Preliminary Draft

Vertical Specialisation in Trade: the case of Malaysia*

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Abstract: The development of vertical trade as a result of production processes stretching across many countries has received much attention particularly in the East Asia region in recent years. Some countries are found to be actively involved in vertical trade while some others are relatively less. Malaysia is a small open economy in Southeast Asia with significant presence of FDI and MNCs especially in the manufacturing sector. This paper aims to investigate the extent and the development of Malaysia's vertical specialisation (VS) in international trade relative to other East Asian countries. VS activities are examined in various sectors with a focus on the manufacturing sector. In addition, the geographical distribution of VS intensity of various manufacturing sectors is also inspected. The definition of VS follows Hummels *et al.* (2001) concept. Data is sourced from Malaysia's national input-output tables and Department of Statistics.

Keywords: Vertical Specialisation, Trade
JEL codes: F1

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1. Introduction

In recent years, the development of vertical trade as a result of production processes stretching across many countries has been particularly noted in the East Asia region. Vertical trade or vertical specialisation (VS) activities has become an important phenomenon in the global trading world especially in the manufacturing activities.

Malaysia is a small open economy in the Southeast Asia region, having a trade sector larger than its own GDP in most years and in some years, exceeding 200 per cent of its GDP (Figure 3). In addition, there is a significant FDI/MNCs presence especially in the manufacturing sector. VS activities are actively conducted in Malaysia and they are particularly observed in the electronic and electrical subsector.

For a small economy like Malaysia, having high VS activities in its economy is important for at least two reasons. First, it represents an opportunity for the economy to continue to be part of the global production chain and thus providing a larger external market for local producers to benefit from economies of scale. Second, participation in VS activities can be a means of technology transfer through the use of imported inputs in the production process, for example in the motor vehicle industries.

This paper aims to investigate the extent of Malaysia's vertical specialisation (VS) in trade relative to other selected countries. The rest of the paper is organised as follows. Section 2 provides a brief overview of the Malaysian economy. Section 3 discusses the methodology and data used in the study. Section 4 reports the results and analyses and Section 5 concludes[1].

2. Overview of the Malaysian economy

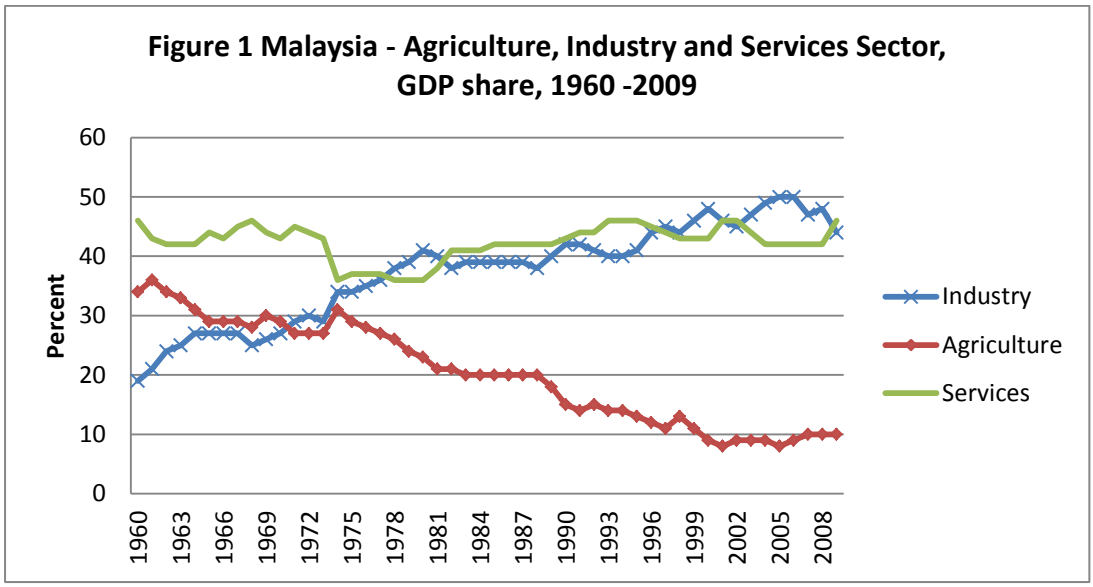
Malaysia is a small open developing economy in the Southeast Asia. It records a GDP per capita of current USD 8,373 in 2010 and a population of 28 million (World Bank). The level of GDP per capita achieved is 21 times the level back in 1970. While this growth is significant and remarkable to many other developing economies' standards, there is a growing concern among economists and policy makers that Malaysia might be 'trapped' in the middle-income group and is struggling to graduate to a high income level economy (see for example Hill *et al* (2012)). This concern is perhaps legitimate when Malaysia's growth is compared to some neighbouring countries such as South Korea's experiences. In 1970, Malaysia's GDP per capita was 1.4 times of South Korea's. But in 2010, South Korea's GDP per capita is nearly 2.5 times of Malaysia's (based on World Development Indicators data).

