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Abstract

In this research paper, the Keynesian, Leontief's and Miyazawa's multiplier concepts are extended in order to decompose the factors that propagate to total import requirements on such variables as domestic intermediate consumption, domestic final consumption, domestic investment and export. From these extended concepts, we are able to quantify the direct and indirect import requirements and determine the decomposition factors that induce total import requirements. Along with domestic output multipliers, policy makers would be able to look into and consider the import multiplier as a key determinant in sectoral economic planning and policy formulation.

I. Introduction.

The imported intermediate input was shown in the usual Keynesian foreign trade multiplier analysis. In an open economy, $Y + M = C + I + E$; the external sector is combined inconsistently with the domestic sector in the circular flow. Where, Y stands for net national products (or net final demand) excluding intermediate products, while M stands for imported including intermediate products. On the other hand, Leontief's matrix multiplier is devoted entirely to the analysis of intermediate products in the circular flow, the Leontief system can regard the household sector as an industry whose output is labor income and inputs are consumption products; An analysis of the multiplier process via the consumption function.

In this paper, we try to estimate import requirements consistently between Leontief system and Keynesian model based on Vietnam time series IO tables (1989, 1996, 2000 and 2005).

II. Foreign trade multiplier

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Based on the traditional Keynesian multiplier on income and we let a be a ratio of intermediate input and $(1-a)$ be a value added ratio, the equation is given:

$$a+a^2+a^3+\dots+a^n = a \cdot (1+a+a^2+a^3+\dots+a^n) = a/(1-a) \quad (n=1,\infty) \quad (1)$$

In the usual Keynesian procedure, the imported intermediate products required for production of investment goods (or export products) are treated as an exogenous factor in the multiplier process. Logically, however, we should treat the imported intermediate products as an endogenous factor induced by the initial injection. Let $\lambda=D/T$; in which D is the demand for domestic intermediate product and T is intermediate products. Then we can rewrite the above sub-multiplier process increase R as follows:

$$a \cdot (a^0 \cdot \lambda^0 + a\lambda + a^2\lambda^2 + a^3\lambda^3 + \dots + a^n\lambda^n) = a / (1-a \cdot \lambda) \quad (2)$$

This foreign trade multiplier takes into the intermediate products in the circular flow. Of course, the usual Keynesian foreign trade multiplier generally does take into account the import of intermediate products required for the production of consumption, but this is done inadequately. Nevertheless, the intermediate products required for the production of consumption goods and services, as well as those required for the production of investment (or export) products, are not imported at the expenditure level, but in the sub-multiplier process. In that multiplier, the import of intermediate products is taken into account at the proper place, namely, in the circular flow of intermediate products.

In order to express our multiplier in a form comparable with the orthodox Keynesian multiplier; let $X = T+V$ denote gross output and V is value added, that:

$$(1-a) = V/X \text{ is value added ratio and}$$

$$\delta = T/V$$

$$\text{So that: } \delta = (T/X) / (V/X) = a/(1-a)$$

$$\text{So that } h = (1-a) / (1-\lambda a) = (1-a) / (1-a+a\lambda a) = \{(1-a)/(1-a)\} / \{1+a \cdot (1-\lambda)/(1-a)\} =$$

$$1 / [1+\delta \cdot (1-\lambda)] \quad (3)$$

Based on Miyazawa's concept, we call p the marginal propensity to consume domestic products. Since similar sub-multiplier processes precede all the other secondary increases in income (due to additional consumption expenditure), the whole income – generating process can be given:

$$h + ph^2 + \dots + p^{n-1}h^n = h/(1-ph) \quad (4)$$

This is called foreign trade multiplier; it takes into account the intermediate products in the circular flow.

From equation (3) and (4) *foreign trade multiplier* becomes:

$$h/(1-ph) = 1 / [(1-p+\delta.(1-\lambda))] \quad (5)$$

We call m the marginal propensity to import finished products and c stands for the marginal propensity to consume, we put $p=c-m$. So the equation (5) can be rewritten as follows:

$$h/(1-ph) = 1 / [(1-(c-m)+\delta.(1-\lambda))] \quad (5')$$

III. The revised multiplier

The multiplier in equation (5) or (5') has different values since the inter-industrial average values of δ and λ differ with each pattern of propagation. That is a characteristic which has not been found in the Keynesian foreign trade multiplier.

If we put $\lambda=1$, that means (5) and (5') becomes equal to: $1/1-p$ or $1/[(1-(c-m))]$

And it coincides with the Keynesian multiplier in the case where induced imports are restricted to finished products only.

The multiplier also can be derived from a revised fundamental equation for an open economy. Based on Keynesian and Leontief's equations we can rewrite this as follows:

$$X - A.X = C + I + E - M \quad (6)$$

Where: X is vector of gross output; M is vector of import; C is vector of consumption, I is vector of Investment and E is vector of export.

