VNU Journal of Science, Economics and Business 26, No. 5E (2010) 24-36

# Developing a bilateral input-output table in the case of Thailand and Vietnam: Methodology and applications

Bui Trinh*, Francisco Secretario, Kim Kwangmoon

*General Statistics Office,*
*No2 Hoang Van Thu, Ba Dinh, Hanoi, Vietnam*

Received 5 August 2010

**Abstract.** This paper attempts to measure and analyze the interdependent economic relations between the countries of Thailand and Vietnam, made possible by constructing a bilateral input-output (I-O) table linking the said two countries. It is an inter-regional type of I-O models that provides a compact and comprehensive accounting framework to quantify the economic inter-relationships among and between industries located in the study regions. Similar to a single-region (national) IO table, an Inter-Regional IO (IRIO) table can be used to estimate the magnitude of an external "shock" on major macroeconomic indicators such as output, value-added, income and employment. However, unlike its single-region counterpart, an IRIO table is able to capture and assess the inter-regional spillover and feedback effects arising from an exogenous change in demand for the output of any one of the study regions. In other words, constructing an IRIO table will not only allow us to estimate the stimulus to production outside the study region benefiting from, say, an increase in foreign demand for its output, but also the resultant impact on its output arising from the production stimulus it causes in the other study regions. This study is deemed to be a prototype of what AREES needs to support its ongoing efforts to develop an integrated database for its proposed research project, entitled: "Impact Analysis of Infrastructure Investment in the Indochina Region: An Input-Output (I-O) Approach."

## 1. The Thailand-Vietnam Inter-Regional IO framework

### *The IRIO model*

The Thailand-Vietnam bilateral IO table, as configured in Figure 1, is of the Isard-type of IRIO models that traces inter-sectoral economic flows, intra-nationally and inter-nationally alike. To complete the IRIO accounts, the model also contains a third country - the Rest of the World (ROW) - that represents all areas outside the two countries under study. The resulting IRIO table is also thus able to measure and analyze trade interdependencies between the study regions and the ROW. The (money) flows are valued at producers' prices (ie, prices net of trade and transport margins, but gross of product taxes).

The outlined IRIO model is of the non-competitive, open and static variety. It is non-competitive because it makes an explicit distinction between nationally-produced and imported products. Such a distinction provides

* Corresponding author. Tel: 84-01259370026
E-mail: buitrinhcan@gmail.com

a better reflection of the use of domestic production technology and inputs in the production of output in each country. The "openness" of the model is derived from the fact that economic activities are split into the intermediate and final demand categories. The transactions in the former category can be explained by the model, while the latter category contains exogenous transactions which must be initially known or given. The static nature of the model is a consequence of the absence of a time dimension from it, i.e. the IO transactions relate to the selected fixed period, which, in this case, is calendar year 2000.

**FIGURE 1. CONFIGURATION OF BILATERAL (THAILAND-VIETNAM) IRIO TABLE**

| FROM \ TO | | | INTERMEDIATE DEMAND | | | FINAL DEMAND | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | THA | VIE | TID | THA | VIE | ROW | | TFD | TGO |
| | | | 1...j...n | 1...j...n | | 1...k...o | 1...k...o | E | M | | |
| INTERMEDIATE INPUTS | THA | 1 : i : n | $X^{TT}$ | $X^{TV}$ | TOTAL INTERMED DEMAND | $F^{TT}$ | $F^{TV}$ | $E^{TW}$ | 0 | TOTAL FINAL DEMAND | $X^{T}$ |
| | VIE | 1 : i : n | $X^{VT}$ | $X^{VV}$ | | $F^{VT}$ | $F^{VV}$ | $E^{VW}$ | 0 | | $X^{V}$ |
| | IF | | $^{I}IF^{T}$ | $^{I}IF^{V}$ | | $^{F}IF^{T}$ | $^{F}IF^{V}$ | 0 | $-IF^{W}$ | | 0 |
| | ROW | | $^{I}M^{WT}$ | $^{I}M^{WV}$ | | $^{F}M^{WT}$ | $^{F}M^{WV}$ | 0 | $-M^{W}$ | | 0 |
| | DT | | $^{I}DT^{T}$ | $^{I}DT^{V}$ | | $^{F}DT^{T}$ | $^{F}DT^{V}$ | 0 | $-DT^{W}$ | | 0 |
| TII | | | TOTAL INTERMED INPUTS | | $\sum X$ | $F^{.T}$ | $F^{.V}$ | $\sum E^{.W}$ | $-\sum M^{W}$ | $\sum Y$ | $\sum X$ |
| VALUE ADDED | | 1 : p : s | $V^{T}$ | $V^{V}$ | $V^{.}$ | | | | | | |
| TPI | | | GVA | | $\sum V$ | | | | | | |
| TOTAL GROSS INPUT | | | $X^{T'}$ | $X^{V'}$ | $\sum X'$ | | | | | | |

***Source*: *Authors***

***Balance and structural equations***

A system of IRIO tables is balanced, implying that the supply and demand sides are equal. Using Figure 1, this equality can be translated into the following accounting identities:

(1) $X^{T} = X^{T\prime}$, (ie, column vector of gross outputs of Thailand's products is equal to row vector of gross inputs of Thailand's production sectors); $X^{V} = X^{V\prime}$, (ie, column vector of gross outputs of Vietnam's products is equal to row vector of gross inputs of Thailand's production sectors).

(2) $\sum V = \sum \left( F^{.T} + F^{.V} + SE^{W} - SM^{W} \right)$, (ie, sum of the two economies' value added or gross domestic product (GDP) is equal to the two economies' total final demands).

Figure 1 can also be used to form the following balancing equations in matrix form:

$$X^{T} = X^{TT}i + X^{TV}i + F^{TT} + F^{TV} + E^{TW} \qquad (1)$$

$$X^{V} = X^{VT}i + X^{VV}i + F^{VT} + F^{VV} + E^{VW} \qquad (2)$$

In both equations, represents a column vector of appropriate ones. The first term on the right hand side of equation (1) represents intermediate consumption of products of Thailand by its (Thailand's) own production sectors, the second term denotes the trade flows of products of Thailand to Vietnam for intermediate consumption, the third and fourth terms represent the sales of the output of Thailand to its own final domestic demand and Vietnam respectively, while the last term represents the exports of Thailand to the ROW, i.e. all areas outside the bi-nation's territorial limits. An analogous explanation applies to equation (2).

