and use of input in the production of this country induce output and value added of other country.

National input-output table in the most basic way of understanding output and value added, sees imports induced by inter-industry relations and final demand. The intercountry input-output system aims to measure the fluctuation in production and final demand of one country in respect of production and income of another country. Production effects on a State include:

Multiplier effects; it includes direct and indirect effects on output induced by domestic final demand.

International feedback effects: there are output requirements of country A induced by production of country B that used products of country A for intermediate input.

^{*}We would like to thank Mr. Bui Can, Ms. Vy Phan for their supports on this res* Acknowledgement: We would like to thank Mr. Bui Can, Ms. Vy Phan for their supports on this research.

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Source: General Statistics Office (2019) Figure 1: Export, import and net export of Vietnam from China (billion)

Spillover effects: the import demand of country A for the products of country B. This means domestic final demand is not only induced by it own outputs, but also induced by outputs of other countries.

In general, the output and value added of one nation can be created by the final use of another country. According to Noguera (2012), the value added purchased abroad was called VAX-C. Los & Timmer (2018) proposed measuring the added value of country A when exporting to country B for production needs called VAX-P. Gross value added in bilateral trade flows (VAX-D) was mentioned by Los et al. (2016). Other studies were related to commercial flows such as Bems et al. (2011, 2013), Bui et al. (2008), Nguyen & Lam (2017), Muchdie & Sugema (2017), Oosterhaven & Stelder (2007), Muchdie & Narmaditya (2019), He & Wang (2019), and Tran & Nguyen (2018).

This study examines the output and the value added of a nation created by the ultimate domestic final demand and the production requirements of another country. This spread is understood when country A uses country B products for final demand that will eventually lead to country B's production stimulation. Due to national manufacturing process, country B uses country A's products as an intermediary cost, resulting in a backward stimulus to country A's output; country B uses country A's products for final needs and as soon as country B uses its own domestic production, it will lead to a change in country B's own production. When country B uses products of country A as input costs, it will spread to country A's output (see Figure 2).

The inter-country input-output table has the same structure as the inter-regional input-output table, while the

inter-regional input-output table in one country describes intra-trade flows with other regions, the inter-country inputoutput table describes foreign trade flows between one country and another. The Leontief input-output system has been developed into an inter-regional (or inter-country) input-output model by Isard (1951); the idea of interregional input-output model was developed by Richardson (1972) and Miyazawa (1976). The inter-regional inputoutput model not only describes inter-sectorial relations, but also describes inter-regional relations through trade flows between one region and another (outside). The inter-regional model was perfected by Chenery-Moses (also known as the Chenery-Moses model). Recent contributions come from Miller-Blair (1985), Hewings & Jensen (1986), Ihara (1999), and Bui (2017).

A study comparing the economic structure between Vietnam and China was also investigated by Bui and Pham (2014). However, this study only compares the economic structure between the two countries and does not expand the analysis of reciprocal effects of trade flows between the two countries. Previously, the inter-national input-output model of Vietnam and Thailand was also studied by Kwangmoon et al. (2011) and presented at a workshop of the International Input-Output Association (IIOA).

2. Data Collection

The national input-output tables of Vietnam and China in 2015 were used for compiling data within bilateral inputoutput framework. The 2015 national input-output table of China was issued by the National Bureau of Statistics of



Note: (1) Multiplier effects; (2) Spillover effects; (3) inter_national feedback effects **Figure 2:** Relationship in bilateral input – output model

China. The last input-output table of Vietnam dates from 2012. The Vietnam development research institute compiled the country's national input-output table in 2015. The approach for compiling these data are based on Vietnam's national input-output of 2012 and vectors of intermediate input and gross output from firm survey and data from Vietnam Household Living Standard Survey (VHLSS) as well as data on gross capital formation, export and import of goods and services collected from Vietnam's General Statistics Office. The RAS method was, then, employed for balancing gross input and gross output of input-output table (Lahr and de Mesnard, 2004; Miller & Blair, 2009; Bui & Nguyen, 2013, Bui et al., 2018).

There are 36 sectors of bilateral input-output between Vietnam and China, presented in Appendix 1. The general framework of bilateral input-output system between Vietnam and China is described in Table 1:

The unit of bilateral input-output table between Vietnam and China is in USD million. The exchange rate was the 2015 average rate: 1 USD = 6.3597 YUAN; 1 USD = 21,673 VND.

3. Research Methodology

The basic relationship of Leontief is as follows:

$$X = (I - A)^{-1}.Y$$
 (1)

Where: X is a vector of output, I is an identity matrix, A is a direct input coefficient matrix, Y is a matrix of final demand.

