

Measurement of International Economic dependencies of China-Thai-Lao PDR based on the International Input-Output Table

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This paper attempts to measure and analyze the economic interdependencies among China, Thailand and Lao PDR, made possible by constructing a three-nation inter-national input-output (TNIO) table. It is an inter-national type of IO models that provides a compact and comprehensive accounting framework to quantify the economic inter-relationships among and between industries located in the three countries concerned.

Key Words : TNIO, economic interdependencies, linkage, different economic development stage

1. INTRODUCTION

Economic integration (globalization) in Asia has not only induced the region's growth but has also accelerated diversities of industrial cluster or international assembly work among Membership Countries. While some of upper stream country/region will get the position to produce and receive fruits of work, there would be fear of the situation that new Asian economic power exploits opportunities in other growing Asian markets. With the growing international economic relations among nations (Cambodia, the People's Republic of China, Lao PDR, Myanmar, Thailand, and Viet Nam) in the Greater Mekong Sub-region (GMS), notably in terms of cross-border trade, investment, and labor mobility, this paper attempts to measure and analyze the economic interdependencies, based on a three-country international input-output (TNIO) table constructed by linking the three nations of China, Thailand and Lao PDR where IO data are made available for the latest 2005.

The paper is structured as follows: Section 2 is concerned with previous studies related to this study. Section 3 outlines the accounting framework used to develop the TNIO table. The methods and data used to construct the TNIO table linking China, Thailand and Lao PDR with year 2005. in Section 4 before we discuss the salient findings of the interdependency among three countries in Section 5. Finally, Section 6 concludes.

2. Previous Studies Related to the IO Table in the GMS countries

In the GMS, we survey the compilation of national IO tables related to this study. The countries of GMS geographically cover Thailand, Vietnam, Lao PDR, Cambodia, Myanmar, and China.

Thailand has produced benchmark national IO table since 1975, and it has been compiled regularly every five years. Its first IO table was compiled by the National Economic and Social Development Board (NESDB) in coordination with the National

Statistical Office (NSO). Thailand has also been one of 10 partner countries involved in the periodic compilation of Asia international IO table as a continuing project of the Institute of Developing Economies-Japan External Trade Organization (IDE-JETRO), Japan since it started in the 70's. In collaboration with Asia Development Bank (ADB), Thailand has compiled a supply and use table (SUT) for 2007.

Since its accounting shift from the Material Product System (MPS) to the United Nations System of National Accounts (UN-SNA) in the late 1980's, Vietnam has produced benchmark national IO tables since 1989. First IO table for 1989 was compiled by the General Statistics Office (GSO). The latest national IO table is Year 2007. Vietnam has also compiled its 2005 SUT in collaboration with ADB.

There is no official IO table yet for Cambodia although its National Institute of Statistics (NIS) in cooperation with a non-profit organization of Japan had compiled a small-size, non-survey-based IO table with year 2000 as reference period. NIS has recently compiled a SUT for year 2005 under an ADB-sponsored project. Given this 2005 SUT, the 2005 IO table can be derived. In Lao PDR, there is no benchmark national IO table compiled by the Government nor an SUT since it did not join the 2005 ADB-sponsored project. The same is true with Myanmar as it has neither IO table nor an SUT.

China has made benchmark national IO table since 1981, and it has 6 tables (1981-87-92-97-2002-07). China also joined the IDE-JETRO group in compiling the Asian International IO table, the latest one is for year 2005.

3.FRAMWORK

(1) The TNIIO Table

The TNIIO table, as configured in Fig.1, is of the Isard-type model that traces inter-sectoral economic flows, intra-nationally and inter-nationally alike. The outlined TNIIO table is of the non-competitive and open type. It is non-competitive because it makes an explicit distinction between nationally-produced and imported products. Such a distinction provides a better reflection of the use of domestic production technology and inputs in the production of output in each country. The “openness” is derived from the fact that economic activities are split into the intermediate and final demand categories. The TNIIO table also contains a third country – the Rest of the World (ROW) – that represents all areas outside the three countries under study. The (money) flows are valued at producers' prices.

