

1. Introduction

Intersectoral input-output linkages: a review

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1. Introduction

The input-output (IO) analysis was introduced by Wassily Leontief in the mid-1930s. The analytical framework has since been adopted as an imperative tool in economic planning (Miller and Blair 1985). The analysis has the advantage of showing the impacts of a specific action and the ripple-effects that the action or event has on other sectors of the economy. Within this analytical framework, Rasmussen (1956) and Hirshman (1958) respectively developed measures for intersectoral linkages and application of intersectoral linkages in the identification of key sectors in the economy. Hirshman (1958) contended that developing economies should aimed investments in key sectors, *i.e.*, selected sectors that are known to have high degree of forward and backward intersectoral linkages. Doing so would also stimulate production in other sectors of the economy; thus maximizing impacts of investments.

Since Rasmussen (1956), researchers have suggested numerous measures of strength of backward (*BL*) and forward (*FL*) linkages and each with slightly different interpretation. While all are not controversial free, several are widely accepted as standard measures for *BL* and *FL*, at least for the time being. This paper attempts to use several of these methods for identifying key sectors in the Malaysia economy with emphasis on the manufacturing sector. This paper will also demonstrate the differences in economy wide impacts arising from doubling of foreign direct investment inflow in key sectors previously identified.

This paper is organized as follows. In the next section, several often used indices for *BL* and *FL* are briefly described. This is followed a general overview of foreign direct investment (FDI) inflow in Malaysia. Section 4 presents results of *BL* and *FL* calculations. The final section concludes this paper.

2. Intersectoral input-output linkages: concept and measurement

The basic framework of IO model is presented in Appendix A. It is generally accepted that inter-industry or inter-sectoral linkages provide good indicator for structural interdependence of an economy. To measure a sector's inter-industry linkage means we must evaluate its direct and indirect relationships with the rest of the economy.

2.1. Linkages based on the Leontif Inverse

When a sector increased production, there will also be increased in demand for inputs from other sectors of the economy that are related to it. This kind of direct and indirect upstream input-relationships is termed backward linkage (also referred as "power of dispersion"). From another perspective, increased output in one sector means more is

available to be used as input in other sectors of the economy. This kind of direct and indirect downstream output-relationships is termed forward linkage ("sensitivity of dispersion").

Rasmussen (1956) and Hirschman (1958) suggested (1) and (2) below as indicators of strength of BL and FL .¹

$$(1) \quad BL = \frac{1}{n} \sum_{i=1}^n b_{ij} = \frac{1}{n} B_{\cdot j}$$

and

$$(2) \quad FL = \frac{1}{n} \sum_{j=1}^n b_{ij} = \frac{1}{n} B_{i \cdot}$$

where, as in Appendix A, B is the Leontif inverse matrix with elements b_{ij} . Hazari (1970) suggested modification to the measures by dividing the terms in (1) and (2) by a global average as in (3) below.

$$(3) \quad \text{Global average} = \frac{1}{n^2} \sum_{j=1}^n \sum_{i=1}^n b_{ij} = \frac{1}{n^2} \sum_{j=1}^n B_{\cdot j} = \frac{1}{n^2} \sum_{i=1}^n B_{i \cdot}$$

He contended that this would allow inter-industry comparison. With these normalizations, the linkage indices are

$$(4) \quad BL = U_j = \frac{\frac{1}{n} B_{\cdot j}}{\frac{1}{n^2} \sum_{j=1}^n B_{\cdot j}}$$

and

$$(5) \quad FL = U_i = \frac{\frac{1}{n} B_{i \cdot}}{\frac{1}{n^2} \sum_{i=1}^n B_{i \cdot}}$$

A sector is said to have strong backward linkages if $U_j > 1$; and $U_i > 1$ indicate strong forward linkages. A key sector is defined as those sectors having U_j and U_i greater than 1. To eliminate selection error due to extreme values in the calculation of average, Hazari (1970) also suggested using the coefficient of variation to complement (4) and (5) in identifying key sectors (see also Bharadwaj 1966).² The coefficients of variations associated with BL and FL respectively are defined as follows.

$$(6) \quad V_j = \frac{\sqrt{\frac{1}{n-1} \sum_{i=1}^n \left(b_{ij} - \frac{1}{n} B_{\cdot j} \right)^2}}{\frac{1}{n} B_{\cdot j}}$$

and

¹ From Hazari (1970), Jones (1976), Lenzen (2003), and Cai and Leung (2004).

² Mentioned in Jones (1976) that Rasmussen (1958) suggested using variance as a way to solve this problem.

$$(7) \quad V_i = \frac{\sqrt{\frac{1}{n-1} \sum_{j=1}^n \left(b_{ij} - \frac{1}{n} B_{i\cdot} \right)^2}}{\frac{1}{n} B_{i\cdot}}$$

All indices mentioned above do not account for the level of economic activities or the policy context of key sector (see Lenzen (2003), Soofi (1992), and Cuello (1992)). To remedy this deficiency, researchers recommended incorporating weighting scheme into *BL* and *FL* measures (see Rasmussen (1956), Hirschman (1958), Hazari (1970), Lauman (1976), Chatterjee (1989), Soofi (1992), Cuello (1992)). Following Soofi (1992) and Claus and Li (2003), the weighted *BL* and *FL* measures are:

Let the final demand weighted Leontif inverse elements be b_{ij}^w where

$$(8) \quad b_{ij}^w = b_{ij} \frac{y_i}{\sum_{i=1}^n y_i} \quad \text{and} \quad B_{\cdot j}^w = \frac{1}{n} \sum_{j=1}^n b_{ij}^w$$

