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Intersectoral Linkages and Imports of Vietnam: An Input-Output Approach*

Hai Thanh Nguyen

Abstract

This study traces the intersectoral linkages, or the interdependence of industries, in Vietnam's economy within the period of 2000-2012 using the input-output analysis. The total linkages–computed using Leontief inverse–are generally employed by policymakers in identifying critical industries for policy focus However, for many countries that heavily dependent on imported inputs like Vietnam, total linkages can give an erroneous result. The paper shows how important are the domestic linkages, which is the inverse net of imports, in analyzing the importance of industries in the economy. By constructing the non-competitive input-output tables relying on the assumption that imports are distributed across industries in the same proportion as the gross domestic output of the corresponding industry, the paper finds that there are considerable divergences between total and domestic linkages. The results indicate that failure to take into account import dependence tends to overestimate intersectoral linkages of some key sectors in the Vietnamese economy.

JEL Codes: D57, O21, O53

Keywords*:* Input-output table, domestic linkages, backward, forward, Vietnam

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An Input-Output Approach

1. Introduction

It has always been the goal of Vietnam's industrial policy to promote the development of prioritized sectors. In the recent Resolution 23-NQ/TW dated 22 March 2018 issued by the Politburo on 'Developing the national industry until 2030, with a vision to 2045', further speeding up the development of industries with positive spillovers to other sectors has been again emphasized. This is to ensure choosing prioritized sectors in the sense of their potential stimulus that will be induced in other industries. However, Vietnam still has a long way to go before materializing this goal as lacking a sufficient and consistent methodology to identify sources of induced economic development.

The most recent published books of input-output (IO) table of Vietnam (GSO, 2010, 2015) recommended policy makers to employ linkages using the Leontief inverse as an important reference in choosing the key economic sector. Indeed, some policy makers have proposed prioritized sectors basing on this index (Huynh, 2014). However, there have been some scholars that use 'domestic linkages', which is the exclusion of imported intermediate inputs in linkage measurement to take into account the leakage to import (this term is sometimes referred as 'net linkages') (Bui, Kobayashi, & Nguyen, 2012; Bui, Kobayashi, & Vu, 2011; Nguyen & Bui, 2018; To, Nguyen, & Bui, 2016). However, they show inconsistency in their measurement procedure. One cannot find how they construct related variables and what assumptions lying under their estimation process, given the unavailability of data supporting the calculation of domestic linkages.

The merit of our work lies in the use of a more recent procedure laid out by National Research Council (2006) to determine critical sectors. A long time-period (from 2000 to 2012) allows us to examine the manifestation of more profound variations in the intersectoral linkage, which is particularly relevant in the context of the rapidly changing economy of Vietnam. Finally, we use more disaggregated IO tables of 86 sectors, which leads to a more refined analysis of linkages.

The paper begins with a discussion of the conceptual issues surrounding the analysis of linkages in an open developing country. This section follows related works on ranking sectors based on domestic linkages. The author then develops a procedure for measuring domestic linkages by constructing the non-competitive IO tables relying on a 'similarity' assumption. Finally, we present and interpret the results and offer some practical recommendations.

2. Total vs. domestic linkages, conceptual issues

The concept of linkages has attained a prominent place in the theoretical development literature. Linkages refer to the potential stimulus that one industry has on the economic activity of others. This inducement mechanism might generate a multiplier effect on growth, and countries pursuing growth paths that put more emphasis on high-linkage industries might achieve higher growth rates (Jones, 1976).

The linkage analysis, firstly developed by Hirschman (1959), was extensively employed as a planning tool in various developing countries. The crucial premise of Hirschman's policy advocacy lied in the fact that, given existing domestic demand, a country can direct investment flows towards key industries to maximize developmental gains (Athukorala & Santosa, 2006). A key industry refers the one that has maximum linkages with the rest of the economy in terms of potential sales to others (*forward linkages*) or purchase from others (*backward linkages*).

According to Hirschman (1959), linkages are measured using the Leontief technology matrix or the Leontief inverse (termed as 'total linkages' in this paper). Hirschman (1959) argued that the linkages computation for a developed country would be a guide for less developed countries (LDC) 'on the condition that we expect the commodity composition of underdeveloped country's output to bear eventually some resemblance to that of the country on whose input-output statistics we perform the experiment.' This implicitly assumes that both countries have the same technology. Subsequently, thanks to the rapid accumulation of national input-output tables and literature on the measurement of linkages, a significant number of empirical estimates of linkages began to be published.

However, Acharya and Hazari (1971) claimed that LDC should have their own linkages because there is nothing guarantee that its output composition will resemble that of the developed country. They showed that linkages computed on the Leontief technology matrix or the inverse could not give an accurate picture of the potential sources of induced economic

development and distort the linkage measures that they are supposed to be for the case of LDC's economy. They explained that most of these countries exhibit a determined dependence on imported intermediate goods. When the linkage effects are concerned, imports will induce economic expansion only in the exporting countries. They suggested that, instead of total linkages, 'domestic' ('net' in their paper) linkages, which is the inverse net of imports, should be used for ranking sectors in LDC.

Similarly, Riedel (1976) shows that the backward linkage indicates the actual existing linkages of a given sector if and only if all intermediate inputs are produced and supplied domestically. If, as is the more likely case, especially in developing countries, a significant proportion of intermediate inputs is imported, total backward linkages will be an entirely erroneous measure of existing linkages. For the economy that depends on imports, the domestic inverse may be more appropriate in measuring the linkages and identify the sources of induced economic development.

Jones (1976) shows another problem arising from the inclusion of imported and domestic intermediate inputs in linkage measurement. He explains that the industry would have high backward and low forward linkages if the inputs are domestically available, and the outputs are for export purposes. Similarly, the industry would have low backward and high forward linkages if the inputs are mostly imported, and the outputs are highly demanded domestically. Therefore, the measurement of linkages must be derived using only the domestic flow matrix, instead of the total flow matrix.

Indeed, for many countries increasingly integrating into the global economy, empirical studies show a significant divergence between gross and domestic linkages. Bulmer-Thomas (1978) with the case of Costa Rica, Kubo (1985) with the case of nine (9) different countries, and Clements and Rossi (1991) with the case of Brazil indicate that in a higher import-dependent economy, domestic linkages are likely to provide a more realistic picture of inducement. Similarly, in a higher import-dependent sector, domestic linkages are likely to provide an appropriate industrial interdependence indicator.

Vietnam's domestic economy, like that in most other developing countries, is heavily dependent on imported inputs. The degree of import dependence would presumably have increased in recent years as the country in becoming progressively embodied within global production networks (Ferrarini & Hummels, 2014). Total linkages, therefore, may create a

misleading picture of the potential for inducing development through backward and forward linkages.