Given a small population, of only 2 per cent of China's population, Malaysia's domestic market is tiny. In view of this small domestic market, the Malaysian government adopted an export-oriented policy particularly in the manufacturing activities in the early 1970s, including establishing Free Trade Zones (FTZs) and attracting inflow of FDI into the country. As a result, Malaysia has transformed from being primarily a commodity (such as tin and rubber) producer to an industrialised economy.

[1] Section 3 and 4 (except 4.3) draw mainly from an earlier paper (Loke and Tham, 2011).

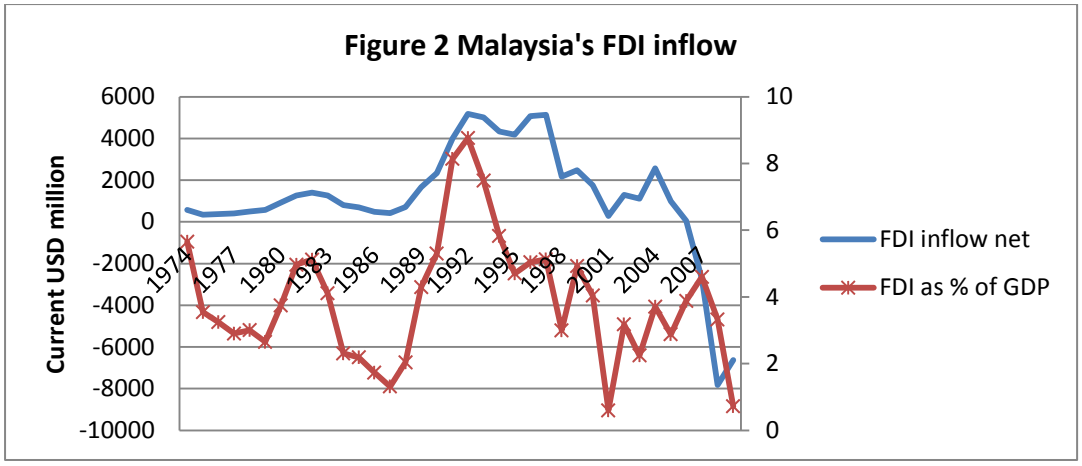
Figure 1 shows the development of the share of agriculture, manufacturing and services sectors of the economy over time. The manufacturing sector has grown steadily from constituting only 20 per cent of GDP in the 1960s to over 40 per cent in recent years. The agriculture sector has steadily declined in its share over time and the sector is just slightly over 10 per cent of the GDP in recent years.

It is interesting to note that Malaysia has a large services sector. It forms over 40 per cent of GDP in most periods. The sector is currently the largest sector with a share of 46 per cent of GDP in 2009.



