

ECONOMICS WORKING PAPER

Manufacturing Performance and Services Inputs: Evidence from Malaysia

Cassey Lee

ISEAS – Yusof Ishak Institute

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Abstract

The Malaysian economy has been deindustrializing since the late 1990s. The relative decline of the country's export-oriented manufacturing sector has led to a decline in the trade ratio. This could reflect a decline in the country's participation in manufacturing global value chains. The services sector makes important contributions to the performance of the manufacturing sector in terms of productivity and exporting. Therefore, any policy attempt to enhance manufacturing performance is likely to require improvements in the performance of the services sector. This is particularly important as there is evidence that the country's manufacturing sector is increasingly dependent on services generated domestically.

Keywords: Manufacturing Performance, Services, Productivity, Exporting

JEL Codes: L16, F14, O14

Manufacturing Performance and Services Inputs: Evidence from Malaysia

Cassey Lee¹

1. Introduction

The manufacturing sector has played a key role in the effort of developing countries to grow and prosper. This has been the experience of the Malaysian economy since the 1960s. However, since the late 1990s, the country's economy has begun to de-industrialize. As much of Malaysia's manufacturing has been primarily export-oriented, the relative decline in the sector's contribution to the country's economy has also resulted in a decline in its participation in the global economy. Parallel to these developments is the rise of the services sector. Whilst the services sector has always been important to the manufacturing sector, its role has likely to become even more important with the advent of global value chains (GVCs) and global production networks (GPNs). Empirically, this can be seen by the contribution of the service sector to the manufacturing sector's output. Globally, services account for half of the value of world trade (Miroudot and Cadestin, 2017).

The goal of this paper is to investigate the empirical relationship between services inputs and the performance of the manufacturing sector in Malaysia. This is undertaken within the context of structural change in Malaysia, namely, deindustrialization in the country. This took the form of a relative decline in the manufacturing sector's share of the economy's GDP and total employment since the late 1990s.

The outline for the rest of this study is as follows. Section 2 of the paper provides a discussion of the structural change in the Malaysian economy since the 1990s. This is to be followed by a broad discussion of the linkages between services and manufacturing in the Malaysian economy in Section 3. The research literature on the relationship between services inputs and manufacturing performance is discussed in Section 4. An econometric analysis of the links between services and manufacturing is undertaken in Section 5. Section 6 concludes with some policy discussions.

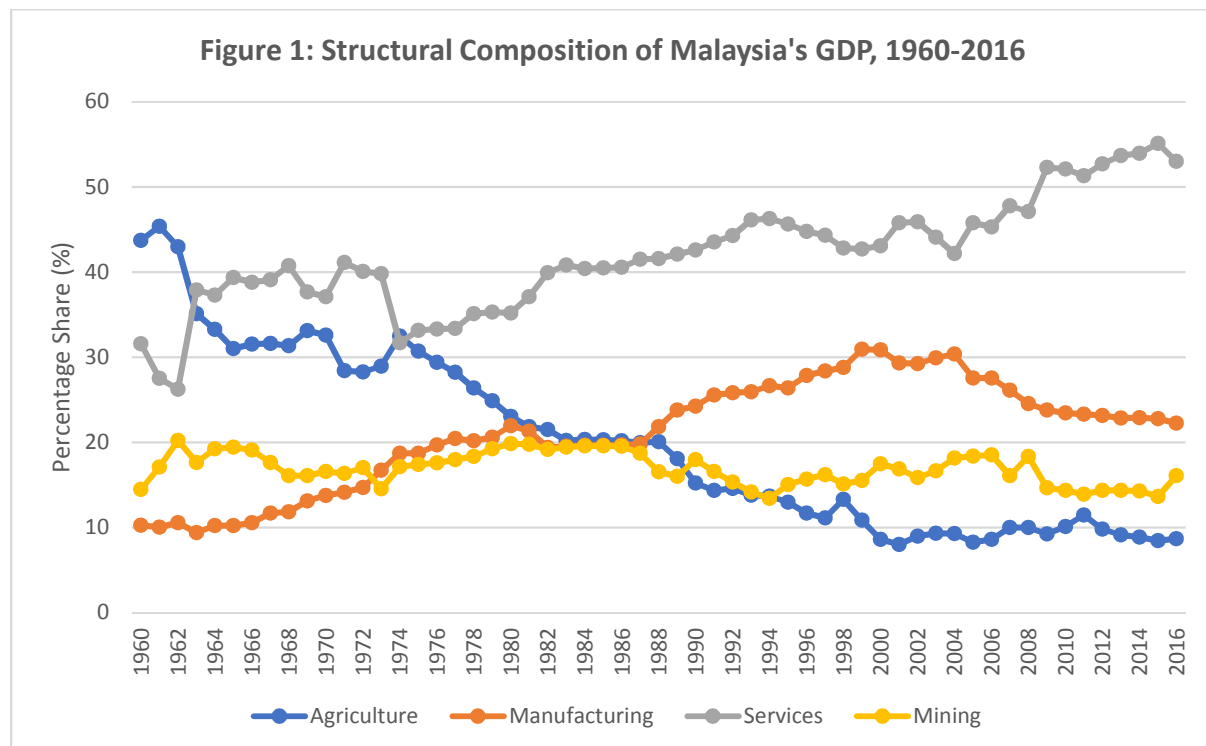
¹ The author thanks Christopher Findlay, Fukunari Kimura, Shandre Thangavelu, Lurong Chen and the Economic Research Institute for ASEAN and East Asia (ERIA) for their comments and support. The usual caveat applies.

2. Structural Change in Manufacturing and Services

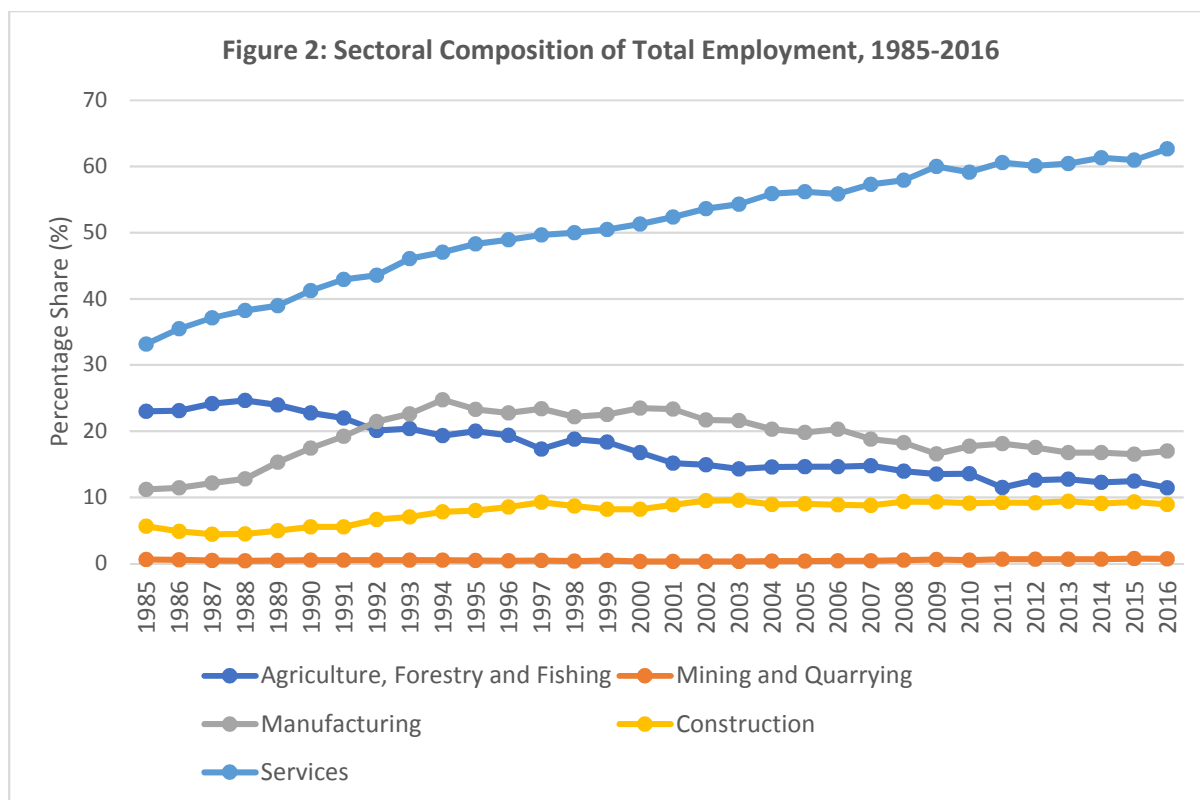
2.1 Manufacturing

The Malaysian economy has been de-industrializing over the past fifteen years. This can be seen in the decline in the manufacturing sector's share of GDP and total employment. In terms of the share of GDP, the manufacturing sector's share of real GDP peaked at close to 31 per cent in 1999 (**Figure 1**). Thereafter, it declined almost continuously every year, and the sector's share of GDP had declined to 22 per cent by 2016. The services sector's share of the GDP has gradually increased from 32 per cent in 1974 to 53 per cent in 2016. Even though there were some fluctuations in the services' share of GDP during some period, it increased rapidly in the period after 2004.

The figures on employment paint a similar picture (**Figure 2**). The “inflection point” where the decline in the manufacturing sector's share of total employment occurred even earlier, namely in 1994 – some five years earlier than the decline in the sector's share of GDP. In that year, the manufacturing sector's share of employment stood at 25 per cent. This share had declined to 17 per cent by 2016. In contrast, the services' sector share of total employment increased from 47 per cent in 1994 to 63 per cent in 2016.



