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An Inter-Regional Input-Output Simulation Analysis on the Trade Liberalization of Dairy Products and Starch

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Abstract

The purpose of this paper is to investigate the result of a simulation analysis using inter-regional input-output analysis to desermine the impact of the trade liberalization of dairy products and starch on regional economies in Japan.

The results of this study suggest that the policy implications of dairy and starch production are that it is not only important to improve dairy and starch productivity, but also to adjust the dairy and starch industries to the regional industries effected by the trade liberalization. Traditional agricultural policies have put a heavy emphasis on individual farmers' income and production ; however, dairy policies that emphasize processing and distribution are more important, considering their backward linkage effect on agribusiness policies.

Key words : Trade liberalization on Dairy products and Starch, Inter-regional Input-Output Analysis

1. Introduction

As represented by the Japan-US Structural Impediments Initiative, Japan's trade liberalization is at great issue these days. Concerning Japan's agricultural products, the restriction of free trade is criticized by many foreign countries. Dairy products and potatoes have been brought up for discussion at the GATT talks. Agricultural production has strong connections with regional economies, unlike other manufacturing industries that have production activities with large-scale equipment and factories. If there were dairy and starch products trade liberalization, the impact of the structural adjustment in dairy and starch production would affect not only agricultural industries in the region, but also other industries. So far, most studies and analyses of the effect of trade liberalization have been made on the basis of Japan as a whole. Very few of them were quantitative analyses of the effect of trade liberalization on the whole structure of inter-regional industries, though there was one qualitative analysis of a specific region. There have been no analyses which were made using an inter-regional input-output table.

The purpose of this study is to clarify what influences the trade liberalization of dairy products and starch will have on regional industrial structures using the simulation model that allows the coefficient of import in inter-regional input-output analysis to change according to the trade liberalization scenarios. Our analytical viewpoints for this study

were as follows :

1) We made the effects of trade liberalization clear from the viewpoint of spatial general equilibrium and spatial partial equilibrium. Spacial general equilibrium occurs when all the regions in the nation interact with change in each region, and spacial partial equilibrium occurs when change in a region effects interaction among all the regions. Applying an inter-regional noncompetitive model, we used spacial general equilibrium for analyzing changes in all the regions of the nation, and spacial partial equilibrium for change in a region. The effects were determined according to (a) change of total production, which is the total amount of the first stage production and the second stage production and (b) change of value added using the two criterion values of total production and value added changes.

2) The relation among industries concerning the effects caused by trade liberalization in certain regions is evaluated from the forward linkage effect and backward linkage effect.

3) The effects of free trade liberalization among the regions have been compared with induced production and induced value added.

The areas where we made analyses were nine regions (Hokkaido, Tohoku, Kanto, Chubu, Kinki, Chugoku, Shikoku, Kyushu, Okinawa) and Japan as a whole[1].

2. Theoretical Framework

This study focuses on trade liberalization's effects on industries from the spatial viewpoint of an inter-regional one. The simulation model is a transformed model of the equilibrium production amount model using an inter-regional noncompetitive input-output table that distinguishes products in the region from those in other regions. The theoretical framework of the analytic model is as follows :

A balance equation on production according to the inter-regional noncompetitive model

$$AX+F(D)+E-M=X, \tag{1}$$

A : inter-regional output coefficient matrix,
X : regional production amount vector,
F (D) : the total of each region's final demand vector,
E : each region's export amount vector,
M : each region's import amount vector.

Therefore, production amount X becomes :

$$X=(I-A)^{-1}(F(D)+E-M). \tag{2}$$

The import coefficient $\bar{M}$ is defined as the regional import amount M in proportion to the regional demand in the consumption area of the imported product, so the import amount will be shown as below :

$$M=\bar{M}(A^{*}X+F^{*}(D)), \tag{3}$$

$$\text{Provided } A^* = \begin{vmatrix} A^{11} & 0 & 0 \\ 0 & A^{22} & 0 \\ 0 & 0 & A^{33} \end{vmatrix}$$

$$F^*(D) = \begin{vmatrix} F^{11}(D) \\ F^{22}(D) \\ F^{33}(D) \end{vmatrix}$$

Therefore production amount X becomes :

$$X = [I - (A - \bar{M}A^*)]^{-1}[F(D) - \bar{M}F^*(D) + E]. \tag{4}$$

The purpose of this study is to examine what effects there are on regional production of dairy products and starch and related industries, and the effects in other areas as a result of the interregional mutual reliance of supply and demand.

In order to make the model show explicitly the effects of the structural changes made by the trade liberalization of dairy products and starch, we contrived on a model which allowed for a change in the import coefficient based on the model including import as an endogenous variable. Therefore, suppose that the change in import coefficient is $\bar{M}'$ and the amount of each region's final demand and exports are given. The change of gross production value in the case that the import coefficient has changed is expressed as shown below :

$$\blacktriangle X = \{[I - (A - \bar{M}'A^*)]^{-1} \cdot -\bar{M}'F^*(D)\} - \{[I - (A - \bar{M}A^*)]^{-1} \cdot -\bar{M}F^*(D)\}. \tag{5}$$

This means the changes in the import coefficient will be revealed through the impact on the production process through the change of the diagonal element of $\bar{M}$. Here we define A as a constant, as we suppose the technical structure will not be influenced. As for the import coefficient, we adopted the selected coefficients according to the real condition of each industry. Therefore, the inverse matrix is changed by the change in the import coefficient.

Using equation (5), the effects of trade liberalization on dairy products and starch in a specific region or in the whole country can be examined, including the effects on each region's industrial structure, through the process by which production is impacted.

Next, we estimate the change of value added $\blacktriangle V$, based on the change of production $\blacktriangle X$. Change of additional value $\blacktriangle V$ will be obtained in equation (6) :

$$\blacktriangle V = \hat{V} \cdot \blacktriangle X, \tag{6}$$

$\hat{V}$: diagonal matrix with value added as a diagonal element

Propensity to consume η[2] is defined in formula (7) :

$$\eta = \frac{PC}{EI + OP}, \tag{7}$$

PC : private consumption,

EI : employer's income,

OP : operation surplus.

Change of consumption ▲C is found in equation (8) :

$$\blacktriangle C = \eta \cdot \blacktriangle V. \tag{8}$$

From equations (6) through (8), the second stage change of production $\blacktriangle X^{(2)}$ is shown as follows :

$$\blacktriangle X^{(2)} = [I - (A - \bar{M}'A^*)]^{-1} \cdot \blacktriangle C. \tag{9}$$

The total change of production (TP) is defined in equation (10) by the sum of the first stage change of production in equation (5) :

$$TP = \blacktriangle X + \blacktriangle X^{(2)}. \tag{10}$$

The notable characteristics of our analytic method to simulate the effects of the trade liberalization of dairy products and starch are (1) that the model has the import coefficient as an endogenous variable and (2) that we disaggregated 45 inter-regional input-output table sectors to the 54 table sectors[3].