3. Related works on ranking sectors based on domestic linkages

Alauddin (1986) and Mujeri and Alauddin (1994) rank sectors in Bangladesh, distinguishing between gross (total) and net (domestic) linkages. In terms of total linkage, key sectors include those from the manufacturing industries and services, such as petroleum, miscellaneous industries, transport service, and basic metals. However, in terms of domestic linkage, most key sectors are nonindustrial and agricultural sectors, such as jute, rice, other crops, livestock, electricity, wood, and basis metal. The significant divergence in sectoral rankings comes from the inclusion of imports or not. Sectors with high import content, such as petroleum and cotton, are likely to rank low when linkages are computed net of imports. In contrast, less import-dependent sectors, such as agricultural sectors, appear to rank high when net linkages are considered. In a highly import-dependent economy like Bangladesh, net linages are likely to provide a more realistic industrial interdependence indicator.

Lekuthai (2006, 2007) compares the importance of the food industry with other sectors in the Thailand economy using IO tables of the years 1980, 1990, and 2000. Both total and domestic linkages were calculated based on the Leontief inverse matrix. Regarding the total linkages, the backward linkage of the food industry is lower than some leading industries. However, both backward and forward linkage indices of the food industry become noticeably higher when net linkages were used. Lekuthai (2006, 2007) explains that the food industry is less import-dependent, thus getting higher indices after employing net linkage. As the food industry has provided the most substantial contributions to the Thai economy, this industry needs more severe and continuous government support for development. Lekuthai (2006, 2007) also found a large difference in gross and net linkages in office equipment and electronic appliances, the sectors with high import content.

As for the literature of domestic linkages and key sectors regarding Vietnam, we can refer to the study of Nguyen and Bui (2018) and some related studies of Bui et al. (2011), Bui (2010), Bui et al. (2012), and To et al. (2016). The methodology used involved converting the existing IO table into a non-competitive import[1] type. Then the backward linkage and forward linkage

[1] There are two types of IO tables, 'competitive' and 'non-competitive', which differ on their treatment of import data. In the competitive IO tables, both domestically produced and imported inputs are lumped together in a single interindustry IO

are estimated, based on which the power of dispersion index and sensitivity for dispersion index is identified. The combination of the two latter indicates the relative importance of sectors in the economy. The authors found that four industry groups of agriculture, forestry and aquatic product; food processing, beverage, and tobacco; the production of oil and gas products; and other manufacturing industries have strongly stimulated other industries of the economy, while service industries have low linkages with others industries.

Despite the extensive literature on ranking sectors based on domestic linkages, limited attention was paid to computation procedure. Furthermore, some studies use a highly aggregated level, sacrificing a considerable amount of detail in the process. In this study, we take the denominator of Rasmussen's power of dispersion to measure inter-industry linkages and follow the National Research Council (2006) to construct the domestic linkages. Moreover, given that the current study is particularly interested in the linkage analysis of the most recent inter-industry structure, we employ the most disaggregated IO tables.

matrix, A, assuming that these inputs are perfect substitutes. This allows to compute total linkages using Leontief inverse $(I - A)^{-1}$. In contrast, non-competitive IO tables, inputs are clearly separated into two interindustry matrices: A^d (domestic input coefficients) and A^m (imported input coefficients), and this allows to compute domestic linkages using the inverse net of imports $(I - A + m)^{-1}$. For most countries, including Vietnam, only competitive type IO tables are available.

4. Methodology and data

Methodology

Leontief standard equation at competitive-import type:

$$AX + Y = X$$

Where X is the gross output matrix, A = (a_{ij}) is the direct intermediate input coefficient matrix with $a_{ij} = \frac{X_{ij}}{X_j}$, Y is the final demand matrix. Thus, $X = (I - A)^{-1}Y$ gives total inverse of $(I - A)^{-1}$, based on which the total linkages, backward and forward, are computed.

Under the IO framework of the non-competitive import type, we have:

$$A^d X + Y^d = X$$

Where X is the gross output matrix, $A^d = a_{ij}^d$ is the domestic direct intermediate input coefficient matrix with $a_{ij}^d = \frac{X_{ij}^d}{X_j}$, X_{ij}^d is domestic coefficient matrix and Y^d is the domestic final demand matrix. Thus, $X = (I - A^d)^{-1}Y^d$ gives domestic inverse of $(I - A^d)^{-1}$, based on which the domestic linkages are computed.

This paper employs the Rasmussen's indices (Rasmussen, 1956) of backward and forward linkages because these indices include both the direct and indirect effects of linkages.[2] Table 1 shows indices for total and domestic linkages.

Table 1: Linkage indices, total and domestic

Linkages		Definition	Note
Total linkages	Backward	$U_j = \frac{\frac{1}{n}K_{.j}}{(\frac{1}{n^2}\sum_{j=1} K_{.j})^n}$	Where $K_{.j} = \sum_{i=1}^{n} K_{ij}$ is the sum of the column elements of the total inverse $(I - A)^{-1}$, which indicates the direct and indirect increase in supply of all sectors needed to sustain a unit increase in final demand of j[th] sector.

[2] Rasmussen termed these indices as the Index of Power of dispersion and the Index of Sensitivity of Dispersion.

			This index shows the importance of a sector as a user of inputs.
	Forward	$U_i = \frac{\frac{1}{n}K_{i.}}{(\frac{1}{n^2}\sum_{i=1} K_{i.})^n}$	Where $K_{i.} = \sum_{j=1}^{n} K_{ij}$ is the sum of the row elements of the total inverse $(I - A)^{-1}$, which indicates the direct and indirect increase in supply of i[th] sector needed to sustain a unit increase in final demand of all sectors. This index shows the importance of a sector as a provider of inputs.
Domestic linkages	Backward	$\bar{U}_j = \frac{\frac{1}{n}\bar{K}_{.j}}{(\frac{1}{n^2}\sum_{j=1} \bar{K}_{.j})^n}$	Where $\bar{K}_{.j} = \sum_{i=1}^{n} \bar{K}_{ij}$ is the sum of the column elements of the domestic inverse $(I - A^d)^{-1}$, which indicates the direct and indirect increase in domestic output of all sectors needed to sustain a unit increase in final demand of j[th] sector.
	Forward	$\bar{U}_i = \frac{\frac{1}{n}\bar{K}_{i.}}{(\frac{1}{n^2}\sum_{i=1} \bar{K}_{i.})^n}$	Where $\bar{K}_{i.} = \sum_{j=1}^{n} \bar{K}_{ij}$ is the sum of the row elements of the domestic inverse $(I - A^d)^{-1}$, which indicates the direct and indirect increase in domestic output of i[th] sector needed to sustain a unit increase in final demand of all sectors.

Source: Rasmussen (1956)

Domestic linkages can only be calculated under the availability of non-competitive IO tables. This paper follows the procedure laid out by National Research Council (2006) to convert competitive IO tables to non-competitive ones applying the import similarity assumption.[3] This assumption shows that intermediate imports are distributed in the same way of output in the corresponding industries, and the latter refers to the fractions of total output that are shipped to each sector. For example, concerning the agricultural sector, if 24.5% of total agricultural production was shipped to farmers and 51.6% to manufacturers, then 24.5% of intermediate agricultural imports sold to farmers and 51.6% to manufacturers. The assumption is reasonable because we are dealing only with competitive imports of the same type as the output produced domestically (Hazari, 1967). We cannot work on a more firm basis than making this assumption given the current data availability. This approach has been used in Athukorala and Patunru (2019) to separate domestic and imported inputs matrices.