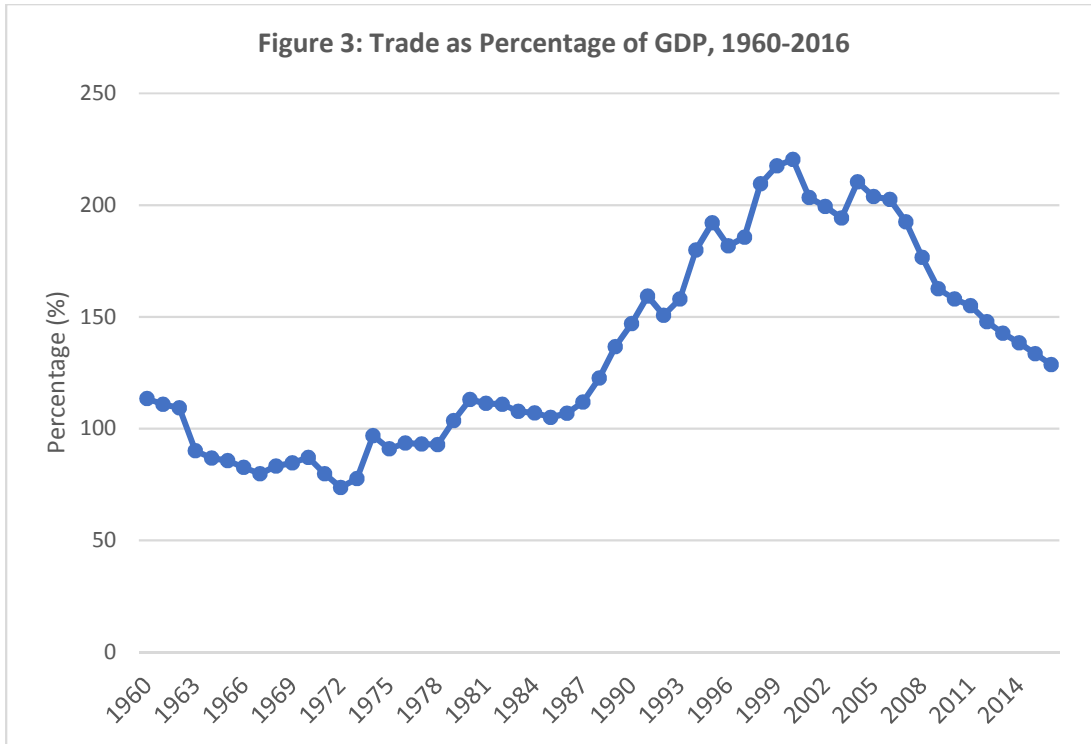
Source: World Bank



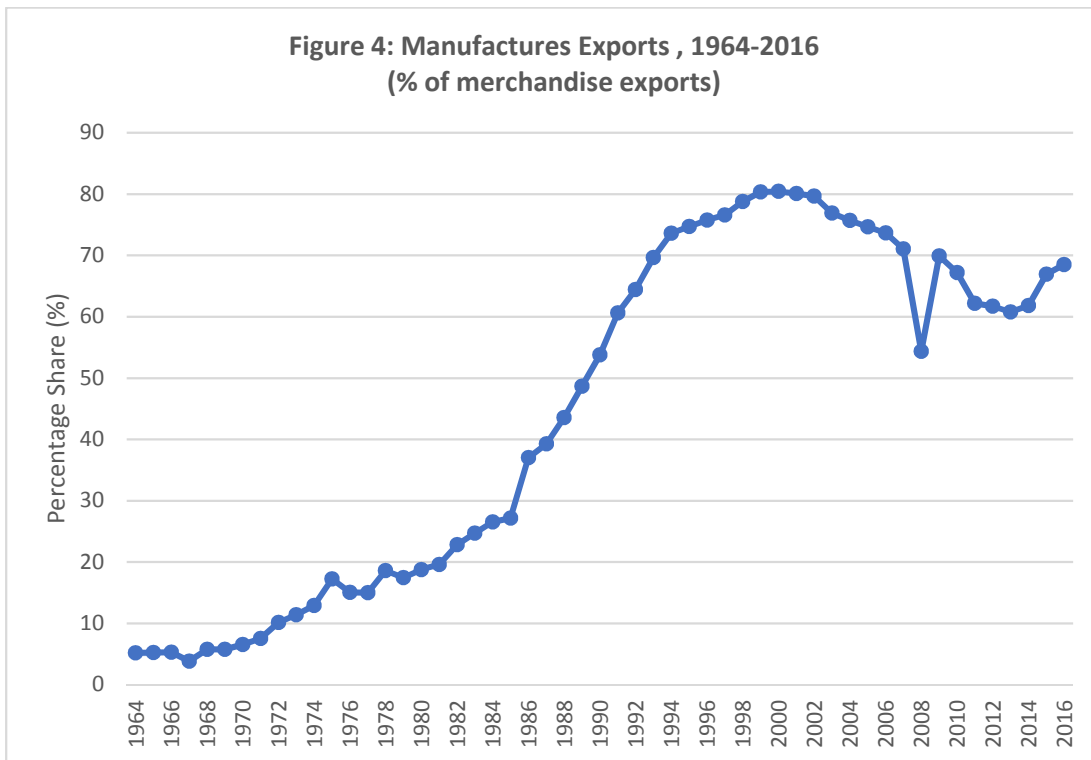
Source: Department of Statistics, Malaysia

As the manufacturing sector is very export-oriented, the decline in its relative share has also affected the country’s “openness” or engagement with the global economy. Malaysia’s trade ratio (i.e. total exports and imports divided by GDP) has also declined during this period of deindustrialization. After increasing over a period of about thirty years, Malaysia’s trade ratio peaked at 220 per cent in 2000 (**Figure 3**). Thereafter, it declined to 129 per cent in 2016. The manufacturing sector’s share of total merchandise exports also declined from 80 per cent in 2000 to 61 per cent in 2013 (**Figure 4**). Its share of total merchandise exports has recovered slightly since 2014, probably due to the decline in the value of oil exports amidst step decline in oil price and the ringgit depreciation.

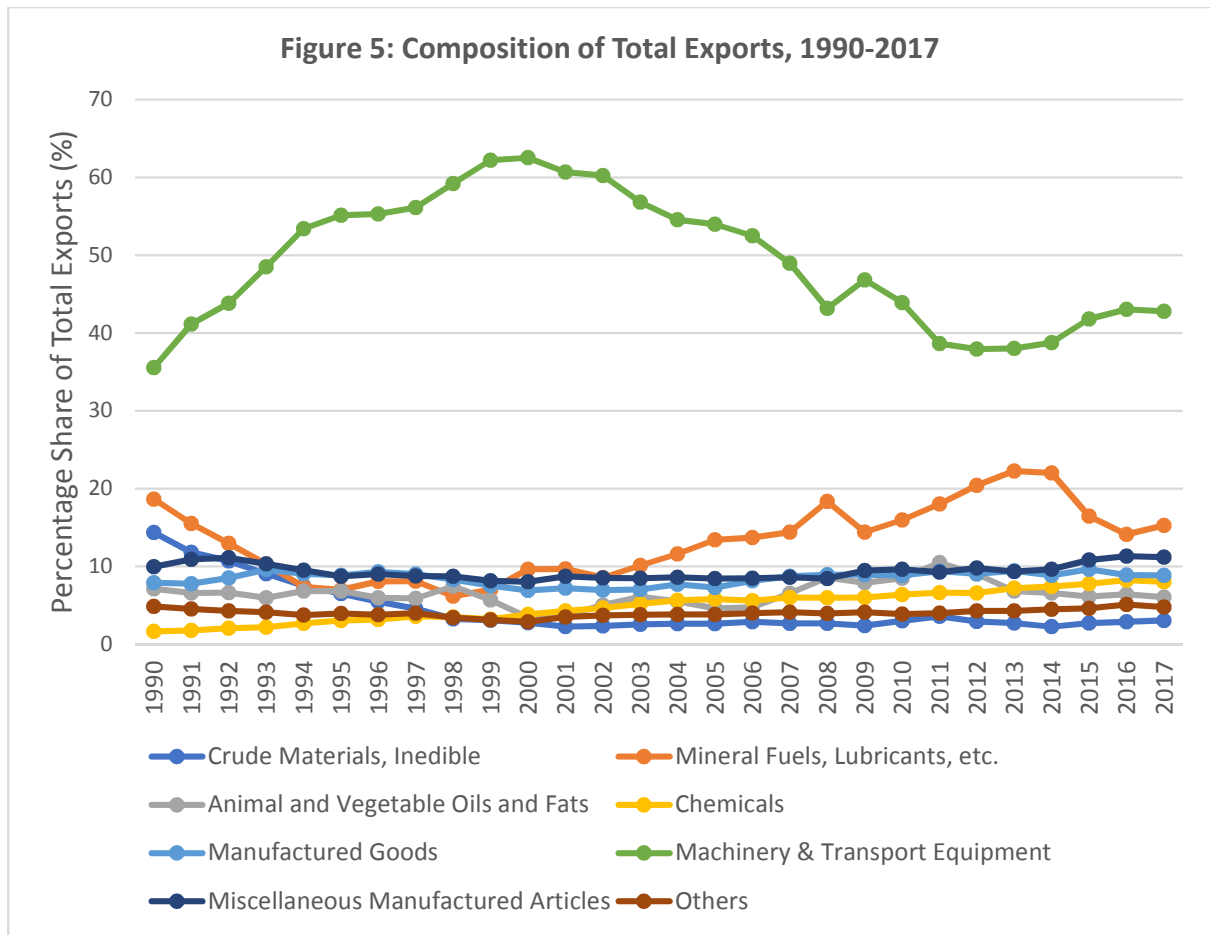
It might be useful to take a more disaggregated and detailed analysis of the export performance of the manufacturing sector to better understand the structural changes taking place within the sector. In terms of the composition of manufactured exports, the machinery and transport equipment industry is by far the largest contributor, accounting for almost 63 per cent of total manufactured exports. The industry’s decline in its share of total manufactured exports began in 1999 and fell to as low as 38 per cent by 2012 (**Figure 5**).



