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Vertical Specialisation and Backward Linkages: Reconsidering Malaysian Manufacturing Development

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Abstract: Malaysia has undergone substantial transformation, shifting from primary commodity to manufacturing production in about five decades since independence. The government is currently concerned with shifting from a middle to high income economy. The Tenth Malaysia Plan (2011-2015) has identified 12 key drivers of economic activities that will serve to propel the country toward a high income economy. Of these 12 activities, only palm oil and related products, electrical and electronics (e&e) and information and technology (IT) sub-sectors are related to manufacturing, while others are services. The objective of this paper is to identify manufacturing sectors that can be further developed to facilitate economic growth. Using Hummel's vertical specialisation index and Rasmussen's backward linkage index, we divide the manufacturing sector into four main groups, using the 2005 Input-Output table of Malaysia. Identifying these groups of industries will enable the government to focus not just on the palm oil and related products, e&e and IT sub-sectors alone, but to diversify to other subsectors that have a great potential to facilitate the shift to a high-income economy.

Key words: Backward linkages, Malaysia, manufacturing, vertical specialisation
JEL classification: F14, O1

1. Introduction

Globalisation of the production process initially shifted trade patterns from inter-industry to intra-industry trade. Subsequent fragmentation in the production process further changed the face of international trade as intra-industry trade evolved into "intra-product" trade or vertical specialisation (VS). The increasing importance of VS has been facilitated by (i) rapid changes in technology that has enabled the separation of production activities in the supply chain in both time and space, and (ii) declining tariff barriers, transportation and communication costs, thereby reducing the costs of trading across borders. This has increased the opportunity for developing countries to participate in international trade based on their comparative advantage on one (or a few facets) of the whole chain of production activities in the production of a good rather than the

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entire process of production. Vertical specialisation therefore permits developing countries to explore export niches within product groups that were not available before the spread of fragmentation. Technology spill-overs represent an important possible gain from participating in fragmentation as multinationals (MNCs) play a key role in this process (Nordås 2005; Miroudot and Ragoussis 2009). Positive spill-overs enable firms to move up the value chain in production as they shift from lower-skilled to higher skilled tasks through interactions with the multinationals producing in their countries (Dean 2011).

Malaysia has long participated in global production networks since it embarked on a pro-foreign direct investment (FDI) development strategy through the opening of Free Trade Zones (FTZs) in the early 1970s. It is therefore not surprising that the nature of trade in the country has shifted progressively from inter-industry into intra-industry trade. With increasing fragmentation, Malaysia's participation in vertical trade is also attracting research attention (Noor Aini and Zakiah 2010; WTO and IDE JETRO 2011). There are also considerable studies on linkage development and technology spill-overs from FDI in Malaysia, given that this is one of the main reasons for attracting FDI into the manufacturing sector since independence (Batra *et al*. 2003; Tham 2004; Noor Aini and Raziah 2010; Tham *et al*. 2011; Tham and Loke 2011).

However, the manufacturing sector has been losing competitiveness after the Asian Financial Crisis (AFC) (Rasiah 2011). Hence, the government is promoting the services sector as the next engine of growth. For example, the Tenth Malaysia Plan (2011-2015) has identified 12 key drivers of economic activities that will serve to propel the country toward a high income economy. But, of the 12 targeted national key economic activities, only palm oil and related products, electrical and electronics (e&e) and the information and technology (IT) sub-sectors are related to manufacturing while the others focus on sub-sectors such as services. It appears that there is a lack of focus on the manufacturing sector's prospects for growth, despite the sector's continued importance in terms of its contribution toward employment, exports and the Gross Domestic Product (GDP) of the country. In this regard, the manufacturing sector's trade links with the external world is important as these channels facilitate technology learning while backward linkages indicate the extent to which the aspired learning has been localised. This paper seeks to measure both VS and backward linkage development using the 2005 input-output table in Malaysia that was released in 2010. The objective of doing this is to identify Malaysia's VS and backward linkage development pattern in the manufacturing sector. This will allow us to identify manufacturing sub-sectors, other than the electrical and electronics sub-sector, that can be tapped for shifting into higher value added production to facilitate economic transformation and growth in the country.

The rest of the paper is organised as follows. Section 2 provides an overview of the Malaysia's development, including the development of the manufacturing sector. A selected literature review on vertical specialisation and backward linkages is discussed in Section 3. Section 4 presents the methodology and data used while Section 5 presents the findings and analyses. Section 6 provides the conclusion, including policy implications based on the main findings of this paper.

2. Overview of Malaysia's Development since Independence

In the last five and half decades since Independence in 1957, Malaysia has shifted from a primarily commodity producing country to an industrialised economy. At the time of independence, Malaysia was a key producer of tin and rubber in the world. By 1970, the share of agriculture in the country's GDP was almost the same as the share of non-government services (29% and 31%, respectively based on Table 1). Manufacturing's share was only 14 per cent then, although import-substitution manufacturing activities were pursued from 1957 to 1968.

Subsequently, the shift into export-oriented manufacturing activities in 1969 and the opening of FTZs in 1970 as well as a concerted effort to attract FDI into the country changed the pace of industrialisation. The share of manufacturing in Malaysia's GDP grew steadily to a peak of 32 per cent in 2000 (Table 2). Its share in total employment also grew gradually from 9 per cent in 1970 to 28 per cent in 2000. This sector also registered the highest average annual growth rate from 1970 to 2000. The increasing importance of the manufacturing sector is contributed largely by the push for FDI by the government through the provision of incentives, FTZs, infrastructure, a conducive business environment as well as a relatively well-educated labour force. Furthermore, the government also progressively liberalised foreign equity constraints in the manufacturing sector. This in turn enabled Malaysia to increase her manufactured exports as the country integrated progressively with the global production networks of the MNCs operating in the region.

In the 1980s, the state partnered with MNCs to develop heavy industries such as the national car. This foray of the state into manufacturing was accompanied by an increase in protection for the heavy industries. The subsequent economic crisis forced the government to shift back to an FDI, export-oriented strategy for the development of the manufacturing sector but the state's involvement in heavy industries and the protection of these industries continued to coexist with the progressively liberalised outward looking sectors.

