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# An alternate approach to identify key service sectors' contributors: Experiences from Malaysian economy

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This study analyzes the direct and indirect rankings and contribution of service sectors in the Malaysian economy from 1987 to 2005. Two different methodologies, that is (1) direct service intensities, and (2) direct plus indirect service intensities have been used to calculate the service intensity of different industries. It is found that the contribution of overall service sectors is mostly positive and steady during the selected time period. However, the empirical findings are quite appealing to identify rankings based on direct and indirect sectoral contributions. The direct sectoral rankings indicate that the contribution of transport and communication is moved from rank 4 to 1; real estate sector moved from rank 15 to 2; and trade moved from rank 2 to 10 from the year 1987 to 2005. However, the direct and indirect intensities and rankings are indicating different directions over the study period. Therefore, the present study aims at studying the evolving nature of service sectors following on the Leontief input-output analysis with means and coefficients of variation. Here, our second method indicates that the manufacturing ranking was 1 in 1987 and also in 2005; the financial related service ranking was 2 in 1987 and 3 in 2005; the trade ranking was 3 in 1987 and 5 in 2005; and the transport and communication ranking was 4 in 1987 and 2 in 2005. We mostly use direct methods to identify key contributors which may direct wrong indications without other supporting justification. This study can be used to identify key contributors especially for policy formulations in Malaysia and elsewhere.

**Key words:** Malaysian economy, service sectors, sectoral contribution, alternative approach, input-output analysis.

## INTRODUCTION

The service sectors in the Malaysian economy have played an important role in its growth and development process. The greater presence of the service sectors in the Malaysian economy is indeed in line with the growth transformation that has taken place in many of the developed economies (MP, 2006). Service sectors form a major structural component of an economy compared to that of the manufacturing or primary sector. With the greater role of the service sectors over the last decade such as transport and communication, finance, insurance, real estate, business service, electricity, gas

and water, wholesale and retail trade, hotels and restaurants, government services, and other services, Malaysia has moved into the third stage of economic development (MP, 2006). In this stage, economic growth is no longer led by the manufacturing sector alone (Eswaran and Kotwal, 2002). Instead, economic growth is powered by both the manufacturing and service sectors (Economic Report, 2006). The increasing role and contribution of the service sectors in Malaysia can be measured from its rapid growth and increasing contributions to total output, total employment and export earnings of the country. Over the last decade, the service sectors have registered strong and healthy growth, comparable to that of the manufacturing sector (MES, 2003). In the period 1980 - 2005, on average, the service sectors grew by 8.3 percent per year (manufacturing 9.1

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**Table 1.** Malaysian growth of GDP, services and manufacturing sectors: 1980 – 2005.

	Average growth rate (%)			
	1980-1989	1990-1999	2000- 2005	1980-2005
GDP	6.5	7.2	5.4	6.5
Services	8.8	9.2	6.1	6.3
Manufacturing	9.4	10.0	7.1	9.1

Source: Economic report (2006).

**Table 2.** Malaysian growth of service sectors: 1980 - 2005.

Sectors	Average growth rate (%)			
	1980-1989	1990-1999	2000- 2005	1980-2005
Overall Service sectors	8.8	9.2	6.1	8.3
Electricity, Gas and Water	9.1	11.1	7.5	9.5
Transport and Communication	8.9	9.5	7.2	8.7
Wholesale and Retail trade, Hotels and Restaurants	7.0	9.4	4.2	7.3
Finance, Insurance, Real estate and Business service	12.7	12.8	8.3	11.7
Government services	6.1	4.5	5.2	5.3
Other services	0.6	8.6	4.7	4.6

Source: Economic report (2006).

percent per year). Alternatively, growth in the service sectors in this period exceeded the Gross Domestic Product (GDP) growth of 6.5 percent per year (Table 1).

