An Interregional Input-Output Table of Mie Prefecture, Japan: Estimation and Applications[1]

By
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Abstract

We will attempt to estimate an interregional input-output table of Mie Prefecture for 1985, which consists of five subregions. Combining this table and the national table of the same year, we will compile a nation-wide interregional input-output table. We will show two applications: one to evaluate the effects of public investment by a local government, and the other to evaluate the effects of the nuclear power station planned in the prefecture. We can observe some regional characteristics in both cases.

1. Introduction

In Japan, many input-output tables have been estimated for both national and regional economies. National input-output tables have been compiled every five years beginning in 1950 by the Management and Coordination Agency and other related Ministries cooperatively, and also interregional input-output tables for nine regions covering the whole of Japan have been estimated by MITI. In addition, local governments now produce estimations of their own input-output tables in almost all prefectures and some large cities. Regions defined in such estimations are usually administrative units because of data availability and the policy-oriented use of the tables. However, each table should be suited to its own specific analytical purposes.

There have been some attempts to disaggregate the area of a prefecture into several subregions and to estimate some kind of interregional input-output table to capture interregional interdependences among them. One example is a table for Ehime Prefecture, 1988, and another is for Hokkaido Prefecture, 1985[2]. In this paper, we will present an interregional input-output table for Mie Prefecture, 1985, in which the interdependence of subregions in the prefecture will be indicated.

Mie Prefecture is located almost at the center of Honshu Island in Japan (See Figure 1). Its population was about 1.8 million persons in 1990, or 1.5 percent of the Japanese population. The value of its production was 4,505 billion yen in 1990, which

Manuscript received May 13, 1996. Revised November 19, 1996.
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[1] The author thanks the anonymous referee for useful comments and suggestions.

[2] Tsubouchi (1991) discussed the estimation of Ehime Prefecture's input-output table, and Takahata (1992) introduced the input-output table of Hokkaido Prefecture.

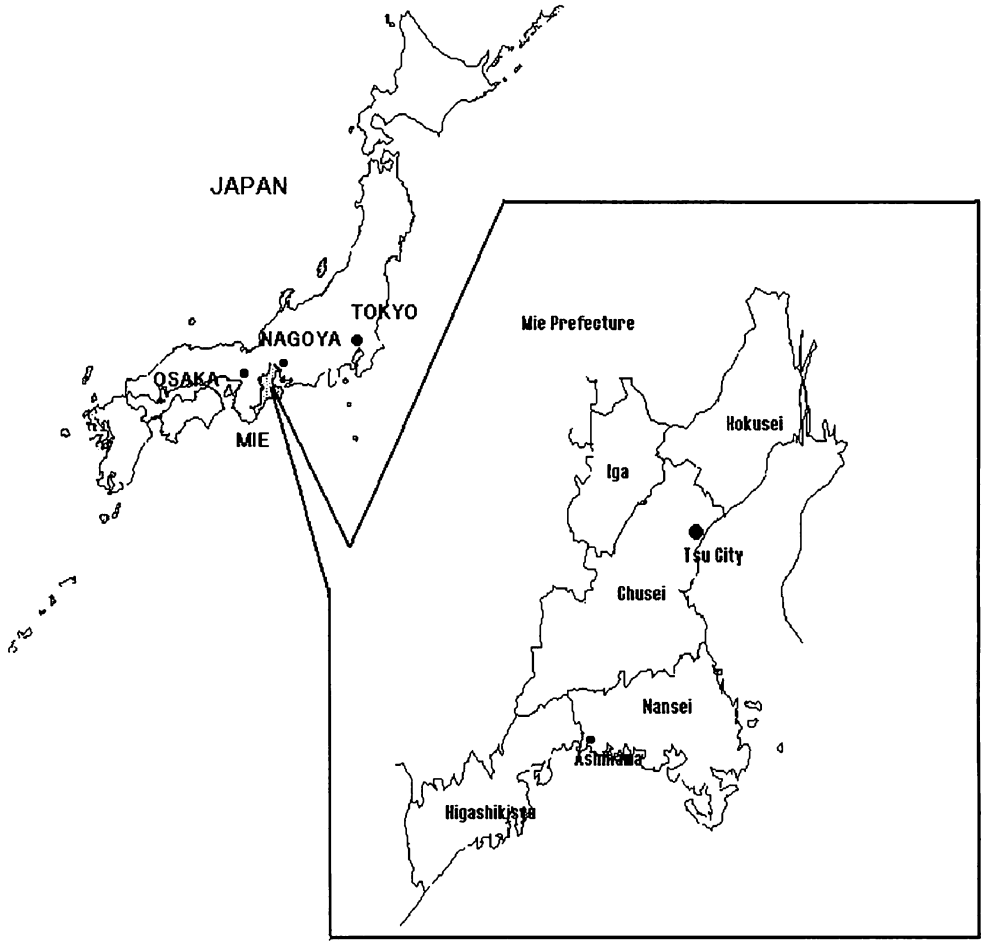

Figure 1: Location of Mie Prefecture

was about 1.1 percent of the Japanese GDP. There are five areas in the prefecture: Hokusei, Chusei, Nansei, Iga, and Higashikisyu. The Hokusei area in the northern part of the prefecture is characterized as the industrial area, in which many chemical and machinery industries are located. These industries have been leading the growth of the local economy. The Chusei area in the central part is regarded as the administrative functioning area where Tsu City, the capital of the prefecture, is located. However, the relative weakness of industrial competitiveness in the Chusei area has prompted it to seek out ways to promote some high-technology industries. The Iga area in the northwestern part has played a historically important role culturally and socially in connection with the Kansai Metropolitan Area, and now the population of this area is

