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Medical Tourism Industry in Kangwon Province and Its Economic Impacts on the Region

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Abstract This paper has two purposes. The first is to suggest the new and simple method to derive a regional input-output model from the national input-output table published by the Bank of Korea. The interregional input-output table has not been devised in spite of its potential use while the national table has been made every five years with the revised version during each five years. Second, this paper aims to derive Kangwon interregional input-output model from the national model using the regional supply proportion of industry and to analyze the effect of medical tourism industry on the regional economy of Kangwon Province. The paper measures, in particular, the effect of medical tourism industry on the financial self-sufficiency of Kangwon Province using the estimated output elasticity of tax revenue with the autoregressive distributed lag scheme ADL(1,1) in which the dependent variable and the single explanatory variable are each lagged once.

Key Words: interregional input-output model, the autoregressive distributed lag scheme, medical tourism industry, output elasticity of tax revenue

1. Introduction

Over the last quarter century Kangwon Province in Korea has recorded relatively low economic growth and thus has suffered from low financial self-sufficiency. Recently as a leading and strategic industry, Kangwon Province has chosen medical tourism sector which has grown rapidly over the last two decades and has fostered the local medical tourism industry with large financial support. Kangwon Province needs to make an effort to create more demand of medical tourism by developing a variety of medical tourism commodities and services, instead of depending on the natural increase in medical tourism demand. Under the above context this paper has two purposes. The first is to suggest the new and simple method to derive a regional input-output model from the national input-output table published by the Bank of Korea.

The interregional input-output table has not been devised despite its potential use while the national table has been made every five years with the revised version during each five years. Second, this paper aims to derive Kangwon interregional input-output model from the national model using the regional supply proportion of industry and to analyze the effect of medical tourism industry on the regional economy of Kangwon Province.[1] The

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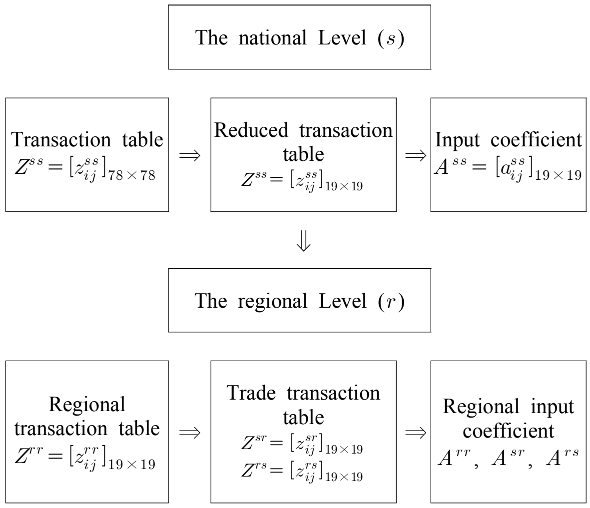
1] For derivation of interregional input-output model, see Flegg et. al.(1995)[1], Fletcher(1989)[2], and Miller and paper measures, in particular, the effect of medical tourism industry on the financial self-sufficiency of Kangwon Province using the estimated output elasticity of tax revenue with the autoregressive distributed lag model, in which the dependent variable and the single explanatory variable are each lagged once and suggests ways to promote its financial stability.

2. The Empirical Setup: The Inter- regional Input-Output Model

The single-regional input-output model has disadvantages not to recognize in operational way the connections between regions. In deriving the regional input-output model of Kangwon Province, we consider two-region economy model with which we can estimate the transactions between regions. The two regions indicate Kangwon Province and the rest of Korea denoted by r and s respectively. To derive the regional input-output table from the national table we follow the steps that are shown in <Fig. 1>.

First, the industries which do not exist in Kangwon Province are removed from the national transaction table(78×78) and the industries with very small output in the region are integrated. Then we have the reduced national transaction tables, Z^{ss} adjusted to the regional economy. Z^{ss} is a 19×19 matrix whose elements, z_{ij}^{ss} indicate the intra-regional transaction flows from sector i to sector j within the s region.

Blair(2009)[3]. The method to derive the regional input-output table in the paper is based on the previous studies: Miller(1969)[4], Richardson(1985)[5], Sasaki and Shibata(1984)[6], Morrison and Smith(1974)[7], Kang and Jeong(2003) [8], Kang et. al.(2011)[9], and Liu et. al.(2012, 2013)[10-11].