Source: Department of Statistics, Malaysia



Source: Department of Statistics, Malaysia

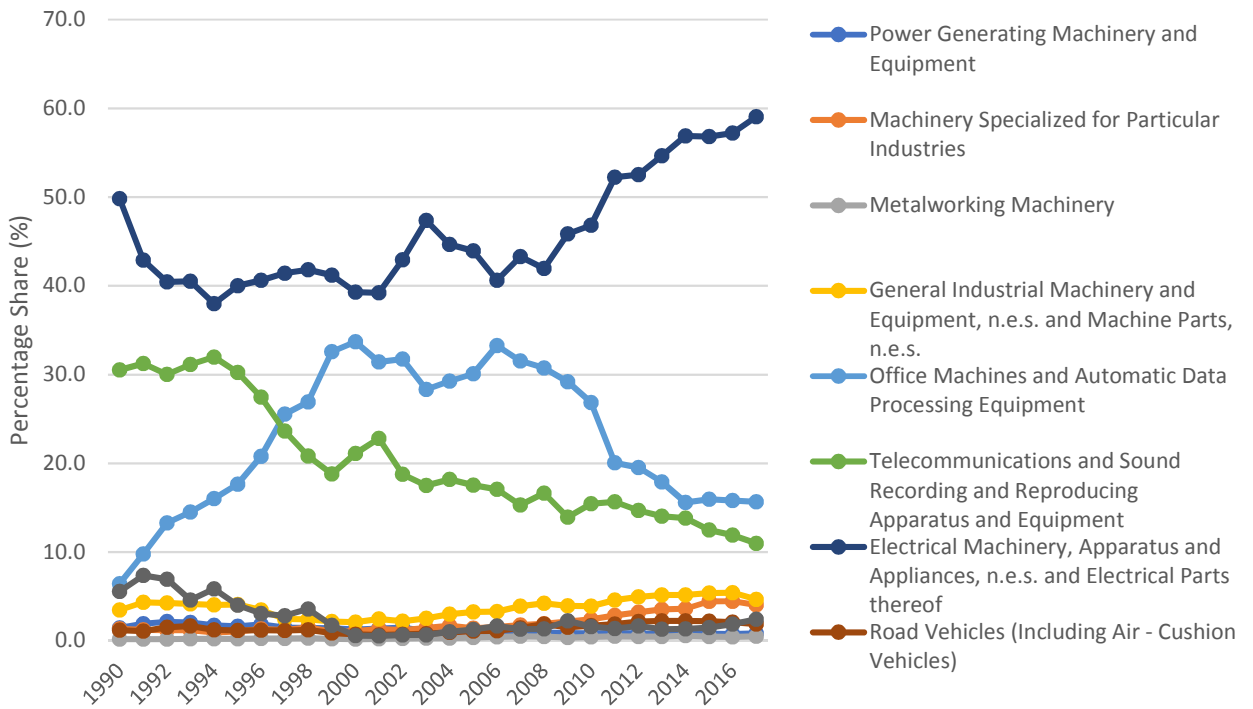


Source: Department of Statistics, Malaysia

Within the machinery and transport equipment industry (two-digit level), two sub-industries (at three-digit level) experienced a significant decline in the percentage share of exports from the industry (**Figure 6**). These are: (i) office machines and automatic data processing equipment; and (ii) telecommunications and sound recording and reproducing apparatus and equipment. The total exports from these industries also declined in absolute terms, though the inflection point for the declines occurred much later in 2006 (**Figure 7**). Within these industries, at the four-digit level, the decline can be observed for the manufacturing of computers and televisions (**Figure 8** and **Figure 9**). Thus, Malaysia participation in the GVCs in these industries may have declined.

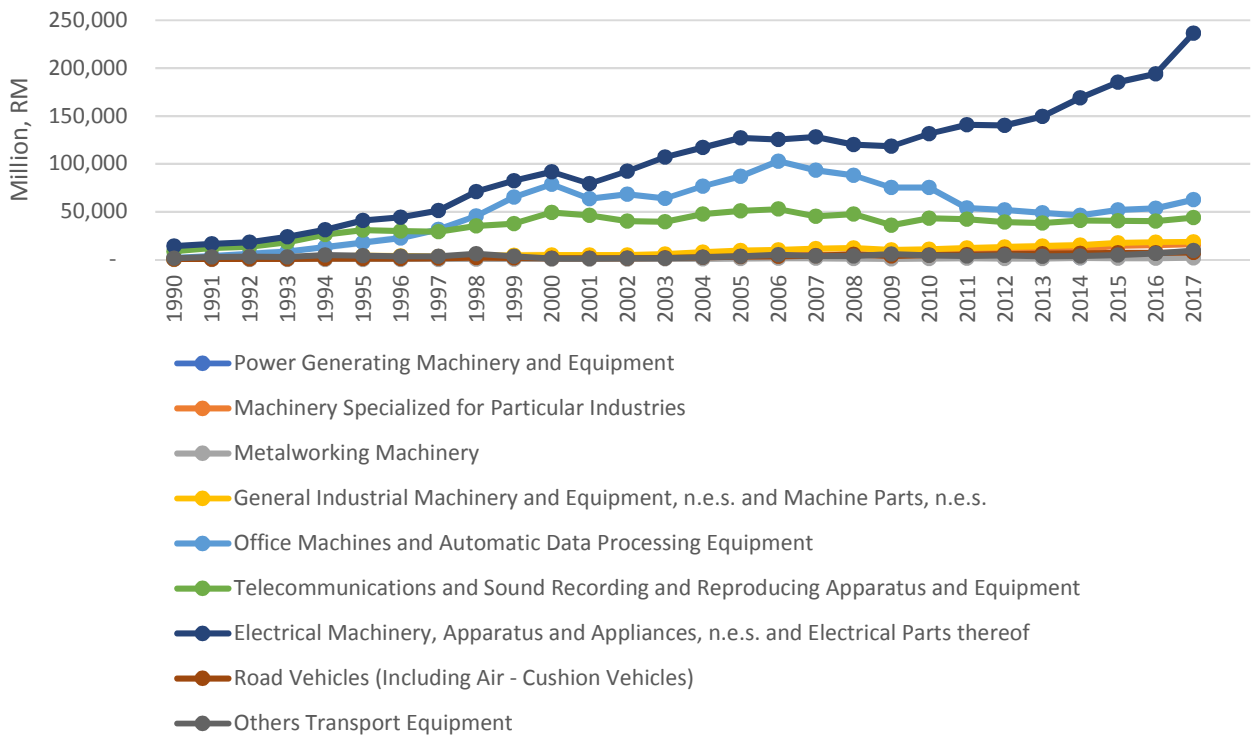
In contrast, one sub-industry, namely electrical machinery, apparatus and appliances experienced an increase in absolute terms as well as in terms of its share of exports from the machinery and transport equipment industry (**Figure 6** and **Figure 7**).

Figure 6: Composition of Exports from the Machinery & Transport Equipment Industry



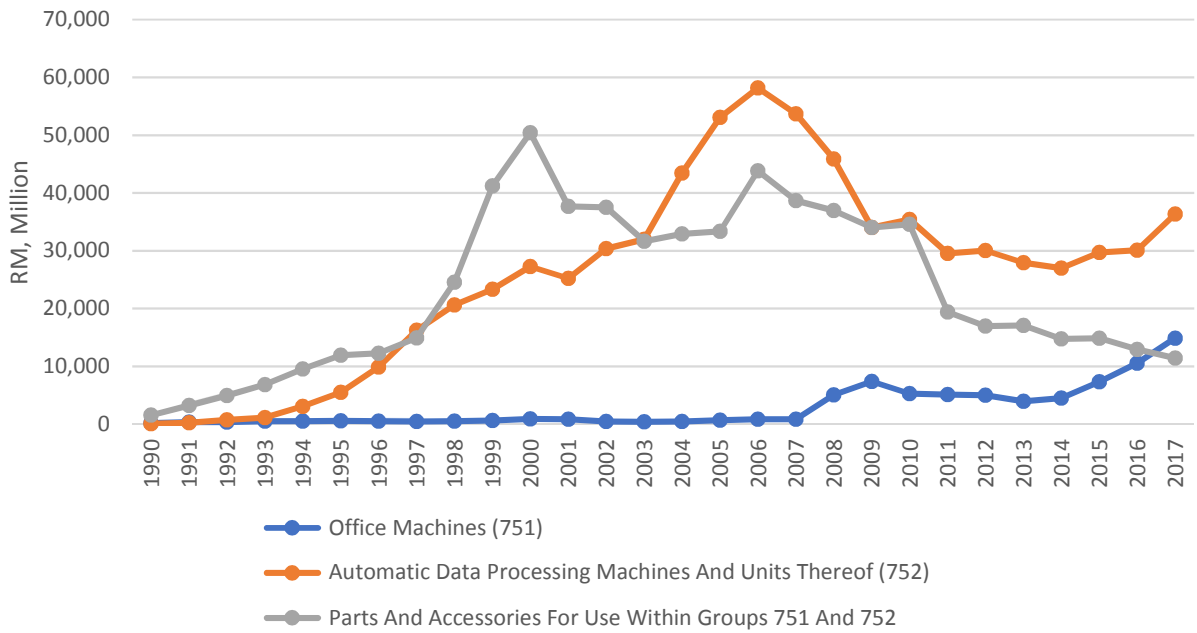
Source: Department of Statistics, Malaysia