growing as a bed town of the Kansai area. The Nansei area and the Higashikisyu area in the southern part of the prefecture are characterized by many natural and historical sightseeing resources, such as Ise-Shima National Park and the Isejingu Shrine. Though a large number of tourists visit these areas, especially from the Kansai and Chubu regions, every year, they strongly require regional development assistance because they have many depopulated areas.

Combining the 1985 input-output table of Mie Prefecture and the national table, we can estimate a nation-wide interregional input-output table for six subregions: the Hokusei area, Chusei area, Nansei area, Iga area, Higashikisyu area, and the rest of the nation[3]. We will discuss the method of estimation and analyze the interdependence among the regions in the sections 2 and 3, respectively. In section 4, we will show two applications of this table: one to evaluate the effects of the nuclear power station planned in the Nansei area.

2. Method of Estimation

In this section, we will discuss the method used to estimate the interregional input-output table from the 1985 table of Mie Prefecture with 84 sectors. The method is divided into four steps. To start with, we will disaggregate a prefectural table into five tables for each subregion. Second, we will estimate interregional commodity flows among the subregions. Then data relating to the rest of Japan will be compiled. Finally, all the tables will be combined into one interregional table using the information on commodity flows.

2.1. Spatial Disaggregation in the Prefecture

First, we disaggregate a production vector of the prefecture into five vectors, one for each subregion, using available regional statistics. For example, the sales of manufacturing sectors can be compiled for the five subregions in each sector from the Manufacturing Census Statistics. Then we can divide the production of the prefecture into each subregion's vector by the ratio of the subregion's sales value to the prefecture's vector. Assuming the equality of the input coefficients and value-added coefficients among the subregions for each sector, we can determine the subregional input vector and value-added vector by multiplying the subregional value of production by the same coefficients.

The way to disaggregate final demand vectors is as follows. In respect to consumption expenditure outside households, the contribution to final demand is the same as the summation of consumption expenditure outside households in the value-

[3] The Hokusei and Iga areas are located in the northern part of Mie Prefecture, and the central part is called the Chusei area. The Nansei and Higashikisyu areas belong to the southern part of the prefecture.

added sectors, whose values we have estimated for each subregion. So we can derive the column vector by multiplying this summation value by the average share coefficients, which are assumed to be the same for each region.

The consumption expenditures of households are estimated using Farm Census Statistics and Family Expenditure Survey Statistics. We can determine the expenditure values of both the average farm family and the average non-farm family by surveying 10 items: food, housing, clothing, electricity and fuel, education, etc. These values are for the prefecture. However, data on the numbers of farm and non-farm families is available for each subregion. Then we can calculate the values of expenditures on the 10 items for each subregion by multiplying the average expenditures by number of families. Using this information, we can derive the vector of household consumption expenditures for each subregion.

Only seven sectors have non-zero values for the vector of general government consumption: water supply, sanitary services, transport, public administration, education, research, and health and social insurance. The value of the education sector is calculated according to the share of the regional number of teachers and other school staff. The value of health and social insurance is spatially disaggregated using hospital numbers. Other values are determined according to the regional share of current expenditures of local governments located in each subregion.

In the case of gross domestic fixed capital formation, the investment demand of the construction and public engineering sectors is the same as the production of those sectors, which we have already estimated for each subregion. Using this information, we can divide the values of the other sectors into five subregions. To disaggregate the vector of the increase of stocks, we use the regional share of the sum of the intermediate demand and final demand that appear so far.

With exports and imports, both international and interprefectural, we can derive regional vectors assuming that export-output ratios are the same among all subregions and that import coefficients, which are the ratio of import to total internal demands, are also the same.

After some adjustments for inconsistencies between sectors, we get an input-output table of 84 sectors for each subregion, from which we can observe some characteristics of regional structures and trade balances, both international and interprefectural, some of which will be described in the next section.