Using Leontief's assumption of linearity or first-order homogeneity in the production functions, we can define the following national input coefficients in matrix form:

$$A^{TT} = X^{TT}\left(\hat{X}^{T}\right)^{-1} \qquad (3)$$

$$\mathbf{A}^{TV} = \mathbf{X}^{TV}\left(\hat{\mathbf{X}}^{V}\right)^{-1} \quad (4)$$

$$\mathbf{A}^{VT} = \mathbf{X}^{VT}\left(\hat{\mathbf{X}}^{T}\right)^{-1} \quad (5)$$

$$\mathbf{A}^{VV} = \mathbf{X}^{VV}\left(\hat{\mathbf{X}}^{V}\right)^{-1} \quad (6)$$

Equations (3) and (6) represent the matrices of intra-national direct input coefficients, while equations (4) and (5) stand for the matrices of inter-national trade coefficients. Substituting these structural equations into equations (1) and (2), we have:

$$\mathbf{X}^{T} = \mathbf{A}^{TT}\mathbf{X}^{T} + \mathbf{A}^{TV}\mathbf{X}^{V} + \mathbf{F}^{TT} + \mathbf{F}^{TV} + \mathbf{E}^{TW} \quad (7)$$

$$\mathbf{X}^{V} = \mathbf{A}^{VT}\mathbf{X}^{T} + \mathbf{A}^{VV}\mathbf{X}^{V} + \mathbf{F}^{VT} + \mathbf{F}^{VV} + \mathbf{E}^{VW} \quad (8)$$

Combining equations (7) and (8), we have:

$$\begin{bmatrix}\mathbf{X}^{T}\\ \mathbf{X}^{V}\end{bmatrix} = \begin{bmatrix}\mathbf{A}^{TT} & \mathbf{A}^{TV}\\ \mathbf{A}^{VT} & \mathbf{A}^{VV}\end{bmatrix}\begin{bmatrix}\mathbf{X}^{T}\\ \mathbf{X}^{V}\end{bmatrix} + \begin{bmatrix}\mathbf{Y}^{T}\\ \mathbf{Y}^{V}\end{bmatrix} \quad (9)$$

where $\mathbf{Y}^{T} = \mathbf{F}^{TT} + \mathbf{F}^{TV} + \mathbf{E}^{TW}$ and $\mathbf{Y}^{V} = \mathbf{F}^{VT} + \mathbf{F}^{VV} + \mathbf{E}^{VW}$.

Simplifying equation (9), we have:

$$\begin{bmatrix}\mathbf{X}^{T}\\ \mathbf{X}^{V}\end{bmatrix} = \left[\begin{pmatrix}\mathbf{I} & \mathbf{0}\\ \mathbf{0} & \mathbf{I}\end{pmatrix} - \begin{pmatrix}\mathbf{A}^{TT} & \mathbf{A}^{TV}\\ \mathbf{A}^{VT} & \mathbf{A}^{VV}\end{pmatrix}\right]^{-1}\begin{bmatrix}\mathbf{Y}^{T}\\ \mathbf{Y}^{V}\end{bmatrix} = \begin{bmatrix}\mathbf{L}^{TT} & \mathbf{L}^{TV}\\ \mathbf{L}^{VT} & \mathbf{L}^{VV}\end{bmatrix}\begin{bmatrix}\mathbf{Y}^{T}\\ \mathbf{Y}^{V}\end{bmatrix} \quad (10)$$

Equation (10) can be further simplified and shown its generalized form as:

$$\mathbf{X} = \mathbf{L}\mathbf{Y} \quad (11)$$

where $\mathbf{X}$ is the matrix of national outputs, $\begin{bmatrix}\mathbf{X}^{T}\\ \mathbf{X}^{V}\end{bmatrix}$; $\mathbf{Y}$ is the matrix of national final demands, $\begin{bmatrix}\mathbf{Y}^{T}\\ \mathbf{Y}^{V}\end{bmatrix}$; and $\mathbf{L}$ is the inter-national Leontief inverse matrix, $\begin{bmatrix}\mathbf{L}^{TT} & \mathbf{L}^{TV}\\ \mathbf{L}^{VT} & \mathbf{L}^{VV}\end{bmatrix}$.

The Leontief inverse matrix, $\mathbf{L}$, is a table of multipliers that links production, $\mathbf{X}$, and final demand, $\mathbf{Y}$. In this case study, it shows the total (direct plus indirect) outputs in both Thailand and Vietnam that are needed to sustain unit changes in their respective final demands. The inverse matrix is the most important table needed in inter-national input-output analysis as it unravels the inter-national, inter-industrial dependencies brought about by the repercussive effects of changes in final demands.

In order to be able to measure the spillover and feedback effects due to inter-regional (national) trade, Round (2001) decomposed the Leontief inverse, thus rewriting equation (10) into the following form:

$$\begin{bmatrix}\mathbf{X}^{T}\\ \mathbf{X}^{V}\end{bmatrix} = \begin{bmatrix}\mathbf{F}^{T} & \mathbf{0}\\ \mathbf{0} & \mathbf{F}^{V}\end{bmatrix}\begin{bmatrix}\mathbf{I} & \mathbf{S}^{TV}\\ \mathbf{S}^{VT} & \mathbf{I}\end{bmatrix}\begin{bmatrix}\mathbf{M}^{T} & \mathbf{0}\\ \mathbf{0} & \mathbf{M}^{V}\end{bmatrix}\begin{bmatrix}\mathbf{Y}^{T}\\ \mathbf{Y}^{V}\end{bmatrix} \quad (12)$$

where:

$$\mathbf{M}^{T} = \left(\mathbf{I} - \mathbf{A}^{TT}\right)^{-1} \quad \mathbf{S}^{TV} = \mathbf{M}^{T}\mathbf{A}^{TV} \quad \mathbf{F}^{T} = \left(\mathbf{I} - \mathbf{S}^{TV}\mathbf{S}^{VT}\right)^{-1}$$
$$\mathbf{M}^{V} = \left(\mathbf{I} - \mathbf{A}^{VV}\right)^{-1} \quad \mathbf{S}^{VT} = \mathbf{M}^{V}\mathbf{A}^{VT} \quad \mathbf{F}^{V} = \left(\mathbf{I} - \mathbf{S}^{VT}\mathbf{S}^{TV}\right)^{-1} \quad (13)$$

$\mathbf{M}$ accounts for the intra-regional linkages, while S and F show the inter-regional spillover and feedback effects, respectively.