Table 2 also shows that the growth of the service sectors from 1980 to 2005 was quite significant. The strong growth in the service sectors was contributed by the high growth in services sub-sectors such as finance, insurance, real estate and business services by 11.7 percent per year; electricity, gas and water by 9.5 percent; transport, storage and communication by 8.7 percent; and wholesale and retail trade, hotels and restaurants by 7.3 percent. Government services grew at a lower rate of 5.3 percent per year (Economic Report, 2006).

A survey of the literature on the service sectors reveal that it plays an important role in the economic development in Malaysia (Economic Report, 2006). It has been noted that the contribution of the service sectors in the GDP of Malaysia is growing progressively (MP, 2006; MES, 2003). However, almost all researchers use direct methods like regression, correlation and coefficient of variations to show the service sectors' contributions. These methods only show the direct impacts or partial contributions of service sectors in an economy. However, how much services are indirectly used in an economy is hidden without an appropriate measure. Therefore, using only direct methods to identify key sectors may direct wrong indications for policy formulations. This present study figured out the gap between direct and indirect methods with two different methodologies, that is: (1) direct service intensities, and (2) direct plus indirect

service intensities to calculate the service intensities and rankings of different industries. The present study aims at studying the evolving nature of the services consumption for production directly and indirectly in the Malaysian economy from the period 1987 to 2005.

## METHODOLOGY

Towards the achievement of the stated objective, the employed methodology of this paper is based on Leontief's input-output (I-O) framework (Leontief and Wassily, 1966, 1970, 1974; Miller and Blair, 1985), where the structure of an economy is analyzed in terms of interrelationships between production sectors. Generally, the input-output model describes the relationships among economic sectors through the use of a system of linear equations, which represent each sector's identity between the total output produced and the output purchased and consumed by all the other sectors of the economic system. In other words, everything produced by a sector is purchased and consumed respectively by the other ones as inputs or by the consumer as final demand. In matrix notation, this system of linear equations is:

$$x = Ax + f$$

This equation is the fundamental equation of the open Leontief system, which states that the gross output  $x$ , is the sum of all intermediate demand  $Ax$  and final demand  $f$ . The solution of the I-O model can be written as  $x = (I - A)^{-1} f$ , where  $(I - A)^{-1}$  is known as 'Leontief inverse',  $A$  input coefficients, and  $I$  is a  $n \times n$  identity matrix. In our study the I-O model succinctly discussed the core aspects of two basic types of services intensity in the Malaysian economy, firstly based on direct productive services use,  $S_d$  to total outputs  $x$  of the economy and secondly indirect productive services

use,  $S_{ind}$  to direct and indirect demands of the economy. If there are  $n$  producing sectors in the economy and if sector  $i$  buys services  $s_i$  for its productive process and since sector  $i$  has total output  $x_i$  so, direct service intensities is defined by  $i = S_i/x_i$ . Using this definition more specifically, we get:

$$i = S_i/x_i = S_d \quad (1)$$

where  $i$  is the row vector with element  $i$  indicating the direct productive services requirements to produce one unit of goods by sector  $i$ . On the other hand, the direct intensity vector and the

Leontief inverse gives the multiplier matrix  $e_i$  which represents the total (direct plus indirect) services requirements to produce one unit of goods delivered to given demand in sector  $i$ :

$$\hat{e}_i = i(I-A)^{-1} = S_{ind} \quad (2)$$

Lastly, other statistical tools used to justify the significance of the service sectors in the Malaysian economy are the mean and coefficient of variations (V) (Roy et al., 2002). Sometime researchers find selection errors to compare the direct and indirect service intensities to identify key sectors. To eliminate selection error due to extreme values in the calculation on direct and indirect intensities, the coefficient of variation is a effective tool to justify results to further recognize key sectors. The coefficient of variations (V) as the ratio of the standard deviation and the mean of each industry are calculated as follows:

$$V_i = \frac{\sqrt{\frac{\sum (e_i - \bar{e})^2}{k-1}}}{\bar{e}}$$

with  $\bar{e} = \frac{\sum e_i}{k}$ , where  $k$  is the number of years. Likewise,  $V_i$  is defined using  $i$  instead of  $e$ .