So far, there have been no other studies that have simulated, using inter-regional input-output analysis, the effects of trade liberalization on industries by letting the import coefficient of the regional final demand and reverse matrix change. In particular, a unique feature of this model is that it allows the nine regions' import coefficients to change simultaneously to analyze the spatial general equilibrium.

3. Results of the Simulation Analysis and Discussion

3-1 Analytic Scenarios and Assumptions

As for a simulation analysis on the trade liberalization of dairy products and starch, the analytic secenarios and assumptions are shown below.

a) An analytic scenario of dairy products.

The analytic scenarios are shown in Table 1 ; consisting of 1) regional trade liberalization secnarios and 2) a trade liberalization scenario for the whole country.

In the regional trade liberalization scenario, firstly two regions, Kanto and Kinki, were selected, as they have the highest final demand. Secondly, Hokkaido was selected because its production amount is the largest. We set two scenarios that show import coefficient as the degree of trade liberalization, that is, (1) a case with 1.5 times the import coefficient of the present condition, and (2) a case with 3 times the import coefficient[4].

The trade liberalization scenario for the whole country is the case in which the market is simultaneously opened for all nine regions. We set import coefficients of 1.5 and 3.0 as in the regional scenarios above.

b) An analytic scenario of starch.

The analytic scenarios are shown in Table 2 ; consisting of 1) regional trade liberalization scenarios and 2) a trade liberalization scenario for the whole country.

In the regional trade liberalization scenario, firstly Kanto and Kinki were selected as

Table 1. Scenario

	Contents
Trade liberalization scenario of daily product	Case A-R1-(1) :A case supposing the degree of liberalization in Hokkido at 1.5 times present condition
	Case A-R1-(2) :A case supposing the degree of liberalization in Hokkido at 3.0 times present condition
	Case A-R2-(1) :A case supposing the degree of liberalization in Kanto at 1.5 times present condition
	Case A-R2-(2) :A case supposing the degree of liberalization in Kanto at 3.0 times present condition
	Case A-R3-(1) :A case supposing the degree of liberalization in Kinki at 1.5 times present condition
	Case A-R3-(2) :A case supposing the degree of liberalization in Kinki at 3.0 times present condition
	Case A-RA-(1) :A case supposing the degree of liberalization in whole region at 1.5 times present condition
	Case A-RA-(2) :A case supposing the degree of liberalization in whole region at 3.0 times present condition

Table 2. Scenario

	Contents
Trade liberalization scenario of starch	Case B-R1:A case supposing the degree of liberalization in Hokkido at 1.5 times present condition
	Case B-R2:A case supposing the degree of liberalization in Kanto at 1.5 times present condition
	Case B-R3:A case supposing the degree of liberalization in Kinki at 1.5 times present condition
	Case B-RA:A case supposing the degree of liberalization in whole region at 1.5 times present condition

they have the highest final demand. Secondly, Hokkaido was selected because its production amount is the largest. We set a trade liberalization scenario with 1.5 times the import coefficient of the present condition[5].

The trade liberalization scenario for the whole country is the case in which the market is simultaneously opened for all nine regions. We set an import coefficient of 1.5 as in the regional scenario above.

c) The analytic assumptions.

The analytic assumptions of this study are as follows :

1) The year of analysis is 1985.

For the data, which are the basis of the analysis, we used the input-output analysis table. Since the latest input-output table is from 1985, we chose it as the year of analysis.

2) Policies that may lessen the effect of trade liberalization are not assumed at all.

Since this is a simulation analysis under trade liberalization scenarios which are based on the structure in the year of analysis, any policies or measures to soften or lessen the effect are not contained in the analysis.

3) We suppose there is no difference between the import price of the analyzed agricultural products and the domestic price.

3-2 Simulation Results

a) Simulation Results on Dairy Products

The sector that is possibly influenced economically by trade liberalization of dairy products is the material of dairy products sector, especially milk and its processed products. Tables 3 and 4 show the simulation result in the whole country according to the simulation analysis scenario.

The characteristic effects of the trade liberalization of dairy products are discussed below.

1) When we treat the influence of trade liberalization as a change of general production because of the effect on production, three regions especially exhibit the characteristic effects. One is the Kanto region, which is highly influenced both in the sector of dairy products as a direct effect and in that of dairy farming as an indirect effect, as well as in all the sectors of industries. The other two are the Tohoku and Hokkaido regions which show a high influence in the sector of dairy farming.

2) When we estimate the intra-regional impact of the five high-ranking sectors in these regions, we can find a backward linkage effect to the sector of dairy farming in all three regions. The Kanto region shows a forward linkage effect to the sectors of services, commerce, finance and insurance. The Tohoku regions shows a forward linkage effect to finance, insurance and transportation, and the Hokkaido region to finance, commerce and insurance.

3) Table 5[6] shows that in the Hokkaido and Tohoku regions, both the sector of dairy farming as material and the sector of all industries as a general effect on regional economies, have a higher effect on change of value added as induced value added than that of general production as induced product.

Other results of the simulation are shown in the Appendix.

b) Simulation Results on Starch

Potatoes and sweet potatoes[7] will be the sectors which are economically influenced by the trade liberalization of starch. Table 6 shows the simulation results of trade liberalization in the whole country.

The characteristic effects of the trade liberalization of starch are discussed below.

1) When we treat the influence of trade liberalization as a change of general production because of the effect on production, three regions especially exhibit the characteristic effects. One is the Kanto region which is highly influenced in both the sector of starch as a direct effect and in that of potatoes as an indirect effect, as well as in all the sectors of industries. The other two are the Hokkaido and Kyushu regions which show a high influence by increase of import of starch in the sectors of potatoes as material.