In bilateral input-output system, the matrix A includes sub-matrices as follows:

$$\mathbf{A} = \begin{bmatrix} A_{VV} & A_{VC} \\ A_{CV} & A_{CC} \end{bmatrix}$$
(2)

Where:

Avv is a coefficient matrix of intermediate input of Vietnam using Vietnam's products;

Avc is a coefficient matrix of intermediate input of China using Vietnam's products;

Acv is a coefficient matrix of intermediate input of Vietnam using China's products;

Acc is a coefficient matrix of intermediate input of China using China's products;

Gross output vector (X) was divided gross output vector of Vietnam (Xv) and China (Xc)

$$\mathbf{X} = \begin{bmatrix} X_{\nu} \\ X_{C} \end{bmatrix}$$
(3)

Final demand matrix is expressed:

$$\mathbf{Y} = \begin{bmatrix} \mathbf{Y}_{VV} & \mathbf{Y}_{VC} \\ \mathbf{Y}_{CV} & \mathbf{Y}_{CC} \end{bmatrix}$$
(4)

		Intermedia	ate input	Final d	Gross output	
		Vietnam	China	Vietnam	China	
Intermediate consumption	Vietnam	Xvv	Xvc	Yvv	Yvc	Xv
	China	Xcv	Хсс	Ycv	Ycc	Хс
Rest of the world (ROW)		MPv	MPc	MYv	MYc	
Value added		VAv	VA _c			
Gross input		Xv	Xc			

Where:

Xvv: Intermediate input of Vietnam used Vietnam's products;

Xvc: Intermediate input of China used Vietnam's products;

Xcv: Intermediate input of Vietnam used China's products;

Xcc: Intermediate input of China used China's products;

Yvv: Final demand of Vietnam used themselves products;

Yvc: Final demand of China used Vietnam's products;

Ycv: Products of China for final demand of Vietnam;

Ycc: Final demand of Vietnam used themselves' products;

MPv: Import from rest of the world (ROW) for intermediate input of Vietnam;

MPc: Import from rest of the world (ROW) for intermediate input of China;

MYv: Import from rest of the world (ROW) for final demand of Vietnam;

MYc: Import from rest of the world (ROW) for final demand of China;

VAv, VAc, Xv và Xc are vectors of value added and gross output of Vietnam and China corresponding.

Where:

Yvv being the last demand matrix of Vietnam using domestic products;

Yvc is the last demand matrix of China using Vietnamese products;

Yev is the last demand matrix of Vietnam using Chinese products;

Ycc is China's last demand matrix using domestic products.

Put:

$$\mathbf{B} = (\mathbf{I} - \mathbf{A}) - 1 = \begin{bmatrix} B_{vv} & B_{vc} \\ B_{cv} & B_{cc} \end{bmatrix}$$
(5)

Leontief basic relationship has the form:

$$\mathbf{X} = \mathbf{B} \cdot \mathbf{Y} \tag{6}$$

Bij is sub-matrix of Leontief inverse matrix that shows one unit of change in the production of a certain sector can lead to a combination of both direct and indirect changes in other industrial sectors.

$$\mathbf{X} = \begin{bmatrix} X_{\nu} \\ X_{c} \end{bmatrix} = \begin{bmatrix} B_{\nu\nu}.Y_{\nu\nu} + B_{\nu c}.Y_{c\nu} & B_{\nu c}.Y_{cc} + B_{\nu\nu}.Y_{\nu c} \\ B_{c\nu}.Y_{\nu\nu} + B_{cc}.Y\nuc & B_{cc}Y_{cc} + B_{c\nu}.Y_{\nu c} \end{bmatrix}$$
(7)

From the relationship (7), it can be seen that the production value of Vietnam and China is spread by:

$$Xv = Bvv.Yvv + Bvc.Ycv + BvcYcc + BvvYvc$$
(8)

$$Xc = Bcv.Yvv + Bcc.Ycv + Bcc.Ycc + Bcv.Yvc$$
(9)

The above relation shows that the production value of a country is created by (i) the final domestic demand; (ii) production needs of another country. This spread is understood when country A consumes country B's products for a demand that will eventually lead to country B's production stimulation. In the national production process, country B using national products creates a mediated stimulation leading to reversing the nation's output A; (iii) country B uses country A products for its final needs; and (iv) as soon as country B uses its own domestic production, it will lead to a change in country B's own production. Where country B uses products of country A as input costs, it will spread to country A's output.

The matrix offspring should be interpreted as a measure of the value of production caused by the influence of one unit of final demand and production of water for other countries.