### Data preparation

The study uses an input-output approach based on the input-output tables for 1987, 1991, 2000 and 2005<sup>1</sup> of the Malaysian economy and the industrial classification system is used as a base to define the classification of the present study (DOS, 1990, 2000, 2005). The input-output table of 1987 to 2005 contains various sectors. For our empirical study, we aggregated all I-O tables for a 15 x 15 matrix of sectors in order to confirm our desired results. We considered 8 service sectors in our empirical study. They are trade (6), entertainment (7), transport and communication (8), financial related services (9), education (10), health (11), public service (12) and real estate (13). In this analysis, the output of the service sectors is being considered as an intermediate input of other sectors. The service related data are collected from the Malaysian 9th Development Plan (MP, 2006) and the Department of Statistics, Malaysia (MES, 2003).

## RESULTS AND DISCUSSION

In this study we calculated the vectors  $e$  and  $i$  of the

Malaysian economy for the four years of 1987, 1991, 2000 and 2005 based on the aggregated 15 sectors input-output tables. The figures of the vectors  $e$  and  $i$  and their rankings are shown in Tables 3 and 4. From Tables 3 and 4 the figures indicate that the average direct services use per unit of output produced in the Malaysian economy is mostly steady from 1991 to 2005, however, slightly increased (less than 2%) from 1987 to 1991. For example, the average direct intensities of service sectors were 10.61% in 1987, 12.06% in 1991, 12.07% in 2000 and 12.15% in 2005. On the other hand, the indirect intensities increased from 15.29% in 1987 to 17.09% in 1991 and for the remaining time periods, the indirect intensities slightly decreased by less than 0.25%. These figures indicate that both the direct service contributions and the overall direct plus indirect service contributions are almost the same throughout the study period in the Malaysian economy except for the 1991 period where direct and indirect service sectors' contributions increased, although, not very significantly.

On the other hand, it is evident from the study (Tables 3 and 4) that in the Malaysian economy, service consumption both directly and indirectly is remarkably high compared to the direct method for different industries throughout the study period. It is found that  $e_i$  in 1987 varies from 1.93% for real estate (13) to 20.315% for financial related services (9). More compactly this study indicates that the direct service intensity is lowest in real estate (13) and highest in financial related services (9), followed by trade (6), entertainment (7), transport and communication (6), public services (12), health (11), construction (5) (that is, major sectors)<sup>2</sup> and direct plus indirect service intensities  $i$  varies from 5.67% for real estate (13) to 32.31% for manufacturing (2). The indirect service intensity for 1987 is also lowest in real estate (13) and highest in manufacturing (2) followed by financial related service (9), trade (3), transport and communication (8), and entertainment (7). Similarly, in 1991,  $e_i$  varies from 2.42% for real estate (13) to 21.38% for others (15). In this year, the direct service intensities is lowest in real estate (13) and highest in others (15) followed by financial related services (9), transport and communication (8), trade (6), entertainment (7), public service (12), and health (11).

Direct plus indirect service intensities  $i$  varies from 4.04% for real estate (13) to 28.88% for others (15) and the indirect service intensities of 1991 are lowest in real estate (13) and highest in others (15), followed by transport and communication (8), financial related service (9), trade (6), entertainment (7), public services (12) and construction (5). In 2000, direct service intensities  $e_i$  varies from 3.78% for mining and quarrying (3) to 25.00% for others (15). The direct service intensities of 2000 are lowest in mining and quarrying (3) and highest in others (15), followed by transport and communication (8), public service (12), financial related service (9), entertainment

<sup>1</sup> The 2005 Input-Output table is an updated Input-Output table of 2000.

<sup>2</sup> We followed descending order.