## 2. Main results and applications

This section describes and explains the key results and applications of the study. A comparison of the economies of both countries is made first, before the findings of applications such as multiplier, linkage and impact analyses as well as spillover and feedback effects are presented and analyzed. For the purpose of this paper, the results are presented based on the IO tables for 14 production sectors, which are further aggregated into three major sectors, where appropriate.(1)

### *Output Multipliers*

Presented in Table 1 are estimated total (direct and indirect) output multipliers, calculated from the bilateral IRIO table's Leontief inverse. The column sums of the IRIO inverse represent the total outputs that producing sectors have to produce in order to sustain a unit demand of their products. For example, in order to satisfy 1000 units of demand for crops, livestock & poultry products by both Thailand and Vietnam, Thailand's economy needs to produce 1,511 units of output, out of which

(1) The table mapping the countries' basic sector classifications into the 14-sector and 3-major sector aggregations used in this study is presented in Annex A.

1000 units goes to the crops, livestock & poultry sector itself and the residual 511 units to sustain the direct and indirect demand by other sectors in both Thailand's and Vietnam's productive economies.

Ranked in descending order, Table 1 indicates that the extent of interdependencies between the production sectors in Thailand's economy is observed to be relatively more intense than in Vietnam's. Evidently, 9 sectors in Thailand exhibited total output multipliers ranked in the upper half of the 28-sector ladder against 5 in Vietnam. The food, beverage & tobacco sector of Vietnam exhibited the highest output multiplier effect of 2.016, followed by Thailand's transport services (12) and food, beverage & tobacco (05) sectors with output multiplier effects of 1.995 and 1.966, respectively. This finding indicates that these sectors are relatively the heaviest intermediate consumers of domestically-produced outputs, while their dependencies on imported inputs are observed to be relatively low.

The top bottom three, in terms of total output multipliers, all belongs to Vietnam's post & telecommunication (13), electricity, gas, steam & water (09) and logs & forest products (02) with TOMs of 1.16, 1.19 and 1.20, respectively. These sectors are least users of intermediate inputs, with most of their material purchases coming from the ROW, as can be observed in Table 3B.

Table 1: Total output Multipliers

(Total Output Requirements Per Unit of Final Demand)

| SECTOR | | THAILAND | | VIETNAM | |
|---|---|---|---|---|---|
| | | TOM | RANK | TOM | RANK |
| 01 | Crops, livestock & poulty | 1.511 | 13 | 1.318 | 22 |
| 02 | Logs & forest products | 1.245 | 25 | 1.202 | 26 |
| 03 | Fishery products | 1.651 | 10 | 1.353 | 21 |
| 04 | Minerals, metallic & non-metallic | 1.471 | 15 | 1.286 | 24 |
| 05 | Food, beverage & tobacco products | 1.966 | 3 | 2.016 | 1 |
| 06 | Other consumer goods | 1.730 | 7 | 1.707 | 8 |
| 07 | Industrial materials | 1.504 | 14 | 1.619 | 11 |
| 08 | Capital goods | 1.408 | 18 | 1.527 | 12 |
| 09 | Electricity, gas, steam and water | 1.753 | 5 | 1.190 | 27 |
| 10 | Construction | 1.822 | 4 | 1.654 | 9 |
| 11 | Wholesale & retail trade services | 1.301 | 23 | 1.430 | 17 |
| 12 | Transportation services | 1.995 | 2 | 1.375 | 19 |
| 13 | Post & telecommunication | 1.463 | 16 | 1.160 | 28 |
| 14 | All other services | 1.732 | 6 | 1.360 | 20 |
| | TOM: Total Ouput Multiplier | | | | |

### *Backward and Forward Linkages*

Linkages reflect the dependence of industries on one another in an economy and measure the potential stimulus that will be induced in other industries arising from an increase in activity in a particular industry. In essence, there are two types of linkages, namely, backward linkages and forward linkages.

A backward linkage is a measure of the relative importance of an industry as a user of inputs from the entire production system. It measures the output increases which will occur in industries which supply inputs to the industry concerned. A backward linkage can be computed as the ratio of the sum of the elements of a column of the Leontief inverse to the average of the whole system. This ratio is described by Rasmussen (1957) as the index of the power of dispersion, $\mu_j$, and is defined mathematically as.

$$\mu_j = \frac{\sum_{i=1}^{n} l_{ij}}{\frac{1}{n}\sum_{i=1}^{n}\sum_{j=1}^{n} l_{ij}} \qquad (14)$$

where the $\mathbf{l}_{ij}$ is the element of the inter-regional Leontief inverse. The higher the value of $\mu_j$, the stronger is the influence of production sector *j* as a user of intermediate inputs.

A forward linkage indicates the relative importance of an industry as a supplier of inputs to the entire production system. It measures the output increases which will occur in industries which use the inputs supplied by the industry concerned. A forward linkage can be expressed as the ratio of the sum of the elements along a row of the Leontief inverse to the average of the entire system. This ratio is described by Rasmussen (1957) as the index of sensitivity, $\mu_i$, and is defined mathematically as

$$m_i = \frac{\sum_{j=1}^{n} l_{ij}}{\frac{1}{n}\sum_{i=1}^{n}\sum_{j=1}^{n} l_{ij}} \qquad (15)$$

The higher the value of, the greater is the influence of production sector i as a supplier of intermediate inputs to the entire production system.

The estimated inter-regional linkages in our study are presented in Table 2. As can be seen, the estimated values of the backward and forward linkages in both countries appear to be relatively quite low, when compared to linkage effects of more developed economies.

Table 2: Inter-regional Backward and Forward linkage effects, 2000

| SECTOR | | THAILAND | | | | VIETNAM | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Backward Linkage | | Forward Linkage | | Backward Linkage | | Forward Linkage | |
| | | INDEX | RANK | INDEX | RANK | INDEX | RANK | INDEX | RANK |
| 01 | Crops, livestock & poultry | 0.990 | 13 | 1.050 | 10 | 0.863 | 22 | 1.091 | 08 |
| 02 | Logs & forest products | 0.815 | 25 | 0.680 | 26 | 0.787 | 26 | 0.753 | 23 |
| 03 | Fishery products | 1.082 | 10 | 0.762 | 20 | 0.886 | 21 | 0.756 | 22 |
| 04 | Minerals, metallic & non-metallic | 0.963 | 15 | 0.963 | 15 | 0.843 | 24 | 0.760 | 21 |
| 05 | Food, beverage & tobacco products | 1.288 | 03 | 1.048 | 12 | 1.320 | 01 | 0.834 | 18 |
| 06 | Other consumer goods | 1.133 | 07 | 1.049 | 11 | 1.118 | 08 | 1.045 | 13 |
| 07 | Industrial materials | 0.985 | 14 | 1.885 | 01 | 1.060 | 11 | 1.547 | 02 |
| 08 | Capital goods | 0.922 | 18 | 1.158 | 06 | 1.000 | 12 | 0.954 | 16 |
| 09 | Electricity, gas, steam and water | 1.149 | 05 | 1.084 | 09 | 0.779 | 27 | 0.877 | 17 |
| 10 | Construction | 1.193 | 04 | 0.664 | 27 | 1.084 | 09 | 0.655 | 28 |
| 11 | Wholesale & retail trade services | 0.852 | 23 | 1.264 | 04 | 0.936 | 17 | 1.135 | 07 |
| 12 | Transportation services | 1.307 | 02 | 0.993 | 14 | 0.901 | 19 | 0.714 | 25 |
| 13 | Post & telecommunication | 0.958 | 16 | 0.815 | 19 | 0.760 | 28 | 0.751 | 24 |
| 14 | All other services | 1.135 | 06 | 1.546 | 03 | 0.891 | 20 | 1.170 | 05 |