Applying the assumption, steps to obtain rows representing imported intermediate goods and thus, the import coefficients matrix m_{ij} are as follow:

[3] A similar approach sees in Hazari (1967) and Acharya and Hazari (1971). Another method developed by Hazari (1967) and Acharya and Hazari (1971) is based on assumption that there is a proportionality relationship between imports and gross domestic output levels (called 'proportionality assumption'). This alternative approach give similar results, which are available on request.

1. Identifying destination sales matrix

   $\alpha_{ij} = \frac{X_{ij}}{X_i + M_i}$ (ij=1, …, n)

2. Estimating import uses to produce domestic output by multiplying each row of the destination sales matrix by M_i:

$$\begin{bmatrix} \alpha_{11}\mathrm{M}_1 & \alpha_{12}\mathrm{M}_1 & \dots & \alpha_{1n}\mathrm{M}_1 \\ \alpha_{21}\mathrm{M}_2 & \alpha_{21}\mathrm{M}_2 & \dots & \alpha_{21}\mathrm{M}_2 \\ \dots\dots\dots & \dots\dots\dots & \dots & \dots\dots\dots \\ \alpha_{n1}\mathrm{M}_\mathrm{n} & \alpha_{n2}M_\mathrm{n} & \dots & \alpha_{nn}\mathrm{M}_\mathrm{n} \end{bmatrix}$$

   Each element of this matrix indicates the absolute magnitude of imports being absorbed by a particular sector

3. Converting into import coefficients matrix m_{ij} where the elements are given by:

   $m_{ij} = \frac{\alpha_{ij} * \mathrm{M}_i}{X_j}$ (ij=1, …, n)

To test whether a nation is import-dependent, the paper uses the Spearman rank correlation method:

$$r_s = 1 - 6\frac{\sum {d_i}^2}{n(n^2-1)}$$

Where d_i is the difference in the ranks assigned to the two different total and domestic linkages indices of the i^{th} sector and n is the number of sectors ranked.

If $0 \leq r_s \leq 0.4$ then the economy is heavily relying on imported intermediates (r_s is weak), if $0.4 < r_s \leq 0.7$ then the import requirements of the economy are relatively high (r_s is medium-strong), and if $0.7 < r_s \leq 1$ then the economy has strong domestic industrial linkages and low imports dependence (r_s is strong).

Data

This paper makes use of the recently published IO tables for the years 2000, 2007 and 2012. In Vietnam, the General Statistics Office (GSO), under the Ministry of Planning and Investment, has been compiling and publishing IO tables. The IO table for the year 2000 was published with 112 sectors and subsequently the tables were published at more disaggregated levels with 138 sectors for the year 2007 and 164 sectors for the year 2012 (Table 2).

Table 2: Input-output tables for Vietnam for the years of 2000, 2007 and 2012

Reference year	Tables' size	Type	Methodology
2000	112x112	Competitive	Direct full survey, compiled from the make and use matrices
2007	138x138	Competitive	Direct full survey, compiled from the make and use matrices
2012	164x164	Competitive	Direct full survey, compiled from the make and use matrices

To assist interpretation, reporting, and comparison, official IO tables were aggregated to 86 sectors using concordance tables.[4] The appendix shows the list of these 86 sectors.

The IO tables of Vietnam have no rows for imported inputs as distinct from Vietnamese output (competitive type). Thus, they cannot reveal how much of imports of a sector were used as intermediate inputs and how those intermediate imports were allocated across industries. This paper applies the methodology developed above to convert the existing IO tables to non-competitive type.

Before turning to the results, it is pertinent to comment on the limitations of our estimation procedure. The procedure in which the import coefficient matrices are derived based on certain assumptions regarding the distribution of imports among industries involves the issue of stability of import coefficients. Given the fact that various policies and other considerations contribute to determining import activities, the adopted procedure could be a drawback of this research. This limitation might suggest a significant effort to remedy the shortcomings in the data.

5. Empirical results

With the above data, the relevant set of matrices and vectors have been computed using the aforementioned methodologies. Table 3 and Table 4 record the values of U_j, $\overline{U}_j$, U_i, $\overline{U}_i$ for 86 sectors of Vietnam in 2000, 2007 and 2012. In these tables, each industry has been ranked by each linkage index.

[4] Unlike National Research Council (2006), which is based on a 9-commodity breakdown, this paper disaggregates data into 86 sectors for more accuracy and validity of the content calculations. Almost studies for the case of Vietnam also use an instead aggregated classification of industries (for example, 22 sectors in Bui et al. (2012), 19 sectors in Nguyen and Bui (2018)).

According to Table 3, the top-ranking backward-linking sectors change when shifting from a total linkage index to a domestic linkage index. For example, using total linkage index, sectors of motor vehicles, motorbikes (44), special-purpose machinery (46), machinery and equipment used for broadcasting, television and information activities (51), iron, steel, iron (52), other metal products (53), vegetable and animals oils and fats (20), and poultry (8) can be seen as highest-ranking backward-linking sectors across the years. However, using the domestic linkage index, the sectors that can induce growth in other input-supplying sectors the most are pigs (6), processed, preserved meat and by-products (19), and processed preserved fishery and by-products (30).

Table 3 also shows that, almost all of the agriculture sectors have experienced a better ranking when move from total to domestic linkages, such as paddy (1), sugarcane and tea (4), pigs (6), buffaloes, cows (7), poultry (8), fish farming (13). In contrast, the rankings have worsened for most of manufacturing sectors during the period. They include vegetable and animals oils and fats (20), basic organic chemicals (35), medicine, chemical prophylaxis and pharmacy (37), plastic and primary synthetic rubber (40), medical equipment's, dental, orthopaedics and rehabilitation (42), special-purpose machinery (46), cars (all kinds) (47), machinery and equipment used for broadcasting, television and information activities (51), iron, steel, iron (52), textile products (all kinds) (54). For most services sectors, the rankings have remained the same when moving from total to domestic linkage indices. Education and training (82), healthcare and social supporting services (83), cultural services, sports and entertainment (84) and services of organizations and foundations (85) are representative illustration.

Our results are widely consistent with those found by Alauddin (1986), Mujeri and Alauddin (1994), and Lekuthai (2006, 2007). Under the exclusion of imported intermediate inputs in linkage measurement, nonindustrial and agricultural sectors with less import content, such as paddy (1), sugarcane and tea (4), and pigs (6), are likely to have stronger linkages with the rest of the economy in terms of purchase from others. In contrast, some manufacturing sectors like motor vehicles, motorbikes (44), and special-purpose machinery (46), which depend much on imports for their inputs, fail to be the most important backward-linking sectors when domestic linkages are considered.