<Fig. 1> Derivation Steps for a Regional Input-Output Table

In the second stage a reduced input coefficient matrix could be derived from the adjusted national transaction table(Z^{ss}) using the definition of input coefficient matrix expressed in Eq.(1).

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

where A^{ss} is a 19×19 matrix whose elements, a_{ij}^{ss} indicate the intermediate goods flows from sector i to j within the s region. a_{ij}^{ss} is an input coefficient defined as $a_{ij}^{ss}=(z_{ij}^{ss}/x_{j}^{s})$. $\hat{X}^{s}$ is also a 19×19 diagonal matrix whose elements, x_i^s indicate the output of ith industry in the region s. Third, with Eq.(2) we multiply the reduced input coefficient matrix(19×19) by the industry outputs of region r which are published each year by the Bureau of Statistics and then we have the producer's transaction table for Kangwon Province.

$$Z^{rr}=A^{ss}(\hat{X}^{r})^{-1} \quad (2)$$

where $\hat{X}^{r}$ is also a 19×19 diagonal matrix whose elements, x_i^r indicate the output of ith industry in the r region. In the input-output model industrial output is composed of two parts. That is, the ith industry output produced in the region r can be divided into two parts:

$$X_i^r = \Sigma_j a_{ij}^{ss} x_j^r + f_i^r \quad (3)$$

where the first term on the right side indicates the magnitude of the ith industry used as intermediate goods for the production in region r and the second term f_i^r is the final demand of the ith industry in region r. Since we don't know the size f_i^r, the ratio of national final demand to output that is defined as Eq.(4) could be used to obtain the final demand f_i^r in region r.

$$f_i^r = x_i^r \times (f_i^s / x_i^s) \quad (4)$$

where f_i^s is the final demand of sector i in region s. x_i^r and x_i^s are the ith industry output in region r and s respectively. The equation(3) can be written in matrix form

$$X^r = A^{ss} X^r + F^r \quad (5)$$

where X^r is the 19×1 output vector in regions r and F^r is a 19×1 final demand vector in region r.[2]

When the output of ith industry subtracting its final demand is less than the amount of ith industry used for intermediate goods in region r, that is, $(x_i^r - f_i^r) - \Sigma_j a_{ij} x_j^r < 0$, the shortage is assumed to be imported into region r from region s. The imports of good i into r is defined as

$$m_i^r = \Sigma_j a_{ij}^{ss} x_j^r - (x_i^r - f_i^r) \quad (6)$$

Using Eq.(6) we can derive the industrial import in region r whose actual data are shown in <Table 1>. The equation(6) can be written in matrix form

$$M^r = (A^{ss} - I) X^r + F^r \quad (7)$$

where M^r is a 19×1 vector whose element m_i denotes the import of ith industry in region r.[3] Using Eq.(7) and industrial weights, we can construct import transaction table in region r.

$$Z^{sr} = A^{ss} \hat{M}^r (\hat{Z}^r)^{-1} \quad (8)$$

where Z^{sr} is a 19×19 diagonal matrix whose elements, z_{ij}^{sr} indicate the trade transaction flows from sector i of region s to sector j of region r. $\hat{M}^r$ is also a 19×19 diagonal matrix whose element, m_i^r indicates industrial imports of ith industry in the r region and $Z^r = A^{ss} X^r$. $(\hat{Z}^r)^{-1}$is a inverse matrix of the diagonal matrix $\hat{Z}^r$ whose diagonal elements are the same elements as Z^r.

When the output of ith industry subtracting its final demand exceeds the magnitude of ith industry used for intermediate goods in region r, that is, $(x_i^r - f_i^r) - \Sigma_j a_{ij} x_j^r > 0$, the surplus is assumed to be exported from region r to region s. The exports of the product of each sector i from r is defined as

$$e_i^r = \Sigma_j a_{ij}^{ss} x_j^r - (x_i^r - f_i^r) \quad (9)$$

Using Eq.(9) we can derive the industrial export in region r whose actual data are shown in <Table 1>. The equation(9) can be written in matrix form

$$E^r = (A^{ss} - I) X^r + F^r \quad (10)$$

where E^r is a 19×1 vector whose element e_i^r denotes the export of ith industry in the region r.[4]

2] The actual data for output and final demand vector are $(X^r)'$=[29,918 11536, ⋯, 31,478]′ and $(F^r)'$=[11,013 2,368, ⋯, 14,627]′ as shown in <Table 1>.