*Source*: *Authors presented at AREE conference at Laos University, March,2010*

Only half of the 14 industries in Thailand and 5 industries in Vietnam had values for backward linkages greater than one in 2000. In the case of forward linkages, 8 industries in Thailand and 5 in Vietnam had values higher than one. One likely reason for these rather low values could be the high reliance of both countries on the outside world (ROW) for their supply requirements.

### *Spillover and Feedback Effects*

A single-region IO table essentially assumes that imports from suppliers and exports to buyers outside the economy are treated as exogenous. However, such a table will not allow us to capture the interregional economic spillover and feedback effects in an economic system. These effects can be

illustrated as follows. Suppose there is an increase in demand by the ROW for the products of the manufacturing industry in Thailand. This will result in an increase in the output of the manufacturing industry in Thailand, which could result in an increase in demand for relevant inputs from suppliers outside the country, say, Vietnam. This new demand for the output of the suppliers in Vietnam will create an increase in their output and, directly and indirectly, the output of other industries in Vietnam. This stimulus of new output in Vietnam due to new output in Thailand is known as the interregional spillover effect. In addition, suppose that the stimulated production in Vietnam includes increased output of industries that use inputs from Thailand in their production process. Thus, the increased manufacturing production in Thailand leads to increased output of its suppliers in Vietnam, which, in turn, leads to more production in Thailand. This is known as the interregional feedback effect. These interregional effects can be measured within the context of an IRIO table.

This sub-section quantifies the spillover and feedback effects due to interregional trade in products to sustain regional final demands. Table 3 shows that, because of weak inter-regional (national) linkages among and between sectors, the estimated spillover and feedback effects appear to be insignificant[(2)].

Table 3: Inter-National Spillover & Feedback Effects, 2000

| | PRODUCTION SECTOR | THAILAND | | VIETNAM | |
|---|---|---|---|---|---|
| | | Spillover | Feedback | Spillover | Feedback |
| 01 | Crops, livestock & poulty | 0.00367 | 0.00000 | 0.00104 | 0.00001 |
| 02 | Logs & forest products | 0.00035 | 0.00000 | 0.00005 | 0.00000 |
| 03 | Fishery products | 0.00055 | 0.00000 | 0.00028 | 0.00001 |
| 04 | Minerals, metallic & non-metallic | 0.00646 | 0.00001 | 0.00145 | 0.00010 |
| 05 | Food, beverage & tobacco products | 0.00246 | 0.00000 | 0.00075 | 0.00001 |
| 06 | Other consumer goods | 0.01866 | 0.00002 | 0.00068 | 0.00002 |
| 07 | Industrial materials | 0.07510 | 0.00006 | 0.00088 | 0.00003 |
| 08 | Capital goods | 0.03748 | 0.00006 | 0.00230 | 0.00008 |
| 09 | Electricity, gas, steam and water | 0.00893 | 0.00001 | 0.00017 | 0.00001 |
| 10 | Construction | 0.00010 | 0.00000 | 0.00000 | 0.00000 |
| 11 | Wholesale & retail trade services | 0.02130 | 0.00002 | 0.00304 | 0.00013 |
| 12 | Transportation services | 0.00868 | 0.00001 | 0.00025 | 0.00001 |
| 13 | Post & telecommunication | 0.00164 | 0.00000 | 0.00010 | 0.00001 |
| 14 | All other services | 0.02066 | 0.00002 | 0.00075 | 0.00003 |
| | OUTPUT WEIGHTED AVERAGE | 0.02515 | 0.00003 | 0.00098 | 0.00003 |

Note: 0.00000 denotes value is less than half of unit employed.

*Source*: *AREE conference at Laos University, March,2010*

Table 3 shows that the average spillover effect of Thailand's productive economy due to its trade transactions with Vietnam is estimated to be a mere US$25 for every US$1000 increase in final demand, while the estimated spillover effect of Vietnam's production sectors as the result of its trade transactions with Thailand is observed to be negligible at US$1 per US$1000 increase in final demand. Spillover effects are seen to be higher for Thailand's manufacturing sectors of industrial materials (07) and capital goods (08) with US$75 and US$37 spillover effects, respectively. Feedback effects in both regions are found to be very negligible. The results indicate that both countries rely heavily, not on each other's produce, but on the ROW for products used in production and for final consumption.

### *Impact Analysis*

Final demand for products has repercussive effects on the economy. In the first round, an increase in demand for a product of a particular

(2) These spillover and feedback effects were computed from the matrices STV and SVT, and FT and FV in equation (12).

sector will require additional output requirement for that sector. Subsequently, the first-order increases in output would require further inputs to generate them. The increased demand therefore translates to an increase in output, which in turn result to increases in income of the sectors involved and so on. These total multiplier effects of final demand for goods and services on economies are best measured through I-O analysis.

Given the I-O table's Leontief inverse, it is possible to quantify the direct as well as the indirect effects of changes in exogenous final demand on such economic variables as output, income, employment and import requirements. This sub-section quantifies the impact of the different components of final demand on these macroeconomic indicators.

***Impact on Production***

The calculation of total (direct + indirect) outputs required to sustain final demands is carried out using equation (11) in its generalized form, as follows:

$$\mathbf{X} = \mathbf{L}\,\mathbf{Y} \qquad (16)$$

where $\mathbf{X}$ is the matrix of national outputs, $\begin{bmatrix}\mathbf{X}^{T}\\ \mathbf{X}^{V}\end{bmatrix}$; $\mathbf{Y}$ is the matrix of national final demands, $\begin{bmatrix}\mathbf{Y}^{T}\\ \mathbf{Y}^{V}\end{bmatrix}$; and $\mathbf{L}$ is the inter-national Leontief inverse matrix, $\begin{bmatrix}\mathbf{L}^{TT} & \mathbf{L}^{TV}\\ \mathbf{L}^{VT} & \mathbf{L}^{VV}\end{bmatrix}$; superscripts **T** and **V** denote bilateral countries, **Thailand** and **Vietnam**, respectively.