The symbolic representations used in Fig.1 are defined as follows:

S: label of State, C:China, T:Thailand, L:Lao PDR, X_{SS} : $n \times n$ transactions of State (Nation's) products consumed in production of State (Nation's) own products, F: $n \times o$ transactions of Nation's products consumed by Nation's own final demand, E(C or T or L) W: Column vector of exports of Nation's products to ROW (all nations except Thailand and Lao), X_S : Column vector of gross product output of State (Nation), IMWC: Row vector of imports from ROW used in production of China's products, IMWT: Row vector of imports from ROW used in production of Thailand's products, IMWL: Row vector of imports from ROW used in production of

From \ To		Intermediate Demand (ID)				Final Demand (FD)					Total Gross Output (TGO)	
		China	Thailand	Lao PDR	TID	China	Thailand	Lao PDR	ROW			TFD
		$1 \sim j \sim n$	$1 \sim j \sim n$	$1 \sim j \sim n$		$1 \sim k \sim o$	$1 \sim k \sim o$	$1 \sim k \sim o$	E	M		
Intermediate Inputs	China	X^{CC}	X^{CT}	X^{CL}	Total Intermediate Demand	F^{CC}	F^{CT}	F^{CL}	E^{CW}	0	Total Final Demand	X^C
	Thailand	X^{TC}	X^{TT}	X^{TL}		F^{TC}	F^{TT}	F^{TL}	E^{TW}	0		X^T
	LaoPDR	X^{LC}	X^{LT}	X^{LL}		F^{LC}	F^{LT}	F^{LL}	E^{LW}	0		X^L
	ROW	IM^{WC}	IM^{WT}	IM^{WL}		FM^{WC}	FM^{WT}	FM^{WL}	0	$-M^W$		0
	D T	IDT^C	IDT^T	IDT^L		FDT^C	FDT^T	FDT^L	0	$-DT$		0
TII		Total Intermedite Inputs			Σ	F^C	F^T	F^L	ΣE^W	$-\Sigma M^W$	Σ	ΣX
Gross Value Added (GVA)		V^C	V^T	V^L	Σ							
Total Gross Input (TGI)		X^C	X^T	X^L	ΣX							

Fig.1 Layout of the TNIIO table linking China, Thailand, and Lao PDR

Lao PDR's products, FMWC: Row vector of imports from ROW consumed by China's final demand, FMWT: Row vector of imports from ROW consumed by Thailand's final demand, FMWL: Row vector of imports from ROW consumed by Thailand's final demand, -MW : Total imports from ROW (as negative entry), IDTC : Row vector of tariff duties of China's intermediate imports from ROW, IDTT: Row vector of tariff duties of Thailand's intermediate imports from ROW, IDTL: Row vector of tariff duties of Lao PDR's intermediate imports from ROW, FDTC: Row vector of tariff duties of China's final imports from ROW, FDTT: Row vector of tariff duties of Thailand's final imports from ROW, FDTL: Row vector of tariff duties of Lao PDR's final imports from ROW, -DT : Total tariff duties incurred on total imports from ROW (as negative entry), VC : Row vector of gross value added generated in production of China's products, VT : Row vector of gross value added generated in production of Thailand's products, VL : Row vector of gross value added generated in production of Lao PDR's products, ROW: Rest of World.

(2) Measurement Methodology of International dependency based on IOT

We can find the many uses of the TNIIO table. It is possibly used to (1) serve as database for a comprehensive evaluation of the interlinked structural relationships between GMS industries, intra-nationally and inter-nationally alike; (2) serve as a simple yet effective tool for extensive intra-and inter-national economic impact analysis; (3) serve as database in the building of suitable econometric models such as SAM, CGE, etc; and (4) provide statistical agencies with a coherent and sustainable framework for the efficient collection and processing of an integrated database in conformity with the data needs by development planners and policy makers.

However, it is difficult for us to adopt all compilation procedures in developing countries because of inadequate statistical data. So, we partly use the non-survey method of IO compilation. The method deals with the collection of existing official statistics, albeit inadequate, complemented by independent researches and personal interviews and discussions with statistical scholars and officers.