Similar to (4) and (5), the corresponding weighted *BL* and *FL* are:

$$(9) \quad BL = U_j^w = \frac{\frac{1}{n} B_{\cdot j}^w}{\frac{1}{n^2} \sum_{j=1}^n B_{\cdot j}^w}$$

and correspondingly, the forward linkage is given by

$$(10) \quad FL = U_i^w = \frac{\frac{1}{n} B_{i\cdot}^w}{\frac{1}{n^2} \sum_{i=1}^n B_{i\cdot}^w}$$

The same weighting scheme could be applied in the calculation of coefficient of variation. Final demand weighted coefficients of variations for *BL* and *FL* respectively are

$$(11) \quad V_j = \frac{\sqrt{\frac{1}{n-1} \sum_{i=1}^n \left(b_{ij}^w - \frac{1}{n} B_{\cdot j}^w \right)^2}}{\frac{1}{n} B_{\cdot j}^w}$$

and

$$(12) \quad V_i = \frac{\sqrt{\frac{1}{n-1} \sum_{j=1}^n \left(b_{ij}^w - \frac{1}{n} B_{i\cdot}^w \right)^2}}{\frac{1}{n} B_{i\cdot}^w}$$

The same calculations could be made using other schemes of weights. For an open economy like Malaysia, export weighted coefficients *BL* and *FL* or coefficient of variation may be more appropriate.

2.2. Linkages based on the Ghosh supply model

Since the forward linkage essentially deals with downstream output supply, despite some reservation by some authors (see for example Oosterhaven (1988), Oosterhaven (1996), and Dietzenbacher (1997)), researchers generally use the Ghosh (1958) supply model in the calculation of forward linkage (and other indices associated with *FL* measures mentioned above).

The supply model direct output coefficients are given by

$$(13) \quad \bar{A} = (\hat{X})^{-1} Z$$

and the Ghosh direct and indirect output coefficients are given by (Miller and Blair 1985):

$$(14) \quad \bar{B} = (I - \bar{A})^{-1}$$

3. A linkage study of the manufacturing sector

3.1. Measurement method

For the purpose of empirically determine the backward and forward linkages, the 2000 94 sector IO table is aggregated into 30 sectors. Appendix C provides the detail sector classification and the corresponding line number of the original table. The new table comprised 19 manufacturing industries (line 3 to line 21 of the new table) with the rest are being in the agricultural and mining (line 1 and line 2) or service sectors (line 22 to line 30).

BL and *FL* were calculated based on four methods (described below). In all of the calculations, the Ghosh supply matrix was used in the calculation of measures associated with forward linkage.

- ⊗ Method I: Based on equations in (4) and (5).
- ⊗ Method II: Based on (4) and (5) with complementation of equations in (6) and (7).
- ⊗ Method III: Based on (9) and (10) with final demand weights.
- ⊗ Method IV: based on (9) and (10) with export weights.

3.2. Summary of results

This sub-section presents all the empirical results.

Method I

Results in Table 1 were obtained by applying equations in (4) for backward linkage and (5) for forward linkage. Details of the result are presented in Appendix D Method I. Under this scheme, we find that for the 19 manufacturing industries:

- Weak *BL* and weak *FL*: 21.1% (4 of 19).
- Weak *BL* and strong *FL*: 10.5%; (2 of 19).
- Strong *BL* and weak *FL*: 42.1%; (8 of 19).
- Strong *BL* and strong *FL*: 26.3%. (5 of 19).

To further illustrate the critical nature of key sectors, we assume investments in manufacturing key sectors were doubled the amount made in 2000. Under this scenario, total additional output generated would amount to RM59,353 billion.³

Table 1
Key sectors, Method I

$U_i > 1$ and $U_j < 1$	$U_i > 1$ and $U_j > 1$
Beverage and tobacco	Food processing
Textile & textile products	Paper, printing & publishing
Leather & leather products	Chemical & chemical products
Wood & wood products	Petroleum (incl petrochemical)
Furniture and fixtures	Non-metal manufactures
Rubber products	
Transportation equipment	
Other manufactures	
Construction	
Hotel & rest.	
$U_i < 1$ and $U_j < 1$	$U_i < 1$ and $U_j > 1$
Plastic products	Agriculture, forestry & fisheries
Machine manufactures	Mining & quarry
Elec & electronic products	Basic metal products
Measuring & scientific instruments	Fabricated metal manufactures
Finance & insurance	Utilities
Real estate & house ownership	Wholesale & retail trade
Business service & indv	Transportation & communication
Govt services	

³ Appendix B gives a brief overview of FDI, DI and industrial development strategies of Malaysia.

Method II

Results in Table 2 were obtained by applying equations in (4) and (5), but complemented by coefficients of variations in (6) and (7). Details of the result are presented in Appendix D Method II. Under this scheme, we find that for the 19 manufacturing industries:

- Weak *BL* and weak *FL*: 21.1% (4 of 19).
- Weak *BL* and strong *FL*: 15.8%; (3 of 19).
- Strong *BL* and weak *FL*: 47.4%; (9 of 19).
- Strong *BL* and strong *FL*: 15.8%. (3 of 19).

Assuming investments in manufacturing key sectors were doubled the amount made in 2000, the potential total additional output generated is RM51,324 billion.

