



TRADE IN VALUE ADDED (TiVA) ANALYSIS: MALAYSIA'S INTERDEPENDENCIES IN THE PRODUCTION STRUCTURE USING SPATIAL LINKAGES ANALYSIS

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9TH MALAYSIA STATISTICS CONFERENCE

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Dealing with Uncertainties: Unearthing Measures for Recovery

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INTRODUCTION



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INTRODUCTION



1. Trade in Value Added (TiVA) refers to the exports, imports, and net trade in value added between one economy and another.
2. TiVA gives the ability to redefine the relationship between countries of origin and destination in international trade. In contrast to the conventional concept based on foreign trade statistics.
3. It focuses on the value added contents of a traded product, and considers each country's contribution to the value added generation in a production process.
4. Note to differ, the value added defined in the national account is the difference between output and intermediate consumption while TiVA analysis captures the value that is added in each step of production process in the global value chain.
5. This paper aims to focus on Malaysia's interdependencies in the production structure using spatial linkages analysis with its eight major trading partners.
6. The purpose of this study is to assess the types and intensities of spatial interdependence or connectedness.
7. This analysis also able to compute the strength of economic connections among regions in an economy, and its evolution over time, for example, increasing regional self-sufficiency or increasing interregional dependence.
8. The aggregation is in line with the Malaysia's external trade statistics in 2022 which showed that China was Malaysia's top trading partner with a contribution of 18.9 per cent, followed by Singapore (12.0%), US (9.7%), European Union (8.1%), Japan (6.7%), and Thailand (4.4%).





LITERATURE REVIEW



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LITERATURE REVIEW



Literature Review

Koopman, Wang, & Wei (2014)	TiVA has been studied and used widely to define the relationship between countries of origin and the trading destination.
Borin, Mancini, & Taglioni (2021)	Since measuring countries' value added in gross trade, there has been a rapidly expanding demand for measures of GVC participation that offer a macro-view of the phenomenon.
Bems & Kikkawa (2021)	The topic of TiVA has proliferated in economic research both in international trade and macroeconomics.
Shao & Miller (1990)	Found out that spatial linkages were relatively stable over this 14-year period, both at an aggregated regional level and at the state level.



LITERATURE REVIEW (cont'd)



Literature Review

Freytag & Fricke (2017)	Evaluated sectoral linkages of financial services of the Nigerian and Kenyan economies by means of an input–output analysis for 2007, 2009 and 2011. They investigated mobile money linkages for the communication sector and found high forward and backward linkages for the Nigerian financial services sector.
Turco, Maggioni, & Zazzaro (2019)	Linkage analysis was used to study about effect of financial development through input-output (IO) linkages in determining the growth of industries across countries.
Tam (2014)	Linkage analysis was used to study about effect of financial development through input-output (IO) linkages in determining East Asian equity market linkages in and out of the Asian and global financial crises.





METHODOLOGY



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METHODOLOGY



- This study uses data from **Multi Regional Input-Output (MRIO)** obtained from Asian Development Bank (ADB) for reference year 2015 – 2021.
- The data consists of **63 economies including Rest of the World**. For the purpose of the analysis, the sectors are aggregated into **10 economies** which includes **Malaysia and top eight major trading partners namely Hong Kong, India, Japan, Korea, China, Singapore, Thailand, USA**. Other countries are aggregated into **Rest of the World**.
- MRIO data is classified into 35 sectors. For this study, data are **aggregated into five main sectors** such as Agriculture, Mining & Quarrying, Manufacturing, Construction and Services.
- The data are presented in USD Million dollars to allow for international comparison.
- This study used the industry by industry MRIO ADB tables.

Spatial Linkages

- Used to assess the types and intensities of spatial interdependence or connectedness.
- There are two types of linkages which is forward and backward linkages.
- Each Linkages consists of two components namely **intra regional** and **inter regional** component.

Intra regional Component refers to components within regional itself. It computes the intra regional dependence between all sectors within the same region.

Inter regional Component refers to components between the regionals. It computes the inter regional dependence between all sectors for all regions.



METHODOLOGY (cont'd)



The **Spatial Backward** and **Forward Linkages** by sector was generated based on the equation below:

Total Backward Linkage (BL)

Backward linkage of sector j is the amount by which sector j production depends on interindustry inputs.

Backward Linkages of sector j in region r captures both direct and indirect linkages and is given by the column sums of the total requirements matrix \mathbf{L} (Leontief Inverse model). It will likewise have an intraregional and an interregional component which are region r and region s .