**Table 3.** Direct service intensities (%) and sectoral rankings: 1987 – 2005.

Sectors	1987		1991		2000		2005*	
	$e_i$	Rank	$e_i$	Rank	$e_i$	Rank	$e_i$	Rank
1. Agriculture	4.47	13	5.63	14	4.90	14	5.30	14
2. Manufacturing	8.43	9	9.59	11	7.86	12	7.71	13
3. Mining and Quarrying	4.21	14	5.90	13	3.78	15	4.15	15
4. Utility	7.35	11	11.50	8	11.59	9	12.57	9
5. Construction	12.38	7	10.21	10	11.61	7	11.93	11
6. Trade	17.21	2	16.66	4	11.45	10	12.55	10
7. Entertainment	15.91	3	14.18	5	11.63	6	10.70	12
8. Transport and Communication	14.97	4	18.98	3	19.97	2	20.36	1
9. Financial related services	20.15	1	19.90	2	15.53	4	15.13	3
10. Education	5.81	12	7.52	12	6.67	13	13.44	5
11. Health	12.71	6	12.64	7	10.89	11	13.45	4
12. Public services	13.62	5	13.25	6	16.57	3	13.43	7
13. Real estate	1.93	15	2.42	15	11.59	8	15.14	2
14. Repairing motor vehicles	11.74	8	11.43	9	11.97	5	13.44	6
15. Others	8.20	10	21.38	1	25.00	1	12.97	8
Total	10.61		12.08		12.07		12.15	

Sources: Author's calculations, \* these results are based on forecasting the I-O table of 2005.

**Table 4.** Direct plus Indirect service intensities (%) and sectoral rankings: 1987 – 2005.

Sectors	1987		1991		2000		2005*	
	$i$	Rank	$i$	Rank	$i$	Rank	$i$	Rank
1. Agriculture	11.18	11	9.33	13	8.27	13	8.93	14
2. Manufacturing	32.31	1	16.08	11	34.20	1	32.78	1
3. Mining and Quarrying	6.65	13	7.91	14	5.19	15	5.43	15
4. Utility	12.29	10	17.08	8	16.45	8	17.32	6
5. Construction	15.15	6	17.10	7	13.24	10	13.33	12
6. Trade	24.58	3	21.15	4	18.35	5	18.73	5
7. Entertainment	19.17	5	20.62	5	16.02	9	14.27	7
8. Transport and Communication	22.48	4	25.41	2	28.00	2	28.07	2
9. Financial related services	26.18	2	25.05	3	24.77	4	23.84	3
10. Education	5.91	14	10.09	12	6.72	14	13.90	9
11. Health	12.90	9	16.88	10	10.90	12	13.67	10
12. Public services	13.77	7	19.83	6	17.30	6	14.20	8
13. Real estate	5.67	15	4.04	15	16.63	7	19.83	4
14. Repairing motor vehicles	12.92	8	16.96	9	12.71	11	13.51	11
15. Others	8.20	12	28.88	1	25.23	3	12.99	13
Total	15.29		17.09		16.93		16.72	

Sources: Author's calculations, \* these results are based on forecasting the I-O table of 2005.

(7), construction (5) and is others. In 2000, indirect service intensities  $i$  varies from 5.19% for mining and quarrying (3) to 34.20% for manufacturing (2). The indirect intensities are lowest in mining and quarrying (3) and highest in manufacturing (2), followed by transport and communication (8), others (15), financial related service (9), trade (6), and public services (12).

Finally, our findings indicate that direct service intensities of 2005  $e_i$  varies from 4.15% for mining and quarrying (3) to 20.36% for transport and communication (8). The estimates indicate that direct service intensities of 2005 are lowest in mining and quarrying (3) and highest in transport and communication (8), followed by real estate (13), financial related services (9), health (11),

education (10), repairing motor vehicles (14). Here we see that for the first time, the direct service intensities of health and education sectors are placed in the first fifteen places. The indirect service intensities in 2005  $i$  varies from 5.43% for mining and quarrying (3) to 32.78% for manufacturing (2). The indirect intensities are lowest in mining and quarrying (3) and highest in manufacturing (2), followed by transport and communication (8), financial related service (9), real estate (13), trade (6), utility (4), and entertainment (7).