2.2. Commodity Flows among Subregions

Data about commodity flows between prefectures, which is surveyed by the Ministry of Transport, is available, whereas there are few such statistics for subregions in prefectures. Fortunately, we can get information about commodity flows among subregions in Mie Prefecture from 1992 survey data. This survey data shows commodity flows among the five subregions in Mie Prefecture already defined. The data is compiled from 268 manufacturing and wholesale and retail trade companies and 31 transportation companies. The reported values, as a whole, cover about 5 percent of the total volume of commodity flows in Mie Prefecture. We can use this information to compile interregional commodity flow tables by sector in spite of the

Table 1 : The Matrix of Interregional Commodity Flows

	Mie Prefecture						
	Hokusei	Chusei	Nansei	Iga	Higashikisyu	Outside the Region	Production
Mie Prefecture							
Hokusei	T_{11}	T_{12}	T_{13}	T_{14}	T_{15}	E_1	X_1
Chusei	T_{21}	T_{22}	T_{23}	T_{24}	T_{25}	E_2	X_2
Nansei	T_{31}	T_{32}	T_{33}	T_{34}	T_{35}	E_3	X_3
Iga	T_{41}	T_{42}	T_{43}	T_{44}	T_{45}	E_4	X_4
Hokusei	T_{51}	T_{52}	T_{53}	T_{54}	T_{55}	E_5	X_5
Outside the Region	M_1	M_2	M_3	M_4	M_5	X_{oo}	X_o
Total Demand	D_1	D_2	D_3	D_4	D_5	D_o	

difference in years between statistics: the input-output table is for 1985 and the survey data of commodity flows is for 1992.

We will now explain the method of estimation of commodity flows among the subregions in the prefecture. First, since the survey data on commodity flows in the prefecture is tonnage based, we should convert the data from a tonnage base to a monetary base. Each company reported sales volumes of their own establishments in one subregion that were delivered to other regions on a tonnage base and total values on a monetary base. So we can derive sales from each establishment in a subregion on a monetary base, multiplying the total sales values by the regional share of volume distribution for each establishment. Commodity flow matrices for the five subregions are made by summing up each establishment's data. These matrices are prepared for the manufacturing, heavy industry, light industry, wholesale and retail trade, and transportation sectors.

This matrix data gives us the information to estimate interregional commodity flows for 84 sectors in 1985. Table 1 illustrates the interregional relationship of commodity flows for one sector. T_{ij} represents the value of commodity flows from subregion i to subregion j in the prefecture. E_i illustrates the value of exports from subregion i to outside the prefecture. M_i is the value of imports for subregion i from outside the prefecture. X_i represents the production of subregion i, and D_i the total demand of subregion i. We can get all the values except T_{ij} from the 1985 table of estimation for each subregion.

Given the data on subregion i's supply to the prefecture, $S_i = X_i - E_i$, and given subregion j's demand within the prefecture, $DD_j = D_j - M_j$, we can estimate T_{ij} consistently for each sector by the RAS iterative method using the export rate, using the above survey data as the initial value.

2.3. Outside the Prefecture

To create a nation-wide interregional input-output table, we must prepare a table of the outer region. This table can be easily estimated from the national table and the Mie

Table 2: Estimated Input-Output Table, 1985

Unit:Billion Yen

Intermediate Demands

	Hokusei	Chusei	Nansei	Iga	Higashikisyu	Rest of Japan	Total
Hokusei	1367.2	120.8	64.0	41.1	9.4	1889.7	3492.2
Chusei	167.3	446.3	38.2	20.1	6.7	402.2	1080.9
Nansei	82.7	19.3	227.1	5.5	6.6	247.4	588.6
Iga	25.4	10.1	7.7	149.0	3.5	192.8	388.5
Higashikisyu	20.9	10.9	11.3	2.4	88.4	142.3	276.1
Rest of Japan	1880.4	510.3	316.9	203.8	138.9	339462.0	342512.3
Total	3543.9	1117.7	665.2	421.9	253.6	342336.4	348338.6
Value Added	2278.3	1164.7	681.5	369.4	208.4	325504.0	330206.3
Output	5822.2	2282.4	1346.7	791.3	462.0	667840.0	678544.6

Final Demands, Domestic

	Hokusei	Chusei	Nansei	Iga	Higashikisyu	Rest of Japan	Total
Hokusei	953.6	74.3	38.2	13.8	12.5	714.1	1806.4
Chusei	74.1	704.6	24.1	10.4	9.2	261.4	1083.8
Nansei	59.5	25.6	329.3	5.9	7.8	259.6	687.6
Iga	12.4	9.0	4.2	219.0	3.1	108.1	355.7
Higashikisyu	2.6	1.8	2.7	0.2	128.0	47.7	183.0
Rest of Japan	507.0	315.5	174.9	100.6	73.1	314992.0	316163.0
Total	1609.2	1130.7	573.3	349.8	233.7	316382.8	320279.5

	Export	Import	Output
Hokusei	605.1	81.5	5822.2
Chusei	153.5	35.7	2282.4
Nansei	90.3	19.9	1346.7
Iga	59.0	11.9	791.3
Higashikisyu	12.2	9.3	462.0
Rest of Japan	46625.0	37460.0	667840.0
Total	47545.0	37618.3	678544.6

Prefecture table, because the outer region is defined as the remaining part of Japan after subtracting Mie Prefecture.

The trade data between Mie Prefecture and the outer region can be obtained from the table of Mie Prefecture. We have already disaggregated the internal trade data into five subregions within the prefecture. Then we can create commodity flow matrices for all regions sector by sector.