3] The actual data on imports is $(M^r)'$=[3,486 0 ⋯ 0] as shown in <Table 1>.

<Table 1> Statistics for Regional Input-Output Table in Kangwon Province

(unit: 100million Won)

	Industry	Output (X_i^r)	Final Demand (f_i^r)	$x_i^r - f_i^r$	$\Sigma_j a_{ij} X_j^r$	e_i	m_i	P_i^r
1	Agriculture, Forestry, Fishery	29,918	11,013	18,905	15,419	3,486	0	1.000
2	Mining	11,536	2,368	9,168	12,165	0	2,997	0.794
3	Food, Beverage	35,115	21,453	13,662	18,153	0	4,491	0.887
4	Textiles, Apparels	1,005	884	121	1,864	0	1,743	0.366
5	Wood and pulp, Printing	2,400	279	2,121	6,485	0	4,364	0.355
6	Chemical and rubber products	9,271	3,590	5,681	38,076	0	32,394	0.223
7	Nonmetallic mineral products	33,249	2,542	30,707	13,008	17,699	0	1.000
8	Metallic products	6,567	1,185	5,382	14,779	0	9,396	0.411
9	Machinery, Electrical equipment	20,581	13,400	7,182	34,992	0	27,810	0.425
10	Other transportation equipment	12,093	8,818	3,275	9,371	0	6,096	0.665
11	Other manufactured product	662	425	236	2,140	0	1,903	0.258
12	Electricity, Gas	16,209	16,209	12,196	11,077	1,119	0	1.000
13	Construction	70,780	70,780	4,370	2,885	1,485	0	1.000
14	Wholesale, retail, accommodation	60,015	60,015	26,104	22,605	3,499	0	1.000
15	Transportation, Communication	44,898	44,898	21,813	25,929	0	4,116	0.916
16	Finance and real estate	52,859	23,947	28,913	47,324	0	18,411	0.742
17	Public administration, Education	102,004	102,923	-919	741	0	1,659	0.984
18	Medical and health services	20,310	17,691	2,619	2,841	0	222	0.989
19	Other services	31,478	14,627	16,851	18,766	0	1,915	0.943
	Total	560,951	417,047	208,387	298,618	27,288	117,517	-

Source: 『Yearly Statistics for Kangwon Province』 2011, Kangwon-Do.

Using Eq.(10) and industrial weights, we can construct a transaction table for exports in region r.

$$Z^{rs} = A^{ss}\hat{E}^{r}(\hat{Z}^{r})^{-1} \qquad (11)$$

where Z^{rs} is a 19×19 diagonal matrix whose elements, z_{ij}^{rs} indicate the trade transaction flows from sector i in region r to sector in j region s. $\hat{E}^{r}$ is also a 19×19 diagonal matrix whose element, e_i^r indicates industrial imports of ith industry in the r region and $Z^r = A^{ss}X^r$. $(\hat{Z}^{r})^{-1}$ is a inverse matrix of the diagonal matrix $\hat{Z}^{r}$ whose element is the element of Z^r.

Finally, in order to derive the input coefficient matrix in region r in Eq.(12), we premultiply the input coefficient matrix for region s by the supply proportion matrix $\hat{P}$ whose diagonal elements are the same ones as P^r.[5] The regional supply proportion of industry i p_i^r means the proportion of the total amount of good i available in region r that are produced in region r.[6]

$$A^{rr} = \hat{P}A^{ss} \qquad (12)$$

where A^{rr} is a 19×19 input a coefficient matrix whose element, a_{ij}^{rr} indicates the intermediate goods flows from sector i to j within region r. Using Eqs.(8) and (11) we can derive the import and export coefficient matrix by postmultiplying the trade transaction matrix Z^{sr} and Z^{rs} by $(\hat{X}^{r})^{-1}$

4] The data on export is $(E^r)'$=[0 2,997 0 ⋯ 1,915]′ as shown in <Table 1>.

5] Some studies have used the LQIndex for the regional weight. However it is more desirable to use the regional supply proportion(p_i^r) as the correlation coefficients of p_i^r and LQIndex with industrial import coefficient show -0.39 and -0.83 respectively.

6] We denote the regional supply proportion of industry i by p_i^r where $p_i^r = (x_i^r - e_i^r)/(x_i^r - e_i^r + m_i^r)$. The data on P^r is $(E^r)'$=[1.000 0.794 ⋯ 0.943]′ as shown in <Table 1>.