Manufacturing growth has declined after the AFC in 1997/98 due in part to increasingly adverse external circumstances such as the dot.com crisis in 2001, the global financial crisis (GFC) in 2008 as well as mounting competitive pressures from the rise of China and Vietnam. It is interesting to note that while the share of manufacturing in GDP has declined since 2000, its employment share has been maintained at around 29 per cent due to the import of migrant labour (Table 1).

The share of non-government services in GDP and employment has grown from 31 per cent and 21 per cent respectively in 1970 to 47 per cent and 38 per cent respectively in 2000 (Table 1). After 2000, this sector recorded higher average annual growth rates than manufacturing and its share in GDP and employment continued to grow to 50 per cent and 42 per cent respectively, in 2009.

Within manufacturing, non-resource based manufacturing has a larger share than resource-based manufacturing. Production continues to be highly concentrated in electrical and electronics (e&e) production that is dominated by mainly multinational production. The manufacture of transport equipment, sheltered from competition by

Table 1. Composition of Gross Domestic Product and employment share by industrial origin[1]

GDP Share (Employment share)	1970	1975	1980	1985	1990	1995	2000	2005	2006	2007	2008	2009*e*	2010*f*
Agriculture	29.0	27.7	22.9	20.8	18.7	10.3	8.6	8.0	7.9	7.6	7.5	7.6	7.6
Forestry & fishing	(53.5)	(49.3)	(39.7)	(31.3)	(28.3)	(18.7)	(15.2)	(12.8)	(12.5)	(12.2)	(12.0)	(12.0)	n.a
Mining & quarrying	13.7	4.6	10.1	10.5	9.8	8.2	7.3	9.4	8.8	8.5	8.1	8.1	8.0
	(2.6)	(2.2)	(1.7)	(0.8)	(0.4)	(0.5)	(0.4)	(0.4)	(0.4)	(0.4)	(0.4)	(0.4)	n.a
Manufacturing	13.9	16.4	19.6	19.7	26.9	27.1	32.0	30.8	30.9	30.1	29.1	26.4	26.2
	(8.7)	(10.1)	(15.7)	(15.2)	(19.9)	(25.3)	(27.6)	(28.8)	(28.9)	(28.9)	(28.8)	(28.4)	n.a
Construction	3.8	3.8	4.6	4.8	3.6	4.4	3.3	3.2	3.1	3.0	3.0	3.2	3.2
	(2.7)	(2.9)	(5.6)	(7.6)	(6.3)	(9.0)	(8.1)	(7.0)	(6.8)	(6.6)	(6.6)	(6.6)	n.a
Services:	36.2	45.0	40.1	43.5	42.4	51.2	54.0	51.1	51.2	53.6	55.0	57.9	58.5
	(32.5)	(35.5)	(37.3)	(45.1)	(47.1)	(46.6)	(48.7)	(51.0)	(51.4)	(51.9)	(52.2)	(52.6)	n.a
Non-Government	30.8	32.3	29.8	31.3	31.8	44.1	47.2	44.3	44.2	46.7	47.6	50.1	50.7
	(20.5)	(22.5)	(23.6)	(30.5)	(34.4)	(35.7)	(38.1)	(41.3)	(41.1)	(41.1)	(41.3)	(41.6)	n.a
Government	11.1	12.7	10.3	12.2	10.6	7.1	6.8	6.8	7.0	6.9	7.4	7.8	7.8
	(12.0)	(13.0)	(13.7)	(14.6)	(12.7)	(10.9)	(10.6)	(9.7)	(10.3)	(10.8)	(10.9)	(11.0)	n.a
Import duty– Imputed bank service charges	3.4	2.6	2.7	0.7	-1.4	-1.2	-5.2	-2.6	-1.9	-2.8	-2.7	-3.2	-3.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: [1]1978 prices 1970 – 1995, 1987 prices since 1990, 2000 prices since 2005; *e* is estimation, and *f* is forecast.
Source: Malaysia, Five-Year Plans and *Economic Report*, various issues.

Table 2. Vertical specialisation as share of total exports, selected countries

Year	Malaysia[1]	Portugal[2]	China[3]	Singapore[4]	Indonesia[4]
1997			0.29		
1999		0.38			
2000	0.52				
2002		0.39	0.36		
2005	0.45				
2008				0.58	0.13

Sources: [1] Authors' calculations; [2] Amador and Cabral (2008); [3] Dean *et al.* (2007: Table 1); [4] WTO and IDE-JETRO (2011: 98)

both tariff and non-tariff measures, is the next largest non-resourced based manufacturing sub-sector.

3. Literature Review

The literature on vertical specialisation(VS) can be divided into two main categories, namely theoretical analyses examining the locational determinants of subcontracted activities (see for example, Grossman and Helpman 2004; Grossman and Rossi-Hansberg 2008), and the empirical literature measuring VS at the cross-country or single country levels, as well empirical verification of the determinants of VS. The focus of this literature review is on the empirical measurement of VS, given the objectives of this paper.

Early literature on international fragmentation of production examined trade in intermediate inputs or component trade, especially in East Asia, as a proxy for measuring VS since cross-border VS cannot be measured from trade statistics (see Ng and Yeats 2001; Athukorala 2003). However, trade in intermediate goods is an imperfect proxy since these products can be used as consumption and intermediate inputs. A better way of measuring VS will require the use of firm level data and or input-output tables that are able to distinguish between imported and locally sourced inputs used in the production of a good.

Hummels *et al.* (2001) defined the use of imported intermediate goods in products that are subsequently exported as international VS. Their measurements of VS for 13 OECD countries, including Taiwan, indicated the share of VS in exports increased from 15 per cent in 1970 to 20 per cent in 1990. Small countries like Singapore and Malta were found to have larger shares of VS in their exports compared to large countries as more links in the global supply chain can be located within the country in large countries compared to small ones (Nordås 2005).

