



# Supply Size in Exports: Expansion Input-Output Analysis Approach

**Bui Trinh**

PhD, Association of Regional Econometrics and Environmental Studies (AREES), Japan

Email: [buitrinhcan@gmail.com](mailto:buitrinhcan@gmail.com)

**Article History**

**Received:** July 22, 2020

**Revised:** August 17, 2020

**Accepted:** August 22, 2020

**Published:** August 25, 2020

Copyright © 2020 ARPG & Author

This work is licensed under the Creative Commons Attribution International

CC BY: Creative Commons Attribution License 4.0

## Abstract

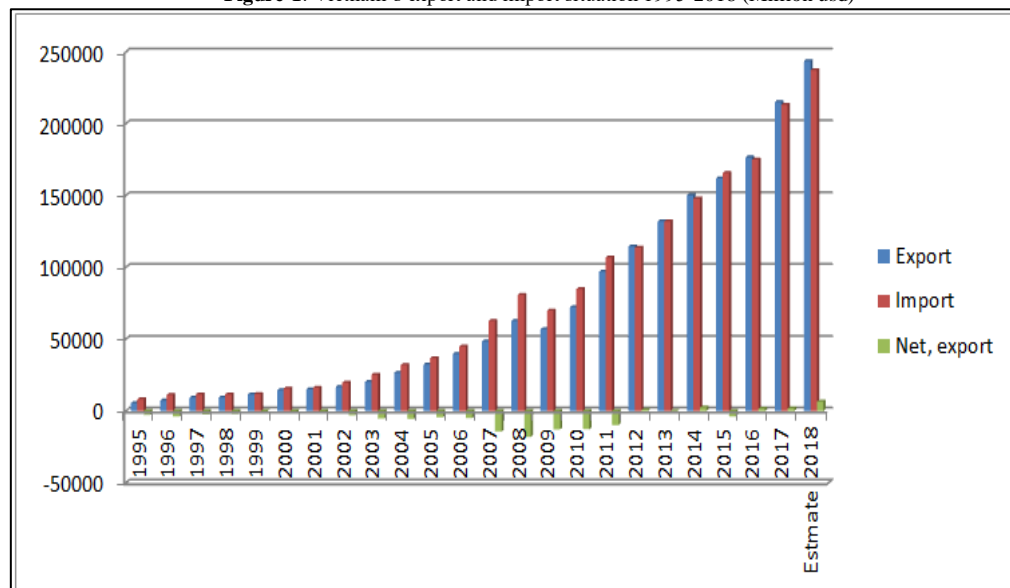
In recent years, Vietnam has joined international intergration by strong export agreements of bilateral and multilateral; Vietnam’s merchandise export in 1995 was only US \$5.4 billion, in 2018 Vietnam’s merchandise export increased by 45 times compared to 1995 with US \$244 billion. Vietnam’s imports increased by 29 times in 2018 compared to 1995. This study is an attempt to test a method of estimating the influence of exports on several Supply-sidefactors such as production value, value added and imports through the expansion of the standard system W. Leontief I.O and Miyazawa-style economic-demographic relations. This study also tries to make an experiment in the “Leontief Paradox”.The result is that Vietnam’s export value spread to production and imports but spread low to added value, especially in the processing industry group’s fabrication. The study is based on the non-competitive I.O table in 2012 and 2018 with 16 sectors.

**Keywords:** Export; Import input; Putput; Value added.

## 1. Introduction

Looking at the overall situation of Vietnam’s import and export of goods shows that before 2011 Vietnam always had trade deficit, but after 2011 this situation was no longer available. In 2018, Vietnam had a trade surplus of US \$6.5 billion (Table 1).