Table 4 summarizes the impact of final demand on production for the 3 major sectors for 2000. The row entries in the table describe how sectoral output is induced by each type of final demand in both countries. Conversely, the column entries in the table record the breakdown of sectoral output required from both countries to satisfy the needs of each type of final demand in one country. The column sums can be interpreted to be the total output induced by each type of final demand in each country.

It can be observed from Table 4 that, of the combined production of US$367.85 billion in both countries in 2000, 81.5% was induced by Thailand's total final demand, broken down into: 37.9% by final consumption demand, 9.4% by capital formation or investment demand and 34.2% by its exports demand. The remaining 18.5% of total production was induced by Vietnam's total final demand, broken down into: 8.1% by its final consumption demand, 3.4% by capital formation and 6.9% by exports demand. It can thus be concluded that, in both countries, total output requirements were primarily induced by final consumption demand, followed by the demand for exports. Total induced output to meet capital formation or investment demand in both countries registered the least contribution ratios since their domestic demands rely heavily on supplies from the ROW.

By sector, it can be seen that, in both countries, the bulk of output requirements for the major sectors of *agriculture, fishery & forestry* and *services* were induced by final consumption, while outputs in *industry* was induced largely by export demand. In conjunction with this finding, Table 4 also shows that Thailand's reliance on Vietnam's products to sustain its (Thailand's) final demand is less than Vietnam's dependence on Thailand's products. In 2000, Thailand imported from Vietnam US$0.61 billion worth of goods and services against US$1.46 billion worth imported by Vietnam from Thailand.

From Table 4, it is also possible to determine the total output inducement coefficients or multipliers resulting from domestic final demands in both countries. It can be observed that, in Thailand, average output requirement to satisfy final consumption demand exhibited the highest multiplier effect of 1.692 per unit of FCE, followed by investment demand (1.631) and export demand (1.581). In Vietnam, it is the demand for investment goods and services that showed the highest output multiplier effect of 1.639, followed by FCE and export demands with output multipliers of 1.567 and 1.530, respectively.

Table 4. Total (direct and indirect) impact on Production

| COUNTRY/SECTOR | | | THAILAND | | | | | | | | VIETNAM | | | | | | | | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | FCE | | GCF | | Exports | | TFD | | FCE | | GCF | | Exports | | TFD | | |
| | | | US$bil | % | US$bil | % | US$bil | % | US$bil | % | US$bil | % | US$bil | % | US$bil | % | US$bil | % | |
| THA | I | AFF | 9.78 | 7.0 | -0.18 | -0.5 | 5.94 | 4.7 | 15.54 | 5.2 | 0.03 | 0.1 | 0.01 | 0.0 | 0.01 | 0.0 | 0.04 | 0.1 | 15.58 |
| | II | INDUSTRY | 56.45 | 40.5 | 24.48 | 70.5 | 90.52 | 72.0 | 171.45 | 57.2 | 0.42 | 1.4 | 0.27 | 2.1 | 0.26 | 1.0 | 0.94 | 1.4 | 172.39 |
| | III | SERVICES | 73.03 | 52.4 | 10.28 | 29.6 | 29.08 | 23.1 | 112.38 | 37.5 | 0.30 | 1.0 | 0.07 | 0.6 | 0.10 | 0.4 | 0.47 | 0.7 | 112.86 |
| | TOTAL - THAILAND | | 139.25 | 99.8 | 34.58 | 99.6 | 125.54 | 99.8 | 299.37 | 99.8 | 0.75 | 2.5 | 0.35 | 2.7 | 0.37 | 1.4 | 1.46 | 2.2 | 300.83 |
| VIE | I | AFF | 0.03 | 0.0 | 0.00 | 0.0 | 0.02 | 0.0 | 0.06 | 0.0 | 7.02 | 23.7 | 0.46 | 3.6 | 3.50 | 13.7 | 10.98 | 16.2 | 11.04 |
| | II | INDUSTRY | 0.11 | 0.1 | 0.07 | 0.2 | 0.14 | 0.1 | 0.31 | 0.1 | 11.37 | 38.3 | 10.54 | 83.1 | 15.07 | 59.1 | 36.98 | 54.5 | 37.30 |
| | III | SERVICES | 0.08 | 0.1 | 0.06 | 0.2 | 0.10 | 0.1 | 0.24 | 0.1 | 10.52 | 35.5 | 1.34 | 10.5 | 6.58 | 25.8 | 18.44 | 27.2 | 18.68 |
| | TOTAL - VIETNAM | | 0.22 | 0.2 | 0.13 | 0.4 | 0.26 | 0.2 | 0.61 | 0.2 | 28.92 | 97.5 | 12.34 | 97.3 | 25.15 | 98.6 | 66.41 | 97.8 | 67.02 |
| Totql INDUCED OUTPUT | | | 139.47 | 100.0 | 34.71 | 100.0 | 125.80 | 100.0 | 299.98 | 100.0 | 29.67 | 100.0 | 12.69 | 100.0 | 25.51 | 100.0 | 67.87 | 100.0 | 367.85 |
| Total FINAL DEMAND | | | 82.43 | | 21.28 | | 79.56 | | 183.27 | | 18.93 | | 7.74 | | 16.68 | | 43.35 | | 226.62 |
| OUTPUT MULTIPLIER | | | 1.692 | | 1.631 | | 1.581 | | 1.637 | | 1.567 | | 1.639 | | 1.530 | | 1.566 | | 1.623 |
| CONTRIBUTION RATIOS (%) | | | | | | | | | | | | | | | | | | | |
| THA | I | AFF | 62.7 | | -1.2 | | 38.1 | | 99.7 | | 0.2 | | 0.0 | | 0.1 | | 0.3 | | 100.0 |
| | II | INDUSTRY | 32.7 | | 14.2 | | 52.5 | | 99.5 | | 0.2 | | 0.2 | | 0.2 | | 0.5 | | 100.0 |
| | III | SERVICES | 64.7 | | 9.1 | | 25.8 | | 99.6 | | 0.3 | | 0.1 | | 0.1 | | 0.4 | | 100.0 |
| | TOTAL - THAILAND | | 46.3 | | 11.5 | | 41.7 | | 99.5 | | 0.2 | | 0.1 | | 0.1 | | 0.5 | | 100.0 |
| VIE | I | AFF | 0.3 | | 0.0 | | 0.2 | | 0.5 | | 63.6 | | 4.2 | | 31.7 | | 99.5 | | 100.0 |
| | II | INDUSTRY | 0.3 | | 0.2 | | 0.4 | | 0.8 | | 30.5 | | 28.3 | | 40.4 | | 99.2 | | 100.0 |
| | III | SERVICES | 0.4 | | 0.3 | | 0.5 | | 1.3 | | 56.3 | | 7.2 | | 35.2 | | 98.7 | | 100.0 |
| | TOTAL - VIETNAM | | 0.3 | | 0.2 | | 0.4 | | 0.9 | | 43.2 | | 18.4 | | 37.5 | | 99.1 | | 100.0 |
| Totql INDUCED OUTPUT | | | 37.9 | | 9.4 | | 34.2 | | 81.5 | | 8.1 | | 3.4 | | 6.9 | | 18.5 | | 100.0 |

*Abbreviations:* FCE: Final Consumption Expenditure; GCF: Gross Capital Formation; TFD: Total final Demand; AFF: Agriculture, Fishery & Forestry.