Dean *et al.* (2007) developed a new method of identifying intermediate goods imported into China as a new measure of vertical specialisation, adapting from Hummels *et al.* (2001). By making use of a new Chinese trade database, in addition to the national input-output tables, this new method allows an improvement in identifying intermediate import, thereby providing a more accurate measure of VS. This new method helps to correct the usually underestimated import content of exports resulting from excluding the processing zone's trade when standard national input-output tables alone are used.

The WTO and IDE-JETRO (2011) study showed that while there are indications of rising VS in the services sector, VS activity in the Asian region is still very much a matter of the manufacturing industry. Using the IDE-JETRO Asian input-output tables, the findings of the study further indicate that the degree of VS has increased for all the selected Asian economies as well as the US over the time period 1985–2008. Consistent with findings in Hummels *et al.* (2001), Singapore was found to have the highest VS share of exports among the countries investigated throughout the entire period studied. A high VS share was also observed for Chinese Taipei, the Republic of Korea and Thailand. The VS share for Japan, the US and Indonesia were found to be far below the Asian average. The low VS in Japan and the US may be due to their larger economic sizes that enable them to be more self-reliant in input source. The low VS in Indonesia is due to its export structure composed of mainly primary products, such as agricultural goods, fuels and mining that need less use of foreign inputs.

Using the method of Hummels *et al.* (2001), Noor Aini and Zakiah (2010) measured vertical and horizontal trade based on establishment level data in Malaysian manufacturing for the year 2005. They found that VS trade comprised 46 per cent of total trade in the manufacturing sector and this was especially high for the e&e industry.

Linkage development can be ascertained through firm level studies or input-output analysis. There are numerous studies on linkage development in Malaysia given the importance of FDI in Malaysia and the country's aspiration for technology transfer from these FDI. These studies have focussed in particular on the electronics sub-sector where MNCs production is dominant. Early firm level studies on the electronics sub-sector indicated few backward linkages in the late 1970s and early 1980s but they started to evolve in the 1990s.[1] The lack of linkage development in the 1970-1980s is supported by input-output analysis. Rasiah (1996) concluded that while the manufacturing sector in general had relatively strong backward and forward linkages before the 1970s, weakening linkages were observed subsequently. He attributed the deterioration in linkage development to the implementation of free trade zones (FTZs) and Licensed Manufacturing Warehouses (LMWs) that promoted exports with the use of duty-free imports. Kanapathy (2004) updated the linkages calculations to 1991 and noted very little change in the linkage structure of the electronics industry. Tham and Loke (2011) found improvements in backward linkage development from 2000 to 2005 but the electronics sub-sector continued to have weaker than average industry backward linkage development in 2005.

4. Methodology and Data

In view of the objectives of this paper, we employed two concepts that are widely used in the literature of international trade and industry studies: the concept of VS as in Hummels *et al.* (2001) and backward linkages index (BW) introduced by Rasmussen (Rasmussen 1956).

We chose these two methods for two main reasons. First, the two concepts are measured using the same data source, namely input-output tables. This is particularly important in terms of consistency of data and industry classification. The improved

[1] See Tham (2004) for a summary of the literature on firm level studies.

method used by Dean *et al.* (2007) is not adopted here in this study as the problem of underestimating import content of exports in China is not present in the case of Malaysia.[2] Second, which is the more important reason, using the two concepts together enables us to understand the position of an industry in the global world as well as in the local economy as will be explained further in the subsequent sections.

The VS index introduced by Hummels *et al.*(2001*)* was originally used to measure the VS phenomenon as well as the extent of international fragmentation of production chain in the world. We employed the same concept in this paper to profile the pattern of VS in Malaysia. In addition, we mapped it with the BW index. This enabled us to assess the extent to which an industry is integrated with the global world (based on the VS) as well as the degree to which it is locally rooted (gauging from the BW). In particular, we could identify industries that had a high degree of integration with the global production chain (or high VS) and that were also deeply rooted in the local economy (or strong BW). Such industries were seen as those where Malaysia possesses strength. We could also identify industries that may face risks of having its firms relocate to another country. These industries are those with high VS but weak BW. In these cases, although Malaysia may be deeply engaged in the global production chain (high VS), the industries are not deeply rooted in the local economy (weak BW). Since these industries depend little on the local economy in terms of value added, they can be easily uprooted from the country to another more favourable location elsewhere when Malaysia loses competitiveness in the production of these goods. Analysis using VS and BW combined help to solve some of the problems encountered when traditional measures of a country's comparative advantage such as the RCA index pioneered by Balassa (1965) are used. The RCA index can be a poor indicator of a country's comparative advantage when international fragmentation of production is prevalent as the measure does not distinguish between final trade flows from trade flows for reasons of processing (Baldone *et al.* 2007). A high RCA may not reflect sustainable export competitiveness when there is low local value added and a correspondingly high imported input content.

The VS and BW concepts are explained briefly, as follows.

4.1 Vertical Specialisation

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

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

[2] The additional step required in Dean *et al.* (2007) to convert the China's input-output tables into the non-competitive type, i.e. separating the imported inputs and domestic inputs, is also not needed in our case since Malaysia's input-output tables are already in the form of non-competitive type.

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

$$\frac{VS_k}{X_k} = \frac{\sum_i VS_{ki}}{\sum_i X_{ki}} \tag{2}$$

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 to 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:

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

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 calculated 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.

4.2 Backward Linkages

Following Rasmussen (1956), the formula for the backward linkages is:

$$U_j = \frac{\frac{1}{n}\sum_{i=1}^{n} k_{ij}}{\frac{1}{n^2}\sum_{j=1}^{n}\sum_{i=1}^{n} k_{ij}}$$

where U_j is the backward linkage index, also known as the power of dispersion index
n is the number of sectors
k_{ij} is the elements of Leontief inverse matrix, $[I - A^d]^{-1}$, A^d being the vector of intermediate consumption coefficients of domestic products.[3]

A sector or an industry with an index value of greater than one indicates that it has a power of dispersion greater than the average of all industries in the country. It can also be interpreted as an industry that is relatively rooted deeper and linked stronger with

[3] Input-Output tables can be divided into two categories – competitive import type and non-competitive import type. In the competitive import type, intermediate inputs are recorded as both domestic and imported inputs combined. In the non-competitive type, domestic inputs and imported inputs are explicitly distinguished. Malaysia's Input-Output Tables are of the non-competitive type. Hence the Leontief inverse matrix is $[I - A^d]^{-1}$ where A^d is the vector of intermediate consumption coefficients of domestic products.

other industries in the economy than the average. Conversely, an industry having an index value of less than one indicates that the industry is weakly linked with other industries in the economy.