Figure 7: Exports - Machinery & Transport Equipment Industry



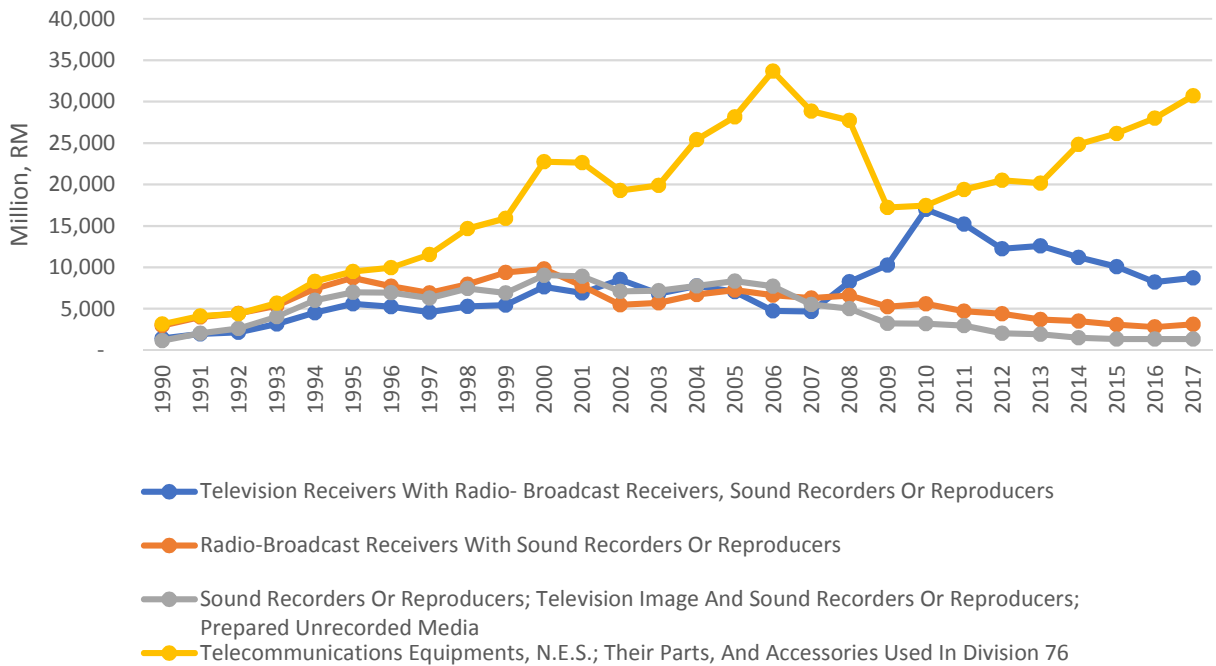
Source: Department of Statistics, Malaysia

Figure 8: Exports from the Office Machines and Automatic Data Processing Equipment Industry



Source: Department of Statistics, Malaysia

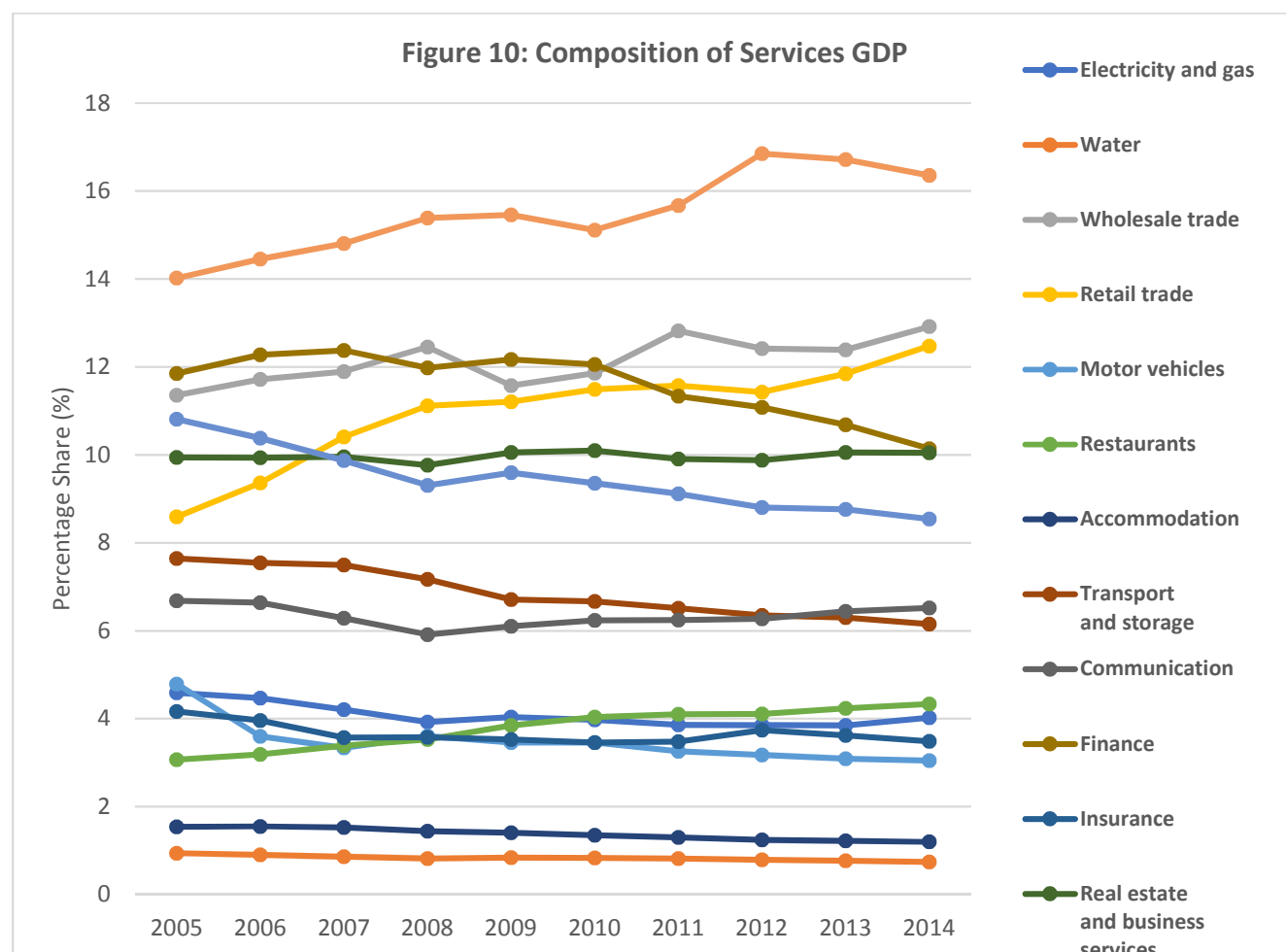
Figure 9: Exports from Telecommunications and Sound Recording and Reproducing Apparatus and Equipment Industry



Source: Department of Statistics, Malaysia

2.2 Services

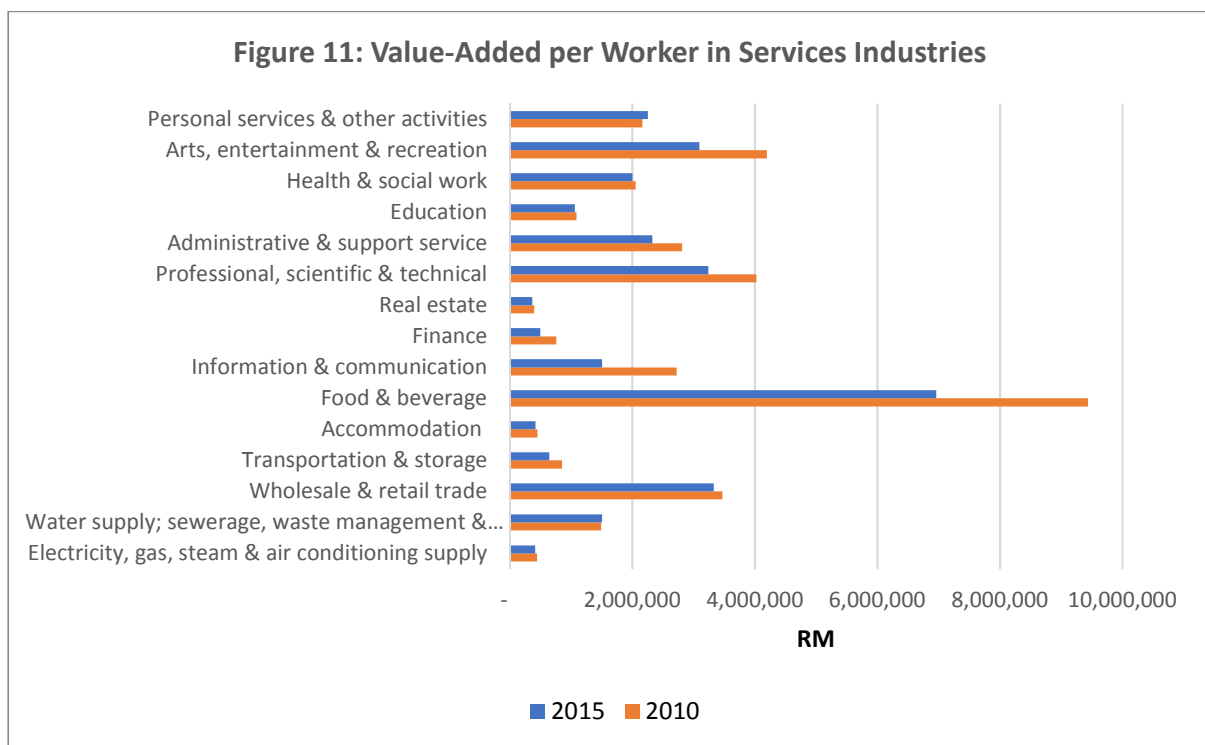
Similar to the manufacturing sector, structural change has taken place in the services sector since 2000.² On the whole, the wholesale and retail trade sub-sectors have become relatively more important (**Figure 10**). Both account for close to 30 per cent of total GDP from the services sector. Retail trade, in particular, has grown rapidly in recent years. Other important services industries include finance and real estate. The share of the former has gradually declined over the past ten years.



