

Exploring the Position of Industry Sector and its Sub-sectors in Yazd Province Economy Based on Input-Output Modeling Approach

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ABSTRACT

The industry sector can act as primary engine of economic growth and development in different parts of the country through communication with other economic sectors. Of course, the type of technology used in this sector as well as its communications intensity with other economic sectors in different regions and provinces of the country can have different effects on the growth and development of various regions. Hence, the aim of this study is to investigate the importance and position of the industry sector and its sub-sectors in Yazd province economy using regional input-output table of the province. The statistical source of this study is the regional input-output table extracted from the national input-output table for 2011 of the parliament research center. The findings of this study show that three industrial sectors including manufacture of chemicals and chemical products, machinery and equipment, and food products and beverages have the highest production multipliers in the province with 2.01, 1.77, and 1.62 unit respectively.

Key Words: industry sector, regional input-output, Yazd Province

1. Introduction

Industry sector is one of the principal sectors in the economy, which can play an important role in growth and economic development of any country or region due to structural features. By expansion of industrialization process, we can increase the productive capacity and power of a country and/or a province and it can be possible to provide a platform for improving economic variables such as employment, production and value added. So, in most developed countries, industry sector is known as an engine of economic growth and capital accumulation. One of the reasons is that the industry sector is the source of increasing returns to production scale. Today, industry sector, in comparison with other productive sectors of the economy, has become to leading sector in the field of economy. The growth of industry allows the power of production factors to increase continuously due to the increasing development of science and technology. Therefore, industry sector can play an important role in sustainable growth and development of the Iranian economy as well as its different provinces. Because it both meets the needs of other sectors and is itself an applicant for various types of production inputs from the economic sectors (Mowlaei & Sahrai, 2014). In terms of creating value added, major industrial activities in Iran are done in the sectors including manufacture of chemicals and chemical products, basic metals, food products and beverages, non-metallic mineral products, coke production industries, oil refineries and nuclear fuels. Looking at the current structure shows that apart from the food and drink industries, most of the industry in Iran is focused on oil and gas based and also mineral based industries and in fact, industry sector in Iran can be considered as a resource based sector (Mohammad Khani & Mohammadi, 2015). In the economy of Yazd province, due to environmental constraints, lack of water resources and the impossibility of quantitative expansion of agricultural activities, the industry sector has

a special position in development of the province. So that in development documents of the province, the industry and mining sector is considered as the main axis of development in the province and achieving sustainable development of industry and mining is one of the long-term goals (Dehghanizadeh, 2008). Of course, industrial development in any region requires study and research on the advantages of each province or region in each of the industrial sub sectors. For example, in an area with different agricultural products, food and beverage sub sector can be the beginning of industrialization in that region due to close access to inputs. Also, an area where metal mines are found in abundance can be predisposing of development in that region through the manufacture of metal products or basic metals. Accordingly, considering the importance of industry sector in the economy and its relationship with other economic sectors, this paper tries to investigate the importance and position of industry sector and its sub sectors in the economy of Yazd by using the regional input-output table of Yazd province.

2. Experimental studies

According to the results of the searches, although relatively extensive research has been done in the field of various sub sectors of industry sector but there is little research about the position of industry sector in the economy. Bakhtiari and Dehghanizadeh (2013) have been studied the role of industrial activities in the economic development of urban areas using the input-output model. The results show that the highest production coefficient with a value of 2.07 is relates to building and construction industry and also the results of dispersion power and sensitivity indices indicate that industry sector due to its relationship with other sectors has more mobility compared to the average of other sectors in the entire system of urban areas, both in terms of purchasing intermediate inputs of other sectors and also selling products to them. Safavi (2004) and Banouei and Mahmoudi (2002) have investigated industry sector from the perspective of employment. Their results show that the industry of textiles, wearing apparel and leather products has the highest creating employment coefficient. In another study, Banouei et al. (2003) performed economic and social analysis of multipliers in three sectors of agriculture, industry and services. Based on the results of this research, matrix of production multipliers in Leontief model of the industry sector is given priority due to the extent of this sector to agriculture and services sectors. Yousefi and Ghelbash Gharebaghi (2013) have investigated the relative importance of economic sectors of Iran by using the input-output technique. The results of this study indicate that in gross links method, agricultural and industry sectors due to higher intermediate share are considered as important sectors in the economy. Jahangard (2002) in his study has identified key industrial activities with input-output approach in Iran. The results of this study show that sectors such as residential buildings, motor vehicles, wearing apparel (except footwear), industrial machinery, infrastructure buildings, carpet and rug, dairy products, radio and television and other communication tools, textiles, footwear, leather and its products had higher elasticity of production, employment and income than other industrial sectors. Regarding regional input-output research, Banouei and Vaisi (2014) have investigated the position of agro-based industries in Kermanshah province. The most recent Location Quotient (AFLQ1) method has been used in this research to estimate regional input-output table. Findings show desired position of agro-based industries among other sectors in the economy of the province. Dehghanizadeh and Dehghan Khavari (2012) have analyzed determination of key sectors of Yazd province using AFLQ method. According to the results, sectors such as agriculture and horticulture, other mines, food production, textiles and wearing apparel, production of other non-metallic mineral products, manufacture of basic metals, building and construction, wholesale and retail (trade), road transport, education and other services have been selected as key sectors in Yazd province. Mirjalili et al. (2010) have evaluated the efficiency of industries in Yazd province using data envelopment analysis. The results show that printing and publishing industry is the most efficient and the industry of manufacturing fabricated metal products except machinery and equipment has been the most inefficient industry in Yazd province. Much research has been done to estimate the regional table from the national input-output one. Some of these studies are as follows. Flegg et al. (2015) have examined