There are important implications obtained from our results. Various nonindustrial and agricultural sectors have provided strong actual production linkages, thus, need to receive consistent support from the government. Certain sectors, such as motor vehicles, motorbikes

(44), special-purpose machinery (46), cars (all kinds) (47), machinery & equipment used for broadcasting, television and information activities (51) do depend heavily on imports as their inputs. If we depend too much on the development of these sectors, imports would induce economic expansion only in the exporting countries. For fully utilizing these sectors' potential linkages and turning them into good candidates for key sectors, the development of upstream industries and supporting industries is highly required (Lekuthai 2006, 2007).

Table 3: Backward linkages and rankings

	Sectors	2000				2007				2012			
		U_j	Rank	$\bar{U}_j$	Rank	U_j	Rank	$\bar{U}_j$	Rank	U_j	Rank	$\bar{U}_j$	Rank
1	Paddy (all kinds)	0.71	74	1.07	60	0.75	63	1.07	60	0.79	67	0.90	58
2	Raw rubbers	0.66	82	1.02	69	0.68	74	1.02	69	0.61	81	0.76	80
3	Coffee beans	0.77	69	1.22	42	0.92	50	1.22	42	0.82	63	0.88	61
4	Sugarcane and tea	0.66	81	1.12	56	0.82	56	1.12	56	0.86	60	0.98	41
5	Other crops and perennial plants	0.58	86	1.20	46	0.90	52	1.20	46	0.80	65	0.89	60
6	Pigs	0.91	49	2.14	2	1.32	13	2.14	2	1.37	5	1.58	2
7	Buffaloes, cows	0.88	54	1.36	25	0.78	61	1.36	25	0.93	57	1.14	17
8	Poultry	0.77	68	1.93	6	1.18	23	1.93	6	1.38	3	1.50	4
9	Other livestock and poultry	0.79	64	1.90	7	1.16	26	1.90	7	0.96	55	1.16	15
10	Agricultural services and other agricultural products	0.88	56	1.76	11	1.06	37	1.76	11	0.79	66	0.93	51
11	Forestry	0.62	85	1.09	57	0.79	59	1.09	57	0.73	70	0.68	86
12	Fishery	0.99	42	0.91	82	1.10	32	0.91	82	1.16	26	0.94	49
13	Fish farming	0.67	79	2.02	4	1.28	17	2.02	4	1.14	28	1.30	9
14	Coal	0.83	60	1.30	30	1.06	39	1.30	30	1.11	33	1.03	29
15	Exploiting mine and ore	0.97	45	1.67	12	1.15	27	1.67	12	0.66	74	0.82	73
16	Exploiting stone, sand, gravel	0.97	46	1.02	67	0.81	58	1.02	67	1.02	47	0.93	50
17	Other minerals	0.89	53	1.06	62	0.77	62	1.06	62	0.83	62	0.87	63
18	Exploiting crude oil and natural gas	0.63	84	0.77	86	0.46	86	0.77	86	0.87	59	0.80	78
19	Processed, preserved meat and by-products	1.10	30	2.41	1	1.44	5	2.41	1	1.37	4	1.70	1
20	Vegetable and animals oils and fats	0.85	59	1.38	23	1.87	1	1.38	23	1.90	1	1.19	12
21	Milk and by-milk	1.18	23	1.45	18	1.05	40	1.45	18	1.35	6	1.37	6
22	Cocoa, chocolate and candy, cake products from flour	1.18	22	1.79	9	1.24	20	1.79	9	1.14	29	1.28	11
23	Processed preserved vegetables and fruit	0.94	47	1.89	8	1.25	19	1.89	8	1.08	36	1.17	14

24	Alcohol	0.94	48	1.42	21	1.03	44	1.42	21	0.94	56	1.05	23
25	Beer	0.99	43	1.45	17	1.06	36	1.45	17	0.68	73	0.79	79
26	Non-alcohol water and soft drinks	1.17	25	1.42	20	1.03	43	1.42	20	1.04	45	1.07	20
27	Sugar	1.06	38	1.54	15	1.04	41	1.54	15	1.06	41	1.34	8
28	Processed coffee and tea (all kinds), rice and flour (all kinds)	1.09	34	1.76	10	1.15	28	1.76	10	1.18	22	1.48	5
29	Cigarettes	0.88	55	1.52	16	1.13	29	1.52	16	0.99	49	1.06	22
30	Processed preserved fishery and by-products	1.21	19	2.09	3	1.41	6	2.09	3	1.30	8	1.55	3
31	Glass and by-product glass	1.12	28	1.00	73	0.87	54	1.00	73	0.97	53	0.94	46
32	Cements and other non-metallic mineral products	1.19	20	1.28	31	0.93	49	1.28	31	0.99	50	1.05	25
33	Paper and by-paper products	1.21	18	1.39	22	1.17	24	1.39	22	1.18	20	1.18	13
34	Processed wood and by-wood products	0.99	44	1.33	28	0.94	48	1.33	28	1.13	31	0.96	42
35	Basic organic chemicals	1.03	41	1.19	47	1.29	16	1.19	47	0.97	54	1.05	27
36	Fertilizer and nitrogen compound	1.08	36	1.21	45	1.32	11	1.21	45	1.01	48	0.98	40
37	Medicine, chemical prophylaxis and pharmacy	1.06	39	1.21	44	1.00	45	1.21	44	0.98	52	0.94	48
38	By-product rubber	1.08	37	0.97	78	0.69	72	0.97	78	1.16	27	0.99	36
39	Other chemical products; man-made fibres	1.17	24	1.31	29	1.21	22	1.31	29	1.21	18	1.02	31
40	Plastic and primary synthetic rubber	1.29	13	1.13	52	1.17	25	1.13	52	1.18	21	0.87	62
41	By-product plastic	1.21	17	1.01	72	0.94	47	1.01	72	1.21	15	0.84	68
42	Medical equipment’s, dental, orthopaedics and rehabilitation	1.09	35	0.91	83	0.69	71	0.91	83	1.05	42	0.91	54
43	Bed, cabinet, tables, chairs	1.24	15	1.26	36	0.86	55	1.26	36	1.10	34	1.01	33
44	Motor vehicles, motor bikes	1.57	1	1.26	34	1.26	18	1.26	34	1.34	7	1.28	10
45	General-purpose machinery	1.29	12	1.13	55	1.04	42	1.13	55	1.17	23	0.91	53
46	Special-purpose machinery	1.34	8	1.26	35	1.48	4	1.26	35	1.43	2	0.84	71
47	Cars (all kinds)	1.12	29	1.25	38	1.31	14	1.25	38	1.07	40	1.01	32
48	Transport means	1.09	32	1.21	43	1.35	9	1.21	43	1.17	25	1.04	28
49	Motor, electric generator, power transformers	1.31	10	1.00	74	0.72	69	1.00	74	1.25	9	0.99	37
50	Other electronic products	1.43	4	1.36	24	1.09	34	1.36	24	1.25	10	0.99	39