2.4. Integration into a Nation-wide Interregional Input-Output Table

We can estimate a nation-wide interregional input-output table by combining input-output tables for each region and commodity trade flow matrices sector by sector. We do this assuming that the import share td_{ij}, which is the ratio of either T_{ij} to D_j or

Table 3: Output by Sector in Mie Prefecture

Unit: %, Billion Yen

Sectors	Mie, total	Hokusei	Chusei	Nansei	Iga	Higashikishu
1)Agriculture, forestry and fishery	3.20	0.70	0.77	1.10	0.29	0.35
2)Mining	0.07	0.03	0.02	0.01	0.01	0.01
3)Food production	4.30	2.22	1.19	0.44	0.34	0.10
4)Textile products	2.22	1.23	0.55	0.22	0.17	0.05
5)Pulp, paper and wooden products	2.34	0.56	0.51	0.11	0.29	0.88
6)Chemical products	8.55	8.16	0.03	0.07	0.29	0.00
7)Petroleum refinery and coal products	4.85	4.18	0.00	0.00	0.00	0.67
8)Ceramic, stone and clay products	2.84	1.02	1.23	0.12	0.42	0.06
9)Steel	1.00	0.87	0.07	0.02	0.04	0.00
10)Non-ferrous metal	1.44	1.38	0.01	0.01	0.04	0.00
11)Metal products	1.75	0.94	0.33	0.23	0.22	0.01
12)General machinery	4.43	2.82	0.29	0.30	0.98	0.04
13)Electric machinery	6.67	2.02	2.10	1.92	0.59	0.04
14)Transportation equipment	11.77	10.03	1.12	0.42	0.18	0.02
15)Precision instruments	0.11	0.04	0.07	0.00	0.00	0.00
16)Miscellaneous manufacturing products	4.05	1.68	0.75	1.05	0.54	0.03
17)Construction	6.22	2.89	1.64	0.71	0.76	0.22
18)Electric power, gas and hot water supply	1.39	0.44	0.56	0.15	0.08	0.16
19)Water supply and sanitary services	0.59	0.25	0.16	0.10	0.04	0.04
20)Trade	5.12	2.06	1.83	0.70	0.32	0.22
21)Financial and insurance services	1.89	0.73	0.71	0.22	0.14	0.09
22)Real estate	2.64	1.23	0.74	0.32	0.25	0.09
23)Transport	4.74	3.06	0.85	0.42	0.21	0.19
24)Communication and broadcasting	0.67	0.19	0.26	0.11	0.06	0.06
25)Public administration	2.12	0.56	0.96	0.29	0.16	0.15
26)Education, research, medical services and health	6.92	2.36	2.61	1.08	0.48	0.38
27)Services	7.03	2.21	1.71	2.30	0.39	0.42
28)Office supplies	0.19	0.08	0.06	0.03	0.01	0.01
29)Activities not elsewhere classified	0.89	0.43	0.21	0.13	0.08	0.03
30)Total	100.00	54.39	21.32	12.58	7.39	4.32
Output	10705	5822	2282	1347	791	462

M_j to D_j, is the same among sectors in the same groups.

Table 2 shows the estimated input-output table, in which 84 sectors are summed into one sector.

3. Regional Structure and Interregional Interdependence

In this section, we will examine some regional characteristics from the estimated input-output table.

Table 3 shows regional outputs, which are aggregated into 29 sectors in Mie Prefecture. We find that economic activities are concentrated in the northern part of

Table 4: Estimated Commodity Flows within Mie Prefecture, All Industries

Unit: Billion Yen, %, %

Origin/Destination	Hokusei	Chusei	Nansei	Iga	Higashikisyu	Mie, total
Hokusei	2239.2	195.0	102.2	54.9	21.9	2613.3
Chusei	241.4	1115.2	62.2	30.5	15.9	1465.4
Nansei	142.1	44.8	536.5	11.4	14.4	749.4
Iga	37.7	19.0	11.8	356.1	6.6	431.3
Higashikisyu	23.5	12.6	14.0	2.5	207.0	259.7
Mie, total	2684.1	1386.9	726.8	455.4	265.9	5519.3

Origin/Destination	Hokusei	Chusei	Nansei	Iga	Higashikisyu	Mie, total
Hokusei	85.69	7.46	3.91	2.10	0.84	100.00
Chusei	16.47	76.10	4.25	2.08	1.09	100.00
Nansei	18.97	5.99	71.59	1.52	1.93	100.00
Iga	8.76	4.42	2.74	82.55	1.53	100.00
Higashikisyu	9.06	4.88	5.40	0.97	79.69	100.00
Mie, total	48.63	25.13	13.17	8.25	4.82	100.00

Origin/Destination	Hokusei	Chusei	Nansei	Iga	Higashikisyu	Mie, total
Hokusei	83.43	14.06	14.06	12.06	8.25	47.35
Chusei	8.99	80.41	8.57	6.70	6.00	26.55
Nansei	5.30	3.24	73.82	2.50	5.43	13.58
Iga	1.41	1.37	1.63	78.18	2.48	7.82
Higashikisyu	0.88	0.91	1.93	0.55	77.84	4.71
Mie, total	100.00	100.00	100.00	100.00	100.00	100.00

the prefecture: the output share of the Hokusei area is 54.39 percent, and that of the Chusei area 21.32 percent.