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

$$A^{rs} = Z^{rs}(\hat{X}^{r})^{-1} \quad (14)$$

where A^{sr} is a 19×19 import coefficient matrix whose elements, a_{ij}^{sr} indicate the intermediate goods flows from sector i for region s.to sector j for region r. A^{rs} is also a 19×19 export coefficient matrix whose elements, a_{ij}^{rs} indicate the intermediate goods flows from sector i of region r to sector j in region s. $\hat{X}^{r}$ is also a 19×19 diagonal matrix whose elements, x_i^r indicate the output of ith industry in the r region.

3. The Results: The Regional Input-Output Model

<Table 2> summarizes the intermediate input coefficient matrix, import coefficient matrix, and value added coefficient in Kangwon Province that we derived from the national input-output table through the steps depicted in <Fig. 1>.

The intermediate input coefficient for industry j, $\Sigma_i a_{ij}^{rr}$ indicates an industrial column summation in the regional 19×19 input coefficient matrix(A^{rr}). The industry jth import coefficient, $\Sigma_i a_{ij}^{sr}$ indicates an industrial column summation in the regional 19×19 import coefficient matrix(A^{sr}). The value added coefficient in industry j can be defined as the formula

$$v_j^a = 1 - \Sigma_i a_{ij}^{rr} - \Sigma_i a_{ij}^{sr} \quad (15)$$

<Table 2> shows that the manufacturing industries generally have higher values in intermediate input and import coefficient than the service industries. For example, Food & Beverage and nonmetallic products indicate the large values 0.6079 and 0.4733 in intermediate input coefficient respectively while the industry average value is 0.3320. In import coefficient Textiles & Apparels and Machinery & Electrical equipment represent relatively higher values, 0.4816 and 0.4952 respectively in comparison with the industry average value 0.2892.

On the other hand Agriculture and Mining sector shows 0.5264 and 0.6069 in value-added coefficient respectively. Also, Finance & Real estate and Public Administration & Education indicate high values, 0.6378 and 0.7205 respectively. Then the service industries are proved to have higher values in value-added coefficient than the manufacturing sector. These high values in value-added coefficient for service sector reflect the lower intermediate input coefficient for the same sector as shown in Eq.(15).

Wholesale · retail & accommodation, the first component of medical tourism sector shows 0.3548 in input coefficient, 0.1430 in import coefficient, and 0.5022 in value-added respectively. It's import coefficient(0.1430) proved to be less than industry average 0.3320 while its input and value-added coefficients(0.3584 and 0.5022) are shown to be higher than industry averages 0.3320 and 0.3789 respectively. The second component of medical tourism sector, medical and health service expresses 0.2174 for input coefficient, 0.2258 for import coefficient, and 0.5568 for value-added respectively. It's intermediate input and import coefficient(0.2174 and 0.2258) are shown to be less than industry averages 0.3320 and 0.2892 respectively while its value-added coefficient(0.5568) is higher than industry average 0.3789.

In <Table 2> the last 4 columns summarize industrial regional supply proportion(p_i^r), industrial LQIndex, and regional and national income multiplier. The p_i^r and LQIndex in manufacturing industries are shown to be much lower than the industry averages, 0.735 and 2.21 respectively except food & beverage(0.887 and 2.27) and nonmetallic mineral products(1.000 and 5.41). High values in nonmetallic mineral products reflect the fact that most of cement manufacturing in Korea has been done in Kangwon Province. On the other hand service industries show the high regional supply proportion p_i^r close to one and high industrial LQ Index that is greater than one, except finance and real estate. Examining the relationships among industrial p_i^r, industrial LQIndex, and import coefficient, we found that the correlation coefficient between p_i^r and LQIndex is 0.29. The correlation coefficients of p_i^r and LQIndex with industrial import coefficient are shown to be -0.89 and -0.39 respectively. These results are consistent with the theoretical expectation that it reflects the negative relationship between regional self-sufficiency and imports for intermediate goods. As shown in the last two columns of <Table 2>, for the industrial income multiplier, called the Leontief multiplier[5], the region has much lower values than those in the nation. The regional and national average value is 1.52 and 2.78 respectively. These lower multipliers imply that the industries in the Kangwon-Do have not been developed enough for industries to have interdependence among them.

<Table 3> summarizes the structural properties on medical tourism sector in terms of the regional coefficients and indexes. Medical tourism sector includes two industries: Wholesale・retail & food・accommodation and Medical and health services.