Table 2
Key sectors, Method II

$U_i > 1$ and $U_i < 1$	$U_i > 1$ and $U_i > 1$
Beverage and tobacco	Food processing
Textile & textile products	Paper, printing & publishing
Leather & leather products	Chemical & chemical products
Wood & wood products	Petroleum (incl petrochemical)
Furniture and fixtures	Non-metal manufactures
Rubber products	
Transportation equipment	
Other manufactures	
Food processing	
Construction	
Hotel & rest.	
$U_i < 1$ and $U_i < 1$	$U_i < 1$ and $U_i > 1$
Plastic products	Agriculture, forestry & fisheries
Machine manufactures	Mining & quarry
Elec & electronic products	Basic metal products
Measuring & scientific instruments	Fabricated metal manufactures
Finance & insurance	Paper, printing & publishing
Real estate & house ownership	Utilities
Business service & indv	Wholesale & retail trade
Govt services	Transportation & communication

Method III

Results in Table 3 were obtained by applying final demand weights to (4) and (5). Details of the result are presented in Appendix D Method III. Under this scheme, we find that for the 19 manufacturing industries:

- Weak *BL* and weak *FL*: 78.9% (15 of 19).
- Weak *BL* and strong *FL*: 0%; (0 of 19).
- Strong *BL* and weak *FL*: 0%; (0 of 19).
- Strong *BL* and strong *FL*: 21.1%. (4 of 19).

Assuming investments in manufacturing key sectors were doubled the amount made in 2000, total additional output generated is RM66,127 billion.

Table 3
Key sectors, Method III

$U_i > 1$ and $U_i < 1$	$U_i > 1$ and $U_i > 1$
	Mining & quarry Food processing Petroleum (incl petrochemical) Machine manufactures Elec & electronic products Construction Transportation & communication Govt services
$U_i < 1$ and $U_i < 1$	$U_i < 1$ and $U_i > 1$
Beverage and tobacco Textile & textile products Leather & leather products Wood & wood products Furniture and fixtures Paper, printing & publishing Chemical & chemical products Rubber products Plastic products Non-metal manufactures Basic metal products Fabricated metal manufactures Transportation equipment Measuring & scientific instruments Other manufactures Utilities Hotel & rest. Finance & insurance Real estate & house ownership	Agriculture, forestry & fisheries Wholesale & retail trade Business service & indv

Method IV

Results in Table 3 were obtained by applying export weights to (4) and (5). Details of the result are presented in Appendix D Method IV. Under this scheme, we find that for the 19 manufacturing industries:

- Weak *BL* and weak *FL*: 73.7% (14 of 19).
- Weak *BL* and strong *FL*: 0%; (0 of 19).
- Strong *BL* and weak *FL*: 5.3%; (1 of 19).
- Strong *BL* and strong *FL*: 21.1%. (4 of 19).

Assuming investments in manufacturing key sectors were doubled the amount made in 2000, total additional output generated is RM64,028 billion.

Table 4
Key sectors, Method IV

$U_i > 1$ and $U_i < 1$	$U_i > 1$ and $U_i > 1$
Petroleum (incl petrochemical)	Mining & quarry Food processing Chemical & chemical products Machine manufactures Elec & electronic products Transportation & communication
$U_i < 1$ and $U_i < 1$	$U_i < 1$ and $U_i > 1$
Beverage and tobacco Textile & textile products Leather & leather products Wood & wood products Furniture and fixtures Paper, printing & publishing Rubber products Plastic products Non-metal manufactures Basic metal products Fabricated metal manufactures Transportation equipment Measuring & scientific instruments Other manufactures Utilities Construction Hotel & rest. Finance & insurance Real estate & house ownership Business service & indv Govt services	Agriculture, forestry & fisheries Wholesale & retail trade

4. Conclusions

This demonstrates using four different but related methods in selecting key sectors. The four methods lead to different selection of key sectors. For the 19 manufacturing industries:

- Paper, printing & publishing was selected in one of the four methods;
- Non-metal manufactures was selected in two of the four methods;
- Machine manufactures was selected in two of the four methods;
- Electric & electronic products was selected in two of the four methods;
- Chemical & chemical products was selected in three of the four methods;
- Petroleum & petrochemical was selected in three of the four methods;
- Food processing was selected in three of the four methods.

For practical purposes, this exercise clearly shows that key sector selection should not be confined to one particular method of selection. Several methods should be applied in complementary to one another.

As a final note, in all of the methods, "agriculture, forestry & fisheries" was consistently selected as one with high forward linkage, but low in backward linkage.

	U > 1 and U < 1	U > 1 and U < 1
the 19 manufacturing industries	Textile & leather products	Wood & wood products
	Food processing	Food processing
	Chemical & chemical products	Chemical & chemical products
	Petroleum & petrochemical	Petroleum & petrochemical
	Non-metal manufactures	Non-metal manufactures
	Machine manufactures	Machine manufactures
	Electric & electronic products	Electric & electronic products
	Paper, printing & publishing	Paper, printing & publishing
	Transportation & communication	Transportation & communication
	Mineral & quarry	Mineral & quarry
	Agriculture, forestry & fisheries	Agriculture, forestry & fisheries
	Wholesale & retail trade	Wholesale & retail trade
	Health & social work	Health & social work
	Education	Education
	Government	Government
	Construction	Construction
	Hotel & rest	Hotel & rest
	Finance & insurance	Finance & insurance
	Real estate & house ownership	Real estate & house ownership
	Business service & indy	Business service & indy
	Govt services	Govt services