Data needed to compute the two indices is sourced from Malaysia's Input-Output Tables 2005 (Department of Statistics, Malaysia, 2010)[4]. The Malaysia Standard Industrial Classification 2000 (MSIC 2000) commodity codes at 5-digit level are regrouped and aggregated to the 120 commodities/activities classifications in the 2005 Input-Output Tables.

Based on the values for the VS index and BW linkages indexes that were computed for each manufacturing sub-sector in the Input-Output Tables, we grouped these sub-sectors into the following four categories:

I. High degree of VS but weak local backward linkages – high VS represents an opportunity for the country to be part of the global production chain, but the country contributes very low value-added to the entire production chain. While these industries contribute to a country's GDP through exports, the low BW linkages suggest that the industries face relatively high risks of firms (both MNCs and local firms) relocating to other countries since their activities are not deeply rooted in the economy.
II. High degree of VS and strong local backward linkages – these are the industries where the country participates actively in the global production chain and the domestic value added is also strong. A country is seen to have strengths in these industries.
III. Low degree of VS and weak backward linkages – these industries have weak external and internal linkages. These industries may have very little exports and/or very little import content (hence the low VS). Their roles in terms of generating exports revenue as well as an avenue for technology transfer through imports of intermediate goods are therefore minimal. Further, the industries are loosely linked with the domestic economy (hence the weak backward linkages), suggesting little contribution to economic development. This may indicate that these industries may not be sustainable or viable in the future.
IV. Low degree of VS but strong local backward linkages – the country may be competitive in production where vertical specialisation is not adopted; or it may also be due to the nature of production of good whereby fragmentation is not feasible.

Given that Malaysia's overall VS share of total exports was 0.45 in 2005, in this paper, we define an industry as having a high degree of VS when VS $\geq$0.45 and low degree of VS as VS<0.45. For backward linkages, we define an industry as having a strong backward linkages when BW> 1 and weak backward linkages when BW $\leq$1.

We note that the definitions, particularly on the high/low degree of VS, are arbitrarily determined. As the paper shows in Section 5.1, Malaysia's VS share is actually relatively high in general when compared to many other countries. Moreover, the degree of VS share is, to a large extent, due to the nature of the production of a good, that is, whether

[4] The 2005 Input-Output Tables is the latest publication at the time of writing (Department of Statistics, 2010).

the production can be sliced or fragmented and placed in different country locations. Manufacturing goods are generally more feasible for production fragmentation than agriculture goods/mining/services. Even within the manufacturing sectors, some are more feasible for production fragmentation than others. For example, e&e products are observed to have higher VS share than resourced based products such as wooden furniture. Hence the definition of high and low degree of VS here should be seen as a working definition, defined for the convenience of grouping the sub-sectors.

5. Results and Analysis

5.1 Vertical Specialisation in Malaysia's Exports

Malaysia's overall VS share is relatively high when compared to many other countries (see Table 2). This high VS share is anticipated since Malaysia is a small country with a considerable amount of trade with the rest of the world and also due to the relatively large share of manufacturing exports in the country. This observation is consistent with findings noted in Hummels *et al.* (2001) where smaller countries are found to have higher VS shares than those of the larger countries among the OECD countries. For example, the US, Japan and Australia are found to have VS shares ranging between 0.05 – 0.10 during the period 1972-1990 while the VS shares of smaller economies such as Canada, Denmark and the Netherlands hovered around 0.30 – 0.35 during the same time period. The result obtained is also the same as that obtained by Noor Aini and Zakiah (2010), using establishment level data for 2005.

At the disaggregated level, Malaysia's VS share is also found to be higher relative to the other countries. Figures 1 to 6 show some of the sub-sectors where Malaysia's VS share exceeds the Asian economies' average.[5]

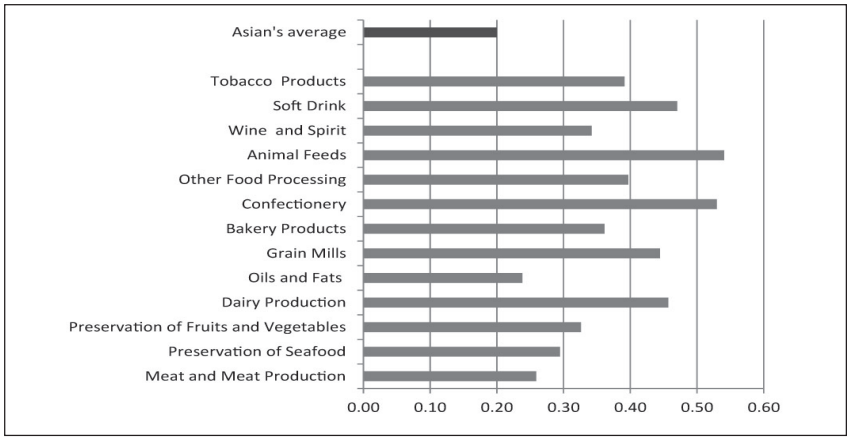

Figure 1. *VS share in Food, beverage and tobacco, 2005*
Source: Malaysia's VS – authors' calculations; Asian VS - WTO and IDE-JETRO (2011: Fig. 5, p 100)

[5] The Asian economies are China, Indonesia, Japan, the Republic of Korea, Malaysia, the Philippines, Singapore, Chinese Taipei and Thailand.