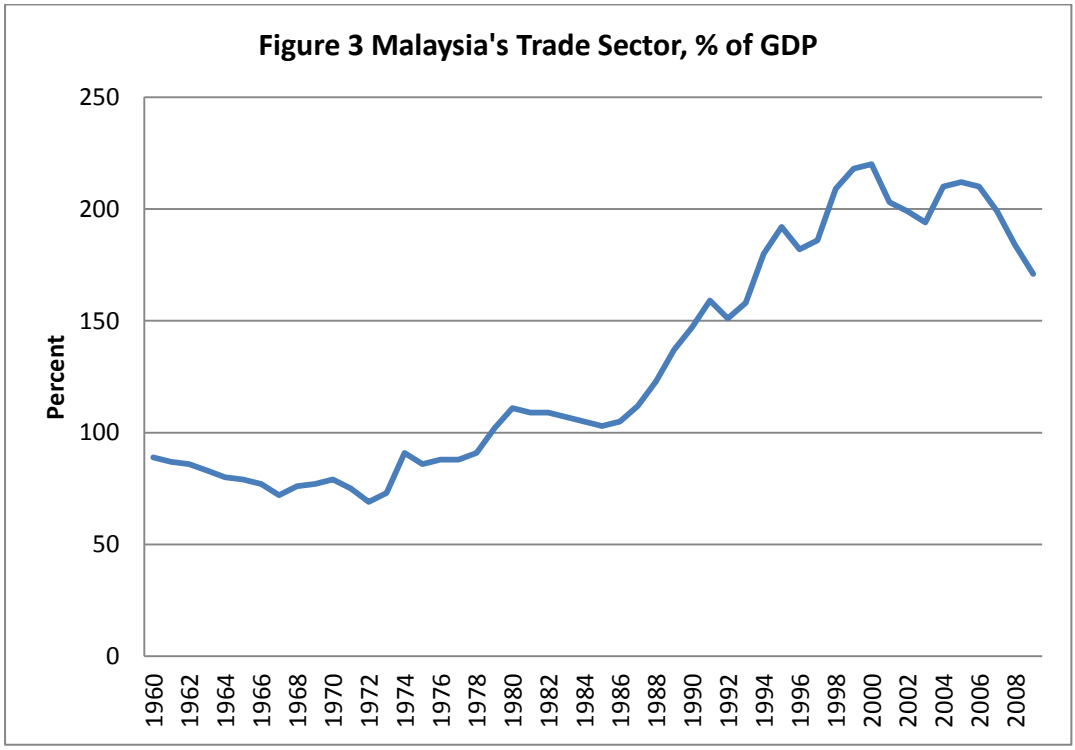
Source: World Bank, World Development Indicators, http://data.worldbank.org/data-catalog/world-development-indicators

As mentioned in the introduction, Inflow of FDI has been significant in Malaysia. Figure 2 shows Malaysia's net FDI inflow in value and as percentage of GDP during the period 1970 - 2009. FDI inflow was most significant during the late 1980s and early 1990s. While the pattern fluctuates over the years, there is a general decline in net inflow from the beginning of the 21st century and onwards and in recent years, the net inflow has been negative. FDI as a percentage of GDP has decline from a peak of close to 9 per cent in 1992 to less than 1 per cent in 2009.



Source: World Bank, World Development Indicators

Malaysia has a large trade sector relative to its own economy. As shown in Figure 3, Malaysia's trade sector has been growing steadily since 1960, at a higher rate than the overall GDP. It measures at over 200 per cent of GDP in some years in the 2000s. Although a decline can be observed during the 2008/9 economic crisis, trade sector is still considerably large relatively to its own GDP.



Source: World Bank, World Development Indicators, http://data.worldbank.org/data-catalog/world-development-indicators

Malaysia's major trading partners include China, USA, Singapore, Japan, Taiwan and the EU. In the past few years, China has emerged as the leading exports destination of Malaysia. Major exports include electronic and electrical products (39.3 per cent of total exports in 2010), other

manufactured goods and articles (14 per cent), palm oil (9.7 per cent) and crude petroleum and liquefied natural gas (10.9 per cent) (Malaysia's Department of Statistics).

Given this background of the Malaysian economy, it would be interesting to examine the development as well as the extent of VS activities in the country.

3. Literature review, Methodology and Data

The early analyses on international fragmentation of production used trade in intermediate inputs as a proxy for estimating VS activities (Ng and Yeats (2001); Athukorala (2003)). This can be a poor proxy since those intermediate goods trade can be used as consumption and intermediate inputs. A number of recent studies (for example WTO and IDE-JETRO (2011); Dean, Fung and Wang (2007); Amador and Cabral (2008)) use the concept of VS introduced by Hummels *et al* (2001). Data from input-output tables are used to measure the extent of VS activities of countries.