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The input-output model

In the IO model, the structure of an economy is analyzed in terms of interrelationships between production sectors. Given an n -sector economy with intersectoral transaction matrix Z and sectoral total output vector X , the direct input requirement matrix, A , is given by

$$(A1) \quad A = Z(\hat{X})^{-1}$$

The implied assumption of I-O framework is that the production process in each economic sector is characterized by linear relationship between the amount the input required and the final output. The input-output relationship is described by the following equation.

$$(A2) \quad X = AX + Y$$

In (A2), Y is final demand vector (which generally are disaggregated into private consumption and investment, public consumption and investment, inventory change, and exports. Solving the equation in (A2) for total output gives the following.

$$(A2) \quad X = (I - A)^{-1}Y = BY$$

In (A2), I is an n by n identity matrix and $B = (I - A)^{-1}$ is the total requirement matrix, or more popularly known as the Leontif inverse matrix.

Overview of FDI inflow and DI

Since independence, Malaysia experienced impressive economic growth with rates averaging about 6% in the 1960s and 1970s. During those decades, the main engine of growth was the agricultural sector with the plantation sector (rubber, cocoa, and oil palm) as the main contributor towards GDP growth; followed by mining and quarry (mainly tin ore).

In spite of the large agriculture and mining dominance, Malaysia was able to transform itself into a manufacturing based export-oriented economy through a series of investment policies which started with the *Pioneer Industries Ordinance of 1958*. This era of import-substitution was later replaced by the *Investment Incentives Act of 1968* which stresses on exports. While FDI was remnants of British interest in the pre-1968 era (Yeoh and Zhao 2005), FDI became a focal for sources of capital and technology in the wake of the Investment Act of 1968. To further boost FDI inflow, the Promotion of Investment Act was introduced in 1986, the same year the First Industrial Master Plan was launched. In this plan, 12 industrial sub-sectors were identified to be developed. These sub-sectors were (i) rubber, (ii) palm oil, (iii) food, (iv) wood-based industries, (v) chemical and petrochemical, (vi) non-ferrous metals, (vii) non-metallic minerals, (viii) electrical and electronics, (ix) transport equipment, (x) machinery and engineering, (xi) iron and steel, and (xii) textiles and apparel. It was during this plan period that FDI had surpassed DI (see Table B1).

In 1996, the Second Industrial Master Plan was formally made public. Among other targets and priorities, this plan laid emphasis on cluster-based approach to developing the industrial sector and on deepening industrial linkages. There, industrial clusters are the aerospace, advance material, information technology, and biotechnology industries. The Third Industrial Master Plan (2006-2020) targeted not only the manufacturing industries, but also eight service sectors for greater development and promotion. The manufacturing industries are (a) Nonresource-based industries: electrical and electronics, medical devices, textiles and apparel, machinery and equipment, metals, transport equipment; (b) Resource-based industries: petrochemicals, pharmaceuticals, wood-based, rubber-based, oil palm-based, and food processing. The service sub-sectors are: business and professional services, logistics, ICT services, distributive trade, construction, education and training, healthcare services, and tourism services.

Currently, the manufacturing sector is a major engine of growth. In 2005, the manufacturing sector contributed 31.4 towards GDP, seconds only to the service sector which was 58.1 percent; it constituted 80.5 percent of export earnings and 28.7 percent share of employment.

As previously indicated, investment and development policies mentioned above were complemented by Malaysia's open and liberal environment for FDI. As shown in Table

Sector classification

Line no.	Line number in original table	Industri	Keterangan
(1)	(1), (2), (3), (4), (5), (6), (7), (8)	Pertanian, Perhutanan dan Perikanan	Padi, buah-buahan, pasaran pertanian, pertanian lain, bunga atau tanaman untuk perhiasasan, koko, perkhidmatan pertanian kecuali aktiviti rawatan, pemburuan, penangkapan dan pemeliharaan binatang untuk pertandingan, getah, kelapa sawit, kelapa, teh, menternak ayam, itik, khinzir,
(2)	(9), (10), (11)	Perlombongan dan kuari	Petroleum mentah, gas asli dan batu arang, perlombongan bijih logam, penggalan batu, perlombongan pasir dan batu kerikil, perlombongan tanah liat, perlombongan dan penggalan.
(3)	(12), (13), (14), (15), (16), (17), (18), (19), (20), (21), (22)	Pengilangan makanan	Daging dan pengeluaran daging, pengeluaran tenusu, pengawetan buah dan sayur, pengawetan makanan laut, pembuatan minyak dan lemak, pembuatan bijirin, bakeri, pembuatan konfeksi, pembuatan ais, pembuatan makanan lain, pembuatan makanan binatang.
(4)	(23), (24), (25)	Minuman dan tembakau	Pengeluaran wain dan minuman keras, pengeluaran minuman ringan, pembuatan tembakau.
(5)	(26), (27), (28), (29)	Tekstil dan produk tekstil	Pembuatan yarn dan kain, pembuatan fabrik kait, pembuatan tekstil lain, pembuatan pakaian.
(6)	(30), (31)	Kulit dan produk kulit	Industri kulit penyamakan dan pembersihan kulit; Pembuatan bagasi, beg tangan, pelana dan abah-abah, pembuatan kasut
(7)	(32), (33)	Kayu dan produk kayu	Pembuatan papan iaitu pengilangan dan pengetaman kayu dan pembuatan kepingan venir, papan lapis, berlamina dan papan partikel, pembuatan produk kayu lain dan rotan, artikel daripada gabus, jerami dan bahan jalinan
(8)	(34)	Perabot dan kelengkapan	Pembuatan perabot