Within the economy, Malaysia's VS share in the manufacturing sector is generally higher than those in agriculture, mining and services sectors (see Figure 7). For instance, the VS share of 'TV, Radio Receivers & Transmitters & Associated Goods' is 0.78, which is the highest among all sub-sectors in the economy in 2005 while 'Other Mining and Quarrying' recorded the lowest VS share of 0.03 in the economy. This observation is similar to the pattern observed in other countries.[6] The higher VS share in the manufacturing sector reflects the high fragmentation of the manufacturing sector overall in the world and in particular in East Asia.

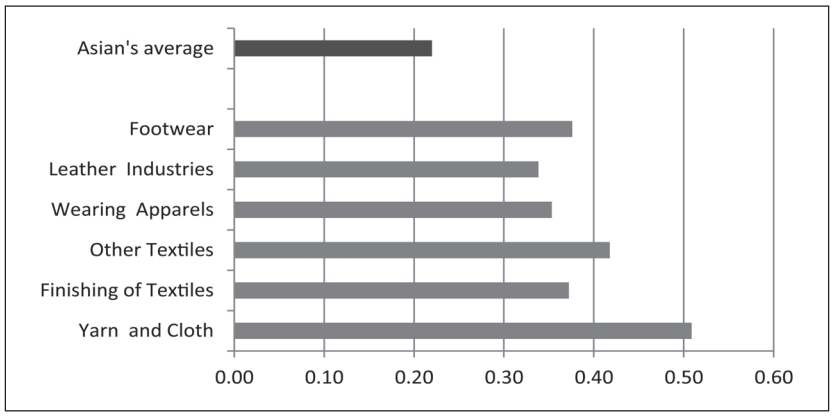

Figure 2. *VS share in textiles, leather and the products thereof, 2005*
Source: Malaysia's VS – authors' calculations; Asian VS - WTO and IDE-JETRO (2011: Fig.5, p. 100).

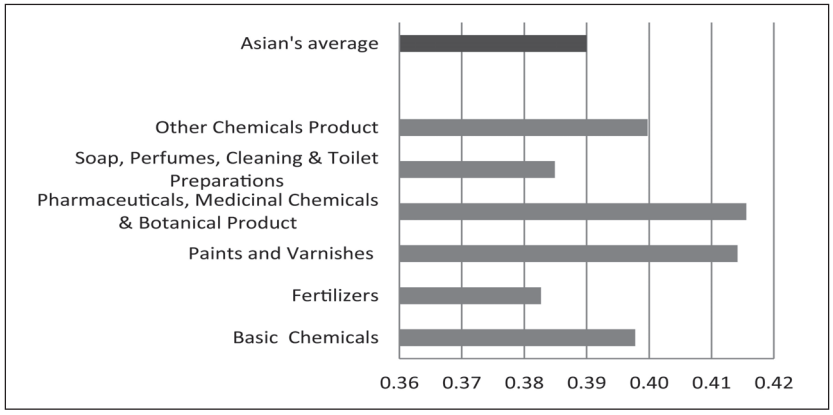

Figure 3. *VS share in chemical products, 2005*
Source: Malaysia's VS – authors' calculations; Asian VS - WTO and IDE-JETRO (2011: Fig. 5, p. 100).

[6] Compare, for example, with calculations on nine Asian economies' average share of vertical specialisation for various sectors in the study by WTO and IDE-JETRO (2011: Fig. 5, p. 100).

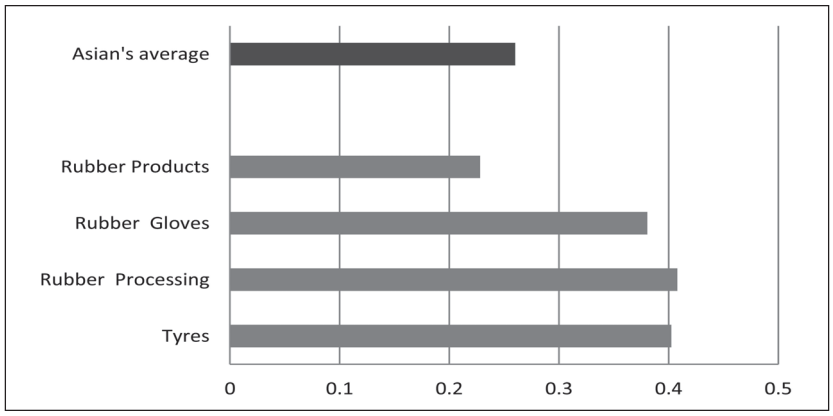

Figure 4. *VS share in rubber products, 2005*
Source: Malaysia's VS – authors' calculations; Asian VS - WTO and IDE-JETRO (2011: Fig. 5, p. 100).

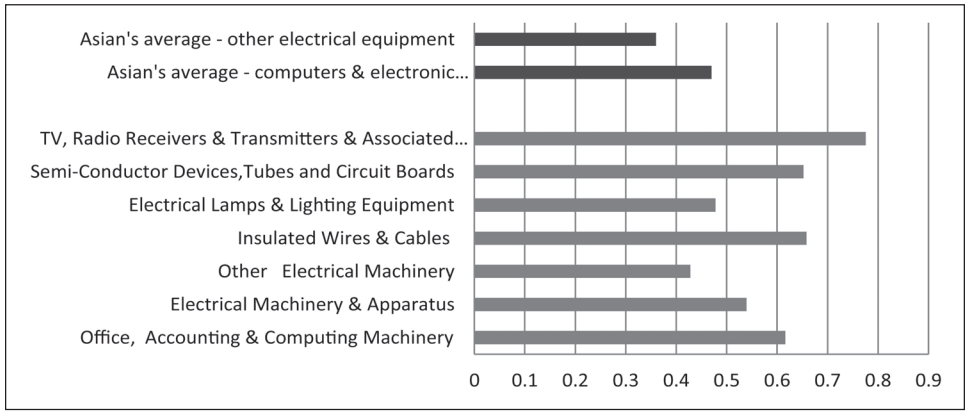

Figure 5. *VS share in computers, electronic equipment and other electrical equipment, 2005*
Source: Malaysia's VS – authors' calculations; Asian VS - WTO and IDE-JETRO (2011: Fig. 5, p. 100).

