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CROSS–INDUSTRY AND SIMPLE LOCATION QUOTIENT TECHNIQUES FOR CONSTRUCTING REGIONAL INPUT–OUTPUT MODELS

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1. Introduction

Within the last twenty years, an increasing number of policy decisions at all levels of govermental and business enterprises have required on extensive knowledge of regional economic conditions. A regional input-output or inter industry model can help business firms and govermental bodies to take decisions about investments and development projects in a region. As we know, a regional input-output model represents the structure of a regional economy at sectoral level. So an analyst or a manager by using the model can understand the potentiality of a regional sector and its production flow in monetary or physical terms. This information can help the managers to take decisions in their investment projects.

A regional input-output model can assist in other studies by collecting and presenting regional data in analytically useful form. Especially, it is chosen as a main planning tool for regional development. On the other hand, a regional input-output model can be useful in the analysis of environmental and ecological problems in a region.

The purpose of this paper is to explain cross-industry and simple location quotient techniques in it construction of a regional input-output models.

2. Regional Interindustry Transactions Model

National and regional accounts show the final result of transactions or final products but interindustry transactions model shows intermediate transactions between sectors as well as final result. Analysis of the intermediate transactions and their relationship to the final result is the main purpose of the regional input-output analysis.

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The regional input-output trasactions model is outlined in Table 1. The model shows the fallowing properties.

a) It shows the destination of each regional sectors' output.
b) It shows the structure of the regional economy.
c) It determines the effects of specified changes in final demand upon gross output.
d) It can explain technical relationship between intermediate demand and final demand.

Table: 1
Simplified Regional Input-Output Transactions Model

Inputs \ Outputs		Selling Industrie				Local Final Demand			Exports	Total Outputs
		1	2	j	n	1	2	m		
		x_{11}	x_{12} ...	x_{ij}....	x_{1n}	y_{11}	y_{12} ..	y_{1m}	e_1	x_1
Purchasing	2	x_{21}	x_{22} ...	x_{2j}...	x_{2n}	y_{21}	y_{22} ..	y_{2m}	e_2	x_2
Industries	.	x_{i1}	x_{i2} ...	x_{ij} ...	x_{in}	y_{i1}	y_{i2} ..	y_{im}	e_i	x_i
	.	.	.	.	.	.	.	.	.	.
	.	.	.	.	.	.	.	.	.	.
	.	.	.	.	.	.	.	.	.	.
	n	x_{n1}	x_{n2} ...	x_{nj}..	x_{nn}	y_{n1}	y_{n2}	y_{nm}	e_n	x_n
Value added		v_1	v_2	v_j	v_n	u_1	u_2	u_m		
Imports		m_1	m_2	m_j ...	m_n	s_1	s_2	s_m		
Total Inputs		x_1	x_2	x_j	x_n	y_1	y_2	y_m		

Lets explain the symbol in Table 1.

x_i = Regional total sales of the selling industry (i)
x_{ij} = Regional gross flows or regionally processed inputs (i) used in industry (j)
m_j = Regional imports of commodity (j)
v_j = Regional value-added in industry (j)
y_{im} = Regional final demand of consuming industry (m)
y_i = Total regional final demand for commodity (i)
e_i = Regional exports of commodity (i)

Our regional Model is static and open. Hence, we can write regional input-output model by the fallowing equation.

$$\sum_{j=1}^{n} r_{ij}x_j + \sum_{j=1}^{m} y_{im} + e_i = x_i \qquad (i = 1, 2, 3, \ldots\ldots\ldots m)$$

The r_{ij} ise referred to as an regional input-output coefficient. The r_{ij} then becomes

$$r_{ij} = \frac{x_{ij}}{x_j}$$

To construct regional input-output model, we must estimate regional gross flows (x_{ij}), final demand (y_i), imports (m_j), outputs (x_i) and value added (v_j).

Location quotient techniques are useful for estimating regional interindustry transactions or coefficients by using national input-output models in conjunction with regional statistical data. The statistical data can be gross regional product, sectoral employment and sectoral production of a region for the study year[1].

3. Location-Quotient Techniques

Location quotient techniques for the construction of regional input-output models have been developed with the purpose of economizing cost, time and money. They are useful to adjust national input-output coefficients for regional input-output models. We should realize that unadjusted national input-output coefficients can not be used in regional studies. Because of the fallowing reasons:

a) There is industry mix problems and related question of product mix[2]. This means that regional sector may be different than national, therefore its input requirements pattern is different from national.

b) Regional propensity to import is higher than national propensity to import. Because the regional propensity to import includes import from other regions within the country and other countries but national propensity to import only includes import from other countries. Hence national trade coefficients will not be suitable to apply for regional trade studies.

c) There are differences in regional price level. When input-output transactions are expressed in monetary terms, price differences will be important.

Location quotient is a weighting quotient which requires a minimal amount of data, therefore it has become an attractive approach for those whose data base limited[3].

The Simple Location-Quotient Technique

The simple location quotient compares the relative importance of an industry in a region and its relative importance in the nation[4]. It is defined in its simplest form for industry (i) as fallows:

$$LQ_i = \frac{x_i/x}{X_i/X} = x_i \,.\, X/X_i \,.\, x$$

Where:

x_i = regional output of industry i

x = total regional output

X_i = National output of industry i

X = Total national output

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1 Ahmet Öztürk, Bölgesel Girdi-Çıktı Analizi ve Doğu Anadolu Bölgesine Uygulama (Regional Input-Output Analysis and its Application for Eastern Turkey), Bursa İktisadi ve Ticari İlimler Akademisi Yayın No: 26, Yargıçoğlu Matbaası, Ankara 1978, s. 28.