**Figure-1.** Vietnam’s export and import situation 1995-2018 (Million usd)

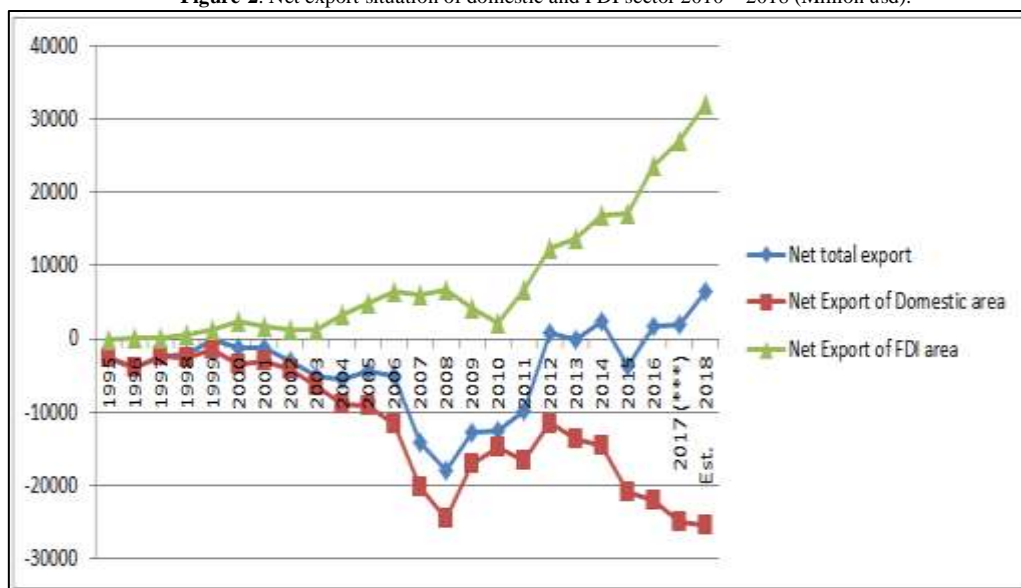


Source: gssso.gov.vn

A closer look at Vietnam’s import and export situation shows that the domestic sector always has trade deficit and the FDI sector always has a trade surplus, in 2010, the domestic trade deficit was US \$14.8 billion, by 2018 the trade deficit of this area was US \$25.5 billion; meanwhile the FDI sector had a trade surplus of US \$2.2 billion in 2010, and by 2018 the trade surplus of the FDI sector was US \$32 billion; The export ratio of the FDI sector accounted for the total value of merchandise exports increased from 54% in 2010 to 72% in 2018. Thus, it can be

seen that the trade surplus or trade deficit of the whole country was decided by the FDI sector. Trade surplus and GDP growth may be a good sign for countries with more trade relations with Vietnam than for the Vietnamese people (Table 2).

Figure-2. Net export situation of domestic and FDI sector 2010 – 2018 (Million usd).



Source: gso.gov.vn (Anonymous)

This study attempts to provide a deeper estimate to measure supply-side factors such as output, value added, imports, capital income and labor income spread by industry exports?

There are two notions about the relationship between trade and value added that are “Trade in Value added” and “Value added in Trade”. “Trade in Value added” measures the value added of one country spread by the final consumption of another country and “Value added in Trade” estimate the value added of an economy, in the production of goods and services of export (OECD, 2020; Robert, 2012). These two notions are often confused as the study of Vo *et al.* (2015), “Trade in value added” analyzes the value added of a country through the Multinational IO model (multi- inter-countries input-output framework), in “Trade in value added” usually have to distinguish between “final demand” and “final products”. Assuming that the value added of a country A doesn’t depend only on “final demand” of country A, but also depend on the production and final demand of other countries that used the “final products” of country A.

There have been many studies on the relationship between trade and the added value of a certain product group in the economy and exports like Barbie doll (Tempest, 1996), the iPod (Linden *et al.*, 2009; Varian, 2007), computers (Kraemer and Dedrick, 2002), or the Nokia N95 (Ali-Yrkkoo, 2010), cars (Baldwin, 2009) or airplanes (Grossman and Rossi-Hansberg, 2008).