Some differences in industrial structure can be observed among some areas. The Hokusei area has the so-called Yokkaichi *Kombinat*, a petrochemical industrial complex. Many machinery manufacturing industries are also located in the Hokusei area. The production share of machinery industries and petrochemical industries in the total output of Mie Prefecture is high: transport equipment 11.77 percent, electric machinery 6.67 percent, chemical products 8.55 percent, and petroleum refinery and coal products 4.85 percent. Almost all of these sectors are located in the Hokusei area.

In the Chusei area, the share of the education, research, medical services and health sector is the highest at 2.61 percent, followed by the electric machinery sector at 2.10 percent.

The production of the agriculture, forestry and fishery sector is not so significant compared with the other sectors. Actually this share in Mie Prefecture is only 3.2 percent. The Nansei area produces the most of all areas at 1.10 percent, followed by the Hokusei area and the Chusei area.

The services sector accounts for 7.03 percent of the prefecture's total production. The Nansei area, where there are many companies related to sightseeing and recreation, is the largest contributor.

Table 4 shows the bilateral trade of all commodities among areas within Mie Prefecture. We find that each area demands more than 70 percent of its own goods and services produced, and supplies more than 70 percent of its product to its own area. These shares are highest in the Hokusei area, due to its high concentration of population and production.

Second, we can observe a star-like connection in commodity flows, in which the Hokusei area functions as the center.

4. Applications

In this section, we will show two applications of the estimated interregional input-output table.

4.1. Impacts of Public Investment by Local Government

The purpose of the first application is to study the impacts of public investment by local government. Tsu City, the capital city of Mie Prefecture located in the Chusei area, has new projects for regional development and city renewal. For these projects, the city will spend about 73.03 billion yen over 10 years starting in 1994, 55.51 billion yen of which is for public investment and the rest for land purchase and removal compensation.

We can examine the effect of this public investment expenditure on Tsu City, the other areas of Mie Prefecture, and outside the prefecture. Public investment expenditure creates new demand for production in many industrial sectors and regions. To evaluate this effect, we compile a four-region, 29-sector interregional input-output table. The four regions are defined as the Chusei area, the Hokusei area, other areas in Mie Prefecture, and the rest of Japan. Tsu City is included in the Chusei area. The sectors are aggregated from 84 to 29 to lessen the computational burden.

Table 5 shows that a public investment expenditure of 55.51 billion yen by Tsu City creates 118.24 billion yen production in the nation as a whole, which means that the investment multiplier is 2.13. 58.10 percent of the increased output is shared in the Chusei area, where the initial expenditure occurs, while 35.02 percent of the output increase exists outside the prefecture, which shows the openness of the regional economy. The Hokusei area receives 4.99 percent of the increased production, and the other areas of the prefecture only 1.90 percent. The leakage of demand outside the prefecture is larger than that inside the prefecture. In the case of Mie Prefecture, the Hokusei area is more closely linked to the Chusei area than are other areas of the prefecture.

If we consider the consumption demand brought about by the increased income of employees, which is part of the value-added increase, then production as a whole will also be expected to rise by 170.37 billion yen. In this case, 46.24 percent of the rise in production is from the Chusei area, while 46.32 percent is from outside the prefecture. The production increase of the Hokusei area is only 5.07 percent of the whole, and the other areas of the prefecture receive a 2.38 percent increase. More than half of total

Table 5: The Effect of Public Investment in Tsu City

Unit: Billion Yen

	Hokusei	Chusei	Rest of Mie	Rest of Japan	Total
Public Investment	-	55.51	-	-	55.51
Effects on Production					
Induced Production	5.89	68.69	2.24	41.41	118.24
(Shares %)	4.99	58.10	1.90	35.02	100.0
(Multiplier)	0.106	1.237	0.040	0.746	2.130
Effects on Production					
Including the secondary effects through consumption					
Induced Production	9.63	78.78	4.03	78.92	170.37
(Shares %)	5.07	46.24	2.38	46.32	100.0
(Multiplier)	0.174	1.419	0.073	1.422	3.069

demand leaks out of the Chusei area. The multiplier of the Chusei area is 1.419, which includes the effect of the increased demand in consumption.

Table 6 shows the effects of the increased production, by industrial sectors and regions. 31.43 percent of the induced production comes from the construction sector as a whole most of which is in the Chusei area. The increase in construction demand creates intermediate demands in the ceramic, stone and clay products sector 5.04 percent, steel sector 3.60 percent, general machinery sector 2.57 percent, and so on. On the other hand, consumption demand creates intermediate demand in the food products sector 3.32 percent, electric machinery sector 1.26 percent, transportation equipment sector 1.38 percent, education, research, medical service and health sector 4.40 percent, and so on. Increased demand also induces production in the services sector 7.21 percent, trade sector 6.10 percent, transportation sector 5.21 percent, financial and insurance services sector 2.94 percent, and real estate sector 3.05 percent.