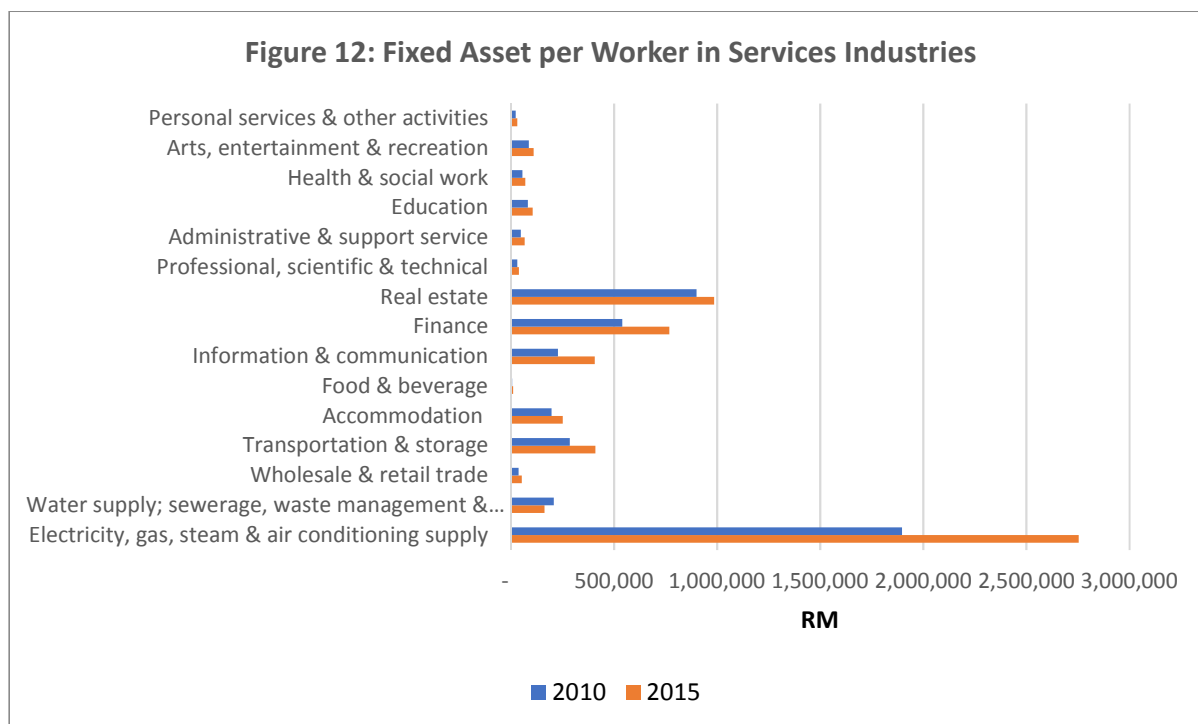
Source: Department of Statistics, Malaysia

² See Appendix for an official classification of services.

Needless to say, the services industries are very diverse. For example, retail trade is very different from transport. This can be seen by examining the significant variations in labour productivity and capital intensity across the different services industries (see **Figure 11** and **Figure 12**). To some extent, this is due to variations in capital intensity across these industries. For example, food and beverage has very high value-added per worker but very low fixed asset per worker. In contrast, labour productivity is very low in industries with very high capital intensity such as utilities (electricity and water). Given that the export performance of the manufacturing sector may depend on its linkages to services, the performance of the relevant services industries is important. Comparing the statistics from the manufacturing census in 2010 and 2015, there has been an overall increase in capital intensity and a decline in value-added per worker. But how exactly are the two sectors linked? This is examined next.



Source: Department of Statistics, Malaysia



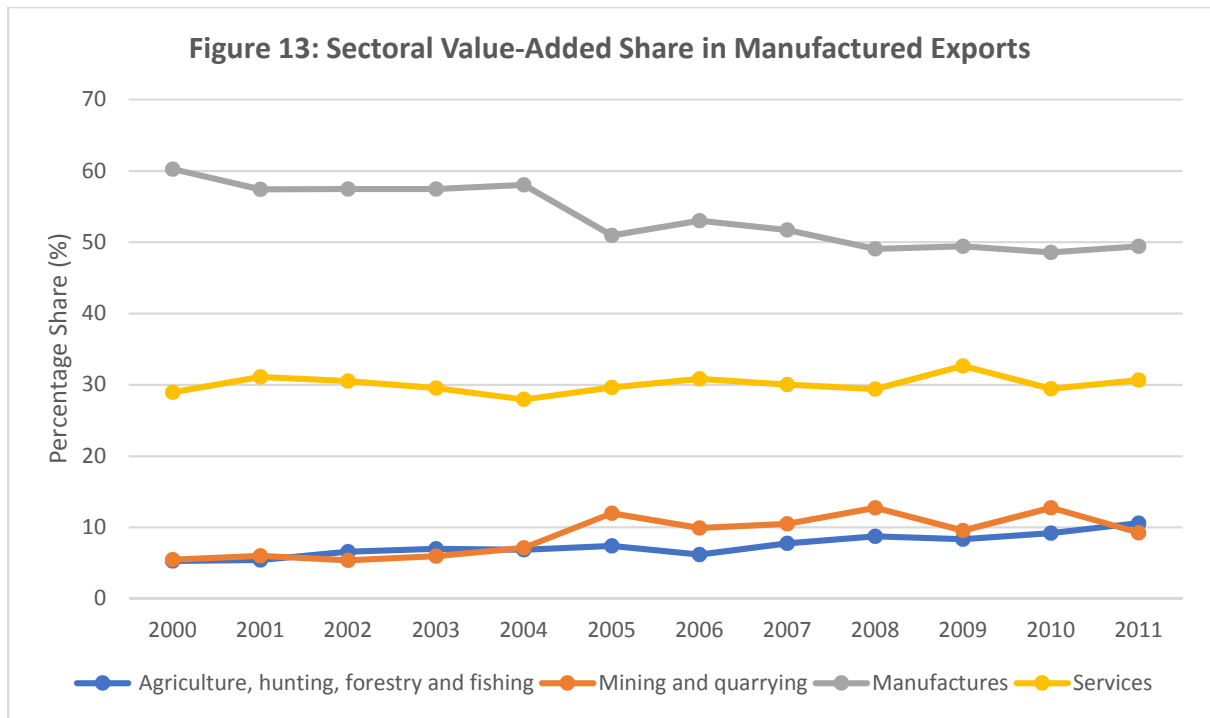
Source: Department of Statistics, Malaysia

3. Linkages Between Services and Manufactured Exports in Malaysia

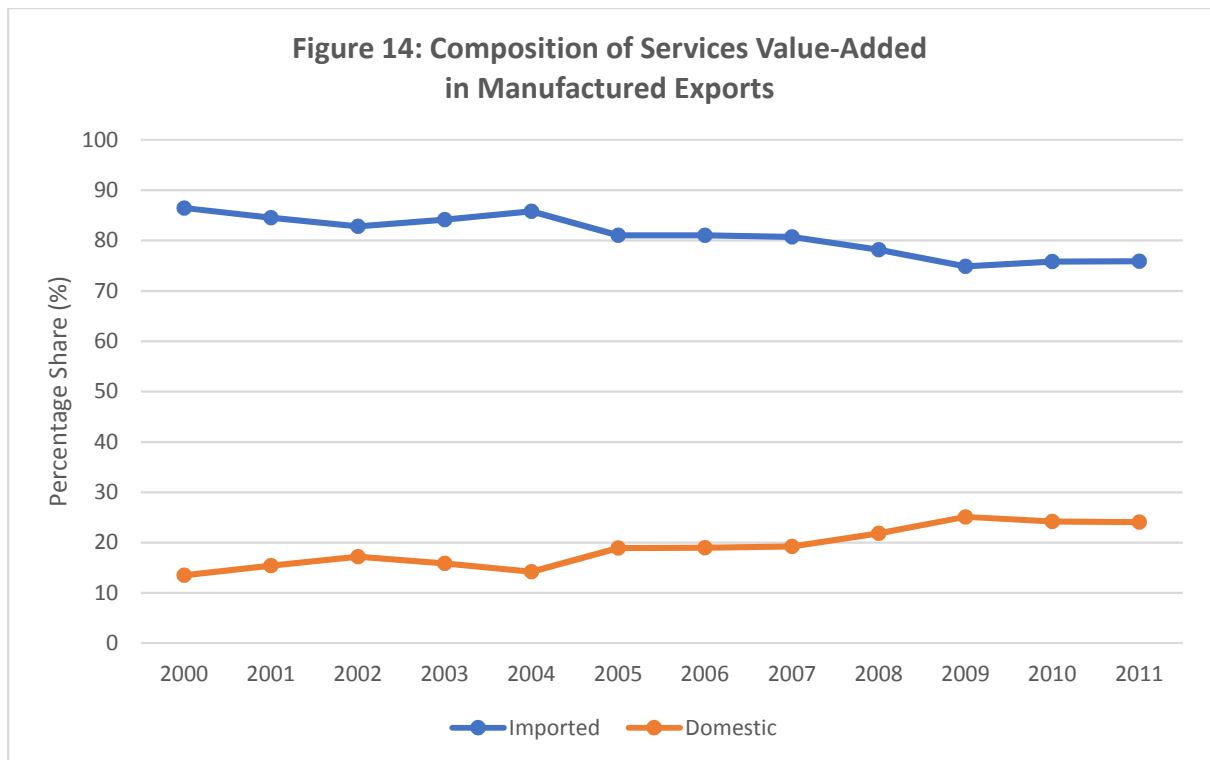
Sectoral interdependence between services and manufacturing is usually studied using input-output (IO) tables. This is the source of data used by the OECD-WTO TiVA Database (2000-2011). Another source is micro-level surveys at the firm level, such as manufacturing surveys and census. In this second source of data, services are recorded as inputs in the production process. Both sources are reviewed in this section.