However, where $a_{ij} = X_{ij}/X_j$; a_{ij} coincides with a in equations (2) and (3) and X_{ij} is intermediate product i of sector j and X_j is gross output of sector j , and $A=(a_{ij})_{(n \times n)}$

and n is number sector of national economic activity, then we can rewrite equation (6) as follows:

$$X - A \cdot X = C + I + E - M^p - M^c \quad (7)$$

Where M^p = the imports of intermediate products, M^c = the imports of finished products ($M = M^p + M^c$) And then, $A \cdot X = A^d \cdot X + A^m \cdot X$, That: $A^m \cdot X = M^p$.

And if we allow $M^c = C^m + I^m$. So equation (7) also can be rewritten as follows:

$$X - A^d \cdot X - A^m \cdot X = C^d + I^d + E + C^m + I^m - M \quad (8)$$

Where: C^d is a vector of consumption of domestic products; I^d is investment domestic goods vector

However, given $Y^d = C^d + I^d + E$ where Y^d final demand domestic products vector. So equation (8) can be rewritten as:

$$X = (I - A^d)^{-1} \cdot Y^d = (1 + A + A^2 + A^3 + \dots) Y^d \quad (9)$$

Where I = the unit matrix of n order

And $(I - A^d)^{-1}$ is the Leontief matrix multiplier, that is, domestic products requirement for increasing a unit of domestic final demand

On the other hand, equation (8) can be also be derived from equation (7) as follows:

$$X - A^m \cdot X = A^d \cdot X + C^d + I^d + E + C^m + I^m - M \quad (10)$$

Total domestic demand can be put as $TDD = A^d \cdot X + C^d + I^d + E$.

That means the total domestic demand equal intermediate demand, domestic consumption demand, domestic investment and export

The equation (10) can be rewritten as follows:

$$X = (I - A^m)^{-1} \cdot (TDD + C^m + I^m - M^p) \quad (11)$$

Matrix $(I - A^m)^{-1}$ is the import matrix multiplier. Equations (10) and (11) show how import requirements are induced by intermediate import product requirements, domestic product, final demand and import final demand.

In the case we only have an input-output table of the competitive-import type, we can estimate A^m and A^d as follows:

Putting the import coefficient $m_i=M_i/TDD_i$ where M_i is import of product i ; TDD_i is total domestic demand of product i , TDD_i excludes export. Note that $m_i < 1$ (or $=1$). And given a Φ diagonal matrix of import coefficients (m_i), then we have:

$$A^m X = \Phi . A . X$$

And $A^d X = (I - \Phi) . A . X$

IV. Case study

This case study is based on the IO tables for Vietnam that have been compiled for benchmark years: 1989, 1996, 2000 and 2005. For the purpose of this study, the IO tables were collapsed following a uniform 16-sector classification of the Vietnamese economy.

Table 1 presents the direct and indirect import requirements per unit increases in final demands during the periods under consideration. We can observe that some sectors such as **other consumer goods (06)**, **industrial materials (07)**, **capital goods (08)** and **construction (10)** have exhibited significantly heavy increases in their import requirements through the years. For example, in the capital goods sector (sector 08) which is traditionally an import-dependent industry, its total direct and indirect import requirements in 1989 amounting to 1.488 (0.343+1.145) units per unit of final demand rose to 1.822 (0.463+1.359) units or a hefty increase of about 22%, way above the national average of approximately 7%. Indirect import requirements account of 1.145 units per unit increase in final demand rose to 1.359 units in 2005 or a hefty increase of about 19%.

Table 1. Direct and indirect import requirement by time
 $(I - A^m)^{-1}$

		1989		1996		2000		2005	
		Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect
01	Agricultural crops, livestock & poultry : agricl services	0.077	1.030	0.109	1.038	0.097	1.046	0.090	1.055
02	Fishery	0.202	1.081	0.105	1.047	0.182	1.094	0.166	1.116