Fig.1 can be used to form the following balancing equations, in a three-region economy, shown in matrix form:

$$\begin{pmatrix} X^C \\ X^T \\ X^L \end{pmatrix} = \begin{pmatrix} A^{CC} & A^{CT} & A^{CL} \\ A^{TC} & A^{TT} & A^{TL} \\ A^{LC} & A^{LT} & A^{LL} \end{pmatrix} \begin{pmatrix} X^C \\ X^T \\ X^L \end{pmatrix} + \begin{pmatrix} Y^C \\ Y^T \\ Y^L \end{pmatrix} \tag{1}$$

$$= \begin{pmatrix} I & 0 & 0 \\ 0 & I & 0 \\ 0 & 0 & I \end{pmatrix} \begin{pmatrix} A^{CC} & A^{CT} & A^{CL} \\ A^{TC} & A^{TT} & A^{TL} \\ A^{LC} & A^{LT} & A^{LL} \end{pmatrix} \begin{pmatrix} Y^C \\ Y^T \\ Y^L \end{pmatrix}$$

where: $Y^C = F^{CC} + F^{CT} + F^{CL} + E^{CW}$, $Y^T = F^{TC} + F^{TT} + F^{TL} + E^{TW}$, $Y^L = F^{LC} + F^{LT} + F^{LL} + E^{LW}$ and , $A^{CC} = X^{CC} (X^C)^{-1}$, $A^{CT} = X^{CT} (X^T)^{-1}$, $A^{CL} = X^{CL} (X^L)^{-1}$, $A^{TC} = X^{TC} (X^C)^{-1}$, $A^{TT} = X^{TT} (X^T)^{-1}$, $A^{TL} = X^{TL} (X^L)^{-1}$, $A^{LC} = X^{LC} (X^C)^{-1}$, $A^{LT} = X^{LT} (X^T)^{-1}$, $A^{LL} = X^{LL} (X^L)^{-1}$

In order to be able to measure the spillover and feedback effects due to international trade, Round (2001) decomposed the Leontief inverse matrix B, thus rewriting equation (1) into the following form:

$$\begin{pmatrix} X^C \\ X^T \\ X^L \end{pmatrix} = \begin{pmatrix} B^{CC} & B^{CT} & B^{CL} \\ B^{TC} & B^{TT} & B^{TL} \\ B^{LC} & B^{LT} & B^{LL} \end{pmatrix} \begin{pmatrix} Y^C \\ Y^T \\ Y^L \end{pmatrix}$$

$$= \begin{pmatrix} F^C & 0 & 0 \\ 0 & F^T & 0 \\ 0 & 0 & F^L \end{pmatrix} \begin{pmatrix} I & S^{CT} & S^{CL} \\ S^{TC} & I & S^{TL} \\ S^{LC} & S^{LT} & I \end{pmatrix} \begin{pmatrix} M^C & 0 & 0 \\ 0 & M^T & 0 \\ 0 & 0 & M^L \end{pmatrix} \begin{pmatrix} Y^C \\ Y^T \\ Y^L \end{pmatrix} \tag{2}$$

where: $M^C = (I - A^{CC})^{-1}$, $S^{CT} = M^C A^{CT}$, $S^{CL} = M^C A^{CL}$, $F^C = (I - S^{CT} S^{CL})^{-1}$, $M^T = (I - A^{TT})^{-1}$, $S^{TC} = M^T A^{TC}$, $S^{TL} = M^T A^{TL}$, $F^T = (I - S^{TC} S^{TL})^{-1}$, $M^L = (I - A^{LL})^{-1}$, $S^{LC} = M^L A^{LC}$, $S^{LT} = M^L A^{LT}$, $F^L = (I - S^{LC} S^{LT})^{-1}$

The unknowns **M**, **S** and **F** account for the intra-regional linkages, inter-regional spillover and feedback effects, respectively.

4. EMPIRICAL ANALYSIS

The economic interdependencies among the three countries are analyzed in terms of the international trade. The findings of applications such as multiplier, linkage and impact analyses as well as spillover and feedback effects are also presented and analyzed.