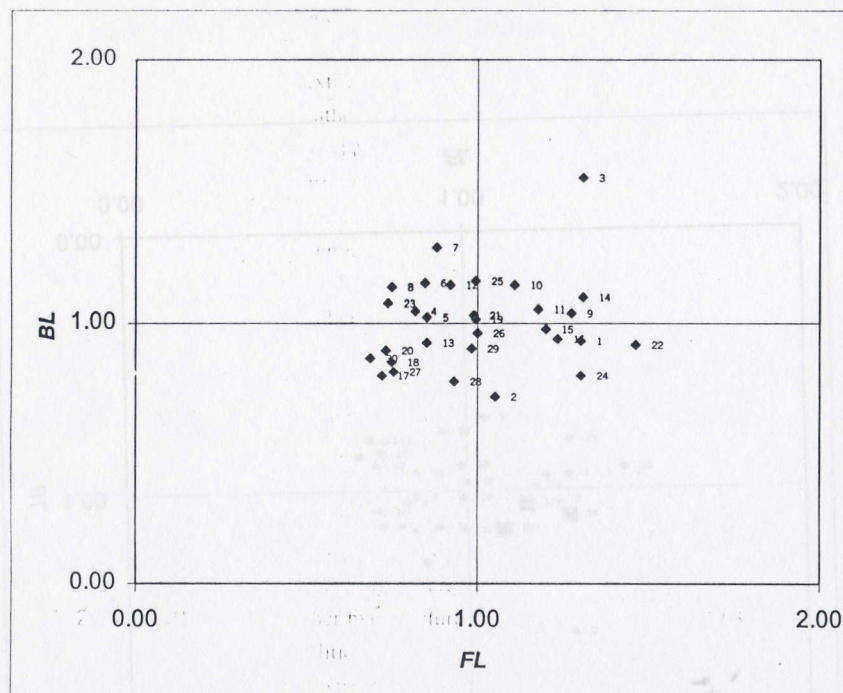
(9)	(35), (36)	Kertas, percetakan dan penerbitan	Pembuatan palpa, kertas dan kertas tebal, pembuatan kertas gelugur dan bekas daripada kertas dan kertas tebal, pembuatan artikel kertas dan kertas tebal lain, penerbitan, penerbitan media rakaman, percetakan dan aktiviti perkhidmatan berkaitan dengan percetakan, pengeluaran semula media rakaman.
(10)	(37), (38), (39), (40), (41)	Kimia dan produk kimia	Pembuatan bahan kimia asas kecuali baja dan sebatian nitrogen, pembuatan baja, pembuatan plastik dalam bentuk utama, pembuatan racun perosak dan kimia pertanian lain, pembuatan serat buatan manusia, Pembuatan cat, varnis dan cat lain dan mastik, pembuatan produk farmaseutikal, kimia perubatan dan botani, pembuatan sabun dan bahan pencuci, pewangi, persediaan pencuci dan dandanan diri, industri bahan kimia lain.
(11)	(42)	Produk petroleum (termasuk petrokimia)	Industri petroleum dan arang batu iaitu pembuatan kok ketuhar, produk petroleum pertapis dan bahan api nuklear.
(12)	(43), (44)	Produk getah	Memproses getah iaitu rumah asap getah, pengilangan semula dan prosesan susu getah, pembuatan tayar dan tiub getah termasuk celup, pembuatan sarung tangan getah, pembuatan produk getah lain.
(13)	(45)	Produk plastik	Pembuatan produk plastik.
(14)	(46), (47), (48), (49)	Produk galian bukan logam	Pembuatan kaca dan produk kaca, pembuatan produk tanah liat dan seramik, pembuatan simen, kapur dan plaster, pembuatan bukan logam lain iaitu pembuatan konkrit dan produk mineral bukan logam lain.
(15)	(50), (51)	Produk logam asas	Industri besi dan keluli, pembuatan besi asas dan keluli, penuangan logam, pembuatan logam tak berferus, industri logam lain
(16)	(52), (53), (54)	Produk logam fabrikasi	Pembuatan logam lain yang direka dan kelengkapan, industri struktur logam iaitu pembuatan produk struktur logam, tangki, takungan dan penjana wap
(17)	(55), (56)	Pengilangan mesin	Pembuatan jentera industri iaitu pembuatan jentera kegunaan am, pembuatan jentera kegunaan khusus, dan pembuatan jentera isu rumah iaitu pembuatan mesin penyaman udara, penyejuk dan pembersih udara, pembuatan mesin pejabat, perakaunan dan pengira
(18)	(57), (58), (59)	Produk elektrik dan elektronik	Pembuatan radio, televisyen dan sebagainya, pembuatan perkakas elektrik dan sebagainya dan pembuatan jentera elektrik lain