¹ *Adjusted Flegg, Webber and Elliott Location Quotient*

regional coefficients based on FLQ2 and AFLQ methods for Cordoba province in Argentina. Flegg and Tohmo (2016) also calculated regional coefficients using FLQ method based on empirical studies for South Korean regions. In another study, Flegg and Tohmo (2013) evaluated regional input-output models for twenty areas in Finland. Flegg and Webber (2000), Kowalewski (2012), Zhao and Choi (2015), and Flegg and Tohmo (2012) have examined the extraction of regional input-output table from the national input-output ones using the FLQ method.

3. Methodology and research data

Research method in this study consists of several stages. First, symmetric table of the sector is prepared in regional section assuming technology of the sector. Then, multipliers of different sectors are compared together using hypothetical elimination method. Accordingly, the methodology of this study is presented in the following section.

3.1. Construction of regional input-output tables

The regional input-output table of Yazd province has been used in this study. This table is extracted from the national input-output table by using the AFLQ method. Mathematical relation of the AFLQ function as given by Eq. (1).

$$AFLQ_{ij} = \begin{cases} FLQ_{ij} \times [\log_2^{(1+SLQ_j)}] & \text{if } LQ_j > 1 \\ FLQ_{ij} & \text{if } LQ_j < 1 \end{cases} \quad (1)$$

In this relation, the FLQ function is obtained based on Eq. (2).

$$FLQ_{ij} = ACILQ \times \lambda^* \quad (2)$$

$$\lambda^* = [\log_2^{(1+x^r / x^r)}]^\delta$$

The coefficients of interregional input-output are obtained through Eq. (3).

$$a_{ij}^{rr} = \begin{cases} AFLQ_{ij} \times a_{ij}^n & \text{if } LQ_j > 1 \\ FLQ_{ij} \times a_{ij}^n & \text{if } LQ_j \leq 1 \end{cases} \quad (3)$$

Where a_{ij} and a_{ij}^{rr} are national and interregional coefficients respectively (Miller and Blair, 2009).

3.2. Inter-sectoral linkage indicators of the economy

3.2.1. Total Forward Linkage indicator (TFL_i):

This index shows that how much products of a sector as intermediate inputs are provided directly and indirectly with other internal sectors of the economy in a region and it is expressed as follows. (Eq. (4))

$$TFL_i = \sum_{j=1}^n c_{ij} \quad C = (I - A)^{-1} \quad (4)$$

Each element of the C matrix, for example c_{ij} , indicates that how much products of i th sector in the region as an intermediary are given directly or indirectly to j sector. The higher this index shows that the mentioned sector mostly serves the internal sectors of the province's economy, and provides its products with them and meets their needs.

3.2.2. Total Backward Linkage indicator (TBL_j):

This index shows the quantity of demand created by each unit of final goods production in j sector directly and indirectly in the sectors of the province's economy which is given as follows. (Eq. (5))

$$TBL_j = \sum_{i=1}^n c_{ij} \quad (5)$$

The higher this index demonstrates that marginal products of this sector have more mobility power in the economy of the region and create more demand for other sectors and it will cause to more dynamics in the economy of that region.

3.2.3. Power of Dispersion Index (P_j)

² Flegg's location quotient

This index shows total backward linkage of a sector compared to the average total linkage index of different sectors of the economy in the region. In other words, it shows total linkage index of a sector compared to the average total backward linkage indicator of all economic sectors which is given as follows. (Eq. (6))

$$P_j = \frac{nTBL_j}{\sum_{i=1}^n TBL_i} \quad (6)$$

If this index is greater than one, it will show that the mentioned sector, compared to the average economic sectors, has more power to create dynamics in the region's economy and with increasing marginal demand of this sector, total production of the region's economy will increase further.