### *Impact on Value Added*

In inter-regional analysis, the value added or income induced by the components of final demand can be calculated using the matrix equation:

$$\mathbf{V} = \mathbf{BLY} = \mathbf{BX} \qquad (17)$$

where **V** is the matrix of value added induced by final demand; and **B** is matrix of value added or primary input coefficients.

Table 5, which presents the impact of final demand on the various factors of production for 2000, shows that 81.1% of the total GDP generated by the 2 economies totaling US$160.1 billion was induced by Thailand's final demand and the remaining 18.9% by Vietnam's final demand. Of the total labor income of US$57.2 billion, 70.1% was induced by Thailand's final demand and 29.9% by Vietnam's final demand, while 89.9% of the 2 economies' operating surplus was induced by Thailand's final demand, with the residual 10.1% by Vietnam's final demand. Approximately three-fourths (74.6%) of total net indirect tax payments generated in both economies was induced by Thailand's final demand and the remaining 25.4% was induced by Vietnam's final demand.

The above findings intuitively suggest that, comparatively, Vietnam's economy in 2000 was more labor intensive than Thailand's, while Thailand's economy was more profit-oriented than Vietnam's. Moreover, Vietnam's economy appeared to be more intense than Thailand's in terms of production tax generation. (GVA)

Table 5. Total impact on income

| (Values are in US$billion) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Factor of Production | | THAILAND | | | | VIETNAM | | | | TOTAL |
| | | Final Consump-tion | Gross Capital Formation | Exports | Total Final Demand | Final Consump-tion | Gross Capital Formation | Exports | Total Final Demand | |
| V1 | Wages and salaries | 23.0 | 3.8 | 13.3 | 40.1 | 8.8 | 2.1 | 6.2 | 17.1 | 57.2 |
| V2 | Operating Surplus | 30.6 | 7.4 | 23.9 | 61.9 | 2.7 | 1.2 | 3.1 | 7.0 | 68.8 |
| V3 | Depreciation | 9.1 | 2.2 | 7.0 | 18.2 | 1.2 | 0.5 | 1.3 | 3.0 | 21.3 |
| V4 | Indirect taxes less subsidies | 4.7 | 1.0 | 3.8 | 9.6 | 1.5 | 0.5 | 1.3 | 3.3 | 12.8 |
| GDP | | 67.3 | 14.5 | 48.0 | 129.7 | 14.3 | 4.2 | 11.8 | 30.3 | 160.1 |
| TOTAL FINAL DEMAND | | 82.4 | 21.3 | 79.6 | 183.3 | 18.9 | 7.7 | 16.7 | 43.3 | 226.6 |
| INCOME MULTIPLIER | | 0.816 | 0.681 | 0.603 | 0.708 | 0.756 | 0.543 | 0.708 | 0.700 | 0.706 |
| CONTRIBUTION RATIOS (%) | | | | | | | | | | |
| V1 | Wages and salaries | 40.2 | 6.7 | 23.2 | 70.1 | 15.5 | 3.6 | 10.8 | 29.9 | 100.0 |
| V2 | Operating Surplus | 44.4 | 10.8 | 34.7 | 89.9 | 3.9 | 1.7 | 4.5 | 10.1 | 100.0 |
| V3 | Depreciation | 42.6 | 10.3 | 32.8 | 85.8 | 5.8 | 2.4 | 6.0 | 14.2 | 100.0 |
| V4 | Indirect taxes less subsidies | 36.5 | 8.2 | 29.9 | 74.6 | 11.9 | 3.7 | 9.8 | 25.4 | 100.0 |
| GDP | | 42.0 | 9.1 | 30.0 | 81.1 | 8.9 | 2.6 | 7.4 | 18.9 | 100.0 |

*Source: Authors calculated base on inter-regional input - output framework*

In terms of income multipliers, final consumption had the highest GDP multipliers in both countries. This suggests that an increase in consumption demand will not only stimulate a relatively high level of output, but also GDP in both economies. The relatively high level of GDP generated in both countries by consumption suggests that such demand might be concentrated in industries with relatively low dependence on imports for production.

Dividing the induced GVA for each of the three factors of production by their column sum results in measures of factor intensity that indicate whether the income induced by the components of final demand is labor-intensive and/or capital intensive. As can be seen in Table 6, consumption-induced income in both countries could be said to be relatively labor-intensive as their wage and salary ratios are the highest among the 3 components of final demand. Likewise, investment-induced income in both countries tends to be relatively capital-intensive as their operating surplus and depreciation components exhibit the highest contribution ratios. In terms of net indirect taxes, export-induced income registers the highest ratio in Thailand, while investment-induced income appears to be relatively the largest contributor to government coffers in Vietnam.

Table 6: Factor intensities

| Factor of Production | | THAILAND | | | VIETNAM | | |
|---|---|---|---|---|---|---|---|
| | | Final Consumption | Gross Capital Formation | Exports | Final Consumption | Gross Capital Formation | Exports |
| VV01 | Wages and salaries | 34.2 | 26.3 | 27.7 | 61.9 | 48.9 | 52.3 |
| VV02 | Operating Surplus | 45.4 | 51.4 | 49.8 | 18.9 | 27.7 | 26.1 |
| VV03 | Depreciation | 13.5 | 15.1 | 14.5 | 8.6 | 12.2 | 10.9 |
| VV04 | Indirect taxes less subsidies | 6.9 | 7.2 | 8.0 | 10.7 | 11.3 | 10.7 |
| GDP | | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

*Source: Authors calculated base on inter-regional input – output framework*

***Impact on Import Requirements***

The non-competitive type of I-O table enables the quantification and assessment of the total imports needed by industries to sustain final demand. The total import requirements induced by the categories of final demand are obtained using the matrix equation:

$$\mathbf{M} = \hat{\mathbf{U}}\mathbf{X} \quad (18)$$

where $\mathbf{M}$ is the matrix of total (direct + indirect) intermediate import requirements induced by final demand; $\hat{\mathbf{M}}$ is diagonal matrix of total imported intermediate input coefficients and $\mathbf{X}$ is matrix of total output requirements induced by final demand.