Multiplier effects:

Measures the change in production caused by a unit of final domestic demand:

$$(I - Avv)-1, (I - Acc)-1.$$

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International Feedback effects:

Measure change in production from one country to another country:

Bvv - (I - Avv) - 1 or Bcc - (I - Acc) - 1

Spillover effects:

Measure the demand for a country's output when there is a change in the final demand of another country: Bcv and Bvc.

The added value of each country is measured:

$$(VR, VS) = (vr, vs).X = (vr, vs).$$
$$\begin{bmatrix} X_{vv} & X_{vc} \\ X_{cv} & X_{cc} \end{bmatrix}$$

With:

Xvv = Bvv. Yvv + Bvc. Ycv(10)

Xvc = BvcYcc + BvvYvc Xvv + Xvc = Xv(11)

Xcv = Bcv. Yvv + Bcc. Ycv(12)

$$Xcc = Bcc.Ycc + Bcv.Yvc$$

$$Xc = Xcv + Xcc$$
(13)

At that time the added value of each nation was measured:

Vv = Vv.Xvv + Vv.Xvc(14)

$$Vc = Vc.Xcc + Vc. Xcv$$
(15)

Table 2: Comparisor	through some	general indicators	(times)	
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Relations (14) and (15) allow analysis of bilateral trade flows spread to the added value of each country.

4. Results and Discussion

Comparison of economic indicators between Vietnam and China on board I/O 2015 of two countries (Table 2) showed that when China produces USD1 million in output, it generates USD32,000 in value added, whereas when Vietnam produced USD1 million in output, it only generates USD29,000 in value added. This ratio shows Vietnam's production in China is not effective or is an economy deeply outsourcing China.

Rate input products are imported intermediate costs of Vietnam that are far greater than the proportion of China (0.29 versus 0.08). It shows that China produces a lot of supporting products that participates in intermediate costs in the production process, while Vietnam, in addition to input products, produces services, electricity and water that participate to intermediate costs. They are still very few supporting products involved in intermediate costs in the manufacturing process. This shows that the spread from the final demand to the supply side of Vietnam is lower than the spread to imports.

Table 2 also shows that the trade relations between the two countries in production are also very clear and quite large. In the intermediate costs of Vietnam, 8% of inputs are imported from China, while in the intermediate cost of China only 0.1% uses input products imported from Vietnam. This partly shows that the relative importance of imported products from China to Vietnamese production is much larger than the opposite. This dependence is worth paying attention.

Items	Vietnam	China
Intermediary costs/production value	0.710	0.673
Value added/production value	0.290	0.327
Import ratio in intermediate costs	0.289	0.076
The rate of use of each other's products in intermediate costs	0.084	0.00
Elasticity's of labor	0.77	0.69
Elasticity's of capital	0.23	0.31
Percentage of final consumption by households/GVA	0.560	0.360
Final consumption of Government/GVA	0.060	0.140
Final consumption/GVA	0.620	0.500
Investment/GVA	0.220	0.440
Net export/GVA	0.010	0.020

The coefficient of elasticity between labor and capital of two countries through inter-sectorial balance sheets showed that Vietnam needs a higher amount of capital than China to create new growth, But the paradox is that the ratio of investment to gross value added (GVA) of Vietnam is much lower than China (22% compared to 44%), however, the growth is still high, not much less than China's average growth period 2010-2015. Vietnam's average growth rate is about 6.1% while the average growth of China during this period is estimated at 7%. This can only explain Vietnam's total factor productivity (TFP) is higher than China. Does this seem a paradox? So, which factors affect total factor productivity (TFP)? Does this suggest that Vietnam's growth is based heavily on the FDI sector?

The factor of the final demand shows that the final consumption of households in Vietnam accounted for a proportion of gross value added (GVA) higher than that of China by 20 percentage points (56% compared to 36%); Government's final consumption expenditure of China is higher than Vietnam by eight percentage points (14% and 6%). However, China's final consumption in gross added value (GVA) is still quite low compared to Vietnam (50% compared to 62%), while the share of net exports in Vietnam's GVA is even higher than China. Thus, in order to achieve China's growth based largely on investment, China's investment in GVA is very high at around 44% of GVA, while Vietnam's ratio is only 22% of GVA. This situation, if taking place for a long time, can lead to a vulnerable economy if the revenue from ownership is in trouble, and savings are always smaller than investment.

The calculation of scenarios when there is trade vulnerability between the two countries (see Table 3) shows that Vietnam is much more affected than China. In Table 3, the assumptions are made as regards how the sudden reduction of trade with China under the current conditions will affect economic growth in the worst case, GVA/GDP of Vietnam may decrease by 5.9%.