5.2 Identifying Strengths in Malaysia's Manufacturing Sector

Figure 8 summarises the VS and BW index values for the year 2005 (Details of the index values are reported in the Appendix – Table 3). Of the total of 68 manufacturing sub-sectors, 18 (27%) fall under group I; 9 (13%) fall under group II; 15 (22%) fall under group III; and 26 (38%) in group IV. The data found that more than one-third of the manufacturing sub-sectors are in group IV, that is, those having low VS but strong BW. There is also a sizeable number of industries that fall under groups I (high VS but low BW) and III (low VS and low BW). Only a small portion of the sub-sectors is in group II, namely high VS and high BW.

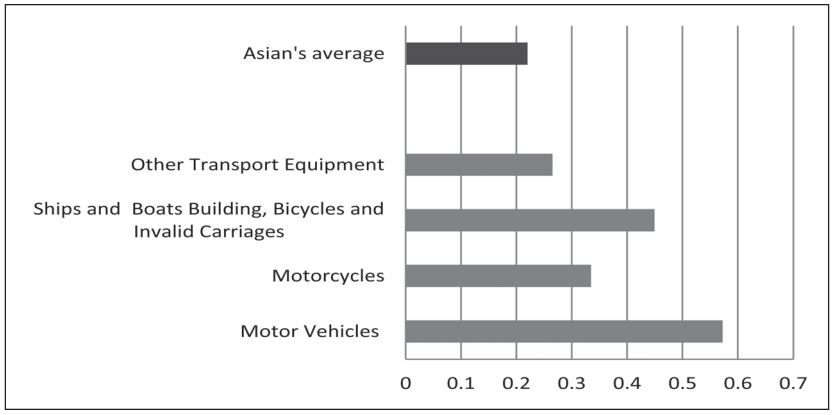

Figure 6. *VS share in transport equipment, 2005*
Source: Malaysia's VS – authors' calculations; Asian VS - WTO and IDE-JETRO (2011: Fig. 5, p. 100).

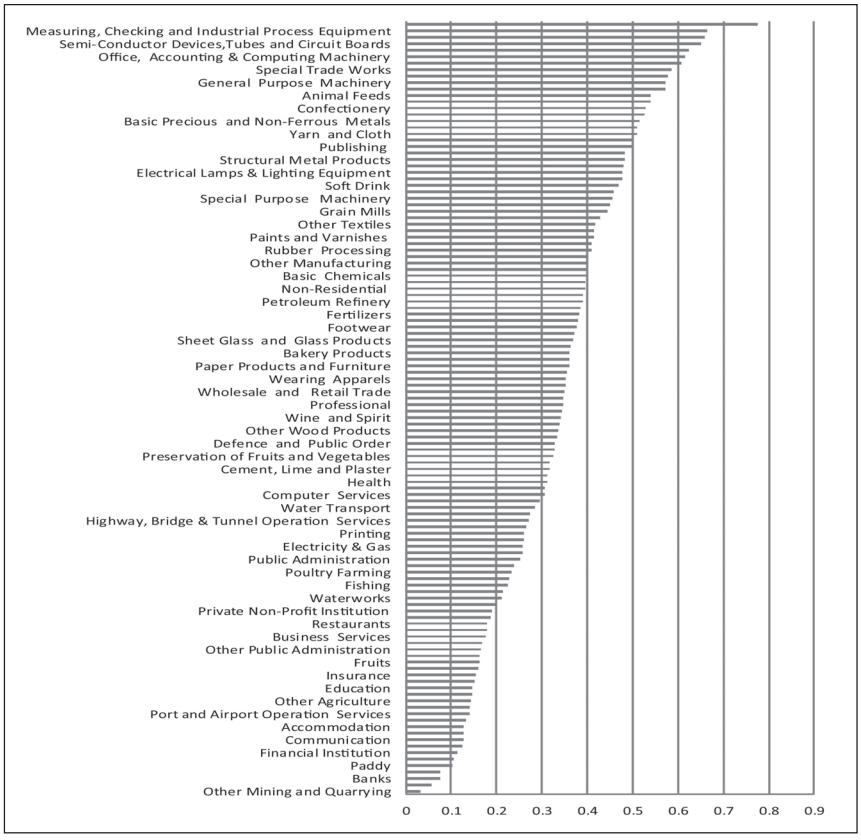

Figure 7. *Malaysia's VS by sector, 2005*
Source: Calculated using Malaysia's 2005 Input-Output tables

We also note a number of interesting observations. First, many of the electronics and electrical industries fall under group I, that is, industries with high VS but relatively weak BW. These are, for example, household machinery, radio, TV, etc. These industries are found to have high VS, indicating high import content as well as exports but with weak BW. This indicates Malaysia does not contribute much value-added to the entire global value chain of production. Since these industries are not deeply rooted within the economy, the risks of firms relocating elsewhere to other countries are high.

Second, there are some industries identified in group II. These industries have relatively high VS as well as strong BW. Examples of these industries are 'dairy production', 'soft drink', 'concrete & other non-metallic mineral products' and 'other fabricated metal products'. The results suggest that Malaysia possesses strengths in these industries where the country participates actively in the global production chain and also plays an important part in the production chain with significant value added.

Third, we find that many of the resource-based industries fall under group IV, that is, with low VS but relatively strong BW. Examples of these industries are 'meat and meat production', 'processed rubber', 'rubber gloves', 'oils & fats', some 'wood products' and 'preserved seafood'. As discussed earlier, the low VS in these industries may not suggest a weakness but Malaysia may actually be competitive in the production where fragmentation is not adopted. The rubber gloves industry is one example.

Finally, we note a number of industries that are low in VS as well as weak in BW. Examples of these industries are sawmills, wine &spirit, and other transport equipment.