3.1 OECD-WTO TiVA Database

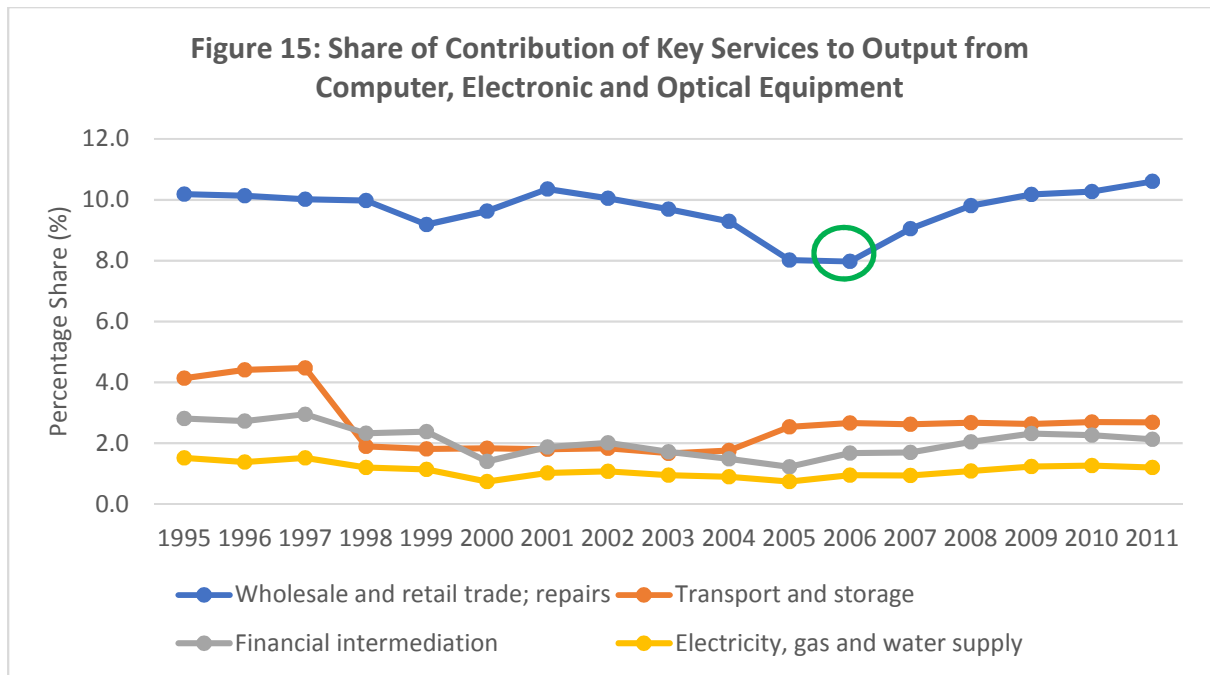
Examining the data for Malaysia, it is found that the share of services' value-added share manufactured exports has been relatively stable at 30 per cent during the 2000-2011 period. Despite such stability in the contribution of services to manufacturing value-added, there has been an important structural change within services. In particular, the domestic component of the services' contribution to manufacturing value-added has increased. For example, the share of domestic services' value-added in manufactured exports has increased from 14 per cent in 2000 to 24 per cent in 2011. Focusing on the key exporting manufacturing sub-sectors such as computers, electronic and optical equipment, the share of retail and wholesale services (the largest services contributor) to the output of this industry decreased during the period 2001 to 2006. However, this trend was reversed after 2006 (see **Figure 13**, **Figure 14** and **Figure 15**).



Source: OECD-WTO TiVA Database

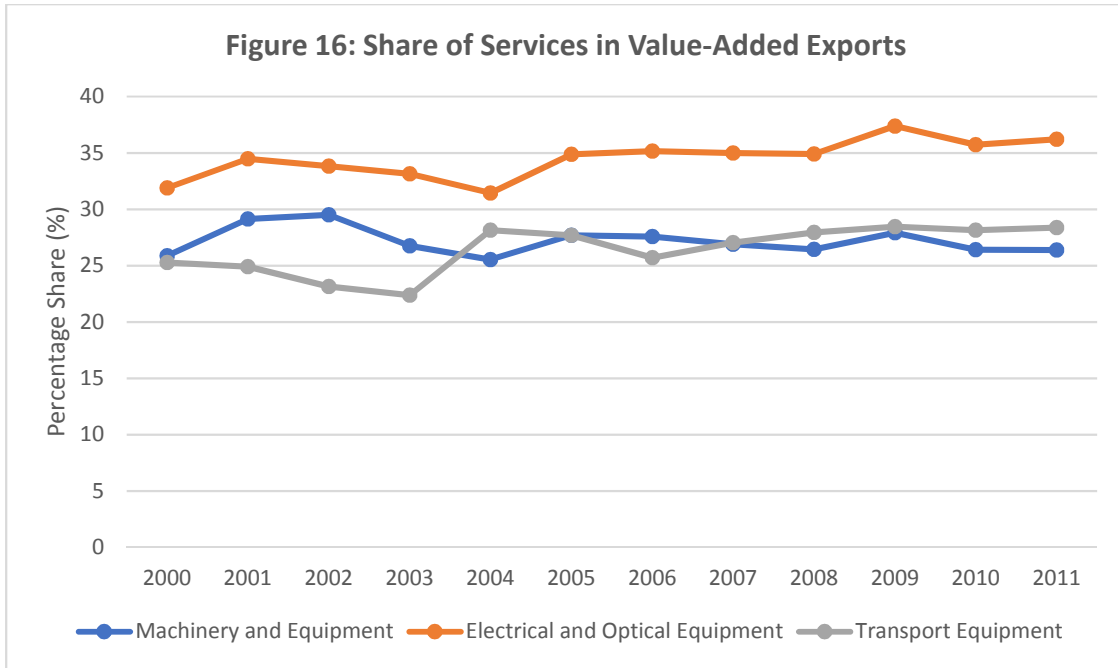


Source: OECD-WTO TiVA Database

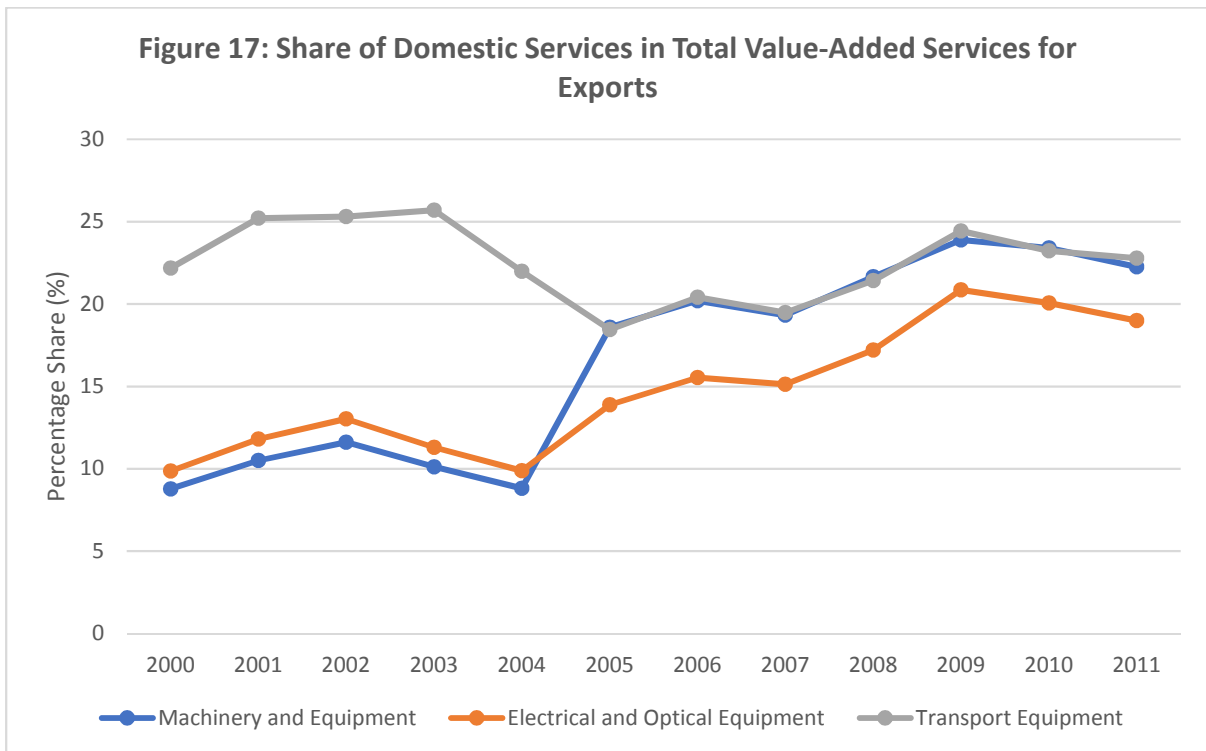


Source: OECD-WTO TiVA Database

Amongst the key exporting manufacturing industries, there has been a slight increase in the share of service’s value-added share in exports of electrical and optical equipment (**Figure 16**). However, the share of domestic services’ contribution to manufactured exports from key exporting manufacturing industries has risen rapidly since 2004 (**Figure 17**). This suggests that the importance of domestic services to manufactured exports in Malaysia has increased in recent years.