Medical tourism sector shows 0.3202 in input coefficient close to industry average, low import coefficient(0.1639) less than average, and 0.5160 in value-added much higher than industry average respectively. The p_i^r and LQIndex in medical tourism are shown to be 0.997 and 1.34 respectively enough to reach the level of self-sufficiency. The

<Table 2> Industrial Coefficients, LQ Index and Income Multiplier in Kangwon Province

	Industry	Intermediate input coefficient	Import coefficient	Value added coefficient	P_i^r	LQ Index	Income Multiplier	
							Kangwon	*National*
1	Agriculture, Forestry, Fishery	0.2964	0.1772	0.5264	1.000	3.15	1.52	2.32
2	Mining	0.2180	0.1751	0.6069	0.794	17.59	1.34	2.12
3	Food, Beverage	0.6079	0.1370	0.2551	0.887	2.27	1.99	2.91
4	Textiles, Apparels	0.2231	0.4816	0.2953	0.366	0.11	1.35	3.02
5	Wood and pulp, Printing	0.3271	0.3846	0.2883	0.355	0.37	1.51	3.05
6	Chemical and rubber products	0.3490	0.4480	0.2030	0.223	0.14	1.50	3.19
7	Nonmetallic mineral products	0.4733	0.2218	0.3049	1.000	5.41	1.76	2.92
8	Metallic products	0.3792	0.4588	0.1621	0.411	0.17	1.59	3.95
9	Machinery, Electrical equipment	0.2697	0.4952	0.2352	0.425	0.21	1.41	3.49
10	Other transportation equipment	0.2705	0.4862	0.2434	0.665	0.32	1.40	3.54
11	Other manufactured product	0.2464	0.4774	0.2762	0.258	0.20	1.38	3.23
12	Electricity, Gas	0.5084	0.1913	0.3003	1.000	1.17	1.76	2.70
13	Construction	0.2887	0.3114	0.3999	1.000	2.09	1.46	2.85
14	Wholesale, retail, accommodation	0.3548	0.1430	0.5022	1.000	1.39	1.59	2.27
15	Transportation, Communication	0.3475	0.2637	0.3888	0.916	1.42	1.55	2.63
16	Finance and real estate	0.2405	0.1217	0.6378	0.742	0.72	1.36	1.84
17	Public administration and Education	0.1775	0.1019	0.7205	0.984	3.17	1.29	1.75
18	Medical and health services	0.2174	0.2258	0.5568	0.989	1.20	1.34	2.23
19	Other services	0.5118	0.1930	0.2952	0.943	1.30	1.84	2.83
	Industry Average	0.3320	0.2892	0.3789	0.735	2.21	1.52	2.78

Sources: National income multipliers are derived from $(I-A^{ss})^{-1}$

<Table 3> Structural Properties on the Medical Tourism Sector

(Million Won, %)

Industries	Intermediate input coefficient	Import Coefficient	Value added Coefficient	P_i^r	LQ Index	Income Multiplier
Wholesale, retail and Food, accommodation	0.3548	0.1430	0.5022	1.000	1.39	1.59
Medical and health services	0.2174	0.2258	0.5568	0.989	1.20	1.34
Medical Tourism	0.3201	0.1639	0.5160	0.997	1.34	1.53
Industry Average	0.3320	0.2890	0.3789	0.735	2.21	1.52

Source: 「Yearly Statistics for Kangwon Province」 Kangwon-Do

income multiplier in medical tourism is shown to be 1.53 almost the same as industry average 1.52.

4. Financial Self-sufficiency in Kang won Province.

Over the last 30 years the Korean economy has remarkably achieved a rapid economic growth. The rapid growth, however, has resulted in side effects such as disparities in region, industry, and income distribution. Until a recent date Kangwon Province has been the region mostly neglected from income growth, industrial growth and regional development. <Table 4> shows that Kangwon economy has grown slowly in comparison with Korean economic growth.