(19)	(60), (61), (62), (63)	Kelengkapan pengangkutan	Pembinaan perahu dan kapal, pembuatan kenderaan bermotor, pembuatan badan, alat ganti dan aksesori untuk kenderaan bermotor; pembuatan treler dan semi-treler, pembuatan motosikal dan basikal serta pembuatan kelengkapan pengangkutan lain
(20)	(64)	Peralatan pengukuran dan saintifik	Pembuatan peralatan dan instrumen perubatan dan ketepatan, pembuatan instrumen optik dan kelengkapan fotografi serta pembuatan jam tangan dan jam
(21)	(65)	Lain-lain pembuatan	Pembuatan barang kemas dan artikel berkaitan
(22)	(66), (67)	Elektrik, gas dan air	Pengeluaran, pengumpulan dan pengagihan elektrik, pengeluaran gas, wap dan pembekalan air panas serta pengumpulan, penapisan dan pengagihan air
(23)	(68)	Pembinaan	Penyediaan tapak pembinaan, pembinaan bangunan sepenuhnya atau sebahagian daripadanya – kediaman, pembinaan bangunan sepenuhnya atau sebahagian daripadanya - bukan tempat kediaman, pembinaan bangunan sepenuhnya atau sebahagian daripadanya - kejuruteraan awam, pemasangan dan pembinaan bangunan siap termasuk pembaikan, penyewaan kelengkapan pembinaan atau pemusnah dengan pengendali
(24)	(69)	Perdagangan borong dan runcit	Borong dan runcit kenderaan bermotor, motosikal dan alat ganti dan aksesori, jualan runcit minyak kenderaan, perdagangan borong dan perdagangan komisen kecuali kenderaan bermotor dan motosikal
(25)	(70)	Hotel dan restoran	Hotel dan tapak perkhemahan, restoran, bar dan kantin serta penjaja dan gerai.
(26)	(71), (72)	Pengangkutan dan perhubungan	Pengangkutan dengan keretapi, bas, teksi dan limusin, pengangkutan barang melalui jalan, pengangkutan dengan saluran paip, pengangkutan air dan udara, pengendalian kargo, operasi kemudahan tempat letak kereta, perkhidmatan operasi lebuhraya, jambatan dan terowong, perkhidmatan operasi pelabuhan dan kapal terbang, aktiviti sokongan lain dan tambahan pengangkutan, aktiviti agensi pelancongan dan pengendali pelancongan, aktiviti agensi pengangkutan lain, aktiviti pos dan kurier, telekomunikasi, perkhidmatan pemancaran serta perkhidmatan data komunikasi dan telekomunikasi

(27)	(73), (74), (75)	Kewangan dan insurans	Perantaraan kewangan, perantaraan monetari dan kewangan lain, pentadbiran pasaran kewangan, aktiviti tambahan insurans dan pencen, insurans hayat, dana kumpulan wang dan pencen, insurans bukan hayat,
(28)	(76), (77)	Hartanah dan pemilikan kediaman	Aktiviti hartanah dan pemilikan kediaman
(29)	(78), (79), (81), (83), (84), (85), (86), (87), (88), (89), (90)	Perkhidmatan perniagaan dan persendirian	Penyewaan bagi kereta, kelengkapan pengangkutan, jentera dan kelengkapan lain, mesin dan kelengkapan pejabat, barang peribadi dan rumah, komputer dan aktiviti berkaitan serta penyelidikan dan pembangunan, aktiviti perundangan, perakaunan, simpan kira-kira dan audit, penyelidikan pasaran; aktiviti perniagaan dan perundingan pengurusan, aktiviti arkitek, kejuruteraan dan teknikal lain, pengiklanan, aktiviti kumbahan dan pembuangan sampah, kebersihan dan aktiviti yang serupa dengannya, aktiviti peniagaan lain, aktiviti agensi berita, pendidikan dan kesihatan swasta, institusi tanpa untung swasta, hiburan, penyiaran radio dan televisyen, rekreasi, membaiki kenderaan bermotor, pembaikan lain, kitar semula dan perkhidmatan swasta lain.
(30)	(80), (82), (91), (92), (93), (94)	Perkhidmatan Kerajaan	Pendidikan dan kesihatan awam, pentadbiran awam, ketenteraan awam, pertahanan awam, pentadbiran awam lain iaitu perkhidmatan penyelidikan dan pembangunan, pentadbiran, perumahan dan perkhidmatan kerajaan tempatan, pentadbiran, rekreasi, kebudayaan, kesenian, sukan, komuniti lain dan hal ehwal sosial, pentadbiran, aktiviti keselamatan sosial, pentadbiran, hal ehwal perdagangan dalam dan luar negeri termasuk hal ehwal sumber manusia, pertanian, perhutanan dan perikanan, termasuk hal ehwal pembuatan, pentadbiran, hal ehwal pekerjaan awam, pengangkutan, pelancongan, tenaga, telekomikasi dan pos, pentadbiran perkhidmatan lain, aktiviti kerja sosial, pentadbiran dan perkhidmatan, aktiviti kumbahan dan pembuangan sampah, kebersihan dan aktiviti yang serupa dengannya, pentadbiran dan perkhidmatan, aktiviti keagamaan serta perpustakaan, arkib, muzium, bersukan, aktiviti kebudayaan dan rekreasi lain