2) When we estimate the intra-regional impact of the five high-ranking sectors in these regions, we can find a backward linkage effect to the sectors of potatoes in all regions. The Hokkaido and Kyushu regions show backward linkage effects to chemical industries. The Kanto region shows forward linkage effects to the sectors of commerce, finance and

Table 3. Regional Change of Value Added and Total Change of Production
Case A-RA-(1) :A case supposing the degree of trade liberalization in the whole region at 1.5 times as present condition (unit:million yen, %)

		Hokkaido	Tohoku	Kanto	Chubu	Kinki	Chugoku	Shikoku	Kyushu	Okinawa	Total
Change of Value Added	Whole Sectors	-4788.2	-2642.0	-12393.6	-3057.8	-4459.1	-1970.7	-1079.2	-3229.8	-288.4	-33908.8
		-0.035	-0.012	-0.009	-0.008	-0.008	-0.010	-0.011	-0.012	-0.014	-0.010
		(14.1)	(7.8)	(36.6)	(9.0)	(13.2)	(5.8)	(3.2)	(9.5)	(0.9)	(100.0)
	Daily Sector	-1298.0	-754.6	-1842.1	-448.1	-418.3	-345.5	-226.4	-690.3	-30.8	-6054.1
		-1.041	-1.599	-2.088	-2.050	-2.365	-1.559	-1.831	-1.361	-1.957	-1.567
		(21.4)	(12.5)	(30.4)	(7.4)	(6.9)	(5.7)	(3.7)	(11.4)	(0.5)	(100.0)
	Daily Product Sector	-442.9	-380.4	-3033.4	-693.1	-1210.6	-452.8	-252.9	-632.1	-88.1	-7186.3
		-0.739	-2.042	-2.532	-2.521	-2.871	-1.757	-2.794	-2.682	-2.368	-2.177
		(6.2)	(5.3)	(42.2)	(9.6)	(16.8)	(6.3)	(3.5)	(8.8)	(1.2)	(100.0)
Total Change of Production	Whole Sectors	-20534.2	-11492.2	-55068.6	-14367.3	-21006.2	-9478.0	-4664.9	-14637.8	-1210.7	-152459.8
		-0.079	-0.028	-0.020	-0.017	-0.018	-0.020	-0.024	-0.027	-0.031	-0.023
		(13.5)	(7.5)	(36.1)	(9.4)	(13.8)	(6.2)	(3.1)	(9.6)	(0.8)	(100.0)
	Daily Sector	-4850.1	-2718.9	-6833.8	-1646.2	-1595.9	-1252.0	-828.1	-2541.2	-119.7	-22385.9
		-1.504	-2.331	-3.027	-2.942	-3.373	-2.248	-2.713	-1.943	-2.990	-2.263
		(21.7)	(12.1)	(30.5)	(7.4)	(7.1)	(5.6)	(3.7)	(11.4)	(0.5)	(100.0)
	Daily Product Sector	-3283.2	-2691.1	-17602.6	-4403.0	-8084.9	-2766.3	-1296.1	-4011.7	-400.0	-44538.9
		-0.886	-2.333	-2.923	-2.818	-3.335	-2.066	-3.234	-2.855	-2.908	-2.454
		(7.4)	(6.0)	(39.5)	(9.9)	(18.2)	(6.2)	(2.9)	(9.0)	(0.9)	(100.0)

Note: The top line shows the amount of change, the middle line shows the change rate of the amount of change in the definite sector and region, and the bottom line (in parenthesis) shows the rate of effect in each region.

Table 4. Regional Change of Value Added and Total Change of Production
Case A-RA-(2) :A case supposing the degree of trade liberalization in the whole region at 3.0 times as present condition (unit:million yen,%)

		Hokkaido	Tohoku	Kanto	Chubu	Kinki	Chugoku	Shikoku	Kyushu	Okinawa	Total
Change of Value Added	Whole Sectors	-17858.8	-10118.2	-44928.5	-11650.8	-16283.7	-7499.0	-4211.2	-12413.1	-1016.0	-125979.2
		-0.132	-0.046	-0.032	-0.031	-0.028	-0.036	-0.042	-0.045	-0.048	-0.038
		(14.1)	(7.8)	(36.6)	(9.0)	(13.2)	(5.8)	(3.2)	(9.5)	(0.9)	(100.0)
	Daily Sector	-4829.7	-2866.3	-6641.5	-1727.6	-1517.5	-1308.4	-888.7	-2665.0	-106.0	-22550.7
		-3.873	-6.074	-7.529	-7.905	-8.580	-5.903	-7.189	-5.256	-6.734	-5.835
		(21.4)	(12.5)	(30.4)	(7.4)	(6.9)	(5.7)	(3.7)	(11.4)	(0.5)	(100.0)
	Daily Product Sector	-1698.8	-1535.8	-10835.8	-2689.0	-4352.2	-1752.4	-1024.4	-2458.3	-303.0	-26649.7
		-2.835	-8.244	-9.043	-9.782	-10.321	-6.798	-11.319	-10.432	-8.143	-8.072
		(6.2)	(5.3)	(42.2)	(9.6)	(16.8)	(6.3)	(3.5)	(8.8)	(1.2)	(100.0)
Total Change of Production	Whole Sectors	-76658.8	-44174.0	-199614.7	-54710.2	-76659.4	-36045.8	-18182.0	-56242.1	-4264.7	-566551.1
		-0.295	-0.106	-0.072	-0.065	-0.066	-0.078	-0.092	-0.102	-0.109	-0.084
		(13.5)	(7.5)	(36.1)	(9.4)	(13.8)	(6.2)	(3.1)	(9.6)	(0.8)	(100.0)
	Daily Sector	-18037.0	-10321.2	-24640.9	-6344.9	-5792.2	-4741.7	-3252.2	-9810.3	-411.8	-83352.1
		-5.593	-8.848	-10.914	-11.341	-12.241	-8.516	-10.654	-7.503	-10.285	-8.426
		(21.7)	(12.1)	(30.5)	(7.4)	(7.1)	(5.6)	(3.7)	(11.4)	(0.5)	(100.0)
	Daily Product Sector	-12561.8	-10856.0	-62899.6	-17078.2	-209073.6	-10702.6	-5248.6	-15599.6	-1375.2	-165395.0
		-3.389	-9.412	-10.446	-10.932	-11.993	-7.993	-13.096	-11.100	-9.999	-9.112
		(7.4)	(6.0)	(39.5)	(9.9)	(18.2)	(6.2)	(2.9)	(9.0)	(0.9)	(100.0)

Note: The top line shows the amount of change, the middle line shows the change rate of the amount of change in the definite sector and region, and the bottom line(in parenthesis)shows the rate of effect in each region.

insurance The Hokkaido region also shows forward linkage effects to the sectors of transportation and commerce, and the Kyushu region to that of transportation.

3) Table 7 shows that the tendency found in 1) and 2) is found both in the change of general production as induced product, and in the change of value added as induced value added, in the sectors of potatoes as material and all the sectors of industries as a general influence on regional economies.

Other results of the simulation are shown in Table a-Table i in the Appendix.