(1) International trade

A salient feature of the TNIIO table is international trade. In our study, international outflows/inflows of products are explicitly recorded as separate sub-matrices. Thus, our TNIIO table can be used to determine the extent of China's dependence on Thailand's products, Thailand's dependence on Lao PDR's products, and Lao PDR's dependence on China's products and, vice versa. Given the Leon-

tief's international inverse, the spillover and feed- merchandise trade balance with Thailand, Lao PDR,

Table 4. International Trade Summary: China, Thailand, Lao PDR and ROW, 2005

Destination	CHINA		THAILAND		LAO PDR		ROW		Total
	Value	%	Value	%	Value	%	Value	%	
Origin									Exports
CHINA			12,262	9.3	116	10.1	882,439	88.3	894,817
%			1.4		0		98.6		100
THAILAND	11,807	1.7			732	63.3	116,187	11.6	128,726
%	9.2				0.6		90.3		100
LAO PDR	24	0	205	0.1			484	0.1	713
%	3.4		28.8				67.9		100
ROW	680,518	98.3	119,677	90.6	308	26.6			800,503
%	85		15		0				100
Total Imports	692,349	100	132,144	100	1,156	100	999,110	100	1,824,759

back effects of international trade on the three economies can then be measured.

Table 4 summarizes, in matrix format, the origin-destination of trade outflows (or exports) and inflows (or imports) of merchandise goods and services for 2005. As can be observed from Table 4, total international trade in 2005 among China, Thailand, Lao PDR, and ROW amounted to US\$1,825 billion, with China getting the biggest bulk of the total trade. Also, China's and Thailand's foreign trade transaction was almost made with ROW while Lao PDR's foreign transaction was relatively made partly with Thailand. China had a positive

and ROW. In contrast, Thailand had a negative trade balance with China and ROW though it exhibited a favorable merchandise trade balance with Lao PDR. Lao PDR had a negative trade balance with both China and Thailand though it exhibited a favorable merchandise trade balance with ROW.

(2) Spillover and Feedback Effects

A single-national IO table essentially assumes that imports from suppliers and exports to buyers outside the economy are treated as exogenous. However,