This shows that Vietnam has deepened its dependence on trade relations with China for many years. Up to this point, the idea of "escaping from China" seems to be unrealistic. Thus, the trade deficit between Vietnam and China is basically due to the fact that Vietnam has hardly changed in many years; production has always depended on imports as input costs, inputs are products, and Vietnam is the basis for electricity, water, packaging and service costs only.

In general, the influence from the final demand of Chinese's gross output is higher than Vietnam. Especially, the final demand of Vietnam-induced output of China is higher in final demand than China-induces production of Vietnam. An increase of USD1 million in Vietnam's final demand generates USD318,000 of Chinese output, while an increase of USD1 million in China's final demand generates only USD3,000 worth of Vietnamese production (see Table 4).

Table 5 shows that the value added of each country is induced by the final demand and production other countries. Specifically as:

(i) China's final demand induced China's value added 48% higher than Vietnam's final demand to Vietnam's value added 48%;

(ii) Vietnam's production induces China's value added 115 times higher than China's production induces Vietnam's value added.

The economic structure of Vietnam is a problem worth thinking about as the country's GDP growth is a virtual achievement that is very misleading. The study shows that GDP growth only benefits other countries, not only with

Items	GDP Vietnam	GDP China
Imports for manufacturing from China decreased by 10%	-0.59	-0.006
Imports for manufacturing from China decreased by 20%	-1.19	-0.012
Imports for manufacturing from China decreased by 50%	-2.97	-0.029
Cut off trade relations	-5.94	-0.058

Table 3: Trade effects on GDP of Vietnam and China

Table 4: Dividing effects from final demand on output of two countries (times)

	Vietnam	China
Output requirement – (Backward linkage)	2.337	2.651
In which:		
+ Multiplier effects	2.019	2.648
+ International feedback effects	0.0004	0.0005
+ Spillover effects	0.318	0.003

Table 5: The value added of each country induced by the final demand and production other countries (tim	nes)
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	Value added			
	Vietnam	China		
Multiplier effects on value added	0.585	0.865		
Inter - national feedback effects on value added	0.001	0.104		
Total value added	0.586	0.969		

Source: Authors calculated from bilateral input - output table, 2015

Table 6: Demand factors finally spread to production value (%)

		Vietnan		China				
	Final consumption	Gross capital formation	Export	Average of final demand	Final consumption	Gross capital formation	Export	Average of final demand
Vietnam	84	81	86	85	0.2	0.11	0.06	0.1
China	16	19	14	15	99.8	99.89	99.94	99.9
Gross output	100	100	100	100	100	100	100	100

Chinese partners, but also with almost all countries having trade relations with Vietnam because Vietnam does not have enough supporting products, Even Vietnamese production uses very little of the input which is domestically produced except electricity, water and service costs.

Appendix 2 shows the breakdown of the total effect of how much the increase in the final demand unit of a region spreads to the input of each country. How much the final demand of country A stimulates internal output of that country (Multiplier effects)? How much is due to country B's production stimulating the output of country A (International feedback effects)? And how much of the country A's final demand stimulated the national output of county B? In this section, there are 36 sectors, which show the influence on output of industries due to the impact of the final demand.

Vietnam's domestic sectors stimulated (benefiting) from Chinese manufacturing include: Textile (sector 4), Textile clothing, shoes and hats, leather and its products (sector 5), Printing paper and paper products (Sector 7), Transport equipment (13), Communications equipment, computers and other electronic devices (14), Specialized machinery and equipment (18), Other manufactured products (19), Information transfer, software and information technology services (27). The final demand for some Vietnamese products spread very strongly to Chinese production such as Textile (sector 4), Textile clothing, shoes and hats, leather and its products (sector 5), Printing of paper and paper products (7), Petroleum, coking products and products of processing nuclear fuel (9), Metal products (12), Transport equipment (13), Equipment communication equipment, computers and other electronic devices (14), Repair of metal products, machinery and equipment (15), Instrumentation (16), Specialized machinery and equipment (17), Other manufactured products (18), Construction (23), Transport, warehousing and postal services (25). Although some sectors entertain mutual stimulation, the weight of the spillover from Chinese manufacturing to Vietnam's output is too low compared to the needs of Vietnam finally spreading to the output of China. Strangely, the final demand of waste materials spread so highly to the output of this product group, what does this mean? Is Vietnam stimulating import of waste from partner countries? Many people think that Vietnam is a dump area for another country.

Vietnam's production stimulates China's output much more than Chinese production stimulates Vietnam's output (0.0004 compared to 0.001-88%) (Appendix 3). In addition, Vietnam's final demand induces China's output in a bigger way than China's final demand induces Vietnam's output. Vietnam's final aggregate demand increased by USD1 million, stimulating China's output to increase by USD323,000, while China's final aggregate demand increased by USD million, stimulating Vietnam's production of only about USD3,000. In the inter-regional or inter-country input-output model, a country's products are divided for domestic final needs (final consumption, asset accumulation and exports to countries other than foreign countries partners) and the final demand of the partner country.

