Supply Size in Exports: Expansion Input-Output Analysis Approach

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Abstract
In recent years, Vietnam has joined international integration 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-side factors 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)

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")\textsuperscript{1}, 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 IO 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), IO systems have been developed and expanded by various researchers in many ways. Typically, the IO table is expanded to an Isard inter-regional IO model (Isard, 1951). The economic-demographic model was developed in parallel with the social accounting matrix by Miyazawa (1976) and Baty 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 IO table by consumption group in columns and corresponding income groups in rows.

This study attempts to expand the IO 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 IO table in 2012 (GSO, 2015) and the IO 2018 table is updated based on enterprise survey results, investigation on

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\textsuperscript{1} 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:

| Agriculture |
|-------------|
| 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

\[
X = (I - L)^{-1}Y
\]  

(1)

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

\[
X = (I - L_d)^{-1}Y^d
\]  

(2)

Where: \(X\) is an output matrix created by the factors of the final demand; \(I\) is the unit matrix, \(L_d\) is the domestic direct coefficient matrix and \(Y^d\) is a matrix of domestic final demand

\[
Y^d = C_d + I_d + E
\]  

(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:

\[
L_d = \begin{bmatrix}
A^d & e \\
v & e
\end{bmatrix}
\]  

(4)

\(e\) is a column vector of export with elements \(e_i = E/V\) and \(v\) is value added coefficient vector with \(v_j = V/X_j\).

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:

\[
\begin{bmatrix}
X \\
V
\end{bmatrix} = \begin{bmatrix}
A^d & e \\
v & 0
\end{bmatrix} \begin{bmatrix}
X \\
V
\end{bmatrix} + \begin{bmatrix}
F \\
g
\end{bmatrix}
\]  

4

Equationa (4) can be rewritten as follow:

\[
X = A^dX + eV + F = X
\]  

(5)

\[
V = vX + g = V
\]  

(6)

Relations (5) return to Leontief's standard relationship, relationship (6) is Miyazawa-style, this relationship needs to assume: \(E_i < V\).

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

\[
\begin{bmatrix}
X \\
V
\end{bmatrix} = \begin{bmatrix}
I & 0 \\
0 & I
\end{bmatrix} \begin{bmatrix}
A^d & e \\
v & 0
\end{bmatrix} \begin{bmatrix}
F \\
g
\end{bmatrix}
\]  

(7)

According to Michael and Geoffrey (1993) we have:
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\[
B = \begin{bmatrix} I & 0 \\ 0 & I \end{bmatrix}, \quad (A^d e) = \begin{bmatrix} \Delta_1 & \Delta_1 e \\ v & v \Delta_1 & \Delta_2 \end{bmatrix}, \quad (9)
\]

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:

\[
\Delta^d = \Delta_1 - (I - A^d)^{-1}, \quad (10)
\]

And the effects of an export unit on value added:

\[
v^* = \Delta_1 - (I - A^d)^{-1}, \quad (11)
\]

Where \( v^* \) is the diagonal matrix with elements on diagonal are elements of vetor \( v \), \( v^d \) represents the value added 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:

\[
m^e = m^* \Delta^d
\]

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 industry raw materials and machinery & equipment.

| Table 1. Outputs were induced by export (times): \( x^d = \Delta_1 - (I - A^q)^{-1} \) |
|---------------------------------|----------------|----------------|----------------|
|                                | 2012 Spread of | 2018 Spread of | 2012 Spread of |
|                                | exports to output | exports to output | exports to output |
| 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 | 5.819 | 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) $E^v = v^* \cdot x^v$, $m^E = m^* \cdot x^E$

|                | 2012         | Ranking of VA | 2015         | Ranking of VA | 2018         | Ranking of Imports | 2015         | Ranking of Imports |
|----------------|--------------|---------------|--------------|---------------|--------------|-------------------|--------------|-------------------|
| Agriculture    | 0.139        | 0.817         | 0.150        | 0.890         | 0.049        | 0.885             | 0.069        | 0.811             |
| Fisheries      | 0.166        | 0.978         | 0.160        | 0.955         | 0.073        | 1.326             | 0.092        | 1.244             |
| Forestry       | 0.108        | 0.613         | 0.104        | 0.617         | 0.057        | 1.034             | 0.057        | 0.767             |
| Mining and quarrying | 0.186   | 1.086         | 0.187        | 1.110         | 0.064        | 1.174             | 0.064        | 0.871             |
| Food processing industry | 0.061 | 0.358         | 0.065        | 0.327         | 0.033        | 0.605             | 0.063        | 0.553             |
| Processing consumer goods | 0.077 | 0.454         | 0.085        | 0.315         | 0.069        | 1.257             | 0.139        | 1.523             |
| Raw materials processing industry | 0.046 | 0.271         | 0.038        | 0.225         | 0.081        | 1.468             | 0.159        | 2.028             |
| Machinery & equipment | 0.052 | 0.191         | 0.025        | 0.146         | 0.082        | 1.497             | 0.182        | 2.463             |
| Electricity, gas and water | 0.342 | 2.015         | 0.542        | 2.082         | 0.028        | 0.319             | 0.028        | 0.385             |
| Construction   | 0.049        | 0.289         | 0.049        | 0.291         | 0.077        | 1.400             | 0.087        | 1.175             |
| Commercial     | 0.824        | 1.434         | 0.120        | 1.437         | 0.042        | 0.766             | 0.042        | 0.568             |
| Transport      | 0.130        | 0.767         | 0.130        | 0.772         | 0.076        | 1.392             | 0.078        | 1.053             |
| Post office and contact information | 0.153 | 0.901         | 0.155        | 0.920         | 0.062        | 1.122             | 0.067        | 0.966             |
| Finance, banking, insurance | 0.378 | 2.256         | 0.400        | 2.375         | 0.021        | 0.376             | 0.021        | 0.279             |
| Other services | 0.225        | 1.222         | 0.222        | 1.318         | 0.046        | 0.835             | 0.052        | 0.763             |
| State management | 0.353 | 2.364         | 0.381        | 2.273         | 0.019        | 0.355             | 0.020        | 0.270             |
| Total effect   | 3.718        | 2.955         | 0.878        | 2.695         |             |                   |              |                   |

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 IO 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.

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