Most of the increased demand in manufacturing products such as the food products sector, electric machinery sector, and transport equipment sector leaks out of the region, especially outside of the prefecture. However, demand in the service sector, financial and insurance services sector, real estate sector, and education, research, medical services and health sector is largely expected to remain in the Chusei area. Some of the increased demand in manufacturing goods such as the ceramic, stone and clay products sector, general machinery sector, chemical products sector, and transportation sector are satisfied in the Hokusei area.

4.2. Economic Effects of the Construction of a Nuclear Power Station

The second application is related to the construction of a nuclear power station. Electric power, especially that created by nuclear power, is considered one of the most important future energy resources because of limited fossil fuels and higher costs of oil. Nuclear power stations are usually located at the seaside of a relatively sparsely populated region, far from metropolitan areas, mainly because much clean water is

Table 6: Effects on Production by Industrial Sector and Region Including the Secondary Effects through Consumption

Sectors	Share of Induced Output (%) Hokusei	Chusei	Rest of Mie	Rest of Japan	Total
1)Agriculture, forestry and fishery	0.04	0.25	0.15	1.32	1.78
2)Mining	0.02	0.20	0.06	1.45	1.75
3)Food production	0.16	0.32	0.03	2.80	3.32
4)Textile products	0.09	0.08	0.04	0.90	1.12
5)Pulp, paper and wooden products	0.06	0.12	0.10	1.51	1.81
6)Chemical products	0.36	0.01	0.03	1.97	2.38
7)Petroleum refinery and coal products	0.23	0.00	0.03	2.79	3.06
8)Ceramic, stone and clay products	0.71	1.66	0.41	2.24	5.04
9)Steel	0.07	0.02	0.00	3.51	3.60
10)Non-ferrous metal	0.08	0.00	0.00	0.46	0.54
11)Metal products	0.17	0.46	0.03	1.11	1.78
12)General machinery	0.53	0.26	0.03	1.74	2.57
13)Electric machinery	0.01	0.11	0.02	1.10	1.26
14)Transportation equipment	0.19	0.11	0.02	1.06	1.38
15)Precision instruments	0.00	0.01	0.00	0.09	0.11
16)Miscellaneous manufacturing products	0.18	0.16	0.23	2.65	3.24
17)Construction	0.04	31.07	0.01	0.31	31.43
18)Electric power, gas and hot water supply	0.04	0.49	0.04	1.09	1.68
19)Water supply and sanitary services	0.02	0.19	0.01	0.21	0.44
20)Trade	0.30	1.58	0.21	3.99	6.10
21)Financial and insurance services	0.11	0.69	0.05	2.08	2.94
22)Real estate	0.23	0.90	0.09	1.82	3.05
23)Transport	0.74	1.82	0.13	2.50	5.21
24)Communication and broadcasting	0.02	0.31	0.03	0.55	0.93
25)Public administration	0.00	0.10	0.00	0.03	0.14
26)Education, research, medical services and health	0.22	2.52	0.11	1.53	4.40
27)Services	0.26	1.70	0.35	4.89	7.21
28)Office supplies	0.01	0.41	0.00	0.10	0.52
29)Activities not elsewhere classified	0.05	0.61	0.02	0.39	1.08
30)Total	5.07	46.25	2.36	46.32	100.0
Unit: Billion Yen	8.63	78.78	4.03	78.92	170.37

required to operate them. Large amounts of time and money are required to construct a nuclear power station. Many subsidies, however, are offered to promote the construction of such stations.

There is a plan to construct a nuclear power station with two plants of 1.35 million Kw each in the Ashihama coastal region between the towns of Kisei and Nanto in the Nansei area. Construction will start in the year 2000 and will take about five years. The construction cost estimate is 999 billion yen[4].

[4] Plans may be delayed somewhat because more time will probably be necessary to get the agreement of residents.

Table 7: The Direct Effect of The Ashihama Nuclear Power Station

Unit: Billion Yen

	Whole Period 2000 - 2019	Construction Period 2000 - 2004	Operational Periods Period 1 2005 - 2009	Period 2 2010 - 2014	Period 3 2015 -2019
Costs					
of Construction	999.0	999.0	0.0	0.0	0.0
of Maintenance	449.5	0.0	149.8	149.8	149.8
Subsidies	42.2	19.2	17.0	2.9	2.9
Tax Revenues					
Fixed Property Tax	94.2	0.0	49.6	27.8	16.8
Corporate Income Tax	94.5	0.0	31.5	31.5	31.5
Nuclear Fuel Tax	19.2	0.0	9.1	5.0	5.0
Total	1698.7	1018.3	257.2	217.0	206.0
(100.0%)	(59.9%)	(15.1%)	(12.8%)	(12.1%)	

To evaluate the effect of the nuclear power station on regions and industries, we compile an interregional input-output table, which has three regions and 84 sectors. Here we define regions as the Nansei area, other areas in Mie Prefecture, and the rest of the nation to lessen the computational burden.

Table 7 shows the direct effect of the power station during the construction and operational periods. An operational period is considered as 15 years, because of the depreciation of the nuclear energy stock. We divide this period into three periods of five years each.