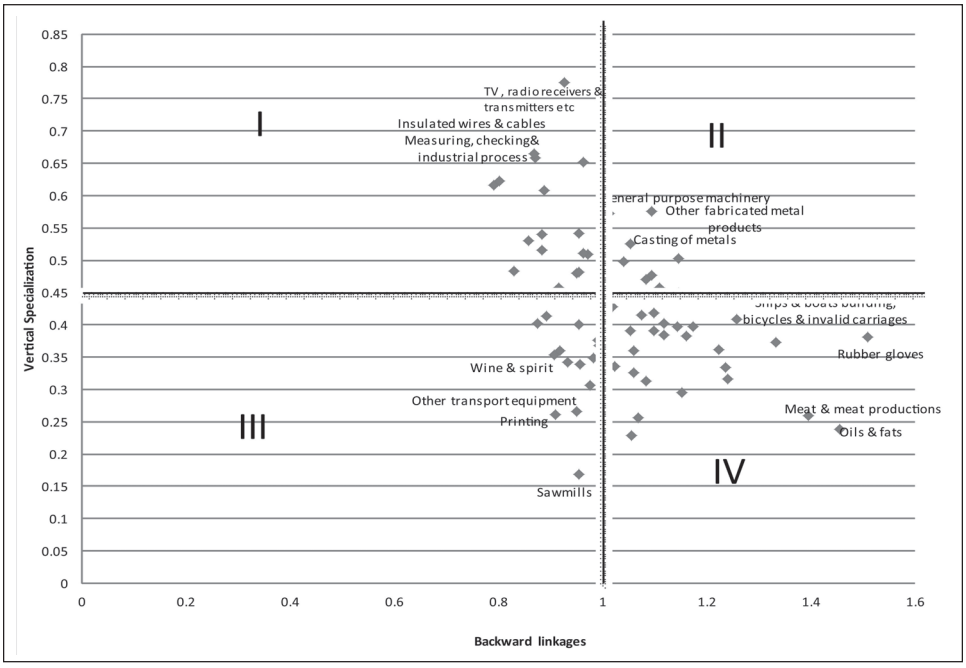

Figure 8. *Malaysia's manufacturing: Mapping VS with BW, 2005*
Source: Based on Table 3 in Appendix 1.

Some studies in the literature suggest that trade costs (tariffs and transport costs) can be a significant factor explaining the growth of VS, with a negative correlation between the two (Bridgman 2010). Comparing the VS index computed in this study with the average insurance and freight costs reported in Loke and Tham (2010) provides empirical support in the case of Malaysia. For example, the electrical and electronics sub-sectors are among those with the lowest transport costs (ranging between 0.7 – 7.5 %). These sub-sectors are found to have high VS in this study. 'TV, radio receivers & transmitters and associated goods' sub-sector has the highest VS share of 0.78 among all sub-sectors in the economy. On the other hand, the 'meat and meat preparation' sub-sector for example has a high transport cost of around 25 per cent but is found to have a low VS of 0.26 in the present study. Another example is 'gas, natural and manufactured' with high transport costs of 45 per cent but a very low VS of only 0.11.

The current relatively higher backward linkages may be fostered due to the availability of resources that can be used for inputs or with the use of tariffs and non-tariff measures such as local content requirements before they were phased out under World Trade Organization (WTO) commitments. If high BWs are due to resources availability, these high BWs may well be sustainable. However, if high BWs are mainly an outcome of government's protection given to local industries, such high BWs may not be sustainable once government support is removed. While the overall average import duty for imported input used in the manufacturing sector is rather low at 0.008 cents for every Ringgit of imported input used for export production (Table 3 in the Appendix), we do note that in group II, there are three sub-sectors that have higher than the average industry import duty, namely 'soft drinks', 'concrete and other non-metallic mineral products', and 'motor vehicles'. Similarly, there are 12 sub-sectors in group IV that have higher than average industry import duty.

Some of these sub-sectors may also be supported by non-tariff measures as well. For example, local content requirements were only phased out on 1 January 2005 for the motor vehicles sub-sector. The vendor development programme continues to provide financial as well technical assistance for the vendors in this sector. Consequently, it is unclear whether the backward linkages are sustainable when government support is removed.

6. Conclusion

This paper seeks to identify Malaysia's manufacturing sub-sectors that have the potential to be further developed to facilitate economic growth by employing two measures that are widely used separately in the literature, vertical specialisation (VS) and backward linkages (BW) indexes.

Vertical specialisation enables developing countries to participate in global trade by developing export niches in the global value chain of production. The use of imported inputs in the process can facilitate learning and moving up the value chain. However, VS does not always translate into learning as countries may face different constraints in the learning and upgrading process. Industries with high VS together with strong backward linkages are promising industries that can be further developed to shift up the value added chain in the production process.

The VS profile of Malaysia in this paper shows that Malaysia's VS is high compared to many countries in the world. This high VS is expected given Malaysia is relatively small economy in the world. In fact having high VS is important for Malaysia for further economic growth since a high VS indicates the country is playing an active role in the global production value chain and there are opportunities for technology transfer.

Within the manufacturing sector, the electrical and electronics (e&e) sub-sector indicates relatively high VS, as expected (see group 1 in Table 3 in the Appendix). However, backward linkages in this subsector have values less than 1, or below the industry average. While the Tenth Malaysia Plan has focused on this sector as one of the National Key Economic Areas (NKEAs) for further development, based on its contributions toward manufacturing output and employment, this sub-sector may have problems sustaining its performance as there has been little structural change to higher value added activities (Rasiah, 2011).

In contrast, there are several other industries not listed in the NKEAs but they indicate relatively high VS as well as backward linkages that are above the industry average, based on the results in this study. These sectors are 'diary production', 'soft drink', 'publishing', 'concrete & other non-metallic mineral products', 'iron and steel products', 'casting of metals', other fabricated metal products', 'general purpose machinery' and 'motor vehicles'. They can be be further developed to shift up the value added chain to diversify manufacturing development in the country. However, it is important to note that strong backward linkages in some sub-sectors may not be due to real strength of these local industries but may be attributed to government policies such as high tariff protection or local content requirements. The manufacture of motor vehicles is one such example where tariff and non-tariff protection is accorded to both intermediate as well as final good production. This sub-sector is especially vulnerable in the wake of the bilateral free trade agreements that are currently being negotiated such as the Trans Pacific Partnership Agreement (TPPA) and the Malaysia-European Union (EU) Free Trade Agreement since these agreements aim to be broader and deeper in scope than the current commitments under the WTO. The sub-sector may not be able to retain its strong backward linkages when the current protection given to this sub-sector is removed.