51	Machinery and equipment used for broadcasting, television and information activities	1.52	3	1.15	49	0.90	51	1.15	49	1.22	12	0.99	38
52	Iron, steel, iron	1.56	2	1.13	54	1.71	2	1.13	54	1.11	32	0.89	59
53	Other metal products	1.42	5	1.22	40	1.51	3	1.22	40	1.22	14	0.96	43
54	Textile products (all kinds)	1.25	14	1.54	14	1.38	8	1.54	14	1.21	16	0.92	52
55	Fibre (all kinds)	1.13	27	1.56	13	1.39	7	1.56	13	1.23	11	0.91	56
56	Costume (all kinds)	1.40	6	1.33	27	1.34	10	1.33	27	1.08	37	0.90	57
57	Leather, preliminary processed fur, suitcase, bags, saddle and other same kinds)	1.19	21	1.27	33	1.23	21	1.27	33	1.05	43	1.05	24
58	Shoes, sandal (all kinds)	1.40	7	1.25	37	0.99	46	1.25	37	1.02	46	1.00	34
59	Animal feed	1.16	26	1.98	5	1.32	12	1.98	5	1.22	13	1.35	7
60	Products of printing activities	1.22	16	1.34	26	1.09	33	1.34	26	1.19	19	1.15	16
61	Other processed industrial products	1.33	9	1.01	71	0.79	60	1.01	71	1.07	39	0.94	47
62	Gasoline, lubricants and other products extracting from oil, gas	1.10	31	0.90	85	1.30	15	0.90	85	1.21	17	1.11	19
63	Electric and gas production	0.74	72	1.06	61	0.63	80	1.06	61	0.57	82	0.72	84
64	Exploitation, processing and water supply	0.65	83	1.01	70	0.63	79	1.01	70	0.76	68	0.84	69
65	Construction	1.29	11	1.28	32	1.10	31	1.28	32	1.09	35	1.05	26
66	Wholesale and retail	0.90	52	0.96	80	0.62	81	0.96	80	0.64	76	0.82	74
67	Repairing car, motorbikes, accessories and auxiliary parts of motorbike and car	1.04	40	0.99	76	0.67	77	0.99	76	0.81	64	0.87	64
68	Residential service	0.82	61	1.04	64	0.59	83	1.04	64	0.70	72	0.86	66
69	Food service	0.87	57	1.24	39	0.71	70	1.24	39	1.04	44	1.14	18
70	Transport by road	0.75	70	0.90	84	1.06	38	0.90	84	1.07	38	0.94	45
71	Railway transport	0.69	76	0.99	77	0.87	53	0.99	77	0.83	61	0.95	44
72	Waterway transport	0.91	50	0.93	81	1.08	35	0.93	81	1.17	24	1.03	30
73	Airline service	1.09	33	1.22	41	1.11	30	1.22	41	1.13	30	1.00	35
74	Postal and delivery, telecommunication services	0.70	75	1.19	48	0.72	68	1.19	48	0.99	51	1.07	21
75	Travel agency services, tour business; supporting services of promoting and organizing tour	0.80	63	1.00	75	0.73	66	1.00	75	0.64	78	0.83	72

76	Financial services (except insurance)	0.67	80	1.07	58	0.62	82	1.07	58	0.63	79	0.86	67
77	Lottery, bet and gamble	0.67	78	1.43	19	0.73	65	1.43	19	0.63	80	0.86	65
78	Insurance	0.81	62	1.13	51	0.75	64	1.13	51	0.54	84	0.76	81
79	Research and technology	0.91	51	1.03	66	0.68	75	1.03	66	0.70	71	0.81	75
80	Real estate business service and other consulting services	0.74	71	0.97	79	0.55	85	0.97	79	0.52	85	0.72	83
81	Service of communist party activities, political and social organization, state management, defence and compulsory social security	0.86	58	1.05	63	0.64	78	1.05	63	0.56	83	0.74	82
82	Education and training	0.72	73	1.02	68	0.59	84	1.02	68	0.50	86	0.69	85
83	Healthcare and social supporting services	0.78	65	1.07	59	0.81	57	1.07	59	0.89	58	0.84	70
84	Cultural services, sports and entertainment	0.78	66	1.13	53	0.69	73	1.13	53	0.66	75	0.81	77
85	Services of organizations and foundations	0.77	67	1.15	50	0.73	67	1.15	50	0.64	77	0.81	76
86	Other services	0.69	77	1.03	65	0.68	76	1.03	65	0.76	69	0.91	55

Source: compiled from 2000, 2007, 2012 IO tables

Turning into forward linkages, wholesale and retail (66) has been consistently the most important forward-linking sectors across the years under both total and domestic indices (Table 4). Other vital sectors playing the role of input providers in the economy consist of resource-based sectors, such as exploiting crude oil and natural gas (18), iron, steel, iron (52), animal feed (59), and gasoline, lubricants and other products extracting from oil, gas (62). From observation, the changes in sectoral rankings by total and domestic linkages are less significant in forward-linking sectors than backward-linking sectors.

Table 4: Forward linkages and ranking

	Sectors	2000				2007				2012			
		U_i	Rank	$\bar{U}_i$	Rank	U_i	Rank	$\bar{U}_i$	Rank	U_i	Rank	$\bar{U}_i$	Rank
1	Paddy (all kinds)	1.10	19	1.71	5	1.34	19	3.15	6	1.03	25	1.52	12
2	Raw rubbers	0.50	68	0.75	65	0.48	55	0.93	67	0.47	60	0.67	65
3	Coffee beans	0.42	81	0.66	80	0.86	25	1.90	19	1.23	22	1.07	26
4	Sugarcane and tea	0.69	38	1.09	19	0.57	44	1.35	34	0.77	33	1.18	21
5	Other crops and perennial plants	1.13	18	1.65	7	1.99	5	3.68	3	2.23	8	2.46	4
6	Pigs	0.55	59	0.87	40	0.58	42	1.44	29	0.86	31	1.36	17
7	Buffaloes, cows	0.49	69	0.76	64	0.38	72	0.97	61	0.51	53	0.80	42
8	Poultry	0.54	61	0.85	44	0.47	60	1.17	47	0.49	57	0.78	45
9	Other livestock and poultry	0.60	50	0.93	35	0.38	74	0.94	64	0.43	68	0.69	60
10	Agricultural services and other agricultural products	0.64	45	1.01	29	0.84	28	2.02	16	0.73	34	0.99	30
11	Forestry	0.99	25	1.31	12	0.78	32	1.43	31	1.52	17	0.78	46
12	Fishery	0.66	43	1.04	23	0.47	59	1.18	46	0.46	63	0.73	53
13	Fish farming	0.54	63	0.84	45	0.50	51	1.24	38	0.67	37	1.05	29
14	Coal	0.70	36	0.96	32	1.52	14	2.29	9	0.57	46	0.77	49
15	Exploiting mine and ore	0.71	34	1.02	27	0.34	86	0.84	86	0.44	66	0.68	62
16	Exploiting stone, sand, gravel	0.61	48	0.81	51	0.58	43	1.23	39	0.41	70	0.65	67
17	Other minerals	0.62	46	0.74	66	0.60	40	1.02	55	1.06	24	0.74	51
18	Exploiting crude oil and natural gas	1.15	17	1.05	21	1.74	7	1.02	56	3.81	4	2.47	3
19	Processed, preserved meat and by-products	0.51	67	0.78	58	0.64	38	1.52	25	0.46	62	0.71	57
20	Vegetable and animals oils and fats	0.45	71	0.68	76	1.54	13	1.45	28	1.66	16	1.11	24
21	Milk and by-milk	0.59	51	0.83	49	0.49	53	1.13	49	0.72	36	0.93	33
22	Cocoa, chocolate and candy, cake products from flour	0.42	79	0.67	79	0.34	83	0.86	82	0.37	74	0.60	73
23	Processed preserved vegetables and fruit	0.48	70	0.74	67	0.60	41	1.47	27	0.41	71	0.63	69