Table 6 illustrates that 85% of Vietnam's gross output was generated by domestic final demand and 15% was generated by the partner country's final demand, meanwhile 99% of

The production value is spread by	Vietnam (%) China (%)		Vietnam (mill USD)	China (million USD)	
Total domestic final demand	100.0	100.0	667,204	42,923,927	
Vietnam	92.0	0.3	614,152	111,329	
China	8.0	99.7	53,052	42,812,598	
Final consumption	100.0	100.0	272,991	14,212,621	
Vietnam	89.5	0.3	244,380	46,749	
China	10.5	99.7	28,611	14,165,872	
Accumulation	100.0	100.0	99,470	16,156,925	
Vietnam	82.5	0.1	82,041	19,323	
China	17.5	99.9	17,429	16,137,602	
Export	100.0	100.0	294,743	12,554,380	
Vietnam	97.6	0.4	287,731	45,257	
China	2.4	99.6	7,011	12,509,124	

Table 7: Production value is spread by the final demand and its components

Chinese output was created through domestic final demand of only 0.1% due to Vietnam's final demand. This suggests that the perception that Chinese tourists do not spend much in Vietnam is not objective.

However, due to the size of the Chinese economy, even 0.3% of the total production value that is spread by the final demand of Vietnam is about USD111 billion, while Vietnam's production value is spread by China's final demand of 8% of the total production value, but only about USD53 billion of the USD 667 billion output of Vietnam is the elements of final demand (see Table 7).

The value added of Vietnam and China generated by the factors of final demand and production of other countries are very different (Appendix 4). The total value of China's value added generated by an additional unit of final demand and Vietnam's production is about 54% higher than what Vietnam received from these factors (0.943 versus 0.612). It is noteworthy that Vietnam's production spread to the value added of China is nearly 100 times higher than the production China induces In Vietnam's value added. Especially, a manufacturing group such as Textile (Sector 4), Textile apparel, shoes and hats, leather and articles thereof (Sector 5), Petroleum, coke products and products of processing nuclear fuel (Sector 8), Metal products (Sector 11), Electrical machinery (Sector 12), Transport equipment (Sector 13), Communications equipment, computers and other electronic devices (Sector 14), Machinery and specialized equipment (Sector 17), Other manufacturing products (Sector 18) and information technology transfer, software and IT services (Sector 27). This fact shows that Vietnam's production is highly priced and the input is mostly made in China. This can only be blamed on more than 20 years of industrialization, but

almost no production of auxiliary products. This also partly proves that the more labor is involved in the manufacturing and manufacturing group, the more the trade deficit between Vietnam and China widens.

In short, trade relation is not only a question of trade deficit, but is also closely related to the structure of the economy. The inter-country input-output table shows that China benefits more from Vietnam's production and consumption than vice versa. Vietnam's inter-sector structure does not stimulate domestic production due to the absence of supporting products as inputs in the production process. With such a structure, if Vietnam were not dependent on Chinese inputs, it would be dependent on other countries. Thus, looking only at the GDP growth figures and not at the structure of the economy can lead to a turbulent future.

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Appendix	1:	Sectors	in	bilateral	input	output	table
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No.	Name of sectors
1	Agriculture, forestry, animal husbandry and fishery products and services
2	Extractive
3	Food and tobacco
4	Textile
5	Textile clothing, shoes and hats, leather and products thereof
6	Wood processing products and furniture
7	Print paper and sports culture and education
8	Petroleum, coking products and products processing nuclear fuel
9	Chemical products
10	Non-metallic mineral products
11	Metal products
12	Electric machinery
13	Transport equipment
14	Communications equipment, computers and other electronic devices
15	Repairing metal products, machinery and equipment
16	Instrumentation
17	Machinery, specialized equipment
18	Other manufactured products
19	Producing and supplying electricity
20	Producing and supplying gas
21	Producing and supplying water
22	Waste scrap
23	Construction
24	Wholesale and retail
25	Transportation, warehousing and postal services
26	Accommodation & Dining
27	Information transfer, software and information technology services
28	Finance
29	Real estate
30	Leasing and business services
31	Scientific research and technical services
32	Other services
33	Education
34	Health and social work
35	Culture, sports and entertainment
36	Public administration, social security and social organization