The Tenth Malaysia Plan has also identified palm oil and related products for further development. This product group may have low VS but has relatively high backward linkages. Indeed, Malaysia is a global leader in the production of palm oil and basic oleochemicals industry (Malaysia 2010). This sub-sector can be further developed by ensuring their sustainability. In particular, although we have only calculated the backward linkages for this group of industries, they also have the potential to be used in other sectors in the country so that forward linkages can also be fostered.

The Tenth Malaysia Plan has also listed 'agriculture' as one of the key areas for development. The findings in this paper point out specific sub-sectors that are indeed promising which are agriculture related, for examples those that are food related such as 'meat and meat production', 'preservation of seafood', preservation of fruits and vegetables', oils and fats', 'bakery products', 'other food processing'. In addition, there are also other promising sub-sectors that are resource-based particularly related to wood and rubber (see group IV in Table 3 for full list).

Based on the findings of this paper, the shift to higher value-added production in the country can be facilitated by focussing on other sub-sectors within manufacturing besides the palm oil and related sectors, e&e and IT sub-sectors. Further detailed studies of the sub-sectors with high VS and backward linkages will help to identify suitable strategies for deepening the development of these sectors. A more diversified industrial development strategy will doubtless enhance Malaysia's shift to a higher income economy.

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Appendix 1

Table 3. Manufacturing sub-sectors - VS and BW, 2005

Manufacturing sub-sectors	VS	BW	Average Import Duty[1]
Group I – High VS, Low BW			
Confectionery	0.53	0.86	0.001318
Animal feeds	0.54	0.96	0.000643
Yarn and cloth	0.51	0.97	0.007916
Plastics products	0.48	0.95	0.012316
Basic precious and non-ferrous metals	0.52	0.89	0.006791
Structural metal products	0.48	0.95	0.010987
Industrial machinery	0.62	0.80	0.002797
Special purpose machinery	0.46	0.92	0.011398
Domestic appliances	0.61	0.89	0.008465
Office, accounting & computing machinery	0.62	0.79	0.001108
Electrical machinery & apparatus	0.54	0.88	0.001929
Insulated wires & cables	0.66	0.87	0.001672
Electrical lamps & lighting equipment	0.48	1.00	0.004389
Semi-conductor devices,tubes and circuit boards	0.65	0.96	0.001201
TV, radio receivers & transmitters & associated goods	0.78	0.93	0.001086
Measuring, checking and industrial process equipment	0.66	0.87	0.001652
Optical instruments and photographic equipment	0.48	0.83	0.001945
Watches and clocks	0.51	0.96	0.006524
Group II – High VS, High BW			
Dairy production	0.46	1.11	0.006097
soft drink	0.47	1.08	0.015583
Publishing	0.50	1.04	0.005078
Concrete & other non-metallic mineral products	0.50	1.15	0.010037
Iron and steel products	0.48	1.09	0.003546
Casting of metals	0.52	1.05	0.005596
Other fabricated metal products	0.58	1.09	0.006559
General purpose machinery	0.57	1.01	0.005394
Motor vehicles	0.57	1.01	0.048688
Group III – Low VS, Low BW			
Grain mills	0.44	0.98	0.001065
Wine and spirit	0.34	0.93	0.126235
Wearing apparels	0.35	0.91	0.007831
Leather industries	0.34	0.96	0.002883
Footwear	0.38	0.99	0.011675
Sawmills	0.17	0.96	0.006617
Wooden and cane containers	0.31	0.98	0.002894
Printing	0.26	0.91	0.003630
Paints and varnishes	0.41	0.89	0.006303

Other chemicals products	0.40	0.96	0.008795
Sheet glass and glass products	0.37	0.99	0.013367
Clay and Ceramic	0.35	0.98	0.004625
Medical, surgical & orthopaedic appliances	0.36	0.92	0.005358
Other transport equipment	0.27	0.95	0.060283
Other manufacturing	0.40	0.88	0.004458
Group IV – Low VS, High BW			
Meat and meat production	0.26	1.40	0.008472
Preservation of seafood	0.29	1.15	0.002867
Preservation of fruits and vegetables	0.33	1.06	0.004650
Oils and fats	0.24	1.46	0.004768
Bakery products	0.36	1.22	0.004684
Other food processing	0.40	1.17	0.006351
Tobacco products	0.39	1.05	0.010144
Finishing of textiles	0.37	1.33	0.009360
Other textiles	0.42	1.10	0.014486
Plywood and particle board	0.26	1.07	0.004384
Builders' carpentry and joinery	0.31	1.08	0.005433
Other wood products	0.34	1.02	0.003074
Paper products and furniture	0.36	1.06	0.014946
Petroleum refinery	0.39	1.10	0.038135
Basic chemicals	0.40	1.14	0.009711
Fertilisers	0.38	1.16	0.009419
Pharmaceuticals, medicinal chemicals & botanical products	0.42	1.08	0.005927
Soap, perfumes, cleaning & toilet preparations	0.38	1.12	0.007933
Tyres	0.40	1.12	0.015863
Rubber processing	0.41	1.26	0.003157
Rubber gloves	0.38	1.51	0.009690
Rubber products	0.23	1.06	0.014781
Cement, lime and plaster	0.32	1.24	0.012912
Other electrical machinery	0.43	1.02	0.003802
Motorcycles	0.33	1.24	0.134932
Ships and boats building, bicycles and invalid carriages	0.45	1.15	0.007445

Note: 1 – The average import duty shows the amount (in ringgit value) of import tax paid for each ringgit of imports of intermediate goods used for the production of goods in a sub-sector.Source: Authors' own computation using data from Malaysia's Input-Output Tables 2005.