The empirical studies indicate that the degree of VS has increased for many Asian economies as well as the US over the years. These studies also noted that while there is a rising VS activities in the services sector, VS are still pretty much a phenomenon in the manufacturing sector. This is because manufacturing goods are generally more feasible for production fragmentation than services or even agriculture and mining. Even within the manufacturing sectors, some are more feasible for production fragmentations than the others. For example, electrical and electronic products are observed to have higher VS share than resourced based products such as wooden furniture. Further, the studies also indicate that in general, smaller countries are found to have higher level of VS activities than larger countries. Countries such as Singapore are found to have higher degree of VS as compared to the US and Japan. This is because the larger economies are relatively more self-reliant in their sourcing for inputs.

Following these studies, this paper uses the same concept to profile the pattern of VS in Malaysia. Data is sourced from the latest 2005 Malaysia's input-output tables which were released in 2010.

Hummels et al (2001) define the occurrence of VS as a phenomenon when the following three conditions are met: (i) a good is produced in two or more sequential stages, (ii) two or more countries provide value-added during the production of the good and (iii) at least one country must use imported inputs in its stage of the production process, and some of the resulting output must be exported.

To measure the VS of a country, i.e. the extent of a country participates/involves in the global production chain that stretches across many countries, VS of country *k* in good/sector i, VS_{ki} is defined as follows:

$$VS_{ki} = \left(\frac{imported\ intermediates}{gross\ output}\right).exports \qquad (1)$$

The overall VS for country *k* is the sum of VS across all *i*, $VS_k = \sum_i VS_{ki}$. Dividing this with total exports of the country, X, gives the VS share of total exports, that is

$$\frac{VS_k}{X_k} = \frac{\sum_i VS_{ki}}{\sum_i X_{ki}} \qquad (2)$$

In matrix notation, $VS_k/X_k = uA^M X/X_k$, where u is a 1 × n vector of 1's, A^M is the n×n imported coefficient matrix, X is an n×1 vector of exports, n is the number of sectors/sub-sectors, and X_k is the sum of exports across the n sectors/sub-sectors.

The above formula measures the value of imported inputs used *directly* in the production of an exported good. As pointed out in Hummels et al (2001), using the Input-Output tables allows us to also calculate the value of imported inputs used *indirectly* as well. This can be done by adding the matrix $[I - A^D]^{-1}$ into the above formula. The VS share of total exports that includes both direct and indirect value of imported inputs used becomes:

$$VS_k/X_k = uA^M [I - A^D]^{-1} X/X_k \qquad (3)$$

where I is the identity matrix, A^D is the n × n domestic coefficient matrix.

Equation (3) is used in most studies as well as this paper as the measure of vertical specialisation for Malaysia. In addition to this overall VS, we calculate VS share of exports at disaggregate levels for all the manufacturing sub-sectors.

The value of VS ranges from 0 – 1. If a sector does not source any imported inputs or has no exports at all, VS = 0. The higher the VS value of a sector, the more integrated a country is with the global production chain in that sector.

In addition to the VS concept by Hummels *et al*, this paper also adopts the measure of geographical orientation of VS introduced by Amador and Cabral (2008) in order to assess the geographical distribution of Malaysia's VS intensity of various manufacturing sub-sectors. The measure of geographical orientation follows the following formula:

$$VS_{c,j} = \frac{VS_j}{X_j} X_{c,j} \qquad (4)$$

where VS_j and X_j are VS level and exports of sector j and $X_{c,j}$ is exports of sector j to partner country c. In the event that the entire exports of sector j goes to one partner country, $VS_{c,j} = VS_j$. This means that Malaysia's VS activities in that sector concentrates in just one location.