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		Vietnam									
			In which					In Which			
No.	Sectors	Output requirements	Multiplier effects	Interregional feedback effects	Spillover Effects	Average of Output requirements	Average of Multiplier effects	Average of Interregional feedback effects	Average of Spillover Effects		
1	Agriculture, forestry, animal husbandry and fishery products and services	2.298	2.116	0.0002	0.182	1.0396	1.2460	0.5261	0.6249		
2	Mining	1.939	1.665	0.0002	0.273	0.8773	0.9808	0.5666	0.9398		
3	Food and tobacco	2.852	2.687	0.0002	0.166	1.2905	1.5821	0.4891	0.5696		
4	Textile	2.689	1.906	0.0021	0.781	1.2166	1.1223	5.3640	2.6871		
5	Textile clothing, shoes and hats, leather and products thereof	2.499	1.851	0.0017	0.646	1.1306	1.0902	4.4650	2.2220		
6	Wood processing products and furniture	2.838	2.634	0.0003	0.203	1.2840	1.5513	0.7068	0.6992		
7	Print paper and sports culture and education	2.797	2.501	0.0004	0.296	1.2655	1.4727	1.0819	1.0179		
8	Petroleum, coking products and products processing nuclear fuel	2.542	2.140	0.0003	0.402	1.1500	1.2600	0.8323	1.3821		
9	Chemical products	2.324	2.066	0.0003	0.258	1.0514	1.2164	0.6685	0.8876		
10	Non-metallic mineral products	2.337	2.105	0.0002	0.232	1.0572	1.2395	0.5523	0.7970		
11	Metal products	2.416	1.902	0.0003	0.514	1.0932	1.1201	0.8890	1.7676		
12	Electric machinery	2.373	1.938	0.0003	0.434	1.0735	1.1414	0.8201	1.4939		
13	Transport equipment	2.652	2.150	0.0005	0.501	1.1997	1.2662	1.1658	1.7237		
14	Communications equipment, computers and other electronic devices	2.613	1.501	0.0019	1.111	1.1825	0.8839	4.8819	3.8205		
15	Repairing metal products, machinery and equipment	2.236	1.835	0.0004	0.400	1.0116	1.0809	0.9167	1.3761		
16	Instrumentation	2.063	1.710	0.0004	0.352	0.9333	1.0073	0.9805	1.2109		
17	Machinery, specialized equipment	2.036	1.556	0.0004	0.480	0.9214	0.9162	1.1450	1.6516		

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		Vietnam									
				In which				In Which			
No.	Sectors	Output requirements	Multiplier effects	Interregional feedback effects	Spillover Effects	Average of Output requirements	Average of Multiplier effects	Average of Interregional feedback effects	Average of Spillover Effects		
18	Other manufactured products	2.325	1.926	0.0006	0.398	1.0519	1.1345	1.5044	1.3689		
19	Producing and supplying electricity	1.682	1.502	0.0002	0.180	0.7611	0.8845	0.5345	0.6195		
20	Producing and supplying gas	1.558	1.393	0.0001	0.165	0.7048	0.8201	0.3001	0.5679		
21	Producing and supplying water	1.978	1.722	0.0003	0.255	0.8948	1.0142	0.7013	0.8784		
22	Waste scrap	1.978	1.722	0.0003	0.255	0.8948	1.0142	0.7013	0.8784		
23	Build	2.448	2.120	0.0003	0.328	1.1078	1.2483	0.7175	1.1297		
24	Wholesale and retail	1.900	1.728	0.0002	0.172	0.8596	1.0174	0.5308	0.5920		
25	Transportation, warehousing and postal services	2.324	1.968	0.0003	0.355	1.0513	1.1588	0.8257	1.2229		
26	Stay and eat	2.403	2.191	0.0003	0.213	1.0874	1.2900	0.6403	0.7311		
27	Information transfer, software and information technology services	2.453	1.859	0.0010	0.594	1.1100	1.0946	2.5574	2.0425		
28	Finance	1.831	1.744	0.0001	0.087	0.8285	1.0269	0.2869	0.3003		
29	Real estate	1.711	1.601	0.0001	0.109	0.7741	0.9431	0.3085	0.3762		
30	Leasing and business services	1.800	1.648	0.0002	0.152	0.8146	0.9706	0.5424	0.5228		
31	Scientific research and technical services	2.090	1.853	0.0003	0.236	0.9454	1.0914	0.7637	0.8119		
32	Other services	2.131	1.929	0.0003	0.202	0.9641	1.1359	0.7352	0.6936		
33	Education	1.663	1.543	0.0002	0.120	0.7524	0.9087	0.4045	0.4114		
34	Health and social work	1.995	1.764	0.0003	0.231	0.9028	1.0387	0.6588	0.7952		
35	Culture, sports and entertainment	1.952	1.806	0.0002	0.146	0.8834	1.0637	0.5206	0.5020		
36	Public administration, social security and social organization	1.841	1.642	0.0003	0.199	0.8331	0.9671	0.7144	0.6839		
	Average	2.210	1.887	0.0004	0.323						