Table 5. Degree of Separation from the Sector of Trade Liberalization in the Rate of Effect in Each Region

Region / Sectors	Hokkaido	Tohoku	Kanto	Chubu	Kinki	Chugoku	Shikoku	Kyushu	Okinawa
Daily Product Sector	± 0	± 0	± 0	± 0	± 0	± 0	± 0	± 0	± 0
	(± 0)	(± 0)	(± 0)	(± 0)	(± 0)	(± 0)	(± 0)	(± 0)	(± 0)
Daily	− 14.3	− 6.1	+ 9.0	+ 2.5	+ 11.1	+ 0.6	− 0.8	− 2.4	+ 0.4
Sector	(− 15.2)	(− 7.2)	(+ 11.8)	(+ 2.2)	(+ 9.9)	(+ 0.6)	(− 0.2)	(− 2.6)	(+ 0.7)
Whole	− 6.1	− 1.5	+3.4	+ 0.5	+ 4.4	± 0	− 0.2	− 0.6	+ 0.1
Sectors	(− 7.9)	(− 2.5)	(+ 5.6)	(+ 0.6)	(+ 3.6)	(+ 0.5)	(+ 0.3)	(− 0.7)	(+ 0.3)

Note 1 : This is obtained by the simulation result of Case A-RA-(2)

2 : The figure on the top line shows the degree of separation in the total change of production, The figure on the bottom line (in parenthesis) is the change of value added.

Table 6. Regional Change of Value Added and Total Change of Production
Case B-RA:A case supposing the degree of trade liberalization in the whole region at 1.5 times as present condition (unit:million yen, %)

		Hokkaido	Tohoku	Kanto	Chubu	Kinki	Chugoku	Shikoku	Kyushu	Okinawa	Total
Change of Value Added	Whole Sectors	-183.5	-205.5	-1434.2	-531.8	-578.0	-274.6	-154.9	-395.6	-4.9	-3763.0
		-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.002	-0.001	-0.000	-0.001
		(4.9)	(5.5)	(38.1)	(14.1)	(15.4)	(7.3)	(4.1)	(10.5)	(0.1)	(100.0)
	Potato Sector	-94.6	-2.7	-118.7	-0.6	0.0	-0.3	-5.4	-104.7	0.0	-327.0
		-0.179	-0.049	-0.411	-0.019	0.000	-0.014	-0.145	-0.249	0.000	-0.232
		(28.9)	(0.8)	(36.3)	(0.2)	(0.0)	(0.1)	(1.7)	-(32.0)	(0.0)	(100.0)
	Starch Sector	-15.7	-31.1	-173.0	-95.2	-95.4	-33.9	-44.0	-91.3	0.0	-579.6
		-0.276	-444.286	-4.201	-0.696	-2.715	-260.769	-488.889	-1.621	0.000	-1.775
		(2.7)	(5.4)	(29.8)	(16.4)	(16.5)	(5.8)	(7.6)	(15.8)	(0.0)	(100.0)
Total Change of Production	Whole Sectors	-705.5	-834.7	-6224.0	-2336.0	-2474.8	-1285.7	-591.3	-1574.6	-30.1	-16056.7
		-0.003	-0.002	-0.002	-0.003	-0.002	-0.003	-0.003	-0.003	-0.001	-0.002
		(4.4)	(5.2)	(38.8)	(14.5)	(15.4)	(8.0)	(3.7)	(9.8)	(0.2)	(100.0)
	Potato Sector	-278.8	-7.4	-292.1	-1.6	0.0	-0.7	-13.5	-267.5	0.0	-861.6
		-0.297	-0.082	-0.644	-0.032	0.000	-0.020	-0.233	-0.415	0.000	-0.372
		(32.4)	(0.9)	(33.9)	(0.2)	(0.0)	(0.1)	(1.6)	(31.0)	(0.0)	(100.0)
	Starch Sector	-104.3	-205.8	-1700.5	-666.2	-706.7	-285.4	-169.8	-482.3	-7.0	-4328.0
		-0.306	-490.000	-4.727	-0.799	-2.995	-291.224	-606.428	-1.891	0.0	-2.136
		(2.4)	(4.8)	(39.3)	(15.4)	(16.3)	(6.6)	(3.9)	(11.1)	(0.2)	(100.0)

Note: The top line shows the amount of change, the middle line shows the change rate of the amount of change in the definite sector and region, and the bottom line (in parenthesis) shows the rate of effect in each region.

Table 7. Degree of Separation from the Sector of Trade Liberalization in the Rate of Effect in Each Region

Region / Sectors	Hokkaido	Tohoku	Kanto	Chubu	Kinki	Chugoku	Shikoku	Kyushu	Okinawa
Starch Sector	± 0	± 0	± 0	± 0	± 0	± 0	± 0	± 0	± 0
	(± 0)	(± 0)	(± 0)	(± 0)	(± 0)	(± 0)	(± 0)	(± 0)	(± 0)
Potato	− 30.0	+ 3.9	+ 5.4	+ 13.2	+ 16.3	+ 6.5	+ 2.3	− 19.9	+ 0.2
Sector	(− 26.2)	(+ 4.6)	(− 6.5)	(+ 14.2)	(+ 16.5)	(+ 5.7)	(+ 5.9)	(− 16.2)	(± 0)
Whole	− 2.0	− 0.4	+ 0.5	+ 0.9	+ 0.9	− 1.4	+ 0.2	+ 1.3	± 0
Sectors	(− 2.2)	(− 0.1)	(− 8.3)	(+ 2.3)	(+ 1.1)	(− 1.5)	(+ 3.5)	(+ 5.3)	(− 0.1)

Note 1 : This is obtained by the simulation result of Case B-RA

2 : The figure on the top line shows the degree of separation in the total change of production, The figure on the bottom line (in parenthesis) is the change of value added.

4. Conclusion

The purpose of this paper is to analyze the effects the trade liberalization of dairy products and starch will have on regional economies through intra-regional and inter-regional linkage, using an inter-regional input-output analysis model containing a change of import coefficient. The result of those effects are as follows :

1) Trade liberalization of dairy products has broubht stronger backward linkage effects than forward linkage effects to the field of material production such as dairy products. Especially in the material production regions of Hokkaido and Tohoku, there is a relatively stronger effect on dairy farming as a sector of material production, and on all the sectors of industries as the regional economies, than on liberalized dairy products. There is also a relatively larger effect on change of value added than on change of production.

2) In the Kanto region, trade liberalization of starch exhibits forward linkage effects and backward linkage effects almost equally. But in the Hokkaido and Kyushu regions, which are the material production areas, trade liberalization has a relatively higher influence on the sector of potatoes as a material compared with liberalized starch as a backward linkage effect.

The great linkage effect of the liberalized sector on other sectors suggests that the present industrial policy be changed in response. A new and comprehensive policy is needed, considering the backward linkage effect in order to improve the present short-sighted industrial policy, which is to only focus on a single sector. Finally, this study implies that regional policies concerning trade liberalization will have to be made considering not only increasing the productivity of regional industries, but also the restructuring of regional industries. A word of warning is that the present study is based upon several assumptions and the adopted model. The validity of this study is limited by these two factors.

Notes

1) Ten kinds of products such as dairy products (powdered milk and condensed milk) and starch were recommended to be liberalized at the GATT Panel Agreement resolved on December 10, 1987. The Japanese government organized the panel and informed the American government and GATT of its decisions.