4. Vertical specialisation in Malaysia

4.1 Overall VS, relative to other countries

Table 1 Vertical specialisation as share of total exports, selected countries

Year	Malaysia[1]	Portugal[2]	China[3]	Singapore[4]	Indonesia[4]	U.S., Japan, Australia[5]
1972-1990						0.05-0.10
1997			0.29			
1999		0.38				
2000	0.52					
2002		0.39	0.36			
2005	0.45					
2008				0.58	0.13	

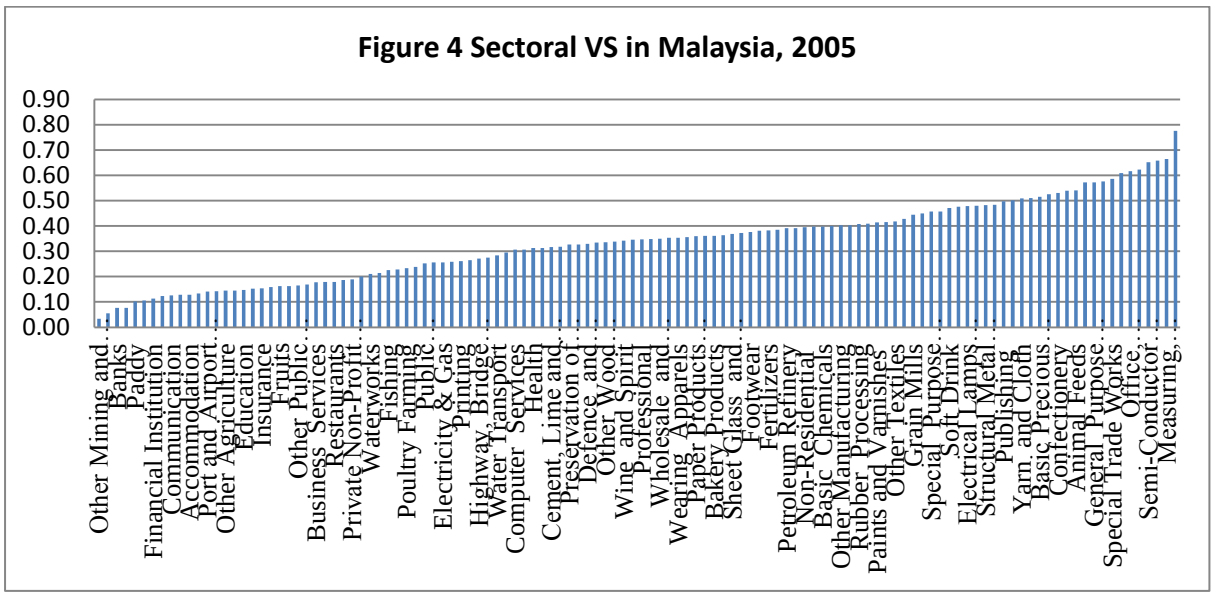
Source: 1 Author's calculations
2 Amador and Cabral (2008)
3 Dean, Fung and Wang (2007), Table 1
4 WTO and IDE-JETRO (2011), page 98
5 Hummels et al (2001)

The overall VS share of Malaysia was 0.52 and 0.45 in 2000 and 2005 respectively (Table 1). This is high relative to many other countries. The results are expected and consistent with findings in the literature since Malaysia is a small open economy with a considerable amount of trade with the rest of the world and also due to its significant large share of manufacturing exports.

Table 2 Malaysia and Asian's VS share, by sector, 2005		
2005	**Malaysia**	**Asian's average**
Food, Beverages and tobacco		0.20
Food Products and Beverages	0.33	
Tobacco Products	0.39	
Textiles, leather and the products thereof		0.22
Textiles	0.44	
Wearing Apparels	0.34	
Leather Industries and Footwear	0.36	
Chemical and Chemical Products	0.40	0.39
Computers, electronic equipment		0.47
Other electrical equipment		0.36
Office, Accounting and Computing Machinery	0.61	
Electrical Machinery and Apparatus n.e.c.	0.49	
Radio, Television and Communication Equipment and Apparatus	0.69	
Transport Equipment		0.22
Motor Vehicles	0.57	
Other Transport Equipment	0.39	
Source: Malaysia - author's calculations, Asian - WTO and IDE-JETRO (2011), Figure 5, page 100		

Table 2 provides a comparison between Malaysia's VS and the Asian's average over some selected sectors. Malaysia is also found to have VS share higher than the Asian's average in all these sectors, particularly in 'office, accounting and computing machinery' and 'radio, television and communication equipment and apparatus'.