2 Harry W. Richardson, Input-Output and Regional Economics, Redwood Press Limited, Trowbridge, 1972, p. 113.

3 Tamer Kıraç, Formulating Regional Input-Output Models, A Case Study of Turkey, Master's Thesis, University of Washington, 1979, p. 14.

4 W. A. Schaffer and K. Chu, "Non-survey Techniques for Constructing Regional Interindustry Models" Papers, Regional Science Association, Vol. 23, 1969, p. 85.

If $LQ_i > 1$, the region is more specialized than the nation in the study industry or the exports some of industry's output i. In this case the national technical coefficient a_{ij} can be used as the proxy for the regional technical coefficient.

If $LQ_i = 1$, the region is self-sufficient in the study industry. In both case national input-output coefficient (a_{ij}) is assumed to the equal regional input-output coefficient (r_{ij}). That is,

$$\text{If} \quad LQ_i \geqslant 1$$

then

$$a_{ij} = r_{ij} \quad \text{and}$$

the regional interindustry gross flows x_{ij}, are computed as

$$x_{ij} = a_{ij} \,.\, X_j = r_{ij} \,.\, X_j = X_{ij} \,.\, \frac{x_j}{X_j}$$

X_{ij} is a national gross interindustry flows.

On the other hand, If $LQ_i < 1$, It is assumed that the importation of commodity i is needed to complement the regional requirement and regional input-output coefficient can be obtained by adjusting national input-output coefficient as such;

$$r_{ij} = a_{ij} \,.\, LQ_i$$

The inadequte regional supply i are estimated depend upon the identical national and regional technologies assumption[5].

So there will be no product or industry mix problems and regional import coefficients are going to be[6]

$$a_{ij} = r_{ij} + m^r_{ij}$$

$$m^r_{ij} = a_{ij} - r_{ij} \qquad \text{or} \qquad m^r_{ij} = a_{ij}\,(1 - LQ_i)$$

There is another method to estimate the regional import gross flows and import coefficient[7].

$$P_{ij} = a_{ij} + m^n_{ij}$$

Where:

P_{ij} = Pure technical coefficient

m^n_{ij} = national import coefficients

m^r_{ij} = $p_{ij} - r_{ij}$

5 S. Panitchpakdi A.C. Verster, Hunterston Potential for Industrial Development, Rotterdam, Netherlands Economic Institute Press, 1972, p. 9.

6 G.J.D. Hewings, "Regional Input-Output Models in the U.K: Some Problems and Prospects for the Use of Nonsurvey Techniques" Regional studies, Vol. 5. 1971, p. 13.

7 S. Panitchpakdi and A.C.P. Verster, op. cit., p. 9.

On the other hand, we can estimate final demand vectors as the regions shares of national final demand vectors[8].

$$y_{ij} = Y_{ij} \cdot y_i / Y_i$$

Where:

y_{ij} = Estimated regional demand for product i by industry j
y_i = Total regional final demand of industry j
Y_i = Total national final demand of industry j
Y_{ij} = National final demand for product i by industry j

Or

$$y_{ij} = Y_{ij} \cdot x/X$$

Then, the exports of industry i may be computed as a residual

$$e_i = x_i - \sum_{j=1}^{n} x_{ij} - \sum_{i=1}^{m} y_{im}$$

To insure success in using the simple location quotient technique, the regional industry structure must closely resemble the national structure.

Cross-Industry Quotient Technique

This quotient is defined as regional output of selling industry i to the national output of selling industry i, by means of this ratio divided by regional output of purchasing industry j to the national purchasing industry j. That is,

$$CIQ_{ij} = \frac{x_i/X_i}{x_j/X_j}$$

If $CIQ_{ij} \geqslant 1$, It means that regional selling industry (x_i) can meet all of the input required by regional purchasing industry (x_j). Therefore, national input-output coefficients can be applicable to the region without any adjustment and regional input requirements level is same as national level[9]. That is,

$r_{ij} = a_{ij}$ and regional gross flows (x_{ij}) are computed as;

$$x_{ij} = r_{ij} \cdot x_j = X_{ij} \cdot x_j/X_j$$

If $CIQ_{ij} < 1$, it means that regional selling industry (x_i) can not meet all of the input required by regional purchasing industry (x_j). Hence national technical coefficient is not representative of the region and regional technical coefficient is different than national. To find regional input-output coefficient of that industry, we should multiply CIQ_{ij} value of with the national input-output coefficient. That is,

$$r_{ij} = a_{ij} \cdot CIQ_{ij}$$

8 Schaffer and Chu, op. cit., p. 88.
9 Ahmet Öztürk, The Construction of Input-Output Tables for Antalya Region, Turkey, I.S.S., the Hague, 1973, p. 28.

If only if, cross industry-quotient is used in regional studies, the major diagonal industries of location value will be equal to one, but this equality express regionally produced input is sufficient in the study industry. It may not be true, because same of these diagonal regional industries may be less specialized than national industries. Even they can not meet regionally required input by purchasing industry. Therefore, to compute the major diagonal industries' location quotient value, simple location quotient technique may be more applicable.

As a conclusion cross-industry and simple location quotient techniques can be useful tool for constructing regional input-output models[10].

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10 If any reader is interested to construct regional input-output models by using these techniques he is suggested to consult the fallowing publications:
Ahmet Öztürk, Bölgesel Girdi-Çıktı Analizi ve Doğu Anadolu Bölgesine Uygulama, op. cit.
Ahmet Öztürk, The Construction of Regional Input-output Tables for Antalya Region, Turkey, op. cit.,
Tamer Kıraç, op. cit.