The premise for “Value added in trade” studies was mentioned early by Leontief, also known as the “W. Leontief (1953), in testing Heckscher–Ohlin model theory (“H–O theory”) <sup>1</sup>, he found that exports in the United States were more spread to labor than capital, this study has triggered further research into the measurement of added transaction value based on input-output techniques including: Hummels *et al.* (2001), Bui *et al.* (2018), Daudin *et al.* (2011), Johnson and Noguera (2012), Muchdie and Sugema (2017), Koopman *et al.* (2010)

Because there is no inter-country I.O table, this study attempts to make an estimate based on the national IO table to measure how the value added is spread from sectoral exports.

Since, the Leontief’s Input-Output System (IOS) was born (Leontief, 1936; Wassily, 1941), I.O systems have been developed and expanded by various researchers in many ways. Typically, the I.O table is expanded to an Isard inter-regional I.O model (Isard, 1951). The economic - demographic model was developed in parallel with the social accounting matrix by Miyazawa (1976) and Batey and Madden (1983), Trinh *et al.* (2012) the economic – demographic models have been developed by Miyazawa to analyze the structure of income distribution according to endogenous consumption expenditure in accordance with the Leontief system.

The economic – demographic systems expand the I.O table by consumption group in columns and corresponding income groups in rows.

This study attempts to expand the I.O table by extending the intermediate cost matrix by column of exports and rows as added value.

The study also tries to test how the impact of exports affects the supply side of an industry group, In the study, the selected sub-sector was the logging and wood product processing industry. The study is based on Vietnam’s I.O table in 2012 (GSO, 2015) and the I.O 2018 table is updated based on enterprise survey results, investigation on

<sup>1</sup>The H-O theorem states that a country will export that good that is intensive in the country’s abundant factor Heckscher *et al.*, (1991)

economic bases of general statistics office and using RAS method for updating (Bui *et al.*, 2018; Trinh and Phong, 2013). The industry is aggregated from Vietnam’s I.O table:

<b>Agriculture</b>
Fisheries
Forestry
Mining and quarrying
Food processing industry
Processing consumer goods
Raw materials processing industry
Machinery & equipment
Electricity, gas and water
Construction
Commercial
Transport
Post office and contact information
Finance, banking, insurance
Other services
State management

## 2. Approach

The basic relationship of I.O system type of competition is in the form

$$X = (I - L)^{-1} \cdot Y \tag{1}$$

Relations (1) can be rewritten to the competitive – import type as follow:

$$X = (I - L^d)^{-1} \cdot Y^d \tag{2}$$

Where: X is an output matrix created by the factors of the final demand; I is the unit matrix, L<sup>d</sup> is the domestic direct coefficient matrix and Y<sup>d</sup> is a matrix of domestic final demand

$$Y^d = C^d + I^d + E \tag{3}$$

Apply Miyazawa's ideas, this study offers another approach when expanding the intermediate input coefficient matrix by adding an export coefficient column corresponding to the row of value added coefficients:

$$L^d = \begin{bmatrix} A^d & e \\ & v \end{bmatrix}$$

e is a column vector of export with elements e<sub>j</sub> = E<sub>j</sub>/V and v is value added coefficient vector with v<sub>j</sub> = V<sub>j</sub>/X<sub>j</sub>,

Call F is the matrix with the column showing the final consumption and gross capital formation and the row represents the industry number, g is the other income vector.

The Leontief - Miyazawa balance system has a matrix form:

$$\begin{bmatrix} X \\ V \end{bmatrix} = \begin{bmatrix} A^d & e \\ v & 0 \end{bmatrix} \cdot \begin{bmatrix} X \\ V \end{bmatrix} + \begin{bmatrix} F \\ g \end{bmatrix} \tag{4}$$

Equation (4) can be rewritten as follow:

$$X = A^d X + eV + F = X \tag{5}$$

$$V = vX + g = V \tag{6}$$

Relations (5) return to Leontief's standard relationship, relationship (6) is Miyazawa-style, this relationship needs to assume: E<sub>i</sub> < V.