From our analysis, we scrutinized that both direct service intensities  $e_i$  and direct plus indirect intensities  $i$  for different industries vary between 1987 and 2005. We see from our findings that the sectoral percentage allocation of direct use and indirect use is quite appealing. For example, in the year 2005 the sectoral percentage allocation of direct service use of manufacturing sector only 7.71% and the rank 13 out of 15 sectors considered in our study (Table 3). However, the sectoral percentage allocation of direct plus indirect service uses of manufacturing sector 32.78%. Therefore, we see from our results that manufacturing sector indirectly uses 4 times higher than what we see apparently in direct service uses and the empirical findings are quite appealing to identify indirect sectoral contributions. The similar scenarios are being found on other sectors such as on trade, transport and communication and financial related services (Table 4).

Moreover to observe actually how much service consumption in different industries has changed over time, we used coefficient of variations<sup>3</sup> ( $V$ ) for each industry to justify our results. It reflects the performance of service intensities in absolute terms and it is very important in terms of the trend of service contributions in the study period. Furthermore, the correlation of variations is important because it allows for the identification of key service-intensive industries. Principally, the industries which show a high mean and a low coefficient of variations indicate highly service-intensive industries but this may differ for indirect I-O estimation. This is because indirect estimates incorporate indirect linkages over and above direct service use.

Tables 5 and 6 present the mean and the coefficient of variations  $V_i$  and  $\overline{V_i}$  with their ranking of 15 industries for the Malaysian economy between 1987 and 2005. From Tables 5 and 6, it is found that the mean value of direct and indirect intensities for the study period are on average 11.73 and 16.51% correspondingly, on the other hand  $V_i$  and  $\overline{V_i}$  are 0.4234 and 0.1761 respectively. It

shows that service consumption both direct and indirectly for production in the Malaysian economy was remarkably good over time. From this analysis it is also obvious following selected rankings from 1-15 that transport and

communication (8), financial related services (9), others (15), trade (6), public services (12) and entertainment (7) all have direct consumption of the service sectors as an input for their production and the figures of these sectors were overall consistent.

From our findings, it is observed that (Table 6) manufacturing (2), financial related services (9), and transport and communication (8) have high direct and indirect means ( $i$ ) and high direct and indirect coefficients of variations ( $\overline{V_i}$ ) indicating that these industries have high consumption of service output for their production over the study period and they are highly capital intensive. These industries are indirectly using more capital intensive goods in their production processes rather than services.

## Conclusion

This study analyzes the contribution of service sectors in the Malaysian economy from 1987 to 2005. Two different methodologies have been used to calculate the direct and indirect rankings of different industries following the Leontief input-output analysis. It is found that the contribution of overall service sectors are mostly positive during our study period. However, the empirical findings in this study are quite interesting and differ to identify specific sectoral rankings following direct and indirect approaches. We find that the direct sectoral rankings of transport and communication is moved from rank 4 to 1 and the real estate sector moved from rank 15 to 2 from the year 1987 to 2005.

However, the direct and indirect intensities and rankings are indicating mostly different directions between 1987 and 2005 and our findings indicate that manufacturing ranking was 1 in 1987 and also in 2005; the financial related services ranking was 2 in 1987 and 3 in 2005; and the transport and communication ranking was 4 in 1987 and 2 in 2005. Therefore we used the correlation of variation to figure out to identify key industries and justify our findings.

To discriminate among the key sector indicators, we analyzed the means and coefficients to project the economy-wide impact of key sectors. Subsequently, based on magnitude of weights, the key service sectors were identified by rankings in Tables 5 and 6. Our study reflects a modified approach by adding additional information in the key sectors and provides potential outcome to take account of critical economic contributions. Using our different approaches, policy makers may easily figured out key industries comparing each other following Tables 3 - 6. The ranking of key industries is crucial for any economy, so that the limited foreign and domestic investments could be correctly directed to key industries to achieve maximum development impact. This study can be used especially for policy formulations on in Malaysia and elsewhere.