03	Forestry	0.087	1.036	0.072	1.027	0.076	1.034	0.054	1.036
04	Mining and quarrying	0.197	1.082	0.145	1.056	0.069	1.032	0.090	1.056
05	Food, beverage & tobacco manufactures	0.131	1.041	0.096	1.021	0.105	1.038	0.131	1.058
06	Other consumer goods	0.244	1.087	0.243	1.087	0.325	1.146	0.378	1.244
07	Industrial materials	0.288	1.112	0.260	1.096	0.353	1.176	0.430	1.295
08	Capital goods	0.343	1.145	0.468	1.274	0.441	1.274	0.463	1.359
09	Electricity, gas & water	0.248	1.109	0.230	1.155	0.138	1.076	0.164	1.120
10	Construction	0.315	1.125	0.311	1.121	0.386	1.206	0.424	1.304
11	Wholesale and retail trade	0.046	1.016	0.086	1.040	0.196	1.109	0.175	1.128
12	Transport services	0.306	1.131	0.254	1.130	0.213	1.111	0.228	1.163
13	Post and telecommunication	0.167	1.077	0.145	1.077	0.133	1.063	0.124	1.087
14	Finance, insurance & real estate & business services	0.175	1.069	0.105	1.032	0.130	1.050	0.117	1.070
15	Other private services	0.118	1.050	0.096	1.042	0.132	1.061	0.148	1.094
16	Government services	0.078	1.029	0.097	1.039	0.140	1.067	0.145	1.093

Table 2 shows the import requirements being decomposed into its component of demand as induced by domestic final demand (consumption domestic demand (C^d), investment domestic demand (I^d) and Export (E^d)), imports of finished products for consumption (C^m) and investment (I^m), and imports of intermediate products ($A^d.X$). Results in table 2 were calculated by the following formula:

:

$$(I-A^m)^{-1} \cdot (TDD + C^m + I^m) \div l.K$$

Where: l is row unit vector of n order; K is matrix with dimension ($n \times 6$), and (\div) means each element of this matrix divided by a consistent element of the other matrix.

Table 2 shows that induced import requirements in 2005 appeared to be relatively higher than in previous years except for domestic consumption demand (C^d). Most notable is consumption of one unit of imported finished products in 2005 further induces 2.204 units of imports. Imports by domestic investment (I^d) exhibited the largest effect of 1.639 units of imports required for every one unit of domestic investment

Table 2. Total Import requirements induced by total domestic demand and the import of finished products

$$(I-A^m)^{-1} \cdot (TDD + C^m + I^m)$$

C^m	I^m	C^d	I^d	E^d	$A^d.X$
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1989	1.687	1.528	1.321	1.385	1.212	1.231
1996	1.948	1.666	1.312	1.404	1.220	1.242
2000	1.999	1.639	1.389	1.463	1.282	1.321
2005	2.204	1.741	1.264	1.639	1.405	1.435

Table 2 shows in the stage (2001 – 2006) that with the exception of C^d , total import requirements were induced by almost all factors of demand from final demand to intermediate demand.

As we notice, the total demand does not only stimulate domestic production but also stimulating imported products. Annex A and B will show how domestic multipliers induced by domestic demand

Table 2'. Increase percentage of total import requirements induced by factors on demand

	C^m	I^m	C^d	I^d	E^d	$A^d.X$
1989	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
1996	115.47%	109.03%	99.32%	101.37%	100.66%	100.89%
2000	102.62%	98.38%	105.87%	104.20%	105.08%	106.36%
2005	110.26%	106.22%	91.00%	112.03%	109.59%	108.63%

V. Concluding remark.

- Table 1 and annex A shows the sector Food, Beverage & Tobacco manufactures is best significant preparation to economic activities
- In period 2001-2006, domestic investment, export and domestic intermediate demand increase had led to strong stimulated of imported intermediate products and total imported requirement
- The total imported requirement of stage 2001-2006 induced by domestic consumption lower than prior stages

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ANNEX A:

Domestic output multipliers

		Domestic output multipliers			
		1989	1996	2000	2005
01	Agricultural crops, livestock & poultry : agricl services	1,345	1,245	1,320	1,327
02	Fishery	1,286	1,279	1,280	1,339
03	Forestry	1,234	1,189	1,193	1,142
04	Mining and quarrying	1,426	1,464	1,284	1,249
05	Food, beverage & tobacco manufactures	1,846	1,903	2,044	1,943
06	Other consumer goods	1,583	1,689	1,711	1,625
07	Industrial materials	1,646	1,66	1,626	1,490
08	Capital goods	1,299	1,422	1,477	1,519
09	Electricity, gas & water	1,399	1,479	1,156	1,147
10	Construction	1,651	1,688	1,671	1,515
11	Wholesale and retail trade	1,293	1,239	1,433	1,387
12	Transport services	1,313	1,308	1,279	1,305
13	Post and telecommunication	1,177	1,429	1,190	1,214
14	Finance, insurance & real estate & business services	1,408	1,265	1,335	1,305
15	Other private services	1,231	1,344	1,356	1,380
16	Government services	1,401	1,377	1,313	1,311

ANNEX B:

Domestic output induced by factors of final demand

	Cd	Id	Ed
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1989	1,388	1,558	1,464
1996	1,508	1,649	1,533
2000	1,553	1,653	1,526
2005	1,509	1,435	1,505