From the relation (4), (5), (6) Leontief-Miyazawa relation can be rewritten:

$$\begin{bmatrix} X \\ V \end{bmatrix} = \left( \begin{bmatrix} I & 0 \\ 0 & I \end{bmatrix} - \begin{bmatrix} A^d & e \\ v & \end{bmatrix} \right)^{-1} \cdot \begin{bmatrix} F \\ g \end{bmatrix} \tag{7}$$

According to Michael and Geoffrey (1993) we have:

$$\mathbf{B} = \left( \begin{bmatrix} I & 0 \\ 0 & I \end{bmatrix} - \begin{bmatrix} A^d & e \\ v \end{bmatrix} \right)^{-1} = \begin{bmatrix} \Delta_1 & \Delta_1 e \\ v\Delta_1 & \Delta_2 \end{bmatrix} \quad (8)$$

Where:

$$\Delta_1 = (I - A^d - ev)^{-1}$$

$\Delta_2 = I + v \Delta_1 e$  is called the Miyazawa multipliers matrix

Note that  $\Delta_1$  is matrix called the enlarge Leontief inverse matrix, which includes the multipliers, induced and spillover effects.

The effects of a unit of export to output were defined such as:

$$x^E = \Delta_1 - (I - A^d)^{-1} \quad (9)$$

And the effects of an export unit on value added:

$$v^E = v^* \cdot x^E \quad (10)$$

Where  $v^*$  is the diagonal matrix with elements on diagonal are elements of vector  $v$ ,  $v^E$  represents the value added is induced by exports.

From the relationship (10) can also calculate the effects of imports, the production income in the value added being induced by exports:

$$m^E = m^* \cdot x^E \quad (11)$$

### 3. Experimental Results

Generally, each I.O table represents the economic structure over a period of about 5 years. In this study, it is assumed that table I.O, 2012 represents the period 2010-2015 and table I.O, 2018 represents the period 2015-2020. [Table 1](#) shows that the overall export in the period of 2015-2020 spreads to output about 3.5% higher than the period of 2010-2015. Spread of exports to output in the period of 2015-2020 is higher than that in the period of 2010-2015 in most industries, especially in the manufacturing and processing industry group: Food processing industry, Processing consumer goods, Processing industry raw materials and machinery & equipment.

**Table-1.** Outputs were induced by export (times):  $x^E = \Delta_1 - (I - A^d)^{-1}$

	2012		2018	
	Spread of exports to output	Ranking	Spread of exports to output	Ranking
Agriculture	0.363	1.034	0.365	1.004
Fisheries	0.350	0.996	0.352	0.968
Forestry	0.330	0.938	0.329	0.905
Mining and quarrying	0.365	1.038	0.366	1.006
Food processing industry	0.347	0.987	0.350	0.962
Processing consumer goods	0.285	0.810	0.293	0.806
Raw materials processing industry	0.235	0.668	0.250	0.687
Machinery & equipment	0.210	0.597	0.260	0.715
Electricity, gas and water	0.455	1.293	0.455	1.250
Construction	0.251	0.714	0.251	0.689
Commercial	0.419	1.192	0.442	1.215
Transport	0.314	0.892	0.320	0.880
Post office and contact information	0.355	1.011	0.420	1.155
Finance, banking, insurance	0.473	1.345	0.475	1.306
Other services	0.402	1.143	0.420	1.155
State management	0.472	1.342	0.472	1.297
Total effects	5.623		5.819	

**Source:** Authors' calculations from table I.O 2012 and 2018

Overall, [table 2](#) shows that although the export of period 2015-2020 spreads to a higher to output than the period of 2010-2015, but induced impacts from export to value added decrease 2,3% period 2015 – 2020 compare with period 2010 – 2015. In the whole period of 2010-2020, exports of the manufacturing group stimulated high output but spread to very low value added, this trend was increasingly lower. Not only that, except for export food processing industry groups, other manufacturing processing groups such as "consumer goods processing industry, processing industry of raw materials, machinery and equipment " induced very low to value added, but spread very strongly to imports. But ironically, exports of the manufacturing industry account for a very high share of total export value and this trend is increasing ([Figure 1, 2](#)).