Source: Authors calculated from bilateral input-output table, 2015

		China							
			In Which			In Which			
No.	Sectors	Output requirements	Multiplier effects	Interregional feedback effects	Spillover Effects	Average of Output requirements	Average of Multiplier effects	Average of Interregional feedback effects	Average of Spillover Effects
1	Agriculture, forestry, animal husbandry and fishery products and services	1.997	1.994	0.000	0.003	0.7516	0.7515	0.3766	0.8987
2	Mining	2.645	2.643	0.000	0.002	0.9954	0.9960	0.5574	0.6258
3	Food and tobacco	2.717	2.709	0.001	0.007	1.0222	1.0210	0.7873	2.0363
4	Textile	3.149	3.137	0.002	0.009	1.1848	1.1822	2.9951	2.8642
5	Textile clothing, shoes and hats, leather and products thereof	3.044	3.029	0.004	0.012	1.1456	1.1416	4.4335	3.5589
6	Wood processing products and furniture	3.111	3.096	0.002	0.013	1.1706	1.1668	1.9135	4.1365
7	Print paper and sports culture and education	3.163	3.159	0.001	0.004	1.1903	1.1903	1.0445	1.2385
8	Petroleum, coking products and products processing nuclear fuel	2.786	2.783	0.000	0.002	1.0483	1.0489	0.5553	0.6696
9	Chemical products	3.214	3.210	0.001	0.003	1.2092	1.2097	0.6981	0.9415
10	Non-metallic mineral products	3.134	3.131	0.001	0.002	1.1791	1.1798	0.6801	0.7550
11	Metal products	3.302	3.299	0.000	0.002	1.2424	1.2434	0.5420	0.6119
12	Electric machinery	3.261	3.258	0.001	0.002	1.2270	1.2277	0.9786	0.7208
13	Transport equipment	3.175	3.172	0.001	0.002	1.1948	1.1954	0.9106	0.7694
14	Communications equipment, computers and other electronic devices	2.706	2.698	0.003	0.005	1.0181	1.0167	3.7997	1.5169
15	Repairing metal products, machinery and equipment	2.828	2.826	0.001	0.002	1.0642	1.0649	0.7816	0.5908
16	Instrumentation	2.735	2.731	0.001	0.003	1.0293	1.0292	1.8232	0.9024
17	Machinery, specialized equipment	3.136	3.133	0.001	0.002	1.1800	1.1807	0.9680	0.7037

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China									
				In Which				In Which	
No.	Sectors	Output requirements	Multiplier effects	Interregional feedback effects	Spillover Effects	Average of Output requirements	Average of Multiplier effects	Average of Interregional feedback effects	Average of Spillover Effects
18	Other manufactured products	3.005	2.999	0.001	0.005	1.1306	1.1301	1.3371	1.4953
19	Producing and supplying electricity	3.040	3.038	0.000	0.002	1.1440	1.1450	0.4628	0.4650
20	Producing and supplying gas	2.850	2.847	0.000	0.002	1.0723	1.0729	0.5564	0.6379
21	Producing and supplying water	2.612	2.610	0.000	0.002	0.9827	0.9834	0.4845	0.4963
22	Waste scrap	3.155	3.152	0.001	0.002	1.1873	1.1880	0.7320	0.7539
23	Build	3.147	3.144	0.001	0.003	1.1841	1.1846	0.6978	0.8614
24	Wholesale and retail	1.827	1.826	0.000	0.001	0.6875	0.6881	0.2803	0.2414
25	Transportation, warehousing and postal services	2.491	2.489	0.000	0.002	0.9374	0.9381	0.4307	0.4695
26	Stay and eat	2.405	2.400	0.001	0.005	0.9049	0.9043	0.6272	1.4639
27	Information transfer, software and information technology services	2.127	2.125	0.001	0.002	0.8005	0.8007	1.0703	0.5493
28	Finance	1.742	1.741	0.000	0.001	0.6554	0.6560	0.2801	0.2704
29	Real estate	1.605	1.604	0.000	0.001	0.6039	0.6045	0.1929	0.1885
30	Leasing and business services	2.742	2.738	0.001	0.003	1.0316	1.0318	1.0519	0.8657
31	Scientific research and technical services	2.518	2.515	0.001	0.002	0.9473	0.9477	0.9755	0.6304
32	Other services	2.167	2.164	0.001	0.002	0.8152	0.8155	0.6526	0.6044
33	Education	1.497	1.496	0.000	0.001	0.5631	0.5637	0.1644	0.2180
34	Health and social work	2.541	2.539	0.000	0.002	0.9563	0.9568	0.5673	0.6385
35	Culture, sports and entertainment	2.179	2.175	0.001	0.003	0.8200	0.8197	0.9113	0.9734
36	Public administration, social security and social organization	1.922	1.919	0.001	0.002	0.7231	0.7232	0.6799	0.6358
	Total	2.658	2.654	0.001	0.003				