Three factors are considered. The first is the expenditure on construction and maintenance of the plant. It will cost 999 billion yen to construct the plant and 149.8 billion yen each five years for maintenance.

The second factor to be considered is subsidies. Most subsidies are used for infrastructure such as roads, ports and public facilities. Some are directly paid to residents and firms located in a certain neighborhood to lower their power costs. Such subsidies amount to 19.2 billion yen in the construction period, 17.0 billion yen for the first five years of the operational period, and only 2.9 billion yen for the second and third five years of the operational period.

The third factor is taxation. In the operational period, local government revenues will increase due to rises in the fixed property tax, the corporate income tax and the nuclear energy tax. This will amount to 90.2 billion yen for the first five years of the operational period, and 64.3 billion yen and 53.3 billion yen for each of the following five years, respectively. The increase in tax income is expected to fall in the future.

Table 8 shows the overall effects relating to the power station[5]. In the construction period, the direct effect is 1016.3 billion yen, while production increases by 3,140.8

[5] Increased production includes the production induced by the increase of consumption demand as a secondary effect.

Table 8: The Economic Impact of the Ashihama Nuclear Power Station Including the Secondary Effects through Consumption

Unit: Billion Yen

	Whole Period 2000 - 2019	Construction Period 2000 - 2004	Operational Periods Period 1 2005 - 2009	Period 2 2010 - 2014	Period 3 2015 -2019
Nansei					
A) Costs, Subsidies & Taxes	563.5	310.5	112.4	75.7	64.7
B) Direct Effects	469.1	305.7	67.6	49.3	46.5
C) Effects on Production	527.2	325.6	85.8	59.9	55.9
D) Multiplier (=C/B*)	0.341	0.320	0.446	0.351	0.334
Rest of Mie					
A) Costs, Subsidies & Taxes	190.8	63.0	45.0	41.4	41.4
B) Direct Effects	120.5	63.5	19.8	18.6	18.6
C) Effects on Production	313.4	171.7	52.8	44.9	44.0
D) Multiplier (=C/B*)	0.203	0.169	0.274	0.263	0.263
Rest of Japan					
A) Costs, Subsidies & Taxes	944.2	644.8	99.8	99.8	99.8
B) Direct Effects †	955.1	647.0	104.2	102.1	101.8
C) Effects on Production	3989.3	2643.3	475.2	438.1	432.7
D) Multiplier (=C/B*)	2.579	2.601	2.466	2.567	2.585
Total					
A) Costs, Subsidies & Taxes	1698.5	1018.3	257.2	217.0	206.0
B*) Direct Effects	1547.0	1016.3	192.6	170.7	167.4
C) Effects on Production	4830.4	3140.8	613.9	543.0	532.7
D) Multiplier (=C/B*)	3.122	3.090	3.186	3.181	3.182

† The values include the import demands of Nansei and the rest of Mie.

billion yen as a whole, and the multiplier is therefore 3.09. However, about 84.2 percent of total production is related to that outside Mie Prefecture. The Nansei area shares only 10.4 percent of the increase in production.

In the operational period, considerable amounts of money will be paid out as repair costs, subsidies and taxes, which also have significant effects on the economy. These will amount to 257.2 billion yen in the first five years of operation, which will decrease to 206.0 billion yen in the third five-year period. The effects on production will also change from 613.9 billion yen to 532.7 billion yen. However, the multiplier is almost the same for all periods, at 3.18.

Production in the Nansei area will increase by 325.6 billion yen in the construction period, which means about 4.8 percent increase per year in terms of the output in 1985, which was 1,346.6 billion yen. However, this amount will decrease to 85.8 billion yen in the first operational period, and in the third operational period it will be 55.9 billion yen. The effect on production in this area changes from about 1.3 percent to 0.8 percent of the output in the Nansei area. Thus the impact on this area will be considerably larger in the construction period, but the stimulus will lessen in the operational period.

Table 9 shows the effects on the industries in each region, the values of which are