3.2.4. Sensitivity Index (qi)

This index shows total forward linkage of a sector compared to the average total linkage index of different sectors of the economy in the region. In other words, it shows total linkage index of a sector compared to the average total forward linkage indicator of all economic sectors which is given as follows. (Eq. (7))

$$q_i = \frac{nTFL_i}{\sum_{i=1}^n TFL_i} \quad (7)$$

If this index is greater than one, it will show that the mentioned sector, compared to the average total region's economy, provides more products with the internal sectors of the region's economy and meets their needs. In other words, this indicator shows sensitivity and irritability of a sector of the region's economy due to the increase of marginal demand in the region's economy compared to the average regional economy.

4. Result and Discussion

The total inter-sectoral linkages of industrial subsectors (direct and indirect) in Yazd province are given in Table 1. As shown in Table 1, three industrial sectors including the manufacture of non-metallic mineral products, basic metals and rubber and plastic products have the highest forward coefficient in Yazd province economy. On the other hand, three industrial sectors including manufacture of chemicals and chemical products, machinery and equipment, and food products and beverages have the highest backward coefficient (production multiplier) in Yazd province economy. The production multipliers of these sectors are 2.01, 1.77, and 1.62 unit respectively.

Table 1. Total inter-sectoral linkages of industrial subsectors (direct and indirect) in Yazd province

Industry sectors in Yazd province	Forward coefficient	Backward coefficient
Manufacture of food and beverage products	1/12	1/62
Manufacture of Textiles, wearing apparel, and leather products	1/02	1/05
Manufacture of wood, paper and publishing	1/10	1/05
Manufacture of chemicals and chemical products	1/06	2/01
Manufacture of rubber and plastic products	1/75	1/04
Manufacture of non-metallic mineral products	1/86	1/14
Manufacture of base metals	1/82	1/46
Manufacture of Fabricated metal products, except machinery	1/44	1/16
Manufacture of machinery and equipment	1/04	1/77
Other industries	1/17	1/14

Source: Research Calculations

So, the lowest forward Linkage indicator belongs to the industrial sectors including manufacture of chemicals and chemical products, machinery and equipment, and textiles, wearing apparel, and leather

products. Also, the lowest production multiplier (backward coefficient) is related to three sectors including manufacture of wood, paper and publishing, textiles, wearing apparel, and leather products, and rubber and plastic products.

Table 2 shows dispersion power and sensitivity indices in industrial sub-sectors of Yazd province. Based on these two indices can be identified key sectors in the economic growth of the province. In key sectors, both dispersion power and sensitivity indices are higher than one.

According to Table 2, the sector of manufacturing basic metals is only industrial sub-sector in the province where both dispersion power and sensitivity indices are greater than one. So, if the marginal demand in the province's economy increases by one unit, this sector will create more mobility than other industrial sub-sectors of the province.

Table 2. Dispersion power and sensitivity indices of industrial subsectors in Yazd province

Industrial sectors of Yazd province	Dissemination power	Sensitivity index
Manufacture of food and beverage products	1/23	0/85
Manufacture of Textiles, wearing apparel, and leather products	0/80	0/77
Manufacture of wood, paper and publishing	0/80	0/84
Manufacture of chemicals and chemical products	1/53	0/81
Manufacture of rubber and plastic products	0/79	1/33
Manufacture of non-metallic mineral products	0/87	1/42
Manufacture of base metals	1/11	1/39
Manufacture of Fabricated metal products, except machinery	0/88	1/10
Manufacture of machinery and equipment	1/35	0/79
Other industries	0/87	0/89

Source: Research Calculations

5. Conclusion and Policy Suggestions

The aim of this study is to investigate the importance of industrial sub-sectors in Yazd province using regional input-output table. Accordingly, the regional input-output table of Yazd province is extracted from the national input-output table using the most recent methods to regionalize the input-output tables. Since the last input-output table in the country is related to 2011, thus statistical source of this study is the input-output table of 2011 in Yazd province. The results show that three industrial sectors including manufacture of chemicals and chemical products, machinery and equipment, and food products and beverages have the highest backward coefficient (production multiplier). The production multipliers of these sectors are 2.01, 1.77, and 1.62 unit respectively. Therefore, if the purpose of regional policymakers is to achieve more growth and development in the economy, these sectors for each unit of the marginal demand such as investment in the province should be given priority.

Also, three industrial sectors including the manufacture of non-metallic mineral products, basic metals and rubber and plastic products have the highest forward coefficient in Yazd province economy. This shows that these sectors supply the inputs of most industrial sectors of the province's economy. Therefore, in order to grow and prosper the industrial sectors of the province, special attention to these sectors is necessary.

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