4.2 Sectoral vertical specialisation in Malaysia



Source: Author's calculations.

Figure 4 lists the VS share of all subsectors in the economy including agriculture, mining and service sectors at further disaggregation. Manufacturing subsectors are in general found to have higher VS share than other sub-sectors in agriculture and mining. 'TV, radio receivers & transmitters & associated goods' has the highest VS share of 0.78, while 'other mining and quarrying' recorded the lowest VS share of 0.03 in the economy.

4.3 Geographical distribution of VS activities

Table 3 and 4 show the geographical distribution of VS activities in 2006 and 2010 using 2005 Input-Output Tables and 2006 and 2010 exports data from the Malaysia's Department of Statistics. The computation on the sectoral VS level for each trading partner is based on equation (4) with the assumption that the sectoral import content coefficients are the same for all destination countries and they do not vary during the time period of study. These VS values are then converted into percentage share for easy comparison between countries. Subsectors are regrouped for this purpose in order to match the two sets of data, the input-output tables classified based on the Malaysian Standard Industrial Classification (MSIC) which is based on the ISIC, and exports data reported at SITC-3 digit level. Seven export destination partners are selected: China, Japan, South Korea, Singapore, Thailand, Indonesia and the US.

A number of interesting observations are noted. VS trade is found to concentrate more in the non-resource based sub-sectors such as the 'office, accounting and computing machinery' in China, Japan and the US while VS trade is more dispersed in Singapore, South Korea, Thailand and Indonesia. In addition VS trade with China have increased significantly in 'office, accounting and computing machinery' and 'electrical machinery and apparatus n.e.c'. In fact, China has the highest in these two

sub-sectors of all countries considered in 2010. VS trade in 'office, accounting and computing machinery' with the USA, on the contrary, has declined considerably in 2010.

Table 3 Geographical Distribution of Malaysia's VS activities, 2006

2006	VS intensity of sub-sector	China	Japan	S.Korea	Singapore	Thailand	Indonesia	USA
Food Products and Beverages	**0.33**	10.2	2.4	2.7	2.2	1.7	2.3	1.9
Tobacco Products	**0.39**	0.8	0.4	4.2	5.9	4.0	18.1	0.1
Textiles	**0.44**	4.6	3.8	4.9	2.0	2.3	5.4	1.6
Wearing Apparels	**0.34**	0.6	3.1	1.2	0.7	0.7	0.3	13.8
Leather Industries and Footwear	**0.36**	0.8	0.9	0.8	6.1	6.0	4.0	2.1
Wood and Wood Products	**0.24**	1.5	17.7	10.3	0.5	0.5	1.0	2.4
Paper Products and Furniture	**0.36**	6.0	3.6	2.7	8.7	5.8	6.2	1.0
Chemical and Chemical Products	**0.40**	8.4	6.1	13.3	3.4	9.0	9.5	1.5
Rubber and Plastic Products	**0.44**	18.3	6.9	4.5	2.8	5.0	6.9	1.3
Other Non-metallic Mineral Products	**0.40**	3.2	6.3	14.0	5.8	3.7	14.0	1.6
Basic Metals	**0.49**	3.8	4.3	10.6	7.0	13.3	5.9	4.1
Machinery and Equipment	**0.54**	6.5	5.3	5.1	8.9	9.6	8.9	4.2
Office, Accounting and Computing Machinery	**0.61**	6.2	3.8	5.6	4.5	6.2	0.4	25.8
Electrical Machinery and Apparatus n.e.c.	**0.49**	8.7	5.6	5.4	9.2	3.8	1.3	7.0
Radio, Television and Communication Equipment and Apparatus	**0.69**	4.0	10.3	2.2	10.5	1.7	1.7	17.4
Medical, Precision and Optical Instruments, Watches and Clocks	**0.58**	11.5	15.4	10.7	5.4	8.9	1.4	10.0
Motor Vehicles	**0.57**	4.5	3.5	0.6	4.9	13.4	7.4	1.5
Other Transport Equipment	**0.39**	0.4	0.9	1.4	11.5	4.2	5.3	2.8
Total (%)		100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 4 Geographical Distribution of Malaysia's VS activities, 2010