24	Alcohol	0.44	75	0.68	75	0.35	82	0.87	78	0.37	75	0.59	74
25	Beer	0.43	77	0.67	77	0.34	84	0.86	81	0.34	83	0.56	83
26	Non-alcohol water and soft drinks	0.43	76	0.68	74	0.35	79	0.88	76	0.35	79	0.57	78
27	Sugar	0.67	41	1.04	22	0.48	56	1.11	51	0.52	51	0.81	41
28	Processed coffee and tea (all kinds), Rice and flour (all kinds)	0.88	29	1.35	11	1.15	21	2.59	7	0.98	26	1.39	16
29	Cigarettes	0.56	57	0.81	54	0.38	71	0.95	63	0.34	86	0.55	86
30	Processed preserved fishery and by-products	0.56	54	0.87	39	0.55	46	1.33	35	0.48	58	0.73	52
31	Glass and by-product glass	0.67	42	0.91	36	0.53	49	1.00	59	0.56	49	0.71	55
32	Cements and other non-metallic mineral products	1.51	12	1.67	6	0.85	26	1.65	21	0.58	44	0.85	37
33	Paper and by-paper products	1.57	11	1.44	9	1.71	8	2.23	11	1.67	15	1.70	9
34	Processed wood and by-wood products	0.75	32	1.03	24	0.78	31	1.57	23	0.88	29	1.20	20
35	Basic organic chemicals	1.69	10	0.86	41	1.55	12	1.16	48	2.41	6	1.12	23
36	Fertilizer and nitrogen compound	1.17	16	1.03	25	2.47	4	2.03	15	1.47	19	1.41	15
37	Medicine, chemical prophylaxis and pharmacy	0.71	35	0.81	52	0.81	30	1.19	44	0.87	30	0.86	35
38	By-product rubber	1.01	24	1.08	20	0.71	35	1.27	36	0.97	27	1.11	25
39	Other chemical products; man-made fibres	1.21	15	1.14	15	1.57	11	1.77	20	1.83	10	1.32	18
40	Plastic and primary synthetic rubber	2.84	4	0.88	37	1.15	22	1.00	58	2.43	5	0.70	59
41	By-product plastic	1.30	14	1.18	14	1.49	16	2.08	14	1.68	14	1.50	13
42	Medical equipment’s, dental, Orthopaedics and rehabilitation	0.55	60	0.69	69	0.38	73	0.86	80	0.47	59	0.63	71
43	Bed, cabinet, tables, chairs	0.62	47	0.82	50	0.36	77	0.89	73	0.53	50	0.79	44
44	Motor vehicles, motor bikes	2.84	5	1.37	10	0.40	70	0.92	68	0.51	55	0.81	39
45	General-purpose machinery	0.76	31	0.69	71	0.42	65	0.98	60	0.42	69	0.58	77
46	Special-purpose machinery	1.04	23	0.78	57	0.46	62	0.85	84	1.78	11	0.71	56
47	Cars (all kinds)	1.10	20	0.93	34	0.48	58	0.85	83	0.34	85	0.55	85
48	Transport means	0.70	37	0.87	38	0.47	61	0.94	65	0.58	43	0.83	38
49	Motor, electric generator, power transformers	0.42	80	0.66	81	0.48	54	1.12	50	0.50	56	0.65	68
50	Other electronic products	0.98	26	0.98	30	1.34	18	2.18	12	2.07	9	1.48	14

51	Machinery and equipment used for broadcasting, television and information activities	2.78	6	1.09	18	0.46	63	0.93	66	0.57	47	0.77	48
52	Iron, steel, iron	4.42	3	2.14	4	6.85	2	2.39	8	4.44	2	1.54	11
53	Other metal products	1.40	13	1.11	17	1.50	15	2.23	10	4.25	3	2.27	5
54	Textile products (all kinds)	1.05	22	1.02	26	0.92	24	1.21	42	0.60	40	0.73	54
55	Fibre (all kinds)	0.92	27	0.85	43	1.28	20	2.18	13	1.51	18	1.15	22
56	Costume (all kinds)	0.52	65	0.78	60	0.43	64	1.02	54	0.44	67	0.67	64
57	Leather, preliminary processed fur, suitcase, bags, saddle and other same kinds)	0.65	44	0.78	61	0.85	27	1.35	33	0.72	35	0.99	31
58	Shoes, sandal (all kinds)	0.56	56	0.86	42	0.41	66	1.01	57	0.36	77	0.58	75
59	Animal feed	0.74	33	1.14	16	1.71	9	4.07	2	1.46	21	1.87	7
60	Products of printing activities	0.67	40	0.97	31	0.51	50	1.21	43	0.59	42	0.88	34
61	Other processed industrial products	2.30	7	1.50	8	1.40	17	1.98	18	1.19	23	1.07	27
62	Gasoline, lubricants and other products extracting from oil, gas	4.95	2	0.73	68	11.34	1	0.97	62	5.39	1	2.84	1
63	Electric and gas production	2.16	8	2.31	2	1.98	6	3.29	4	1.46	20	1.59	10
64	Exploitation, processing and water supply	0.53	64	0.79	55	0.48	57	1.11	52	0.51	54	0.75	50
65	Construction	0.41	83	0.65	83	0.54	47	1.24	37	0.64	39	0.95	32
66	Wholesale and retail	6.47	1	4.60	1	3.32	3	5.56	1	2.31	7	2.61	2
67	Repairing car, motorbikes, accessories and auxiliary parts of motorbike and car	0.57	53	0.81	53	0.69	36	1.49	26	0.44	65	0.67	63
68	Residential service	0.55	58	0.78	59	0.61	39	1.23	40	0.47	61	0.68	61
69	Food service	0.61	49	0.83	48	0.54	48	1.19	45	0.56	48	0.81	40
70	Transport by road	0.83	30	0.94	33	1.12	23	1.99	17	0.82	32	1.06	28
71	Railway transport	0.45	73	0.69	72	0.41	67	0.89	74	0.36	78	0.57	79
72	Waterway transport	0.56	55	0.77	62	0.66	37	1.23	41	0.57	45	0.79	43
73	Airline service	0.69	39	0.84	46	0.40	69	0.90	71	0.52	52	0.71	58
74	Postal and delivery, telecommunication services	0.90	28	1.19	13	0.72	34	1.55	24	0.60	41	0.86	36
75	Travel agency services, tour business; supporting services of promoting and organizing tour	0.41	85	0.65	85	0.35	81	0.84	85	0.35	81	0.56	82