Table 9: Effects on the Regional Economies: The Whole Period

			Share of Induced Output (%)	
Sectors	Nansei	Rest of Mie	Rest of Japan	Total
1)Agriculture, forestry and fishery	0.05	0.07	1.42	1.53
2)Mining	0.01	0.04	0.43	0.47
3)Food production	0.04	0.13	3.24	3.41
4)Textile products	0.01	0.07	1.15	1.22
5)Pulp, paper and wooden products	0.01	0.08	1.53	1.62
6)Chemical products	0.01	0.16	2.07	2.24
7)Petroleum refinery and coal products	0.00	0.09	2.04	2.14
8)Ceramic, stone and clay products	0.06	0.23	1.25	1.54
9)Steel	0.01	0.12	5.71	5.83
10)Non-ferrous metal	0.01	0.10	1.47	1.58
11)Metal products	0.06	0.30	2.40	2.77
12)General machinery	0.15	1.13	13.62	14.90
13)Electric machinery	0.16	0.82	10.40	11.38
14)Transportation equipment	0.02	0.11	1.35	1.48
15)Precision instruments	0.00	0.01	0.15	0.16
16)Miscellaneous manufacturing products	0.04	0.10	2.83	2.97
17)Construction	9.37	0.57	0.51	10.46
18)Electric power, gas and hot water supply	0.02	0.11	1.94	2.08
19)Water supply and sanitary services	0.02	0.03	0.36	0.41
20)Trade	0.15	0.36	5.88	6.39
21)Financial and insurance services	0.05	0.17	3.03	3.25
22)Real estate	0.09	0.24	3.31	3.64
23)Transport	0.10	0.36	3.43	3.90
24)Communication and broadcasting	0.02	0.07	1.07	1.17
25)Public administration	0.01	0.01	0.07	0.09
26)Education, research, medical services and health	0.23	0.39	3.13	3.76
27)Services	0.21	0.49	7.69	8.39
28)Office supplies	0.00	0.01	0.18	0.20
29)Activities not elsewhere classified	0.03	0.09	0.91	1.03
30)Total	10.92	6.49	82.59	100.00
Unit: Billion Yen	527.4	313.60	3989.40	4830.50

estimates for the whole period. More than 80 percent of the increased production appears outside the prefecture, which suggests that the construction of the power plant should be of national concern. Almost all of the equipment in the power station will be brought from outside the prefecture.

Only 10 percent of the increased production is related to the region where the plant will be constructed, the Nansei area. However, this is large enough for such a small region. A 527.4 billion yen increase over 20 years means about 2 percent increase per year, when compared to total output in 1985. The effect in the Nansei area is concentrated in the construction sector, which is 9.37 percent of total production. Only 1.55 percent of the total production increase is in the other sectors. On the other hand, 6.49 percent of the total production increase appears in the rest of Mie Prefecture. In

Mie Prefecture, the Nansei area can't share in the effects as much as the other areas, because industries are mainly located in the northern part of the prefecture.

5. Concluding Remarks

In this paper, we estimated an interregional input-output table of Mie Prefecture for 1985. There are five subregions in the table. Using this table and a national input-output table of the same year, we compiled a nation-wide interregional input-output table. And we showed two applications: one to evaluate the effect of public investment by a regional government, Tsu City, and the other to evaluate the effect of a nuclear power station planned in the Nansei area. The regional aggregation was done for computational simplicity with somewhat different definitions of regions for both cases, whereas the input-output models are the same for both applications.

A prefectural economy such as that of Mie Prefecture is open to the extent that commodity flows to and from the outside of the prefecture are large compared to the scale of the economy. In the case of increased public investment in the Chusei area, the multiplier is 3.069 for output as a whole, 1.419 for output in the Chusei area, and 1.422 for outside the prefecture. Thus about half of the increased production leaks out. This suggests the importance firstly of evaluating the total effect of public investment using a national-wide interregional input-output table, and secondly of evaluating the effects on each region.

In the Chusei area, the construction sector gains the largest portion of the effects and the service sector follows, but the gain of the manufacturing sector related to that of construction sector is not so large. Outside the prefecture, the manufacturing sector gains a relatively large portion of the effects.

In the case of the construction of a nuclear power station, the gain of the region in question is very low, because there are few industries able to support the construction. Even though the effect on the region is only 10 percent of the whole, this still has a considerable impact on its economy especially in the construction sector. In Mie Prefecture, the gain will be only 17 percent of the whole production. Thus more than 80 percent of the entire effect of the construction of a nuclear power station will appear in outside the prefecture, which is a remarkable characteristic.

Usually we have limited information of commodity flows within a prefecture, which makes it difficult to estimate an interregional input-output table. In Mie Prefecture, fortunately, we have such information as sampling surveys, which we used. The necessity to use such interregional input-output table of the prefecture requires more systematic and continuous statistical surveys on commodity flows within the prefecture.

References

[1] Tsubouchi, T. (1991), "Interregional I-O Table of Ehime Prefecture" (in Japanese), *Innovation & I-O Technique*, Vol. 2, No. 1, pp. 35-42, Pan Pacific Association of

Input-Output Studies, Tokyo.

[2] Takahata, Y. (1992), "Interregional I-O Table of Hokkaido Prefecture" (in Japanese), *Innovation & I-O Technique*, Vol. 3, No. 3, pp. 24-29, Pan Pacific Association of Input-Output Studies, Tokyo.

[3] Yamada, M. (1994), "An Estimation of Mie Prefecture's Interregional I-O Table" (in Japanese), *Innovation & I-O Technique*, Vol. 5, No. 4, pp. 52-67, Pan Pacific Association of Input-Output Studies, Tokyo.

[4] Yamada, M., M. Ito, and H. Mizota (1995), "On Economic Impact of Public Investment in Tsu City" (in Japanese), *Research Report* No. 3, Mie University Cooperative Research Center, pp. 23-30.

[5] Yamada, M. and T. Ito (1995), "The Effect of the Power Generation Station on the Regional Economy" (in Japanese), *Discussion Paper* No. 9501, Mie University, Faculty of Humanities and Social Sciences.