Suppose we want to know the total BL of sector 1 in region s . Given the \mathbf{L} matrix:

Selling sector	Region r			Region s		
	1	2	3	1	2	
Region r	1	l_{11}^{rr}	l_{12}^{rr}	l_{13}^{rr}	l_{11}^{rs}	l_{12}^{rs}
	2	l_{21}^{rr}	l_{22}^{rr}	l_{23}^{rr}	l_{21}^{rs}	l_{22}^{rs}
	3	l_{31}^{rr}	l_{32}^{rr}	l_{33}^{rr}	l_{31}^{rs}	l_{32}^{rs}
Region s	1	l_{11}^{sr}	l_{12}^{sr}	l_{13}^{sr}	l_{11}^{ss}	l_{12}^{ss}
	2	l_{21}^{sr}	l_{22}^{sr}	l_{23}^{sr}	l_{21}^{ss}	l_{22}^{ss}

← Intraregional
Interregional →

$$BL(t)_j^r = BL(t)_j^{rr} + BL(t)_j^{sr} = \sum_{i=1}^n l_{ij}^{rr} + \sum_{i=1}^n l_{ij}^{sr} \quad (1)$$

Where;

$$b(t)^r = b(t)^{rr} + b(t)^{sr} \quad (2)$$

$$b(t)^{rr} = i'(L)^{rr} \quad (2)$$

$$b(t)^{sr} = i' L^{sr} \quad (3)$$



METHODOLOGY (cont'd)



To measure the relative strength of the intraregional vs interregional (internal vs. external) of total backward linkage of sector j in region r , we can calculate them using formula as per below:

Use percentages

$$\text{Relative strength of intraregional BL} = \frac{BL(t)_j^{rr}}{BL(t)_j^r} \times 100 \quad (4)$$

$$\text{Relative strength of interregional BL} = \frac{BL(t)_j^{sr}}{BL(t)_j^r} \times 100 \quad (5)$$

Use alternative normalization

$$\text{Relative strength of intraregional BL} = \frac{BL(d)_j^{rr}}{x_j^r} \quad (6)$$

$$\text{Relative strength of interregional BL} = \frac{BL(t)_j^{sr}}{x_j^r} \quad (7)$$

Total Backward Linkage (BL)

Forward linkage of sector i is the amount by which sector j production supplied to other industries for their intermediary inputs.

Total forward linkage (FL) of sector i in region r captures both direct and indirect linkages and is given by the column sums of the total requirements matrix **G** (Gosh model). It will likewise have an intraregional and an interregional component which are region r and region s .



METHODOLOGY (cont'd)



Suppose we want to know the total FL of sector 1 in regions s. Given the **G** matrix:

Selling sector		Region r			Region s	
		1	2	3	1	2
Region r	1	g_{11}^{rr}	g_{12}^{rr}	g_{13}^{rr}	g_{11}^{rs}	g_{12}^{rs}
	2	g_{21}^{rr}	g_{22}^{rr}	g_{23}^{rr}	g_{21}^{rs}	g_{22}^{rs}
	3	g_{31}^{rr}	g_{32}^{rr}	g_{33}^{rr}	g_{31}^{rs}	g_{32}^{rs}
Region s	1	g_{11}^{sr}	g_{12}^{sr}	g_{13}^{sr}	g_{11}^{ss}	g_{12}^{ss}
	2	g_{21}^{sr}	g_{22}^{sr}	g_{23}^{sr}	g_{21}^{ss}	g_{22}^{ss}

← Intraregional
← Interregional

$$FL(t)_i^r = FL(t)_i^{rr} + FL(t)_i^{sr} = \sum_{j=1}^n g_{ji}^{rr} + \sum_{j=1}^n g_{ji}^{sr} \quad (8)$$

Where;

$$f(t)^r = f(t)^{rr} + f(t)^{sr}$$

$$f(t)^{rr} = i'(G)^{rr} \quad (9)$$

$$f(t)^{sr} = i'G^{sr} \quad (10)$$

To measure the relative strength of the intraregional vs interregional of total forward linkage of sector *i* in region *r*, we can calculate them using formula as per below:

Use percentages

$$\text{Relative strength of intraregional FL} = \frac{FL(t)_i^{rr}}{FL(t)_i^r} \times 100 \quad (11)$$

$$\text{Relative strength of interregional FL} = \frac{FL(t)_i^{sr}}{FL(t)_i^r} \times 100 \quad (12)$$

Use alternative normalization

$$\text{Relative strength of intraregional FL} = \frac{FL(t)_i^{rr}}{x_i^r} \quad (13)$$

$$\text{Relative strength of interregional FL} = \frac{FL(t)_i^{sr}}{x_i^r} \quad (14)$$





RESULT AND DISCUSSION



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RESULT AND DISCUSSION



Overall Domestic and Interregional Consumption and Distribution of Malaysia, 2021