During the period of 2001-2010 the annual average growth rate for Kangwon Province is 3.24% less than the national level rate, 4.67%. And average GRP ratio to national level is 2.61%, its population ratio being 3.06%, which reflects the lower labour productivity in Kangwon Province. This poor performance in Kangwon economy has resulted in the lower financial self-sufficiency in

<Table 4> Gross Regional Product and Financial Selfsufficiency

(unit: billion Won, %)

Year	GDP Nation (A)	Growth rate	GRP Kangwon (B)	Growth rate	GRP Ratio to Nation (B/A)	Population Ratio to Nation (%)	Financial Self-sufficiency	
							National	*Kangwon*
2001	718,652	3.86	20,099	1.74	2.80	3.12	58.9	31.3
2002	778,485	8.00	21,363	6.10	2.74	3.10	57.5	24.3
2003	806,524	3.54	22,828	6.63	2.83	3.09	56.5	44.1
2004	834,771	3.44	22,830	0.01	2.73	3.08	56.1	48.8
2005	869,305	4.05	23,015	0.81	2.65	3.10	56.2	38.0
2006	914,018	5.02	24,155	4.84	2.64	3.07	54.4	28.0
2007	965,298	5.46	25,300	4.63	2.62	3.05	53.6	46.0
2008	991,677	2.70	25,530	0.90	2.57	3.05	53.9	35.1
2009	999,311	0.77	25,360	-0.67	2.54	3.04	54.8	32.0
2010	1,067,218	6.57	26,431	4.14	2.48	3.02	54.1	29.5
annual average	876,066	4.67	23,333	3.24	2.68	3.07%	55.6	35.7

Source: 「Yearly Statistics for Kangwon Province」 Kangwon-Do

Kangwon Province, that is 35.7% far less than the national level, 55.6%.

<Table 5> represents the industrial structure in Kangwon Province and national level in terms of industrial production in 2010. As shown in <Table 5>, the Kangwon economy depends heavily on the service sector, as manufacturing and service industry account for 14.0% and 80.9% in the regional production respectively.

<Table 5> The Industrial Structure in Kangwon Do

(unit: billion Won, %)

Industries	Kangwon Production	Ratio to Total (%)	National Production	Industry Ratio to Total (%)
Agriculture	1,331	5.1	27,312	2.6
Manufacturing	3,682	14.0	319,813	30.3
Service	21,242	80.9	707,104	67.1
Total	26,559	100.0	1,054,229	100.0
Medical Tourism	3,759	14.3	-	-

Source: 「Yearly Statistics for Kangwon Province」, 2011, Kangwon-Do

On the other hand the national ratios indicate 30.3% in manufacturing industry and 67.1% in service industry. Medical tourism, which consists of wholesale & retail trade, food & accommodation, and medical & health services accounts for 14.3%, a little bit greater than the manufacturing 14.0%. This industrial structure suggests that for the regional development we have to focus on service industry such as the medical tourism based on the natural environment and comparative advantage.

5. Economic Impacts of Medical Tourism on the Regional Economy

<Table 6> indicates the actual time series data for the budget, financial self-sufficiency, and medical tourism revenue in Kangwon Province over the period of 1970-2010.

In order to evaluate the impacts of medical tourism on the financial self-sufficiency in the region, first we have to find out the relationship between local tax revenue and regional production. The relationship can be expressed as the output elasticity of tax revenue which measures the percentage change in tax revenue caused by the percentage change in output. To estimate the output elasticity of tax revenue we specify the autoregressive distributed lag scheme in which the dependent variable and the single explanatory variable are each lagged once.

$$y_t = m + \alpha_1 y_{t-1} + \beta_0 x_t + \beta_1 x_{t-1} + \epsilon_t \qquad (16)$$

where ϵ_t is presumed to be white noise. In the static equilibrium Eq.(17) becomes

$$y^* = a + \gamma x^* \qquad (17)$$

where $a = m/(1-\alpha_1)$ and $\gamma = (\beta_0 + \beta_1)/(1-\alpha_1)$ which denotes the long-run effect of a unit change in x_t, that is, the output elasticity of tax revenue. The parameters in Eq.(16) could be estimated by running OLS regression of y_t on y_{t-1}, x_t, and x_{t-1}. Then we could derive the estimate γ from the estimates α_1, β_0, and β_1. The estimation result is

$$\underset{}{Tax_t} = \underset{(-0.798)}{-0.688} + \underset{(10.03)}{0.855}\, Tax_{t-1} + \underset{(0.582)}{0.404}\, Output_t \underset{(-0.341)}{-0.225}\, Output_{t-1}$$

$$R^2 = 0.979 \quad D.W.-stat = 2.482$$
$$(\ )\ denotes\ t-value. \qquad (18)$$

Let γ_1 denote by output elasticity of tax revenue. γ_1 is calculated to be 1.2329 from estimated coefficients in Eq.(18). Then we get the information that 1% increase in regional production results in 1.2329% increase in local tax revenue.