Table 7 shows the total (direct and indirect) import requirements by producing sectors to sustain the final demands in each country. In 2000, total imports from the ROW that producers needed in order to satisfy Thailand's final demands accounted for 80.5% of the combined induced import requirements of both countries, with the remaining 19.6% shared by Vietnam's economic activities. By sector, Table 12 shows that the largest bulk of importations were generally made by the industrial sectors in both countries, notably in Vietnam where its heavy manufacturing industries are observed to be heavily dependent on importations for their input requirements.

In terms of import multipliers, interpreted as the import contents per unit of final demands, Table 7 shows that *exports* to the ROW registered the highest total multiplier effect (0.397) among the 3 categories of final demand in *Thailand's* economy, followed by *investment* and *consumption* demands with import multiplier effects of 0.319 and 0.184, respectively. In *Vietnam*, its *investment* demand exhibited the highest total import multiplier effect (0.454), followed by *export* demand (0.299) and *consumption* demand (0.244).

Table 7: Total Import requirements induces by demands

| COUNTRY/MAJOR SECTOR | | | THAILAND | | | | VIETNAM | | | | BILATERAL TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Final Consump-tion | Gross Capital Formation | Exports | TFD | Final Consump-tion | Gross Capital Formation | Exports | TFD | |
| | | | % | % | % | % | % | % | % | % | % |
| THA | I | AGRI, FISHERY & FORESTRY | 3.5 | -0.1 | 1.0 | 1.6 | 0.0 | 0.0 | 0.0 | 0.0 | 1.3 |
| | II | INDUSTRY | 83.1 | 96.9 | 96.3 | 92.6 | 2.9 | 2.8 | 1.7 | 2.4 | 75.0 |
| | III | SERVICES | 13.1 | 2.8 | 2.5 | 5.5 | 0.2 | 0.0 | 0.1 | 0.1 | 4.5 |
| | | SUBTOTAL - THAILAND | 99.7 | 99.5 | 99.8 | 99.8 | 3.1 | 2.9 | 1.8 | 2.6 | 80.8 |
| VIE | I | AGRI, FISHERY & FORESTRY | 0.0 | 0.0 | 0.0 | 0.0 | 17.2 | 1.3 | 7.9 | 9.5 | 1.9 |
| | II | INDUSTRY | 0.2 | 0.3 | 0.1 | 0.2 | 46.2 | 89.8 | 69.3 | 66.6 | 13.1 |
| | III | SERVICES | 0.1 | 0.1 | 0.1 | 0.1 | 33.4 | 6.0 | 20.9 | 21.3 | 4.2 |
| | | SUBTOTAL - VIETNAM | 0.3 | 0.5 | 0.2 | 0.2 | 96.9 | 97.1 | 98.2 | 97.4 | 19.2 |
| TOTAL INDUCED IMPORTS | | % | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| | | $mil [1] | 15,137 | 6,779 | 31,591 | 53,507 | 4,611 | 3,515 | 4,851 | 12,977 | 66,483 |
| FINAL DIRECT IMPORTS | | [2] | 11,514 | 10,789 | 0 | 22,304 | 3,809 | 1,546 | 0 | 5,355 | 27,659 |
| TOTAL IMPORTS | | [3]=[1]+[2] | 26,651 | 17,568 | 31,591 | 75,810 | 8,419 | 5,061 | 4,851 | 18,332 | 94,142 |
| TOTAL FINAL DEMAND | | [4] | 93,945 | 32,074 | 79,564 | 205,583 | 22,745 | 9,289 | 16,680 | 48,714 | 254,297 |
| TOTAL IMPORT MULTIPLIER | | [5]=[3]/[4] | 0.284 | 0.548 | 0.397 | 0.369 | 0.370 | 0.545 | 0.291 | 0.376 | 0.370 |

*Source: Authors calculated base on inter-regional input – output framework*

One interesting observation of the results is the multiplier effect of (foreign) export demand on intermediate import requirements. While the import content of the production of goods and services for export cannot be directly measured from the basic I-O table, it can be indirectly estimated as can be observed in Table 7. In Thailand's economy, its total import requirements induced by exports demand amounted to US$31.6 billion in 2000, which is then divided by its total export value of US$79.6 billion to yield an inducement coefficient or import multiplier of 0.397. In plain language, the finding suggests that, in

order to sustain US$1,000 worth of demand for export goods and services, Thailand's production sectors need to import US$397 worth of intermediate inputs. In short, Thailand's net foreign exchange earning thus amounts to only US$603, calculated as the gross export receipt of US $1,000 less the import "leakage" of US$397.

Analogous estimation procedure used above is also applied in the case of Vietnam's export-induced total import multiplier effect of 0.291. It can thus be concluded that Vietnam's export-oriented products tended to be less import-dependent than Thailand's. Its estimated net foreign exchange income is therefore US$709 per US$1,000 gross export receipts.

## 5. Conclusion

Our paper has developed an IRIO model that links the neighboring economies of Thailand and Vietnam for the primary purpose of determining the extent of interdependencies among and between industries of the two countries. As a first attempt, the chosen reference year of this study is CY 2000 when the basic IO tables of both countries have readily been made available, thus making the compilation work of the bilateral IRIO table less difficult and time-consuming. The only remaining work then was the utter need to compile the trade flow tables linking the two economies.

In the absence of survey data due to budget constraint, the construction of the trade flow tables, specifically the *import tables*, made use of calculated bilateral trade coefficients. The compilation of *export flows* was not attempted; instead export trade flows were rationalized based on the calculated import flows, on the premise that imports of one partner country approximate the exports of the other partner country.