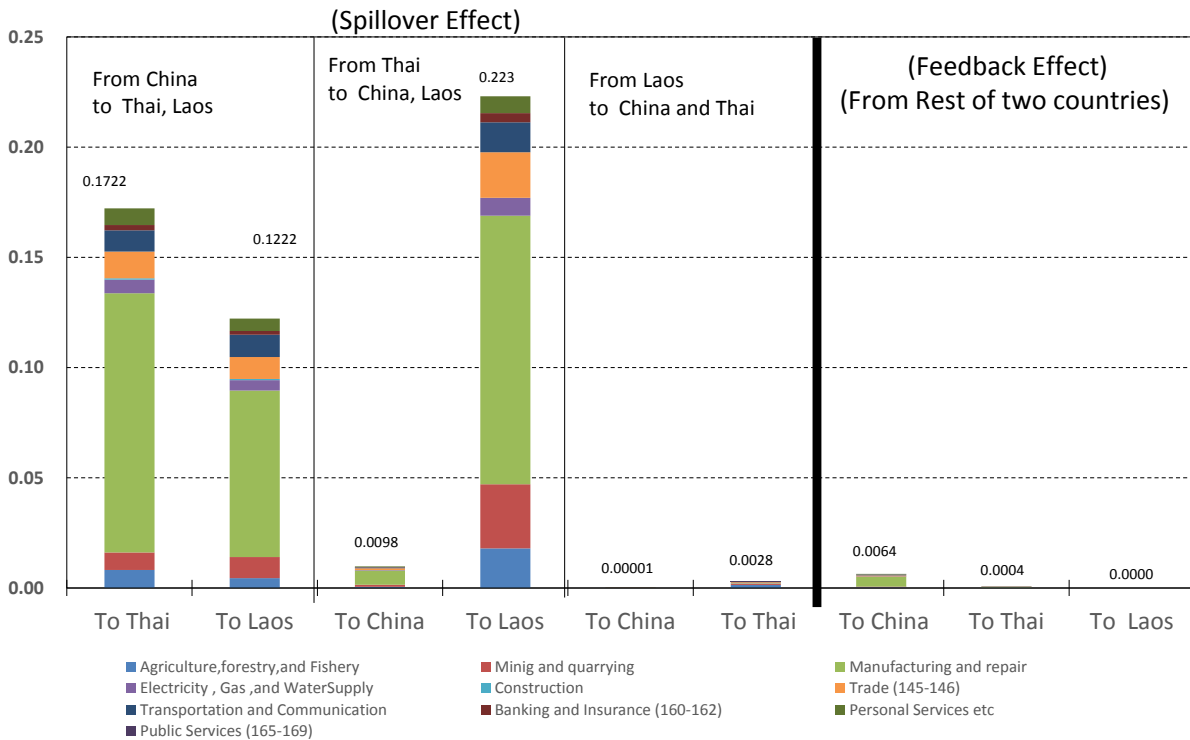


Fig 2. International Spillover and Feedback Effect Among China, Thailand, and Laos

such a table will not allow us to capture the international 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 China. This will result in an increase in the output of the manufacturing industry in China, which could result in an increase in demand for relevant inputs from suppliers outside the country, say, Thailand. This new demand for the output of the suppliers in Thailand will create an increase in their output and, directly and indirectly, the output of other industries in Thailand. This stimulus of new output in Thailand due to new output in China is known as the international spillover effect. In addition, suppose that the stimulated production in Thailand includes increased output of industries that use inputs from China in their production process. Thus, the increased manufacturing production in Thailand leads to increased output of its suppliers in Thailand, which, in turn, leads to more production in China. This is known as the international feedback effect. Also the same correspondence, which is analogously calculated, can be said between China and Lao PDR and between Lao PDR and Thailand.. These spillover and feedback effects are computed using the formulae shown in equation 2.

Fig. 2 shows that, because of weak international linkages among nations and between sectors, the estimated spillover and feedback effects appear to be insignificant. Especially, feedback effects between the three countries are found to be very negligible. Although the international effects can be appear to be little on the average, the spillover effect of manufacturing and repair in China to Thailand and Lao DPR is in some degree significant. Furthermore, its spillover effect in Thailand to Lao PDR is likewise found to be significant.

5. CONCLUSION

Summarized below are the arguments presented in this paper.

This paper has introduced our developed a TNIIO model that links the neighboring economies of China, Thailand, and Lao PDR for the primary purpose of determining the extent of interdependencies among and between industries of the three countries. And the extent of economic interdependence among and between industries of the three countries could be showed by the TNIIO model.

In terms of the degree of interdependencies, our results showed that the multiplier effects, expressed in terms of backward and forward linkages, were observed to be much higher in China's productive

economy than in Thailand's and Lao PDR's. This suggested China's higher dependence on its domestic industries rather than on imports, for its input requirements than Thailand's and Lao PDR's.

The analysis of the economic relationship among the three countries found that the value of their bilateral trade was much lower than their trading patterns with the Rest of the World (ROW) although Lao PDR' economy heavily relied on the trade from and to Thailand. Consequently, the estimated international spillover and feedback effects were found to be almost negligible.

Import analysis revealed that Lao PDR's export-oriented products were found to be much less import-dependent than Thailand's and China's, thus resulting in more net foreign exchange receipts to its economy relative to what Thailand and China receive because of their higher import "leakages" in the production of export products.

In short, the economic interdependencies linking China, Thailand and Lao PDR in the year 2005 were very weak in terms of the great difference of economic development stage or industrial structure in spite of the remarkable traffic development.

Therefore it is very important to try to improve the transportation system and the legal framework of protective trade. But if the free trade will be blindly promoted among three countries, the rich natural or human resources of low underdeveloped countries is apprehensive of the one-sided plunder. So it is necessary to seek to satisfy the mutual prosperity in coexistence among three countries.

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