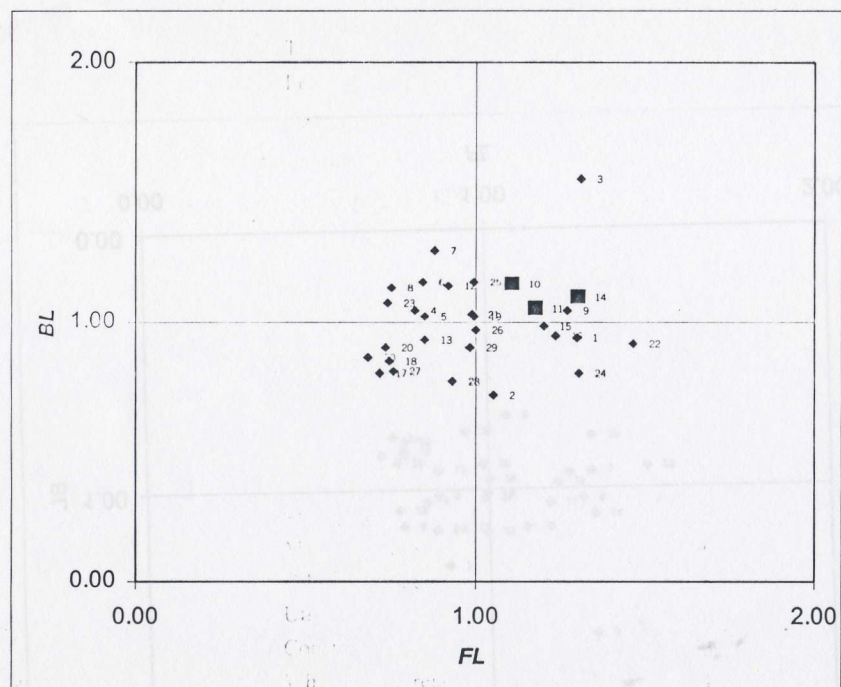
Appendix D

Method I



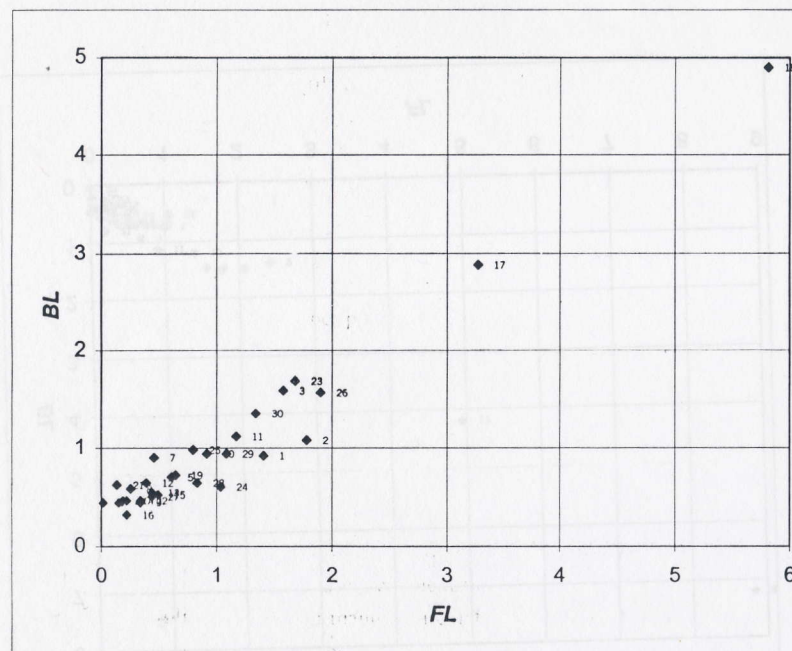
Line	Sector	U_i	U_i
1	Agriculture, forestry & fisheries	0.94	1.30
2	Mining & quarry	0.72	1.05
3	Food processing	1.55	1.31
4	Beverage & tobacco	1.04	0.82
5	Textile & textile products	1.02	0.86
6	Leather & leather products	1.15	0.85
7	Wood & wood products	1.28	0.88
8	Furniture and fixtures	1.13	0.75
9	Paper, printing & publishing	1.04	1.27
10	Chemical & chemical products	1.14	1.11
11	Petroleum (incl petrochemical)	1.05	1.18
12	Rubber products	1.14	0.92
13	Plastic products	0.93	0.85
14	Non-metal manufactures	1.10	1.31
15	Basic metal products	0.98	1.20
16	Fabricated metal manufactures	0.94	1.24
17	Machine manufactures	0.80	0.72
18	Elec & electronic products	0.85	0.75
19	Transportation equipment	1.02	0.99
20	Measuring & scientific instruments	0.90	0.74
21	Other manufactures	1.03	0.99
22	Utilities	0.92	1.46
23	Construction	1.07	0.74
24	Wholesale & retail trade	0.80	1.31
25	Hotel & rest.	1.16	1.00
26	Transportation & communication	0.97	1.01
27	Finance & insurance	0.81	0.76
28	Real estate & house ownership	0.77	0.94
29	Business service & indv	0.90	0.98
30	Govt services	0.86	0.69