The reliability and quality of our results are heavily influenced by the accuracy and precision of the underlying data as well as methods used in our study. The IRIO table assumes that the estimated national input coefficients are stable over time. This assumption of stability entails two separate assumptions. One, it is assumed that the national technical coefficients are stable. Two, the bilateral trade coefficients are assumed to be stable as well. The first assumption is common to all IO tables, while the second assumption is unique in the sense that there are no overwhelming theoretical reasons for the stability of inter-regional trade coefficients, especially over the long run. Thus, while the IRIO table may be a useful device in predicting the short-run reaction path of the economies of both countries, any predictive use of the table over longer time periods will need to take into consideration any variability in trading patterns. *Thus, the need to update trading trends in the short run is imperative.*

Intra-nationally, our comparative analysis revealed that, in CY 2000, Vietnam's economy was still in its developing stage as its total volume of economic transactions was estimated to be a mere one-fifth of Thailand's total available supply. Thailand had a per capita income more than five times that of Vietnam's. GVA in Vietnam was found to be split almost evenly across the agricultural and fishery, industry and services sectors, while GVA in Thailand was found to be dominated by the industrial and services sectors. On the whole, Thailand's economy was found to be self-sufficient, while average self-sufficiency rate in Vietnam was estimated to be below unity, i.e., its production is insufficient to sustain its domestic demand.

The analysis of the economic relationship between the two countries found that the value of their bilateral trade was much lower than their trading patterns with the Rest of the World (ROW). Consequently, the estimated international spillover and feedback effects were found to be rather negligible.

In terms of the degree of interdependencies, our results show that the multiplier effects,

expressed in terms of backward and forward linkages, are observed to be higher in Thailand's productive economy than in Vietnam's. This suggests Thailand's higher dependence on its domestic industries, rather than on imports, for its input requirements than Vietnam's.

The impact analysis found that induced-consumption demand in both countries had the highest GVA and lowest imports multipliers. One likely reason for these results could be their relatively low dependence on imports for final consumption. On the other hand, induced-investment demand exhibited higher import multiplier effects since production of capital goods is highly dependent on imports.

One interesting observation of the results is the multiplier effect of *export* demand on the import requirements in production. While the import content of the production of export-oriented commodities cannot be directly measured from the I-O table, impact analysis revealed that production of export goods and services in Thailand was found to be more import-dependent than in Vietnam's. It can thus be concluded that, in terms of *net foreign exchange earnings*, which is estimated as the difference between gross export receipts and calculated import "leakages", appeared to be relatively more beneficial to Vietnam's economy than to Thailand's.

## References

[1] Chenery, H. B. 1956. *Interregional and International Input-Output Analysis in T. Barna* (ed.), The Structural Interdependence of the Economy. New York: John Wiley and Sons, Inc., pp. 341-356.

[2] Chenery, H. B., and Clark, Paul G., 1959, *Interindustry Economics*, John Wiley & Sons, Inc., New York.

[3] General Statistics Office, *Input-Output Table of Vietnam for 2000*. Statistics publish house, 2002, Hanoi.

[4] Institute of Developing Economies-Japan External Trade Organization. 2006b. *Asian International Input-Output Table Volume* 2: Data. I.D.E. Statistical Data Series No. 90. Tokyo: IDE-JETRO.

[5] Isard, W. 1951. Interregional and Regional Input-Output Analysis: A Model of a Space-Economy. *Review of Economics and Statistics* 33(4):318-328.

[6] Isard, W., Azis, I. J., Drennan, M. P., Miller, R. E., Saltzman, S., Thorbecke, E. 1998. *Methods of Interregional and Regional Analysis*. Aldershot: Ashgate Publishing Limited.

[7] Leontief, W. 1936. *Quantitative Input and Output Relations in the Economic Systems of the United States*. Review of Economic Statistics 18(3):105-125.

[8] Miller, R. E. and Blair, P. D. 1985. *Input-Output Analysis: Foundations and Extensions*. New Jersey: Prentice-Hall, Inc.

[9] National Economic and Social Development Board (NESDB), 2005. *Input-Output Table for Thailand 2000*.

[10] Rasmussen, P. N. 1957. *Studies in Inter-Sectoral Relations. Amsterdam: North Holland Publishing Company*.

[11] Richardson, H. W. 1972. *Input-Output and Regional Economics*. London: Weidenfeld and Nicolson.

[12] Secretario, F. T., Trinh, B., Hung, D. M., and Kim, K. M. 2003. *Inter-Regional Input-Output Analysis: The Case of Ho Chi Minh City and the Rest of Vietnam Economies*, Paper presented at the Symposium on Study on Regional Economic-Natural Environment in Viet Nam's Transition Economy, Hanoi, Viet Nam.

[13] Sim, B., Secretario, F. and Suan, E. 2007. *Developing an Interregional Input-Output Table for Savannakhet and Mukdahan: Methodology and Applications*. ERD Occasional Statistical Paper No. 1, Asian Development Bank, Manila, Philippines.

[14] United Nations Statistics Division. 1999. *Handbook of Input-Output Table: Compilation and Analysis*. Series F, No. 74. New York: United Nations.

# Xây dựng bảng đầu vào - đầu ra song phương: Trường hợp của Thái Lan và Việt Nam: Phương pháp và ứng dụng

Bùi Trinh, Francisco Secretario, Kim Kwangmoon

*Tổng cục Thống kê,*
*Số 2 Hoàng Văn Thụ, Quận Ba Đình, Hà Nội, Việt Nam*

**Tóm tắt:** Bài viết đo lường và phân tích các mối quan hệ kinh tế phụ thuộc lẫn nhau giữa hai nước Thái Lan và Việt Nam thông qua việc xây dựng bảng đầu vào-đầu ra song phương của hai nước. Có thể dùng mô hình liên Quốc gia này làm căn cứ để tính toán mối quan hệ giữa các ngành kinh tế trong khu vực nghiên cứu. Giống như một bảng đầu vào-đầu ra cấp Quốc gia, bảng đầu vào-đầu ra liên vùng/liên Quốc gia (IRIO) có thể được sử dụng để ước lượng mức độ của một "cú sốc" bên ngoài liên quan tới các chỉ số kinh tế vĩ mô lớn như sản lượng, giá trị tăng thêm, thu nhập và việc làm. Tuy nhiên, không giống như bảng I/O đơn, IRIO có thể mô tả và đánh giá tác động lan toả và hiệu ứng ảnh hưởng ngược liên vùng/liên Quốc gia phát sinh từ một thay đổi ngoại sinh liên quan tới nhu cầu về sản lượng của bất kỳ khu vực nghiên cứu nào. Nói cách khác, IRIO không chỉ giúp ước lượng mối quan hệ liên ngành mà còn phản ánh mối quan hệ liên vùng/Quốc gia. Nghiên cứu này là những gì mà AREES (Hiệp hội nghiên cứu về kinh tế - môi trường theo vùng) ủng hộ để phát triển cơ sở dữ liệu tổng hợp cho dự án nghiên cứu: Phân tích tác động của đầu tư cơ sở hạ tầng ở khu vực Đông Dương: Phương pháp tiếp cận dựa trên mô hình vào-ra."