Backward Linkage or Consumption of Inputs for Malaysia

Economy	Intraregional Strength	Interregional Strength
MAL	71.2%	28.8%
MTP	Interregional Strength	
HKG	0.2%	
IND	0.6%	
JPN	1.8%	
KOR	1.2%	
PRC	7.6%	
SIN	1.8%	
THA	0.9%	
USA	1.9%	
ROW	12.6%	

Table 1. The **Intraregional** and **Interregional Consumption** of input for Malaysia by Major Trading Partners for the year 2021

Forward Linkage or Distribution of Outputs of Malaysia

Economy	Intraregional Strength	Interregional Strength
MAL	68.9%	31.1%
MTP	Interregional Strength	
HKG	0.2%	
IND	1.4%	
JPN	1.6%	
KOR	0.8%	
PRC	8.4%	
SIN	1.5%	
THA	0.8%	
USA	3.5%	
ROW	12.9%	

Table 2. The **Intraregional** and **Interregional Distribution** of output of Malaysia by Major Trading Partners for the year 2021



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RESULT AND DISCUSSION (cont'd)



Analysis by Sectors in Malaysia

Backward Linkage or Input Consumption of Malaysia by Five (5) Main Sectors, 2015 - 2021

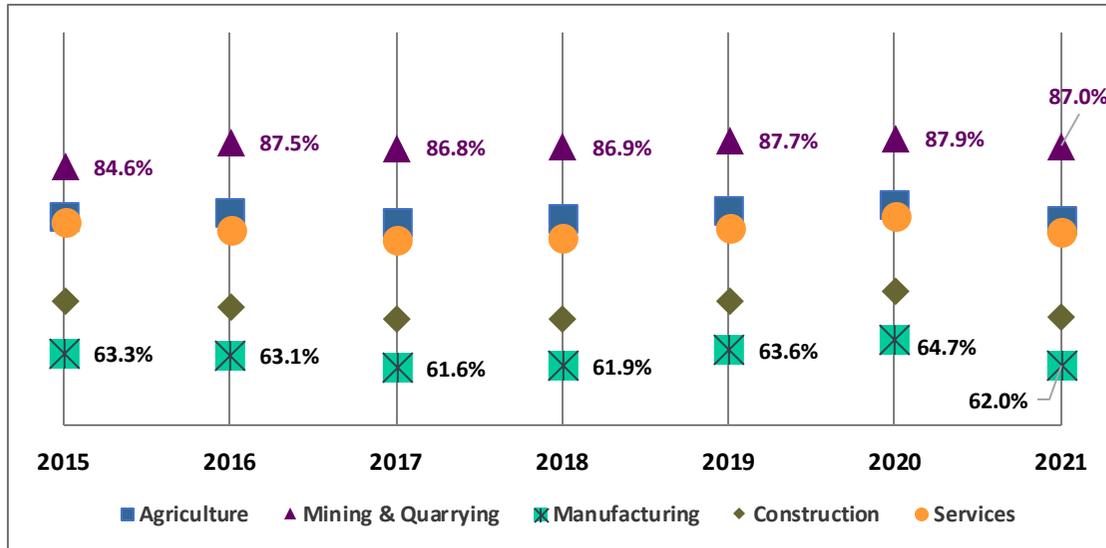


Figure 1. Intra-regional Consumption of input of Malaysia by Sectors from the Year 2015 until Year 2021