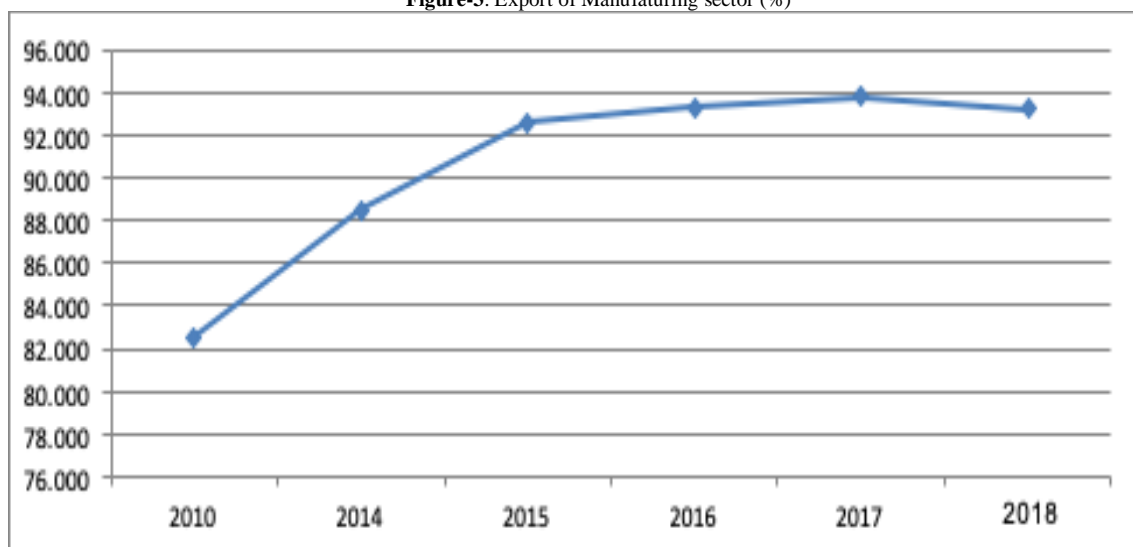
It is noteworthy that the export of services sector in the period 2010-2020 had a high spillover to the value added but a low spillover to the imports.

**Table-2.** Spillover of exports to added value (times)  $v^E = v^*$ ,  $x^E$ ,  $m^E = m^*$ ,  $x^E$

	2012		2018		2012		2018	
	Spillover of exports to value added	Ranking of VA	Spillover of exports to value added	Ranking of VA	Spillover of exports to imports	Ranking of Imports	Spillover of exports to imports	Ranking of Imports
Agriculture	0.139	0.817	0.150	0.890	0.049	0.885	0.060	0.811
Fisheries	0.166	0.978	0.160	0.950	0.073	1.326	0.092	1.244
Forestry	0.108	0.633	0.104	0.617	0.057	1.034	0.057	0.767
Mining and quarrying	0.186	1.096	0.187	1.110	0.064	1.174	0.064	0.871
Food processing industry	<b>0.061</b>	0.358	<b>0.055</b>	0.327	0.033	0.603	0.063	0.853
Processing consumer goods	<b>0.077</b>	0.454	<b>0.053</b>	0.315	0.069	1.257	0.120	1.623
Raw materials processing industry	<b>0.046</b>	0.271	<b>0.038</b>	0.226	0.081	1.468	0.150	2.028
Machinery & equipment	<b>0.032</b>	0.191	<b>0.025</b>	0.148	0.082	1.497	0.182	2.463
Electricity, gas and water	0.342	2.015	0.342	2.032	0.028	0.519	0.028	0.385
Construction	0.049	0.289	0.049	0.291	0.077	1.400	0.087	1.175
Commercial	0.242	1.424	0.242	1.437	0.042	0.766	0.042	0.568
Transport	0.130	0.767	0.130	0.772	0.076	1.382	0.078	1.053
Post office and contact information	0.153	0.901	0.155	0.920	0.062	1.122	0.067	0.906
Finance, banking, insurance	0.378	2.226	0.400	2.375	0.021	0.376	0.021	0.279
Other services	0.225	1.327	0.222	1.318	0.046	0.835	0.052	0.703
State management	0.383	2.254	0.383	2.273	0.019	0.355	0.020	0.270
Total effect	2.718		2.695		0.878		1.183	