2) Propensity to consume is found by an OLS regression of personal consumption expenditures in the National Accounts Annual Report with the total of employers' income and operating surplus. The parameter of (EI+OP) indicates propensity to consume.

Period : 1981−1989 (nominal value)

Result $PC=646.53963+0.7347641\ (EI+OP)\quad R^2=0.9955672$

(0.35) (39.65)

The figures in parentheses are t-values.

3) The inter-regional input-output table for 1985 used in this analysis consists of 45 industrial sectors. Dairy products and starch are included in the sector of agricultural products. Therefore, we disaggregated the categories of dairy products and starch, and also those of dairy materials and potatoes, in order to analyze the influences of their trade liberalization.

4) There is a slight regional difference in the import coefficient of dairy products in the present situation, but it is less than 0.10. The scenarios are based on the assumption that the change in the amount of import would be to one and a half times as many as the current amount ; 1.5 is a highly possible variation of import coefficients for both dairy and starch products. Further, the scenario of dairy products includes a case in which the amount of imported dairy products would change drastically and its import coefficient is set at 3.

5) The import coefficient of starch is slightly different in each region in the present situation, but because potato starch is used as material for processing food together with corn starch, the amount of import is beyond the demand in all regions.

6) Degree of separation is calculated as the regional change rate of the liberalized sector less the regional change rate of the material production or processing sector.

7) Starch is widely utilized as, for example, a filler for fish-paste products or as an ingredient in cakes. It can also be used as a material for saccharifying products such as glucose, lactose and isomerized sugar. Starch produced in Japan is made from potatoes in Hokkaido and sweet potatoes in southern Kyushu, but they are eaten raw or as dried strips (Ibaraki and Saitama are also prefectures that produce sweet potatoes).

This paper is a summary of some parts of a doctoral dissertation of Hokkaido University.

APPENDIX

Table a. Regional Change of Value Added and Total Change of Production
Case A-R1-(1) :A case supposing the degree of trade liberalization in Hokkaido at 1.5 times as present condition (unit:million yen, %)

		Hokkaido	Tohoku	Kanto	Chubu	Kinki	Chugoku	Shikoku	Kyushu	Okinawa	Total
Change of Value Added	Whole Sectors	-1291.3	-35.9	-159.3	-33.5	-41.5	-13.2	-4.9	-9.9	-0.3	-1589.8
		-0.010	-0.000	-0.000	-0.001	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
		(81.2)	(2.3)	(10.0)	(2.1)	(2.6)	(0.8)	(0.3)	(0.6)	(0.0)	(100.0)
	Daily Sector	-363.9	-0.9	-4.5	-0.1	-0.1	-0.1	0.0	-0.2	0.0	-369.8
		-0.292	-0.002	-0.005	-0.000	-0.001	-0.000	0.000	-0.000	0.000	-0.096
		(98.4)	(0.2)	(1.2)	(0.0)	(0.0)	(0.0)	(0.0)	(0.1)	(0.0)	(100.0)
	Daily Product Sector	-271.1	-0.2	-8.1	-0.1	-0.4	0.0	0.0	-0.1	0.0	-280.0
		-0.452	-0.001	-0.007	-0.000	-0.001	0.000	0.000	-0.000	0.000	-0.085
		(96.8)	(0.1)	(2.9)	(0.0)	(0.1)	(0.0)	(0.0)	(0.1)	(0.0)	(100.0)
Total Change of Production	Whole Sectors	-5723.3	-164.4	-761.6	-175.1	-203.6	-84.8	-27.6	-55.8	-2.3	-7198.5
		-0.022	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.001
		(79.5)	(2.3)	(10.6)	(2.4)	(2.8)	(1.2)	(0.4)	(0.8)	(0.0)	(100.0)
	Daily Sector	-1319.4	-3.8	-18.3	-0.5	-0.5	-0.3	-0.1	-0.7	0.0	-1343.6
		-0.409	-0.003	-0.008	-0.001	-0.001	-0.001	-0.000	-0.001	0.000	-0.136
		(98.2)	(0.3)	(1.4)	(0.0)	(0.0)	(0.0)	(0.0)	(0.1)	(0.0)	(100.0)
	Daily Product Sector	-1903.7	-1.6	-52.3	-0.7	-2.9	-0.4	-0.1	-0.9	0.0	-1962.6
		-0.514	-0.001	-0.009	-0.000	-0.001	-0.000	-0.000	-0.001	0.000	-0.108
		(97.0)	(0.1)	(2.7)	(0.0)	(0.1)	(0.0)	(0.0)	(0.0)	(0.0)	(100.0)

Note: The top line shows the amount of change, the middle line shows the change rate of the amount of change in the definite sector and region, and the bottom line (in parenthesis) shows the rate of effect in each region.

Table b. Regional Change of Value Added and Total Change of Production
Case A-R1-(2) :A case supposing the degree of trade liberalization in Hokkaido at 3.0 times as present condition (unit:million yen, %)

		Hokkaido	Tohoku	Kanto	Chubu	Kinki	Chugoku	Shikoku	Kyushu	Okinawa	Total
Change of Value Added	Whole Sectors	-5126.2	-141.7	-633.5	-133.7	-165.6	-53.2	-20.8	-39.8	-1.7	-6316.2
		-0.038	-0.001	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.002
		(81.2)	(2.2)	(10.0)	(2.1)	(2.6)	(0.8)	(0.3)	(0.6)	(0.0)	(100.0)
	Daily Sector	-1444.4	-3.8	-17.9	-0.5	-0.5	-0.3	-0.1	-0.6	0.0	-1468.1
		-1.158	-0.008	-0.020	-0.002	-0.003	-0.001	-0.001	-0.001	0.000	-0.380
		(98.4)	(0.3)	(1.2)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(100.0)
	Daily Product Sector	-1075.9	-0.8	-32.3	-0.4	-1.5	-0.2	-0.1	-0.5	0.0	-1111.7
		-1.795	-0.004	-0.027	-0.001	-0.004	-0.001	-0.001	-0.002	0.000	-0.337
		(96.8)	(0.1)	(2.9)	(0.0)	(0.1)	(0.0)	(0.0)	(0.0)	(0.0)	(100.0)
Total Change of Production	Whole Sectors	-22714.8	-653.9	-3022.2	-696.0	-808.5	-335.8	-111.4	-220.6	-9.7	-28572.9
		-0.087	-0.002	-0.001	-0.001	-0.001	-0.001	-0.001	-0.000	-0.000	-0.004
		(79.5)	(2.3)	(10.6)	(2.4)	(2.8)	(1.2)	(0.4)	(0.8)	(0.0)	(100.0)
	Daily Sector	-5236.3	-15.1	-72.6	-2.1	-2.2	-1.1	-0.5	-2.6	0.0	-5332.5
		-1.624	-0.013	-0.032	-0.004	-0.005	-0.002	-0.002	-0.002	0.000	-0.539
		(98.2)	(0.3)	(1.4)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(100.0)
	Daily Product Sector	-7555.3	-6.3	-207.7	-2.6	-11.5	-1.4	-0.4	-3.5	0.0	-7788.7
		-2.038	-0.005	-0.034	-0.002	-0.005	-0.001	-0.001	-0.002	0.000	-0.429
		(97.0)	(0.1)	(2.7)	(0.0)	(0.1)	(0.0)	(0.0)	(0.0)	(0.0)	(100.0)

Note: The top line shows the amount of change, the middle line shows the change rate of the amount of change in the definite sector and region, and the bottom line (in parenthesis) shows the rate of effect in each region.