Source: OECD-WTO TiVA Database



Source: OECD-WTO TiVA Database

3.2 *Manufacturing Census*

The manufacturing census in Malaysia is carried out by the Department of Statistics once every five years. The latest manufacturing census covers 2010 and 2015. The link between services and manufacturing can be measured in two ways:

- (i) services as an input in total intermediate cost; and
- (ii) services as an output in total sales.

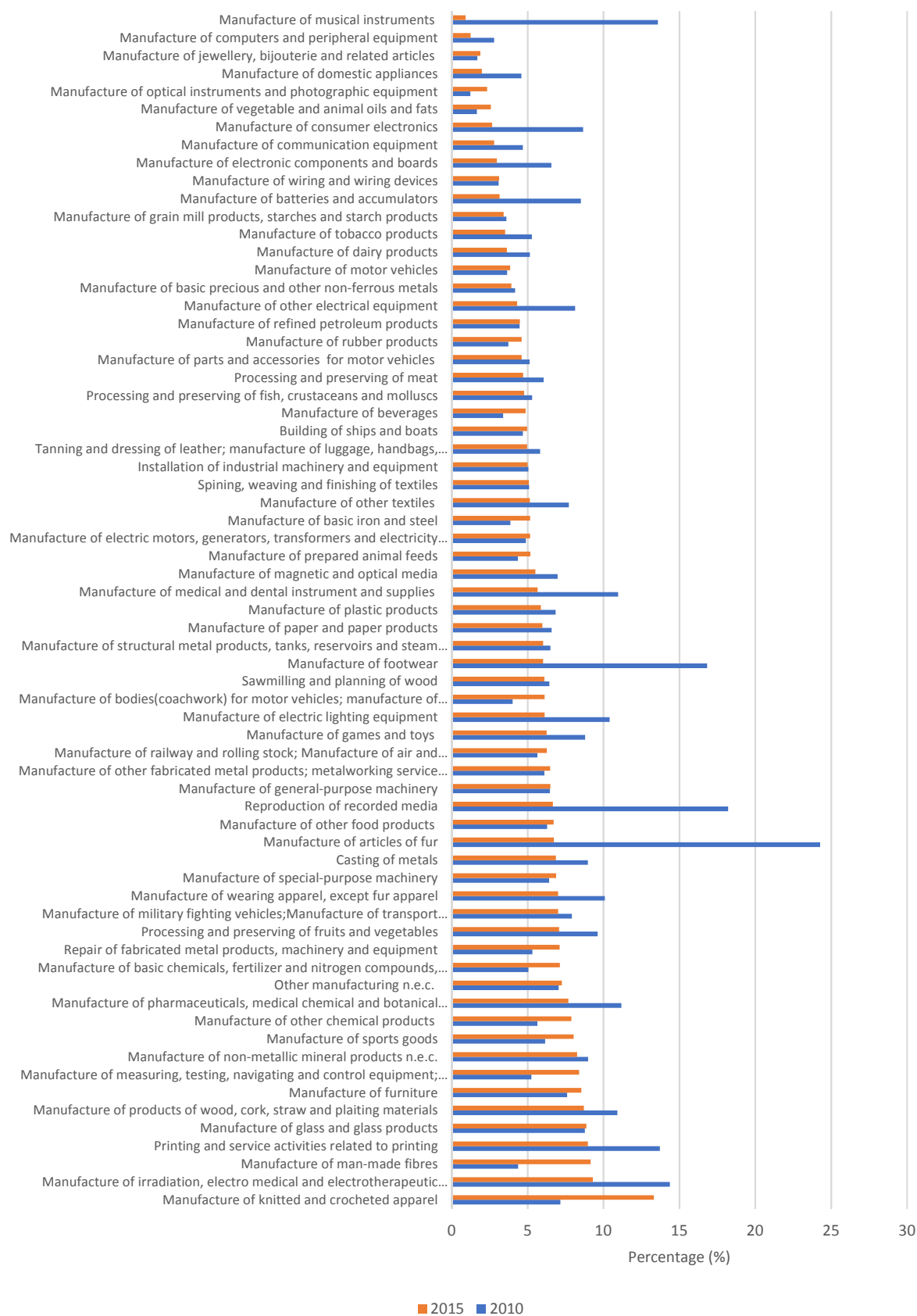
The first measure is a familiar one – services inputs as important factors of production in the manufacturing sector. In the manufacturing census, services inputs are defined as “non-industrial services” which includes transportation of goods, travel by workers, management services, information technology, advertising, banking services, postal/courier services and telecommunications.

The second measure captures a phenomenon not often discussed in the research literature, namely, manufacturing firms selling services. This includes “non-industrial services” such as management services, and income from rental property. It may include (not clarified in the census reports) leasing of products rather than outright sale; (ii) sale of expertise to other firms through consulting services; and (iii) royalty payments on patents owned.

In terms of services as inputs in manufacturing, the trend is very uneven across the various manufacturing industries (**Figure 18**). Overall, services inputs account for less than 10 per cent in many industries. Obviously, the share of services inputs is significantly lower than the estimated derived using the TiVA database because only direct services input costs are included in the manufacturing census.

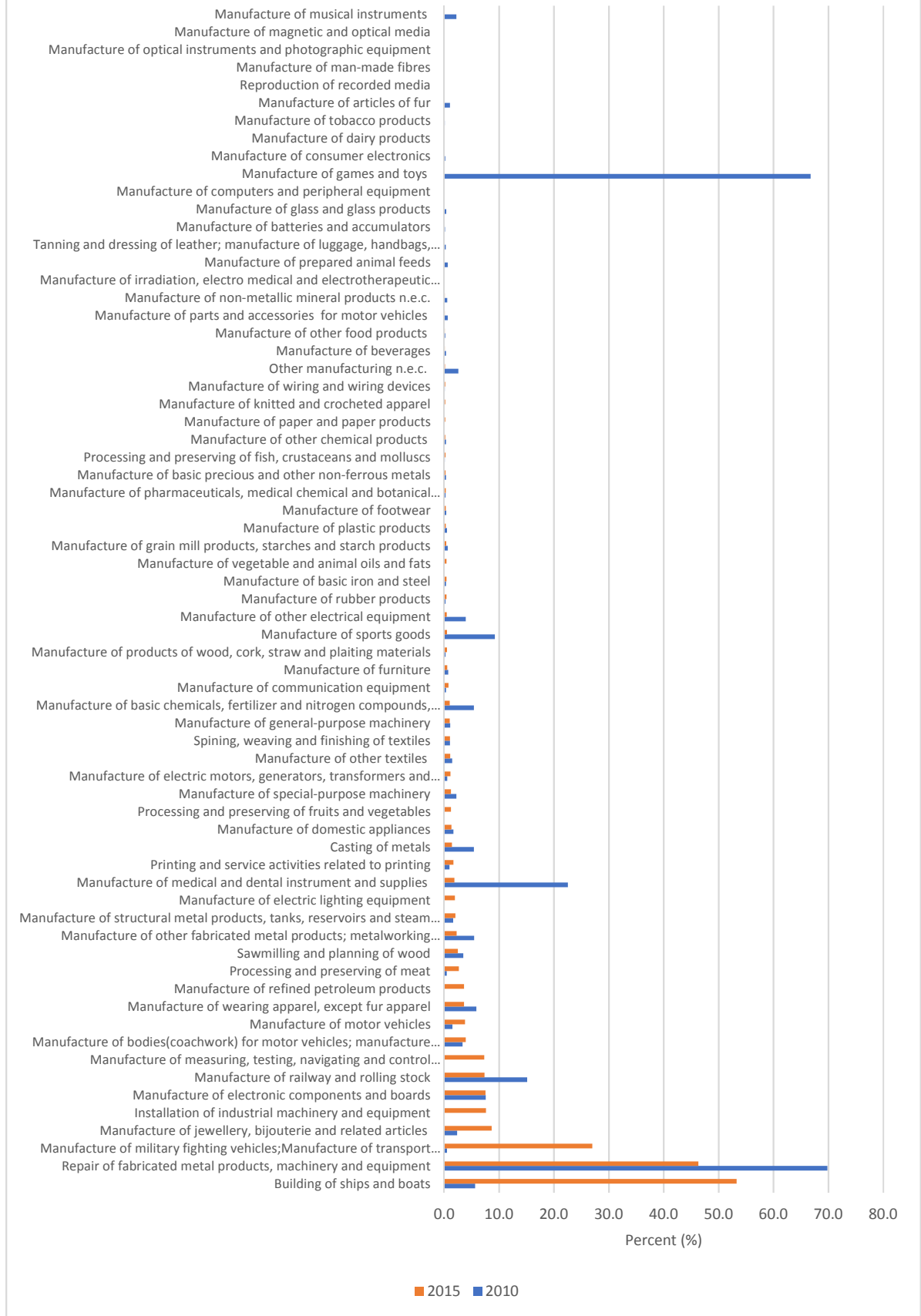
The share of services as percentage of total sales is fairly small in most of the manufacturing industries. There are a few industries with very high share of services in their total sales but these are fairly unstable when we compare the levels in 2010 and 2015 (**Figure 19**).

Figure 18: Services' Share in Intermediate Cost



Source: Department of Statistics, Malaysia

Figure 19: Services' Share of Total Sales



Source: Department of Statistics, Malaysia

4. Literature Review on Services Inputs and Manufacturing Performance

The relationship between services inputs and manufacturing performance has been an active area of econometrics research in recent years. However, data availability has been a key constraint. Ideally, micro-level data would be preferred but most existing surveys and census of manufacturing lack details on the use of the different types of services as inputs. More highly aggregated data in the form of input-output tables has been the key source of data for analysing the linkages between services and manufacturing in the past. As a result, there are variations in the types of data used across the different studies on this topic.