2010	VS intensity of sub-sector	China	Japan	S.Korea	Singapore	Thailand	Indonesia	USA
Food Products and Beverages	**0.33**	6.6	2.2	3.0	2.0	1.3	1.7	3.2
Tobacco Products	**0.39**	1.5	0.1	2.8	7.5	7.6	18.6	0.0
Textiles	**0.44**	4.7	6.3	13.3	1.4	3.3	5.8	1.7
Wearing Apparels	**0.34**	0.5	3.2	1.4	0.7	0.5	0.3	17.7
Leather Industries and Footwear	**0.36**	0.1	0.4	0.6	6.7	4.0	3.9	1.3
Wood and Wood Products	**0.24**	0.7	12.2	12.1	1.0	0.6	1.1	1.6
Paper Products and Furniture	**0.36**	1.2	3.3	2.6	8.9	5.9	5.1	1.6
Chemical and Chemical Products	**0.40**	7.6	4.2	7.9	4.0	6.5	7.8	2.1
Rubber and Plastic Products	**0.44**	18.7	5.0	3.9	2.5	4.5	8.0	1.2
Other Non-metallic Mineral Products	**0.40**	2.1	11.6	11.1	9.3	2.4	8.3	0.8
Basic Metals	**0.49**	4.1	4.6	12.1	8.7	8.6	6.7	3.0
Machinery and Equipment	**0.54**	4.4	3.4	4.0	10.0	8.6	8.5	4.6
Office, Accounting and Computing Machinery	**0.61**	16.7	4.1	5.4	7.4	8.9	0.7	14.5
Electrical Machinery and Apparatus n.e.c.	**0.49**	11.1	4.7	5.4	8.7	2.8	1.1	7.0
Radio, Television and Communication Equipment and Apparatus	**0.69**	4.0	19.2	3.4	3.5	3.6	2.0	16.4
Medical, Precision and Optical Instruments, Watches and Clocks	**0.58**	7.5	10.2	8.3	7.1	8.1	2.3	14.9
Motor Vehicles	**0.57**	8.2	4.5	0.6	3.6	13.9	16.6	2.5
Other Transport Equipment	**0.39**	0.3	0.9	2.1	6.8	8.9	1.5	5.9
Total (%)		100.0	100.0	100.0	100.0	100.0	100.0	100.0

5. Concluding remarks

This paper examines the extent of VS activities in Malaysia in various sectors using Hummels et al (2001) concept of VS. The study shows that VS level in Malaysia is high relative to many other countries. VS level is particularly high in the electronic and electrical sub-sector. The study also looks into the geographical orientation of VS activities of various manufacturing sub-sectors. Among other things, it is noted that VS trade in some electronic and electrical goods has switched from the US to China.

The decline in FDI inflow in recent years mentioned in the beginning of the paper might suggest that Malaysia is losing its attractiveness as the choice of location for MNCs to invest in the future. Whether Malaysia will continue to have high VS activities are therefore a concern as well as a challenge in the near future. While high VS activities may not be a sufficient condition for long term economic development since other factors such as the degree of backward linkages of an industry should also be taken into account (see Loke and Tham (2011) on mapping VS with backward linkages for various sub-sectors in Malaysia), it is definitely a necessary condition and important for Malaysia as a small economy because it represents an opportunity for Malaysia to be part of the global production chain and to access to a larger external market thus benefiting from economies of scale.

Given more countries such as China, India and Vietnam in the Asia region joining the platform of global production, the way to stay on in this global production chain is to move up the value added chain, i.e. to move away from low-skilled assembly operations to higher value own design and even own brand. The ability to do so will help Malaysia a smoother transition from a middle income to a high income economy. A more comprehensive analysis in the future on VS trade that covers the whole East Asia region using the regional input-output tables would be useful to ascertain Malaysia's position (or any other countries in the region) in the global production chain.

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