Table c. Regional Change of Value Added and Total Change of Production
Case A-R2-(1) :A case supposing the degree of trade liberalization in Kanto at 1.5 times as present condition (unit:million yen, %)

		Hokkaido	Tohoku	Kanto	Chubu	Kinki	Chugoku	Shikoku	Kyushu	Okinawa	Total
Change of Value Added	Whole Sectors	-1785.8	-862.1	-9586.2	-472.4	-456.6	-168.5	-94.4	-193.2	-35.1	-13654.3
		-0.013	-0.004	-0.007	-0.001	-0.001	-0.001	-0.001	-0.001	-0.002	-0.004
		(13.1)	(6.3)	(70.2)	(3.5)	(3.3)	(1.2)	(0.7)	(1.4)	(0.3)	(100.0)
	Daily Sector	-432.1	-277.5	-1608.7	-26.4	-3.8	-4.7	-1.3	-6.9	-0.1	-2361.5
		-0.347	-0.588	-1.824	-0.121	-0.021	-0.021	-0.011	-0.014	-0.006	-0.611
		(18.3)	(11.8)	(68.1)	(1.1)	(0.2)	(0.2)	(0.1)	(0.3)	(0.0)	(100.0)
	Daily Product Sector	-98.5	-16.4	-2938.9	-5.4	-8.1	-3.9	-0.6	-1.9	-0.2	-3073.9
		-0.164	-0.088	-2.453	-0.020	-0.019	-0.015	-0.007	-0.008	-0.005	-0.931
		(3.2)	(0.5)	(95.6)	(0.2)	(0.3)	(0.1)	(0.0)	(0.1)	(0.0)	(100.0)
Total Change of Production	Whole Sectors	-7637.3	-3521.0	-42542.3	-2333.5	-2206.9	-999.8	-470.8	-964.5	-154.2	-60830.3
		-0.029	-0.008	-0.015	-0.003	-0.002	-0.002	-0.002	-0.002	-0.004	-0.009
		(12.6)	(5.8)	(69.9)	(3.8)	(3.6)	(1.6)	(0.8)	(1.6)	(0.3)	(100.0)
	Daily Sector	-1651.2	-1013.9	-5958.1	-99.4	-16.1	-18.1	-5.1	-27.3	-0.4	-8789.6
		-0.512	-0.869	-2.639	-0.178	-0.034	-0.033	-0.017	-0.021	-0.010	-0.889
		(1.8)	(11.5)	(67.8)	(1.1)	(0.2)	(0.2)	(0.1)	(0.3)	(0.0)	(100.0)
	Daily Product Sector	-792.8	-132.0	-16981.8	-39.5	-62.2	-27.0	-3.4	-13.8	-1.0	-18053.5
		-0.214	-0.114	-2,820	-0.025	-0.026	-0.020	-0.008	-0.010	-0.007	-0.995
		(4.4)	(0.7)	(94.1)	(0.2)	(0.3)	(0.1)	(0.0)	(0.1)	(0.0)	(100.0)

Note: The top line shows the amount of change, the middle line shows the change rate of the amount of change in the definite sector and region, and the bottom line (in parenthesis) shows the rate of effect in each region.

Table d. Regional Change of Value Added and Total Change of Production
Case A-R2-(2) :A case supposing the degree of trade liberalization in Kanto at 3.0 times as present condition (unit:million yen, %)

		Hokkaido	Tohoku	Kanto	Chubu	Kinki	Chugoku	Shikoku	Kyushu	Okinawa	Total
Change of Value Added	Whole Sectors	-6365.6	-3071.2	-34161.0	-1682.4	-1630.5	-601.0	-336.8	-688.5	-125.9	-48662.9
		-0.047	-0.014	-0.025	-0.004	-0.003	-0.003	-0.003	-0.002	-0.006	-0.015
		(13.1)	(6.3)	(70.2)	(3.5)	(3.4)	(1.2)	(0.7)	(1.4)	(0.3)	(100.0)
	Daily Sector	-1539.0	-989.1	-5731.7	-93.8	-13.7	-16.6	-4.5	-24.7	-0.3	-8413.4
		-1.234	-2.096	-6.498	-0.429	-0.077	-0.075	-0.036	-0.049	-0.019	-2.177
		(18.3)	(11.8)	(68.1)	(1.1)	(0.2)	(0.2)	(0.1)	(0.3)	(0.0)	(100.0)
	Daily Product Sector	-351.1	-58.4	-10472.2	-19.1	-28.8	-13.7	-2.0	-6.6	-0.6	-10952.5
		-0.586	-0.313	-8.740	-0.069	-0.068	-0.053	-0.022	-0.028	-0.016	-3.317
		(3.2)	(0.5)	(95.6)	(0.2)	(0.3)	(0.1)	(0.0)	(0.1)	(0.0)	(100.0)
Total Change of Production	Whole Sectors	-27218.5	-12545.1	-151598.2	-8315.6	-7874.0	-3564.2	-1679.7	-3437.1	-550.8	-216783.1
		-0.105	-0.030	-0.055	-0.010	-0.007	-0.008	-0.008	-0.006	-0.014	-0.032
		(12.6)	(5.8)	(69.9)	(3.8)	(3.6)	(1.6)	(0.8)	(1.6)	(0.3)	(100.0)
	Daily Sector	-5881.4	-3613.5	-21228.5	-353.7	-57.3	-64.4	-18.2	-97.4	-1.4	-31315.8
		-1.824	-3.098	-9.402	-0.632	-0.121	-0.116	-0.060	-0.074	-0.035	-3.166
		(18.8)	(11.5)	(67.8)	(1.1)	(0.2)	(0.2)	(0.1)	(0.3)	(0.0)	(100.0)
	Daily Product Sector	-2824.9	-470.2	-60512.1	-140.8	-221.7	-95.9	-12.2	-49.2	-3.5	-64330.5
		-0.762	-0.408	-10.050	-0.090	-0.091	-0.072	-0.0030	-0.035	-0.025	-3.544
		(4.4)	(0.7)	(94.1)	(0.2)	(0.3)	(0.1)	(0.0)	(0.1)	(0.0)	(100.0)

Note: The top line shows the amount of change, the middle line shows the change rate of the amount of change in the definite sector and region, and the bottom line (in parenthesis) shows the rate of effect in each region.