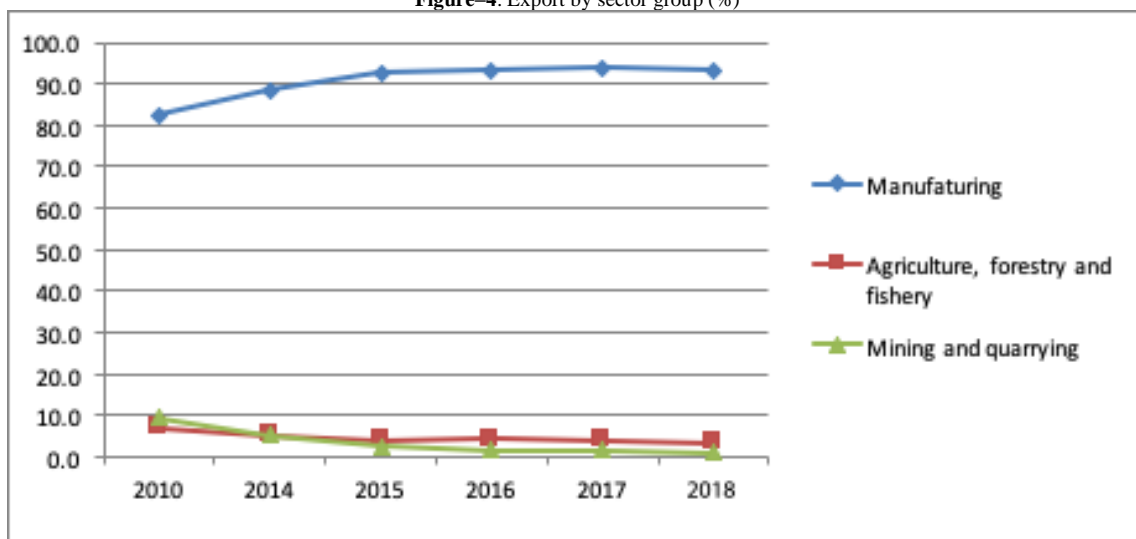
Source: Authors' calculations from Table I.O 2012 and 2018

**Figure-3.** Export of Manufacturing sector (%)



Source: gso.gov.vn

**Figure-4.** Export by sector group (%)



Source: gso.gov.vn

#### 4. Conclusion

This study is an attempt to test a method of estimating the influence of exports on several supply-side factors such as production value, added value and imports through the expansion of W. Leontief's I.O system and Miyazawa-style economic-demographic relations.

This study also tries to make an experiment in the "Leontief Paradox". As a result, Vietnam's exports spill over to production and import values, but spill low to value added, especially in the manufacturing and processing industries.

With policy priorities, on the supply-side is priority on manufacturing & processing industry and on the demand-side is exports seem to need reconsideration. This policy is only suitable when Vietnam has a strong manufacturing industry of auxiliary products. The ratio of manufacturing sector to high GDP is always considered Vietnam's achievement. So, these policy priorities should be reconsidered

## Acknowledgment

I would like to thank Mrs. Vy Phan and Mr. Can Bui and Mr. Quoc Bui for their support of this research.