76	Financial services (except insurance)	1.10	21	1.01	28	0.81	29	1.39	32	1.68	13	1.74	8
77	Lottery, bet and gamble	0.41	86	0.65	86	0.56	45	1.43	30	0.39	73	0.63	70
78	Insurance	0.45	72	0.68	73	0.50	52	1.03	53	0.65	38	0.77	47
79	Research and technology	0.58	52	0.83	47	0.41	68	0.92	69	0.46	64	0.66	66
80	Real estate business service and other consulting services	2.09	9	2.16	3	0.76	33	1.64	22	0.92	28	1.25	19
81	Service of communist party activities, political and social organization, state management, defence and compulsory social security	0.41	82	0.65	82	0.34	85	0.86	79	0.35	82	0.56	81
82	Education and training	0.52	66	0.76	63	0.37	75	0.89	72	0.40	72	0.60	72
83	Healthcare and social supporting services	0.44	74	0.69	70	0.35	78	0.87	77	0.35	80	0.56	80
84	Cultural services, sports and entertainment	0.54	62	0.78	56	0.36	76	0.90	70	0.37	76	0.58	76
85	Services of organizations and foundations	0.42	78	0.67	78	0.35	80	0.89	75	0.34	84	0.56	84
86	Other services	0.41	84	0.65	84	1.68	10	3.21	5	1.71	12	2.08	6

Source: compiled from 2000, 2007, 2012 IO tables

To obtain a clearer idea of how significant changes in sectoral rankings by the two types of linkages are, the Spearman rank correlation has been computed:

Table 5: Spearman rank correlation coefficients between total and domestic linkages

Year	r_s between U_j and $\overline{U}_j$	r_s between U_i and $\overline{U}_i$
2000	0.665	0.847
2007	0.628	0.857
2012	0.683	0.902

Table 5 shows the Spearman rank correlation for all 3 years of 2000, 2007 and 2012. While the r_s between U_j and $\overline{U}_j$ are consistently around the figure 0.6 (i.e. medium-strong correlation), r_s between U_i and $\overline{U}_i$ are considered to be very strong (r_s > 0.7). This implies that, in general, the import requirements of the backward-linking sectors are relatively higher than those of the forward-linking sectors for each respective years.

One explanation for Vietnam's case is that most of the backward-linking sectors, including motor vehicles, motorbikes (44), special-purpose Machinery (46), machinery & equipment used for broadcasting, television and information activities (51) highly engaged in modern technology and depend much on high-quality intermediate imports. In contrast, most of the forward-linking sectors are relatively resource-based, for example exploiting crude oil and natural gas (18) and gasoline, lubricants, and other products extracting from oil, gas (62), and electric and gas production (63). These sectors generally depend less on intermediate imports.

6. Conclusions and policy implications

The total linkages, which have been generally employed to identify sources of induced economic development, are much of arguing. This paper aims at providing proper insight into the analysis of linkages in the context of an open developing country and developing a measurement procedure of domestic linkages given the availability of competitive IO tables with the case of Vietnam.

Notably, the paper shows that conceptual issues were surrounding the analysis of linkages in the context of an open developing country. As most developing countries exhibit a determined dependence on imported intermediate goods, when the linkage effects are concerned, imports

would induce economic expansion only in the exporting countries. Thus, instead of total linkages, domestic linkages should be used for ranking sectors in these economies.

The author then follows National Research Council (2006) to develop a procedure for the measurement of domestic linkages. By constructing the non-competitive IO tables relying on a similarity assumption, which assumes that imports are distributed over the whole range of industries in the same proportion as the gross domestic output of the corresponding sector, the paper introduces a comparison between the total and domestic linkages.

The paper finds a significant difference between total and domestic linkages in the case of Vietnam. In terms of total linkages, key sectors include those from the manufacturing and other sectors within the services and construction groups of economic activity. However, in terms of domestic linkages, nonindustrial and some agricultural sectors tend to emerge as key sectors. The results imply that import plays a significant role in the intersectoral linkages in the Vietnamese economy. The strength of some sectors' linkages is due to the import utilization effects, but not domestic sectors' real own ability to create linkages.

From the results, this study will suggest some policy implications. Nonindustrial and some agricultural sectors need to receive consistent government support as they have provided actual production linkages. Manufacturing industries such as machine and motor vehicle, which have received strong support from the government through various incentives, induced high import for their production. To fully utilize its potential linkages to the economy, Vietnam needs to develop upstream industries and supporting industries.

Although the paper has shed some light on linkage analysis of an open developing country, the adopted estimation procedure could be a drawback of this research. The method in which the import coefficient matrices are derived based on certain assumptions regarding the distribution of imports among industries involves the issue of stability of import coefficients, given the fact that various policies and other considerations contribute to determining import activities. This limitation might suggest a significant effort from open economies to remedy the shortcomings in the data to identify the key sectors.

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Appendix: List of sectors

	Industries	2000 IO code	2007 IO code	2012 IO code	VSIC (4 digits)
1	Paddy (all kinds)	1	1	1	111
2	Raw rubbers	2	4	12	125
3	Coffee beans	3	5	13	126
4	Sugarcane and tea	4, 5	2,6	5,14	114, 127
5	Other crops and perennial plants	6	3,7	2,3,4,6, 7,8,9,10 ,11, 15	112, 113, 117, 118, 115, 116, 118, 119, 121, 122, 123, 124, 128, 129,130
6	Pigs	7	9	17	145
7	Buffaloes, cows	8	8	16	141
8	Poultry	9	10	18	146
9	Other livestock and poultry, n.e.c,	10	11	19	142, 144, 146, 149, 150
10	Agricultural services and other agricultural products	11,12	12	20, 21	161, 162, 163, 164, 170
11	Forestry	13	13, 14	22,23,24,25	210, 221, 222, 230, 240
12	Fishery	14	15	26	311, 312
13	Fish farming	15	16	27	321, 322, 323
14	Coal	16	17	28	510, 520
15	Exploiting mine and ore	17	22	34	910, 990
16	Exploiting stone, sand, gravel	18, 19	20	32	810
17	Other minerals	20	21	31, 33	710, 721, 722, 730, 891, 892, 893, 899
18	Exploiting crude oil and natural gas	21	18, 19	29, 30	610, 620
19	Processed, preserved meat and by-products	22	23	35	1010
20	Vegetable and animals oils and fats	23	26	38	1040
21	Milk and by-milk	24	27	39	1050
22	Cocoa, chocolate and candy, cake products from flour	25	31	42	1073
23	Processed preserved vegetables and fruit	26	25	37	1030
24	Alcohol	27	35	47	1101, 1102
25	Beer	28	36	48	1103