Table e. Regional Change of Value Added and Total Change of Production
Case A-R3-(1) :A case supposing the degree of trade liberalization in Kinki at 1.5 times as present condition (unit:million yen, %)

		Hokkaido	Tohoku	Kanto	Chubu	Kinki	Chugoku	Shikoku	Kyushu	Okinawa	Total
Change of Value Added	Whole Sectors	-984.6	-287.1	841.2	-330.5	-3143.1	-372.2	-176.6	-302.3	-19.2	-6456.8
		-0.007	-0.001	-0.001	-0.001	-0.005	-0.002	-0.002	-0.001	-0.001	-0.002
		(15.2)	(4.4)	(13.0)	(5.1)	(48.7)	(5.8)	(2.7)	(4.7)	(0.3)	(100.0)
	Daily Sector	-344.7	-100.2	-44.1	-22.6	-374.2	-108.7	-38.5	-60.7	0.0	-1093.7
		-0.276	-0.212	-0.050	-0.103	-2.116	-0.490	-0.311	-0.120	0.000	-0.283
		(31.5)	(9.2)	(4.0)	(2.1)	(34.2)	(9.9)	(3.5)	(5.5)	(0.0)	(100.0)
	Daily Product Sector	-37.7	-1.9	-20.6	-10.6	-1181.2	-9.4	-0.4	-4.2	-0.1	-1266.1
		-0.063	-0.010	-0.017	-0.039	-2.801	-0.036	-0.004	-0.018	-0.003	-0.383
		(3.0)	(0.2)	(1.6)	(0.8)	(93.3)	(0.7)	(0.0)	(0.3)	(0.0)	(100.0)
Total Change of Production	Whole Sectors	-4040.6	-1166.1	-3794.8	-1543.3	-14873.7	-1660.1	-747.0	-1343.5	-82.9	-29252.0
		-0.016	-0.003	-0.001	-0.002	-0.013	-0.004	-0.004	-0.002	-0.002	-0.004
		(13.8)	(4.0)	(13.0)	(5.3)	(50.8)	(5.7)	(2.6)	(4.6)	(0.3)	(100.0)
	Daily Sector	-1276.6	-360.0	-166.9	-85.1	-1420.2	-390.3	-138.3	-224.5	-0.1	-4062.0
		-0.396	-0.309	-0.074	-0.152	-3.001	-0.701	-0.453	-0.172	-0.002	-0.411
		(31.4)	(8.9)	(4.1)	(2.1)	(35.0)	(9.6)	(3.4)	(5.5)	(0.0)	(100.0)
	Daily Product Sector	-298.2	-15.2	-135.6	-75.8	-7859.7	-64.1	-2.4	-30.4	-0.3	-8481.7
		-0.080	-0.013	-0.023	-0.049	-3.242	-0.048	-0.006	-0.022	-0.002	-0.467
		(3.5)	(0.2)	(1.6)	(0.9)	(92.7)	(0.8)	(0.0)	(0.4)	(0.0)	(100.0)

Note: The top line shows the amount of change, the middle line shows the change rate of the amount of change in the definite sector and region, and the bottom line (in parenthesis) shows the rate of effect in each region.

Table f. Regional Change of Value Added and Total Change of Production
Case A-R3-(2) :A case supposing the degree of trade liberalization in Kinki at 3.0 times as present condition (unit:million yen, %)

		Hokkaido	Tohoku	Kanto	Chubu	Kinki	Chugoku	Shikoku	Kyushu	Okinawa	Total
Change of Value Added	Whole Sectors	-3533.8	-1029.9	-3020.6	-1185.7	-11283.8	-1336.0	-635.0	-1085.5	-69.1	-23179.4
		-0.026	-0.005	-0.002	-0.003	-0.020	-0.007	-0.006	-0.004	-0.003	-0.007
		(15.2)	(4.4)	(13.0)	(5.1)	(48.7)	(5.8)	(2.7)	(4.7)	(0.3)	(100.0)
	Daily Sector	-1237.4	-359.7	-158.2	-81.4	-1343.4	-390.1	-138.4	-218.0	-0.1	-3926.7
		-0.992	-0.762	-0.179	-0.372	-7.595	-1.760	-1.120	-0.430	-0.006	-1.016
		(31.5)	(9.2)	(4.0)	(2.1)	(34.2)	(9.9)	(3.5)	(5.6)	(0.0)	(100.0)
	Daily Product Sector	-135.1	-6.7	-74.0	-38.3	-4240.3	-33.7	-1.4	-15.2	-0.2	-4544.9
		-0.225	-0.036	-0.062	-0.139	-10.056	-0.131	-0.015	-0.065	-0.005	-1.377
		(3.0)	(0.1)	(1.6)	(0.8)	(93.3)	(0.7)	(0.0)	(0.3)	(0.0)	(100.0)
Total Change of Production	Whole Sectors	-14505.5	-4186.7	-13618.7	-5540.2	-53395.3	-5958.5	-2681.2	-4820.7	-297.7	-105004.4
		-0.056	-0.010	-0.005	-0.007	-0.046	-0.013	-0.014	-0.009	-0.008	-0.016
		(13.8)	(4.0)	(13.0)	(5.3)	(50.9)	(5.7)	(2.6)	(4.6)	(0.3)	(100.0)
	Daily Sector	-4582.7	-1291.9	-598.8	-306.0	-5098.4	-1400.1	-497.2	-805.5	-0.5	-14581.1
		-1.421	-1.108	-0.265	-0.547	-10.775	-2.514	-1.629	-0.616	-0.012	-1.474
		(31.4)	(8.9)	(4.1)	(2.1)	(35.0)	(9.6)	(3.4)	(5.5)	(0.0)	(100.0)
	Daily Product Sector	-1069.9	-54.5	-486.4	-272.5	-28216.0	-230.6	-8.5	-109.3	-1.1	-30448.8
		-0.289	-0.047	-0.081	-0.174	-11.639	-0.172	-0.021	-0.078	-0.008	-1.678
		(3.5)	(0.2)	(1.6)	(0.9)	(92.7)	(0.8)	(0.0)	(0.4)	(0.0)	(100.0)

Note: The top line shows the amount of change, the middle line shows the change rate of the amount of change in the definite sector and region, and the bottom line (in parenthesis) shows the rate of effect in each region.