## References

- Ali-Yrkkoo, J. (2010). *Nokia and Finland in a sea of change*. Taloustieto Oy.
- Anonymous: Available: <https://www.gso.gov.vn/default.aspx?tabid=715>
- Baldwin, R. (2009). Integration of the North American Economy and the new paradigm globalisation. CEPR discussion paper series 7523.
- Batey, P. W. J. and Madden, M. (1983). The modeling of demographic-Economic change within the context of regional decline: Analytical procedures and empirical result. *Socio-Economic Plan*, 17(5): 315-28. Available: [https://doi.org/10.1016/0038-0121\(83\)90038-1](https://doi.org/10.1016/0038-0121(83)90038-1)
- Bui, T. C., Nguyen, V. P. and Bui, Q. (2018). The RAS method with random fixed points. *Journal of Economics and Business*, 1(4): 640-46.
- Daudin, G., Riffart, C. and Schweisguth, D. (2011). Who produces for whom in the world economy? . *Canadian Journal of Economics*, 44(4): 1403-37.
- Grossman, G. M. and Rossi-Hansberg, E. (2008). Task trade between similar countries. NBER working paper 14554.
- GSO (2015). *The Vietnam input-output table*. Statistical publisher: Hanoi.
- Heckscher, E. F., Ohlin, B., Flam, H. and Flanders, M. J. (1991). *Heckscher-Ohlin trade theory*. Mass: MIT Press: Cambridge.
- Hummels, D., Ishii, J. and Yi, K. M. (2001). The nature and growth of vertical specialisation in world trade. *Journal of International Economics*, 54(1): 75-96.
- Isard, W. (1951). Interregional and regional input-output analysis: A model of a space-economy. *Review of Economics and Statistics*, 33(4): 318-28. Available: <https://doi.org/10.2307/1926459>
- Johnson, R. C. and Noguera, G. (2012). Accounting for intermediates: Production sharing and trade in value added. *Journal of International Economics*, 86(2): 224-36.
- Koopman, R., Powers, W., Wang, Z. and Wei, S. J. (2010). Give credit where credit is due: Tracing value added in global production chains. NBER Working Paper 16426.
- Kraemer, K. and Dedrick, J. (2002). *Dell computer: Organization of a global production network*. Unpublished manuscript, Personal Computing Industry Center, UC Irvine.
- Leontief, W. (1936). Quantitative input and output relations in the Economic systems of the United States. *The Review of Economics and Statistics*, 18(3): 105-25.
- Leontief, W. (1953). Domestic production and foreign trade: The American capital position revisited. *Proceeding of the American Philosophical Society*, 97(4): 332-49.
- Linden, G., Kraemer, K. and Dedrick, J. (2009). Who captures value in a global innovation system? The case of Apple's iPod. *Communications of the ACM*, 52(3): 140-44.
- Michael, S. and Geoffrey, J. D. H. (1993). Structure and their multipliers within input – output systems: Miyazawa revisited. *Hitotsubashi Journal of Economics*, 34(1): 33-44.
- Miyazawa, K. (1976). *Input-output analysis and the structure of income distribution. Lecture notes in economics and mathematical systems*. Springer-Verlag: Berlin. <https://doi.org/10.1007/978-3-642-48146-8>
- Muchdie, M. and Sugema (2017). Technical and trade coefficients in China and in the USA economies: Are they different? *International Journal of Advanced Research*, 5(11): 377-90.
- OECD (2020). Domestic value added in gross exports. Available: [https://www.oecd-ilibrary.org/trade/domestic-value-added-in-gross-exports/indicator/english\\_3959a0c6-en](https://www.oecd-ilibrary.org/trade/domestic-value-added-in-gross-exports/indicator/english_3959a0c6-en)
- Robert, S. (2012). Trade in value added and the value added in Tradewiod working paper. 8: 1-19. Available: [www.wiod.org](http://www.wiod.org)
- Tempest, R. (1996). *Barbie and the World Economy*. Los Angeles Times.
- Trinh and Phong, N. V. (2013). A short note on RAS method. *Advances in Management and Applied Economics*, 3(4): 133-37.
- Trinh, Hoa, P. L. and Kobayashi, K. (2012). The expansion input – output tables. *Global Journal of Human Social Science Sociology, Economics and Political Science*, 12(14): 1.0.
- Varian, H. (2007). *An iPod has global value. Ask the (many) countries that make it*. The New York Times.
- Vo, T. T., Nguyen, A. D. and Bui, T. (2015). Trade in value added: The case of Viet nam, ERIA discussion paper series, dp-2015-72.
- Wassily, L. (1941). *Structure of the American Economy, 1919-1929.*: Harverd University Press: Cambridge Mass.