<sup>3</sup> Correlation of variation is the ratio of the standard deviation and the mean of each industry

**Table 5.** The mean and coefficient of variations ( $V_i$ ).

Sectors	Between 1987 and 2005*			
	Mean	Rank	$V_i$	Rank
1. Agriculture	5.08	14	0.5107	2
2. Manufacturing	8.40	11	0.4671	5
3. Mining and Quarrying	4.51	15	0.5182	1
4. Utility	10.75	10	0.4362	6
5. Construction	11.54	9	0.4259	7
6. Trade	14.47	4	0.3874	12
7. Entertainment	13.10	6	0.4053	10
8. Transport and Communication	18.57	1	0.3335	15
9. Financial related services	17.68	2	0.3453	14
10. Education	8.36	12	0.4676	4
11. Health	12.42	7	0.4143	9
12. Public services	14.22	5	0.3907	11
13. Real estate	7.77	13	0.4754	3
14. Repairing motor vehicles	12.15	8	0.4179	8
15. Others	16.89	3	0.3557	13
Total	11.73		0.4234	

Sources: Author's calculations, \* these results are based on forecasting the I-O table of 2005.

**Table 6.** The mean and coefficient of variations ( $\overline{V_i}$ ).

Sectors	Between 1987 and 2005*			
	Mean	Rank	$\overline{V_i}$	Rank
1. Agriculture	9.43	13	0.2477	6
2. Manufacturing	28.84	1	0.4313	1
3. Mining and quarrying	6.29	15	0.3572	2
4. Utility	15.79	8	0.0252	14
5. Construction	14.71	9	0.0630	12
6. Trade	20.70	4	0.1466	8
7. Entertainment	17.52	6	0.0353	13
8. Transport and communication	25.99	2	0.3315	3
9. Financial related services	24.96	3	0.2956	4
10. Education	9.16	14	0.2571	5
11. Health	13.59	11	0.1022	9
12. Public services	16.28	7	0.0081	15
13. Real estate	11.54	12	0.1736	7
14. Repairing motor vehicles	14.02	10	0.0869	10
15. Others	18.82	5	0.0809	11
Total	16.51		0.1761	

Sources: Author's calculations, \* these results are based on forecasting the I-O table of 2005.

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## REFERENCES

- DOS (2005). Input-Output Table of Malaysia 2000, Department of Statistics, Malaysia.  
 DOS (2000). Input-Output Table of Malaysia 1991, Department of Statistics, Malaysia.  
 DOS (1990). Input-Output Table of Malaysia 1987, Department of

- Statistics, Malaysia.
- DOS (2000). Malaysian Standard Industrial Classification:2000, Department of Statistics, Malaysia.
- Economic Report (2006). The Malaysian economy: Report. Department of Statistics, Malaysia and Bank Negara Malaysia.
- Eswaran M, Kotwal A (2002). The role of service sector in the process of industrialization, *J. Dev. Econ.*, 68: 401-420.
- Leontief W (1966). *Input-Output Economics*, Second ed., New York, Oxford University Press.
- Leontief W (1970). Environmental Repercussion and Economic Structure: An Input-Output Approach. *Rev. Econ. Stat.*, 52(3): 262-271.
- Leontief W (1974). Environmental Repercussion and Economic Structure: An Input-Output Approach; A Reply. *Rev. Econ. Stat.* 56(1): 262-271.
- MES (2003). *Time Series of Economic Statistics*, Department of Statistics, Malaysia.
- Miller RE, Blair PD (1985). *Input-Output Analysis: Foundations and Extensions*, Englewood Cliffs, NJ, Prentice Hall.
- MP (2006). *Ninth Malaysia Plan*, Ministry of Energy, Water and Communications and Planning Unit, Malaysia.
- Roy S, Das T, Chakraborty D (2002). A study on the Indian information sector: an experiment with input-output techniques, *Econ. Syst. Res.*, 14: 107-129.