26	Non-alcohol water and soft drinks	29	37	49	1104
27	Sugar	30	30	41	1072
28	Processed coffee and tea, Rice and flour (all kinds)	31, 32, 35, 36	28, 29, 32, 33	40, 43, 44, 45	1061, 1062, 1071, 1074, 1075, 1079
29	Cigarettes	33	38	50	1200
30	Processed preserved fishery and by-products	34	24	36	1020
31	Glass and by-product glass	37, 38	57	70	2310
32	Cements and other non-metallic mineral products	39, 40, 41, 42	58, 59	71, 72, 73	2391, 2392, 2393, 2394, 2395, 2396, 2399
33	Paper and by-paper products	43	45	57	1701, 1702, 1709
34	Processed wood and by-wood products	44	44	56	1610, 1621, 1622, 1623, 1629
35	Basic organic chemicals	45, 46	50	62	2011
36	Fertilizer and nitrogen compound	47, 48	51	63	2012
37	Medicine, chemical prophylaxis and pharmacy	49, 50, 51	54	67	2100
38	By-product rubber	52	55	68	2211, 2212
39	Other chemical products; man-made fibres	53, 54, 57, 58, 59	53	65,66	2021, 2022, 2023, 2029, 2030
40	Plastic and primary synthetic rubber	55	52	64	2013
41	By-product plastic	56	56	69	2220
42	Medical equipment, dental, orthopaedics, rehabilitation	60, 61	81	96	3250
43	Bed, cabinet, tables, chairs	62	79	94	3100
44	Motor vehicles, motor bikes	63, 64	77	92	3091
45	General-purpose machinery	66	72	87	2811, 2812, 2813, 2814, 2815, 2816, 2817, 2818, 2819
46	Special-purpose machinery	67	73	88	2821, 2822, 2823, 2825, 2829
47	Cars (all kinds)	65, 68	74	89	2910
48	Transport means	69	75, 76, 78	90, 91, 93	2920, 2930, 3040, 3011, 3012, 3020, 3030, 3092, 3099

49	Motor, electric generator, power transformers	70	66	81	2710
50	Other electronic products	71	62, 64, 65, 67, 68, 69, 70, 71	77, 79, 80, 82, 83, 84, 85, 86	2610, 2620, 2640, 2651, 2652, 2660, 2670, 2680, 2720, 2731, 2732, 2733, 2740, 2750, 2790
51	Machinery and equipment used for broadcasting, television and information activities.	72	63	78	2630
52	Iron, steel, iron	73	60	74	2410
53	Other metal products	74	61	75, 76	2420, 2431, 2432, 2511, 2512, 2513, 2520, 2591, 2592, 2599
54	Textile products (all kinds)	75, 78, 79	40	52	1321
55	Fibre (all kinds)	76	39	51	1311, 1312, 1313
56	Costume (all kinds)	77	41	53	1322+1323+1324+1329+1410+1430
57	Leather, preliminary processed fur, suitcase, bags, saddle and other same kinds)	80	42	54	1420+1511+1512
58	Shoes, sandal (all kinds)	81	43	55	1520
59	Animal feed	82	34	46	1080
60	Products of printing activities	83, 84	46	58	1811+1812+1820
61	Other processed industrial products	85	80, 82	95, 97, 98	3211+3212+3220+3230+3240, 3290, 3311+3312+3313+3314+3315+3319+3320
62	Gasoline, lubricants and other products extracting from oil, gas	86	47, 48, 49	59, 60, 61	1910, 1920
63	Electric and gas production	87	83, 84	99, 100	3510, 3520
64	Exploitation, processing and water supply	88	85, 86, 87	101, 102, 103, 104, 105	3530, 3600, 3700, 3811+3812+3821+3822+3830, 3900
65	Construction	89, 90	88, 89, 90	106, 107, 108, 109,	4100, 4210, 4220+4290, 4311+4312+4321+4322+4329+4330+4390

				110, 111	
66	Wholesale and retail	91	92	114	4610+4620+4631+4632+4633+4634+4641+4649+4651+4652+4653+4659+4661+4662+4663+4669+4690+4700
67	Repairing car, motorbikes, accessories and auxiliary parts of motorbike and car	92	91	112, 113	4511+4512+4513+ 4530+4541+4543, 4520+4542
68	Residential service	93	103	125	5510+5590
69	Food service	94	104	126	5610+5621+5629+5630
70	Transport by road	95	95, 96	117, 118	4920+4931+4932, 4933+4940
71	Railway transport	96	93, 94	115, 116	4911, 4912
72	Waterway transport	97	97, 98	119, 120	5011+5021, 5012+5022
73	Airline service	98	99, 100	121, 122	5110, 5120
74	Postal and delivery, telecommunication services	99	102, 108	124, 130	5310+5320, 6110+6120+6130+6190
75	Travel agency services, tour business; supporting services of promoting and organizing tour	100	124	147	7911+7912+7920
76	Financial services (except insurance)	101	110	133	6411+6419+6420+6430+6491+6492+6499
77	Lottery, bet and gamble	102	134	159	9200
78	Insurance	103	111, 112, 113	134, 135, 136	6511+6520, 6512+6520, 6611+6612+6619+6621+6622+6629+6630
79	Research and technology	104	118, 120	141, 143	7210+7220, 7410+7420+7490
80	Real estate business service and other consulting services	105, 106	114, 116	137, 139	6810+6820, 7010+7020
81	Service of communist party activities, political and social organization, state management, defence and compulsory social security	107	128	151	8411+8412+8413+8421+8422+8423+ 8430+6530
82	Education and training	108	129, 130	152, 153	8510+8520+8531+8532+8551+8552+ 8559+8560, 8541+8542

					8610+8620+8691+8692+8
				154,	699,
83	Healthcare and social supporting services	109	131, 132	155, 156	8710+8720+8730+8790, 8810+8890
				157,	9000, 9101+9102+9103,
84	Cultural services, sports and entertainment	110	133, 135	158, 160	9311+9312+9319+ 9321+9329
85	Services of organizations and foundations	111	136	161	9411+9412+9420+9490
					5210+5221+5222+5223+5
					224+5229,
					5811+5812+5813+5819+5
					820,
				123,	5911+5912+5913+5914+5
				127,	920, 6010+6021+6022,
				128,	6201+6202+6209,
			101,	129,	6311+6312+6321+6329,
			105,	131,	6910+6920, 7110+7120,
			106,	132,	7310+7320, 7500,
			107,	138,	7710+7721+7722+7729+7
			109,	140,	730+7740,
			115,	142,	7810+7820+7830,
			117,	144,	8010+8020+8030,
			119,12	145,	8110+8121+8129+8130,
			1,122,	146,	8211+8219+8220+8230+8
			123,	148,	291+8292+8299,
			125,	149,	9511+9512+9521+9522+9
			126,	150,	523+9524+9529,
			127,	162,	9610+9620+9631+9632+9
86	Other services	112	137, 138	163, 164	633+9639, 9700+9810+9820

Source: compiled based on IO concordance tables