Source: Authors calculated from bilateral input – output table, 2015

Appendix 4: Value added creation

		Vietnam			China			
No.	Sectors	The added value is generated by the final demand (V _v . X _{vv})	Added value created by other country's production (V _v , X _{vc})	The total value added (V _v)	The added value is generated by the final demand (V _c ,X _{cc})	Added value created by other country's production (V _c , X _{cv})	The total value added (V _c)	
1	Agriculture, forestry, animal husbandry and products and fisheries service	0.648	0.001	0.648	0.937	0.049	0.987	
2	Extractive	0.582	0.001	0.583	0.849	0.071	0.919	
3	Food and tobacco	0.587	0.002	0.589	0.905	0.046	0.951	
4	Textile	0.425	0.002	0.427	0.876	0.216	1.092	
5	Textile clothing, shoes and hats, leather and products thereof	0.522	0.003	0.525	0.882	0.179	1.060	
6	Wood processing products and furniture	0.604	0.003	0.607	0.866	0.055	0.921	
7	Print paper and paper products	0.571	0.001	0.572	0.845	0.078	0.923	
8	Petroleum, coking products and products processing nuclear fuel	0.432	0.001	0.432	0.778	0.110	0.888	
9	Chemical products	0.498	0.001	0.499	0.829	0.067	0.896	
10	Non-metallic mineral products	0.631	0.001	0.632	0.830	0.061	0.891	
11	Metal products	0.424	0.001	0.424	0.789	0.125	0.913	
12	Electric machinery	0.425	0.001	0.426	0.791	0.106	0.898	
13	Transport equipment	0.489	0.001	0.489	0.811	0.126	0.937	
14	Communications equipment, computers and other electronic devices	0.353	0.001	0.355	0.654	0.270	0.924	
15	Repairing metal products, machinery and equipment	0.511	0.000	0.512	0.832	0.098	0.931	
16	Instrumentation	0.489	0.001	0.490	0.736	0.088	0.824	
17	Machinery, specialized equipment	0.281	0.001	0.282	0.797	0.118	0.915	
18	Other manufactured products	0.532	0.001	0.534	0.851	0.104	0.955	
19	Producing and supplying electricity	0.781	0.000	0.782	0.841	0.045	0.887	
20	Producing and supplying gas	0.813	0.001	0.813	0.802	0.040	0.842	
21	Producing and supplying water	0.671	0.000	0.671	0.904	0.068	0.972	
22	Waste scrap	0.671	0.001	0.672	0.814	0.068	0.882	
23	Construction	0.559	0.001	0.560	0.848	0.083	0.931	
24	Wholesale and retail	0.773	0.000	0.773	0.950	0.045	0.994	
25	Transportation, warehousing and postal services	0.560	0.000	0.561	0.885	0.097	0.982	
26	Accommodation and dining	0.647	0.001	0.648	0.927	0.058	0.985	

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		Vietnam China					
No.	Sectors	The added value is generated by the final demand (V _v . X _{vv})	Added value created by other country's production (V _v . X _{vc})	The total value added (V _v)	The added value is generated by the final demand (V _c ,X _{cc})	Added value created by other country's production (V _c , X _{cv})	The total value added (V _c)
27	Information transfer, software and information technology services	0.604	0.000	0.604	0.878	0.146	1.023
28	Finance	0.806	0.000	0.806	0.957	0.023	0.979
29	Real estate	0.853	0.000	0.853	0.970	0.028	0.998
30	Leasing and business services	0.819	0.001	0.819	0.859	0.039	0.898
31	Scientific research and technical services	0.713	0.001	0.713	0.848	0.059	0.908
32	Other services	0.743	0.001	0.743	0.908	0.052	0.961
33	Education	0.845	0.000	0.845	0.966	0.031	0.997
34	Health and social work	0.563	0.001	0.563	0.883	0.060	0.943
35	Culture, sports and entertainment	0.805	0.001	0.806	0.922	0.038	0.960
36	Public administration, social security and social organization	0.776	0.001	0.776	0.937	0.051	0.988
	Average	0.611	0.001	0.612	0.860	0.083	0.943

Source: Authors' calculations via intercountry input - output table between Vietnam and China, 2015