Model II



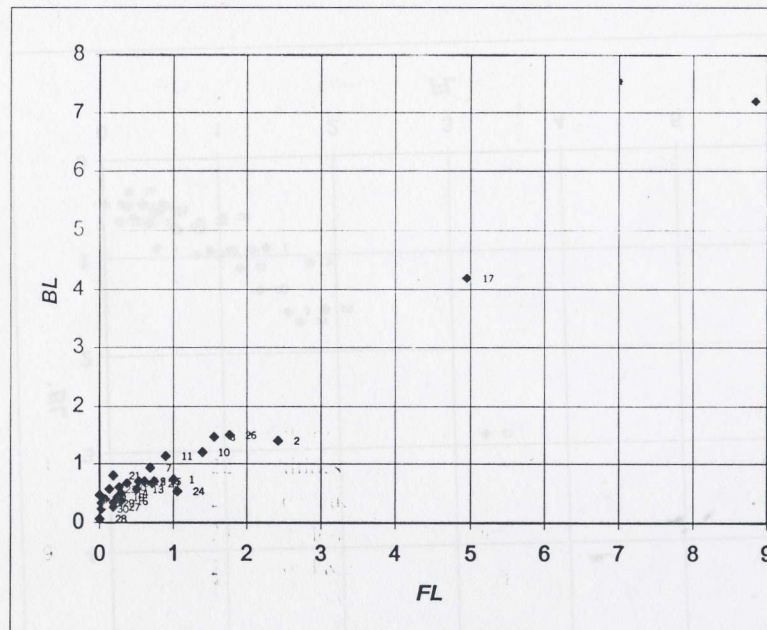
Line	Sector	U_i	U_i	V_i	V_i
1	Agriculture, forestry & fisheries	0.935	1.304	4.130	3.161
2	Mining & quarry	0.719	1.052	5.004	3.551
3	Food processing	1.550	1.313	3.687	4.361
4	Beverage & tobacco	1.042	0.823	3.615	4.690
5	Textile & textile products	1.020	0.855	4.095	4.999
6	Leather & leather products	1.151	0.849	3.132	4.373
7	Wood & wood products	1.280	0.885	3.190	4.312
8	Furniture and fixtures	1.133	0.754	3.336	5.143
9	Paper, printing & publishing	1.039	1.274	4.089	3.373
10	Chemical & chemical products	1.144	1.110	3.619	3.786
11	Petroleum (incl petrochemical)	1.049	1.180	3.827	3.273
12	Rubber products	1.140	0.920	3.737	4.701
13	Plastic products	0.929	0.853	3.971	4.402
14	Non-metal manufactures	1.097	1.308	3.807	3.517
15	Basic metal products	0.978	1.202	4.297	3.602
16	Fabricated metal manufactures	0.944	1.237	3.975	3.187
17	Machine manufactures	0.799	0.723	4.522	5.089
18	Elec & electronic products	0.849	0.750	4.468	5.168
19	Transportation equipment	1.017	0.994	4.317	4.504
20	Measuring & scientific instruments	0.896	0.737	4.118	5.123
21	Other manufactures	1.028	0.990	3.585	3.769
22	Utilities	0.916	1.465	4.089	2.567
23	Construction	1.073	0.743	3.312	4.892
24	Wholesale & retail trade	0.801	1.308	4.456	2.806
25	Hotel & rest.	1.156	0.998	3.188	3.677
26	Transportation & communication	0.966	1.006	4.064	3.969
27	Finance & insurance	0.811	0.761	4.565	4.967
28	Real estate & house ownership	0.775	0.936	4.920	4.133
29	Business service & indiv	0.902	0.983	4.137	3.859
30	Govt services	0.863	0.687	4.134	5.330

Model III



Line	Sector	U_i	U_i
1	Agriculture, forestry & fisheries	0.92	1.41
2	Mining & quarry	1.08	1.78
3	Food processing	1.59	1.59
4	Bevearage and tobacco	0.45	0.15
5	Textile & textile products	0.71	0.61
6	Leather & leather products	0.43	0.02
7	Wood & wood products	0.90	0.45
8	Furniture and fixtures	0.59	0.25
9	Paper, printing & publishing	0.44	0.33
10	Chemical & chemical products	0.94	0.91
11	Petroleum (incl petrochemical)	1.13	1.17
12	Rubber products	0.64	0.39
13	Plastic products	0.55	0.44
14	Non-metal manufactures	0.47	0.22
15	Basic metal products	0.52	0.49
16	Febricated metal manufactures	0.33	0.22
17	Machine manufactures	2.88	3.27
18	Elec & electronic products	4.90	5.81
19	Transportation equiptment	0.71	0.65
20	Measuring & scientific instruments	0.46	0.19
21	Other manufactures	0.62	0.14
22	Utilities	0.45	0.34
23	Construction	1.70	1.69
24	Wholesale & retail trade	0.61	1.04
25	Hotel & rest.	0.97	0.80
26	Transportation & communication	1.57	1.91
27	Finance & insurance	0.50	0.44
28	Real estate & house ownership	0.64	0.84
29	Business service & indv	0.93	1.08
30	Govt services	1.36	1.35

Model IV



Line	Sector	U_i	U_i
1	Agriculture, forestry & fisheries	0.72	1.01
2	Mining & quarry	1.40	2.42
3	Food processing	1.46	1.56
4	Beverage and tobacco	0.41	0.09
5	Textile & textile products	0.70	0.61
6	Leather & leather products	0.43	0.03
7	Wood & wood products	0.94	0.67
8	Furniture and fixtures	0.67	0.38
9	Paper, printing & publishing	0.33	0.18
10	Chemical & chemical products	1.19	1.40
11	Petroleum (incl petrochemical)	1.12	0.90
12	Rubber products	0.69	0.54
13	Plastic products	0.57	0.50
14	Non-metal manufactures	0.51	0.30
15	Basic metal products	0.69	0.73
16	Fabricated metal manufactures	0.36	0.28
17	Machine manufactures	4.19	4.96
18	Elec & electronic products	7.21	8.86
19	Transportation equipment	0.44	0.23
20	Measuring & scientific instruments	0.59	0.27
21	Other manufactures	0.79	0.18
22	Utilities	0.33	0.03
23	Construction	0.55	0.13
24	Wholesale & retail trade	0.54	1.04
25	Hotel & rest.	0.46	0.01
26	Transportation & communication	1.49	1.77
27	Finance & insurance	0.26	0.19
28	Real estate & house ownership	0.0615	0.0013
29	Business service & indv	0.67	0.70
30	Govt services	0.22	0.03