Table g. Regional Change of Value Added and Total Change of Production
Case B-R1:A case supposing the degree of trade liberalization in Hokaido at 1.5 times as present condition (unit:million yen, %)

		Hokkaido	Tohoku	Kanto	Chubu	Kinki	Chugoku	Shikoku	Kyushu	Okinawa	Total
Change of Value Added	Whole Sectors	-74.1	-1.6	-7.1	-1.9	-2.8	-0.7	0.0	-0.4	0.0	-88.6
		-0.001	-0.000	-0.000	-0.000	-0.000	-0.000	0.000	-0.000	0.000	-0.000
		(83.6)	(1.8)	(8.0)	(2.1)	(3.2)	(0.8)	(0.0)	(0.5)	(0.0)	(100.0)
	Potato Sector	-35.7	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	-35.8
		-0.068	0.000	0.000	0.000	0.000	0.000	0.000	-0.000	0.000	-0.025
		(99.7)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.3)	(0.0)	(100.0)
	Starch Sector	-15.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-15.6
		-0.274	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.048
		(100.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(100.0)
Total Change of Production	Whole Sectors	-291.7	-9.0	-35.2	-11.0	-14.2	-6.0	-0.8	-2.7	0.0	-370.6
		-0.001	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	0.000	-0.000
		(78.7)	(2.4)	(9.5)	(3.0)	(3.8)	(1.6)	(0.2)	(0.7)	(0.0)	(100.0)
	Potato Sector	-104.2	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	0.0	-104.4
		-0.111	0.000	0.000	0.000	0.000	0.000	0.000	-0.000	0.000	-0.045
		(99.8)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.2)	(0.0)	(100.0)
	Starch Sector	-103.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-103.1
		-0.303	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.051
		(100.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(100.0)

Note: The top line shows the amount of change, the middle line shows the change rate of the amount of change in the definite sector and region, and the bottom line (in parenthesis) shows the rate of effect in each region.

Table h. Regional Change of Value Added and Total Change of Production
Case B-R2:A case supposing the degree of trade liberalization in Kanto at 1.5 times as present condition (unit:million yen, %)

		Hokkaido	Tohoku	Kanto	Chubu	Kinki	Chugoku	Shikoku	Kyushu	Okinawa	Total
Change of Value Added	Whole Sectors	-82.2	-38.3	-1214.5	-48.2	-51.3	-24.1	-15.8	-44.5	-1.6	-1520.5
		-0.001	-0.000	-0.001	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
		(5.4)	(2.5)	(79.9)	(3.2)	(3.4)	(1.6)	(1.0)	(2.9)	(0.1)	(100.0)
	Potato Sector	-52.6	-2.1	-118.6	-0.6	0.0	-0.2	-5.4	-22.0	0.0	-201.5
		-0.100	-0.038	-0.411	-0.019	0.000	-0.009	-0.145	-0.052	0.000	-0.143
		(26.1)	(1.0)	(58.9)	(0.3)	(0.0)	(0.1)	(2.7)	(10.9)	(0.0)	(100.0)
	Starch Sector	0.0	0.0	-173.0	-0.1	0.0	0.0	0.0	0.0	0.0	-173.1
		0.000	0.000	-4.201	-0.001	0.000	0.000	0.000	0.000	0.000	-0.530
		(0.0)	(0.0)	(100.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(100.0)
Total Change of Production	Whole Sectors	-292.6	-151.5	-5230.0	-240.6	-242.8	-139.1	-63.5	167.1	-7.6	-6534.8
		-0.000	-0.000	-0.002	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.001
		(4.5)	(2.3)	(80.0)	(3.7)	(3.7)	(2.1)	(1.0)	(2.6)	(0.1)	(100.0)
	Potato Sector	-154.3	-5.5	-291.7	-1.5	0.0	-0.6	-13.4	-54.7	0.0	-521.7
		-0.164	-0.061	-0.643	-0.030	0.000	-0.017	-0.231	-0.85	0.000	-0.225
		(29.6)	(1.1)	(55.9)	(0.3)	(0.0)	(0.1)	(2.6)	(10.5)	(0.0)	(100.0)
	Starch Sector	-0.4	0.0	-1699.9	-0.9	-0.3	0.0	0.0	-0.2	0.0	-1701.7
		-0.001	0.000	-4.726	-0.001	-0.001	0.000	0.000	-0.001	0.000	-0.840
		(0.0)	(0.0)	(99.9)	(0.1)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(100.0)

Note: The top line shows the amount of change, the middle line shows the change rate of the amount of change in the definite sector and region, and the bottom line (in parenthesis) shows the rate of effect in each region.

Table i. Regional Change of Value Added and Total Change of Production
Case B-R3:A case supposing the degree of trade liberalization in Kinki at 1.5 times as present condition (unit:million yen, %)

		Hokkaido	Tohoku	Kanto	Chubu	Kinki	Chugoku	Shikoku	Kyushu	Okinawa	Total
Change of Value Added	Whole Sectors	-6.9	-7.8	-61.9	-31.0	-441.2	-26.7	-14.8	-13.5	-1.0	-604.8
		-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
		(1.1)	(1.3)	(10.2)	(5.1)	(72.9)	(4.4)	(2.4)	(2.2)	(0.2)	(100.0)
	Potato Sector	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
		-0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.000
		(100.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(100.0)
	Starch Sector	0.0	0.0	0.0	-0.1	-95.4	0.0	0.0	0.0	0.0	-95.5
		0.000	0.000	0.000	-0.001	-2.715	0.000	0.000	0.000	0.000	-0.294
		(0.0)	(0.0)	(0.0)	(0.1)	(99.9)	(0.0)	(0.0)	(0.0)	(0.0)	(100.0)
Total Change of Production	Whole Sectors	-31.3	-33.5	-280.7	-145.4	-1829.9	-133.7	-64.8	-63.0	-4.4	-2586.7
		-0.000	-0.000	-0.000	-0.000	-0.002	-0.000	-0.000	-0.000	-0.000	-0.000
		(1.2)	(1.3)	(10.9)	(5.6)	(70.7)	(5.2)	(2.5)	(2.4)	(0.2)	(100.0)
	Potato Sector	-0.4	0.0	-0.1	0.0	0.0	0.0	0.0	-0.1	0.0	-0.6
		-0.000	0.000	-0.000	0.000	0.000	0.000	0.000	-0.000	0.000	-0.000
		(66.7)	(0.0)	(16.7)	(0.0)	(0.0)	(0.0)	(0.0)	(16.7)	(0.0)	(100.0)
	Starch Sector	-0.2	0.0	-0.1	-0.7	-706.0	0.0	0.0	-0.1	0.0	-707.1
		-0.001	0.000	-0.000	-0.001	-2.992	0.000	0.000	-0.000	0.000	-0.349
		(0.0)	(0.0)	(0.0)	(0.1)	(99.8)	(0.0)	(0.0)	(0.0)	(0.0)	(100.0)

Note: The top line shows the amount of change, the middle line shows the change rate of the amount of change in the definite sector and region, and the bottom line (in parenthesis) shows the rate of effect in each region.

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