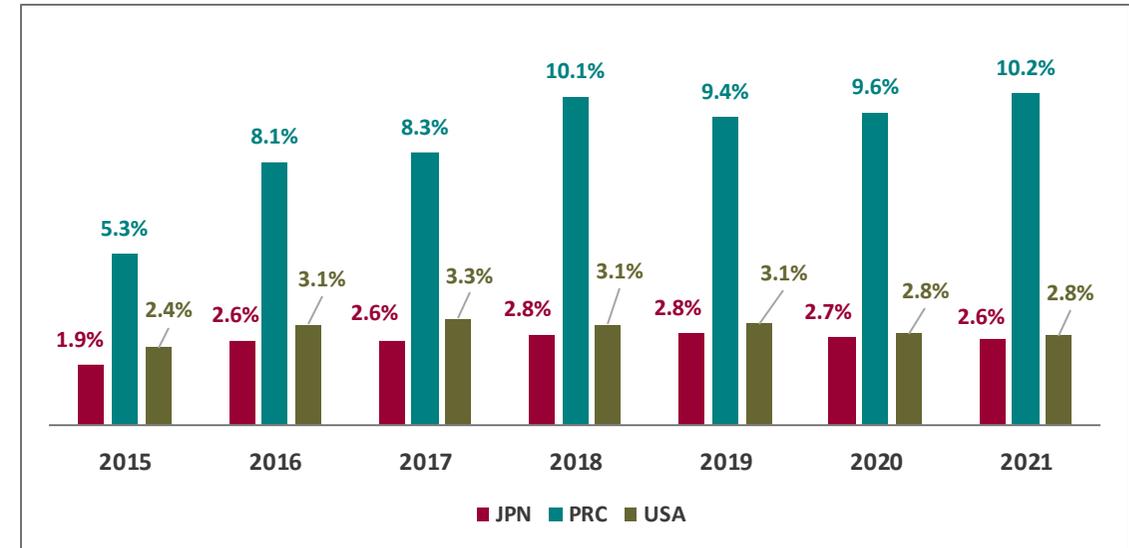


Figure 2. Inter-regional Consumption of the Manufacturing Sector in Malaysia by Top Three (3) Major Trading Partners from the Year 2015 until Year 2021



RESULT AND DISCUSSION (cont'd)



Analysis by Sectors in Malaysia

Forward Linkage or Output Distribution of Malaysia by Five (5) Main Sectors, 2015 - 2021



Figure 3. Intra-regional Distribution of Output of Malaysia by Sectors from the Year 2015 until Year 2021

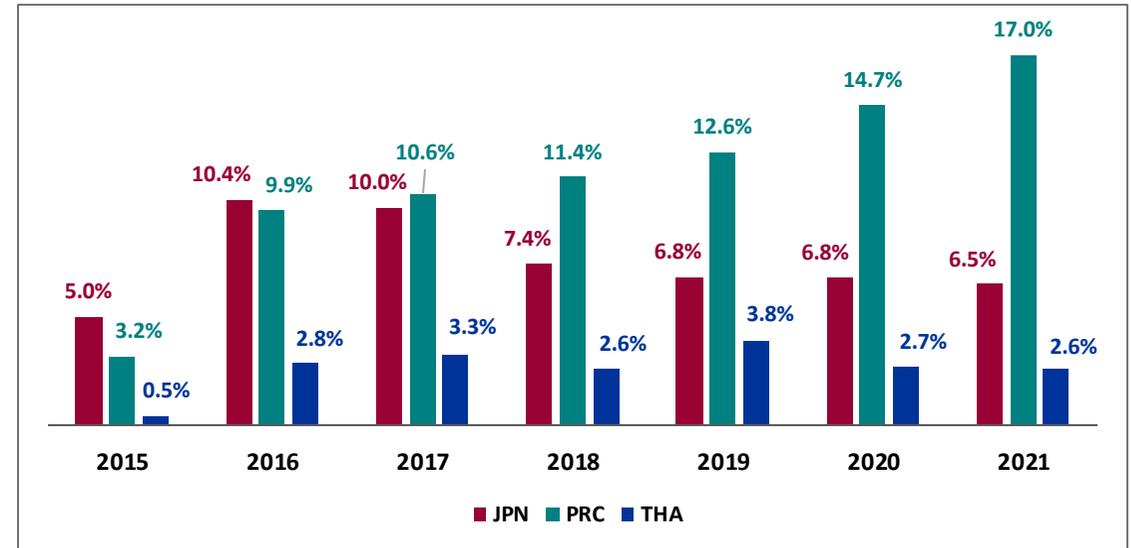


Figure 4. Inter-regional Distribution of the Construction Sector in Malaysia by Top Three (3) Major Trading Partners from the Year 2015 until Year 2021





CONCLUSION



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CONCLUSION



Overall, TiVA reflects the current nature of businesses in view of global production. Its method, Spatial Linkages allows tracking the source of inputs and flows of outputs by intraregional and interregional level, in the production of goods and services consumed worldwide.

From the perspective of interregional level, China and USA are both our major trading partners with imported input of 7.6 per cent and 1.9 per cent, respectively. While, exported output for both countries are 8.4 per cent and 3.5 per cent, respectively. This indicates that we are highly dependent on both countries for our global productivity.

01

02

03

04

Malaysia's input consumption from intraregional remain above 60.0 per cent with domestic input consumption of 71.2 per cent and 28.8 per cent was imported input in 2021. Meanwhile, Malaysia's output distribution was distributed 68.9 per cent domestically and 31.1 per cent exported to interregional level. These findings prove that Malaysia is a self-sufficient country with both intraregional distribution and consumption are above 50.0 per cent.

In further improving the research, several analyses on spill over effects and dependency between sectors and trading partners are recommended to be explored using Value Added Decomposition of Gross Exports, Revealed Comparative Advantage and Global Value Chain. The spatial linkages can be further analysed at deeper level whether by product level or regions in Malaysia.



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