An early work on this topic is that of Francois and Woerz (2007) who used a panel industry-level data covering seventy-eight countries during the period 1994-2004. The authors found that the growth in the manufacturing sector is positively related to demand for producer and business services (the former is a nonlinear or U-shaped relationship). In addition, greater use of imported business services is associated with manufacturing exports especially in technologically-intensive industries.

Another study using industry-level panel data is that by Wolfmayr (2008) who examined the relationship between export market shares of sixteen OECD countries in eighteen industries and the use of domestic as well as imported inputs. The latter is measured by deriving the ratio between total value of services purchased by a given industry divided by the total output of the industry. The author finds that increases in market shares are positively correlated to the use of imported services especially in high-skilled and technology-driven industries.

Tarr (2012) provides a summary of six empirical studies using firm-level data on the impact of the liberalization of the services sector in transition economies. A number of these studies found that liberalisation of the services sector is significantly related to productivity and exporting in the manufacturing sector. Interestingly, one of the studies reviewed suggests that services liberalisation is particularly important for domestic small and medium-size firms.

Berulava (2011) uses firm-level panel data from the surveys conducted by EBRD and World Bank in twenty-nine European and Central Asia countries to investigate the relationship between exporting and services. Services was proxied in two ways - in terms of whether they are considered to be obstacles to businesses and in terms of the EBRD policy reform indices. Overall, the study found that improvements in services would enhance the export performance of manufacturing firms.

Bas (2013) examines the effect of services liberalization on export performance of firms in the manufacturing sector in India. In the study, services liberalization is measured using OECD's ETCR index which measures regulatory conditions in the energy, transport and communications sector. The study found that services liberalization is associated with an increase in the propensity and intensity of exporting in the downstream manufacturing industries.

In Hoekman and Shepherd (2017), the World Bank's survey data covering 119 countries was used to investigate the relationship between services productivity and the productivity of manufacturing firms. This was followed by estimating the relationship between productivity and exporting. The authors found that an increase in services productivity is associated with an increase in firm productivity. The latter is also positively related to the volume of exports.

To sum up the literature, there is sufficient empirical evidence to indicate that: (i) there is a positive link between services inputs and manufacturing activities, and (ii) services liberalization is positively associated with exporting propensity and intensity. These studies provide some useful insights into how to investigate the relationship between services and manufactured exports.

5. Econometric Analysis of Services and Exporting

The services sector has strong links with the manufacturing sector. The literature reviewed earlier shows that the greater use of services and improvements in the performance of the services sector are associated with greater performance of the manufacturing sector in terms of productivity and exporting. In this section, industry-level data is used to investigate the relationship between services input and manufacturing performance in terms of exporting and productivity.

5.1 Methodology: Model Specification and Data

Productivity is a key measure of performance. In the first specification, labour productivity (LP) is used as a dependent variable. The explanatory variables include the use of services inputs (SV - services share of intermediate inputs or services cost per worker), research and development activities (RD - R&D expenditure per worker), investment in information technology (IT – expenditures on IT per worker), and product differentiation (AD - expenditure on advertising per worker). The panel regression model involving industry i at time t can be summarized in the following equation:

$$LP_{it} = \beta_0 + \beta_1 SV_{it} + \beta_2 RD_{it} + \beta_3 IT_{it} + \beta_4 AD_{it} + \epsilon_{it} \quad (1)$$

The relationship between exporting and labour productivity is estimated using two specifications. In the first specification, the dependent variable is the percentage of revenues from exporting (EXPSALE). The independent variables are labour productivity (LP), capital intensity (K - fixed asset per worker) and average firm size (SIZE):

$$EXPSALE_{it} = \beta_0 + \beta_1 LP_{it} + \beta_2 K_{it} + \beta_3 SIZE_{it} + \epsilon_{it} \quad (2)$$

Another alternative to specification (2) is to use the percentage of establishments exporting (EXPESTD) as a dependent variable:

$$EXPESTD_{it} = \beta_0 + \beta_1 LP_{it} + \beta_2 K_{it} + \beta_3 SIZE_{it} + \epsilon_{it} \quad (3)$$

The panel regression is estimated using data from the Malaysian Manufacturing Census compiled by the Department of Statistics for the years 2010 and 2015. The data is at the three-digit level industry involving sixty-seven manufacturing industries. The Hausman specification test is used to identify whether fixed or random effects panel regression is the appropriate approach.

The summary statistics of the data is presented in **Table 1**. From the table, it can be seen that the average share of services as a percentage of intermediate input is around 6-7 per cent. Furthermore, an average of about 38-43 per cent of total shares come from exports. Comparing both data from 2010 and 2015, the average value-added per worker and average R&D expenditure per worker declined significantly from 2010 to 2015. However, the average firm size in terms of number of workers per establishment increased during this period.

Table 1: Summary Statistics

Year 2010					
Variable	Obs	Mean	Std. Dev.	Min	Max
Number of Workers	67	26,597	32,299	21	182,487
Value-Added per Worker (RM)	67	216.92	559.42	23.52	4,601.26
Services' Share of Intermediate Inputs (%)	67	7.06	3.97	1.23	24.28
R&D Expenditure per Worker (RM)	67	4,659.97	10,925.33	-	85,758.44
IT Expenditure per Worker (RM)	67	480	1,306.45	-	10,362.57
Advertising Expenditure per Worker (RM)	67	1,144.38	2,028.93	8	13,929.16
Exports Share of Total Sales (%)	67	43.71	26.26	-	89.76
Workers per Establishment	67	87	127	2	638
Year 2015					
Variable	Obs	Mean	Std. Dev.	Min	Max
Number of Workers	67	31,164	35,969	26	194,068
Value-Added per Worker (RM)	67	92.6	219.14	4.36	1,764.52
Services' Share of Intermediate Inputs (%)	67	5.67	2.24	0.92	13.33
R&D Expenditure per Worker (RM)	67	1,722.15	4,050.04	-	25,149.60
IT Expenditure per Worker (RM)	67	554.55	2,930.44	-	24,011.45
Advertising Expenditure per Worker (RM)	67	880.88	1,761.34	2.02	12,617.75
Exports Share of Total Sales (%)	62	38.29	23.17	-	93.4
Workers per Establishment	67	150	193	4	787

5.2 Empirical Analysis

The results from the panel regressions are summarized in **Table 2** and **Table 3**. For the panel regressions on the determinants of labour productivity, the greater use of services inputs is associated with higher average labour productivity. This relationship is statistically significant and holds irrespective of whether services inputs is measured as a share of intermediate cost or as cost per worker. The independent variables R&D expenditure, IT expenditure and advertising expenditure all have positive coefficients and are statistically significant.

In the second set of panel regressions, higher labour productivity is found to be associated with greater share of exports in total revenues and percentage (propensity) of firms exporting. Firm size is another statistically significant variable with positive coefficient. The

sign of the coefficient for capital intensity differs for share of exports in revenues and propensity of firm exporting. Overall, the findings on the importance of services to exporting is consistent with the literature reviewed earlier.

Table 2: Determinants of Labour Productivity

	(1)	(2)
Variables	ln(VA per Worker)	ln(VA per Worker)
ln(Service Share of Intermediate Cost)	1.257***	
	0.178	
ln(Service Cost per Worker)		0.921***
		0.173
ln(R&D Expenditure per Worker)	0.243***	0.355***
	0.0388	0.0418
ln(IT Expenditure per Worker)	0.284***	0.202***
	0.0409	0.0447
ln(Advertising Expenditure per Worker)	0.283***	0.211***
	0.0623	0.0674
Constant	-2.417***	-9.038***
	0.496	1.788
Observations	126	126
Number of firms	64	64

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Hausman specification test – fixed effects estimation for (1) and (2)

Table 3: Determinants of Exporting

	(1)	(2)
Variables	ln(Export Share of Revenues)	ln(Percentage Firms Exporting)
ln(Value-Added per Worker)	0.209***	19.19***
	0.0624	4.872
ln(Fixed Asset per Worker)	-0.209**	8.136**
	0.0817	3.938
ln(Worker per Firm)	0.194***	25.59***
	0.0675	6.041
Constant	4.184***	-262.0***
	0.961	77.56
Observations	125	129
Number of firms	65	67

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ 0.209***

Hausman specification test – random effects for (1) and fixed effects estimation for (2)

6. Conclusions

The Malaysian economy has been experiencing deindustrialization since the late 1990s. As the manufacturing sector is primarily export-oriented, its relative decline is also reflected in the decline in the country's trade ratio. The decline also reflects a possible decline in the country's participation in manufacturing GVCs. A key issue that may be of importance in analysing this structural change is the role of services in the performance of the manufacturing sector. Existing literature points to the important contributions that services make to manufacturing performance. The empirical analysis in this study validates this.

Drawing from these findings suggest that policy makers in Malaysia should undertake a more detailed analysis on whether there are existing weaknesses in the services sector that may have spillovers that adversely affect the manufacturing sector. This is particularly important given that current statistics indicate that the Malaysia's manufacturing sector is increasingly becoming more dependent on services generated domestically.

Based on findings from the literature, services liberalization may be one approach. Given the predominance of the government-linked companies in key services sectors such as infrastructure, banking and finance, a related policy implication maybe to further examine how the role of GLCs in these industries affects the manufacturing sector indirectly. More evidence, especially at the micro-level, is needed. In this regard, microdata studies in Malaysia are constrained by data access. Data is collected by the government but researchers have no access to these data.

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Appendix: Definition of Services Sector: ISIC Rev.3

- Wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods (G)
- Hotels and restaurants (H)
- Transport, storage and communications (I)
- Financial intermediation (J)
- Real estate, renting and business activities (K)
- Public administration and defence, compulsory social security (L)
- Education (M)
- Health and social work (N)
- Other community, social and personal activities (O)
- Private households with employed persons (P)
- Extra-territorial organisations and bodies (Q)