<Table 6> Financial Self-sufficiency and Medical Tourism

(unit: billion Won, %)

Year	Expenditure	Tax Revenue	Nontax Revenue	Financial Self-sufficiency (%)	Medical Tourism Revenue
1970	9.9	0.6	0.8	14.9	1.0
1975	31.3	3.3	3.4	21.3	7.1
1980	142.2	15.8	8.5	17.0	32.6
1985	333.7	14.2	33.7	14.4	64.1
1990	1,280.5	80.5	85.9	13.0	155.9
1995	2,199.1	364.7	251.2	28.0	432.0
2000	4,307.8	498.1	1,168.6	38.7	591.3
2005	7,247.9	889.3	1,866.5	38.0	868.9
2010	9,369.0	1,222.5	1,542.5	29.5	1,132.1

In the same method, we could estimate the relationship between tax revenue and financial self-sufficiency, that is the tax revenue elasticity of financial self-sufficiency which measures the percentage change in financial self-sufficiency caused by the percentage change in tax revenue. The estimation result is

$$\begin{aligned} FS_t = & \ 1.701 + 0.298 FS_{t-1} + 0.273 Tax_t \\ & (3.756) \quad (1.895) \qquad (1.954) \\ & - 0.185 Tax_{t-1} \\ & (-1.296) \\ & R^2 = 0.53 \quad D.W. - stat = 1.801 \\ & (\ )\ denotes\ t-value. \end{aligned} \tag{19}$$

Let γ_2 denote by the tax revenue elasticity of financial self-sufficiency. γ_2 is 0.1254 that is derived from estimated coefficients in Eq.(19). Then we could say that 1% increase in local tax revenue leads to 0.1254% increase in local tax revenue.

<Table 7> describes the economic effects of medical tourism industry on Kangwon Province. Thus 1 percent increase in final demand for medical tourism leads to 0.2188 percent increase in regional output because the Leontief multiplier[12] and industrial output ratio are 1.53 and 14.3% respectively. Then 0.2188 percent increase in regional output could result in 0.2698 percent increase in local tax revenue increase with γ_1 being 1.2329. which, in turn, leads to 0.0341 percent increase in local financial self-sufficiency with being multiplied by γ_2(0.1254).

<Table 7> Medical Tourism and its Impacts on the Region

Δ(final demand)	Δ(output)	Δ(tax revenue)	Δ(financial self-sufficiency)
1.0000 %	0.2188 %	0.2698 %	0.0341 %

From the past data on medical tourism output it is generally proved that tourism has grown, in average, at the annual rate 4.7%. Thus we may conclude that medical tourism is estimated to improve local financial self-sufficiency by 0.1603% annually.

6. Concluding Remarks

This paper aims to derive Kwangwon interregional input-output model from the national model using the regional supply proportion of industry and to analyze the effect of medical tourism industry on the regional economy of Kangwon Province. The paper measures, in particular, the effect of medical tourism industry on the financial self-sufficiency of Kangwon Province using the estimated output elasticity of tax revenue with the autoregressive distributed lag scheme ADL(1,1). Empirical results are summarized as the followings.

First, Medical tourism sector shows 0.3202 in input coefficient close to industry average, low import coefficient(0.1639) less than average, and 0.5160 in value-added much higher than industry average respectively. The p_i^r and LQ Index in medical tourism are shown to be 0.997 and 1.34 respectively enough to reach the level of self-sufficiency. The income multiplier in medical tourism is 1.53 almost the same as industry average 1.52.

Second, one percent increase in final demand for medical tourism leads to 0.2188 percent increase in regional output because the Leontief multiplier and industrial output ratio are 1.53 and 14.3% respectively Then 0.2188 percent increase in regional output could result in 0.2698 percent increase in local tax revenue increase with γ_1 being 1.2329. which, in turn, leads to 0.0341 percent increase in local financial self-sufficiency with being multiplied by γ_2(0.1264). From the past data on medical tourism output it is generally proved that tourism has grown, in average, at the annual rate 4.7%. Thus we may conclude that medical tourism is estimated to improve local financial self-sufficiency by 0.1603% annually.

Kangwon Province needs to make an effort to create more demand of medical tourism by developing a variety of medical tourism commodities and services, instead of depending on the natural increase in medical tourism demand.

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