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A BASIC STUDY ON THE BALANCE OF INTERREGIONAL TRADE

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1. INTRODUCTION

In recent years, the national projects such as the arterial traffic networks were planned out by governmental bodies. And these projects are the long-range transportation planning and find expression in the form of public investment in very expensive transportation plant and equipment[1].

In the book "Kotsukeikaku" by Hirozo Ogawa[2], he claims that it is necessary to measure the present character of structure of interzonal flow of goods and money for better facilitation of arterial traffic networks. For the deeper analysis of these structures, it is necessary to analyze the observation of interregional balance of trade and industrial interactions and commodity flows.

In this paper, we try to describe the mathematical standard methods of the balance of interregional trade: Hermite Matrix and Hermite Inverse Matrix Methods. Then, we shall classify the conception of interregional balance and analyze the Interregional Input-Output Tables of Japan in 1960, 1965 and the Interzonal Commodity Flow Tables in 1965 by using Hermite Matrix and Hermite Inverse Matrix Methods.

2. THE DEFINITION OF INTERREGIONAL BALANCE

The conception of interregional balance is divided into five kinds.

(1) The First Balance

Q_1^J represents the change in the credit position region J with the rest of the world and a positive Q_1^J represents an improvement, and Q_1^J is designated as the first variation of region J. We have the following definitional equations:

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$$Q_1^J=\Big(\sum_{L\neq J} X^{J\to L}-\sum_{K\neq J} X^{K\to J}\Big)/2$$

The first balance is the following definition: $Q_1^J=0$, over all regions J. And total exports is equal to total imports.

$$\sum_J \sum_{L\neq J} X^{J\to L}=\sum_J \sum_{K\neq J} X^{K\to J}=W$$

Since what is a positive change for one region must necessarily be a negative change for some other region, the change in the credit positions of region J is $Q_1^J=(\sum_{L\neq J} X^{J\to L}-\sum_{K\neq J} X^{K\to J})/2$ and the net change in the credit position over all regions must be zero.

$X^{J\to L}$: J region's value of export to L region.

$\sum_{L\neq J} X^{J\to L}$: J region's total values of exports to all regions.

$X^{K\to J}$: J region's value of import from K region.

$\sum_{K\neq J} X^{K\to J}$: J region's total values of imports from all regions.

(2) The Second Balance

$Q_2^{J,L}$ is designated as the second variation between regions J and L and it is the following definitional equations:

$$Q_2^{J,L}=(X^{J\to L}-X^{L\to J})/2$$
$$=\Big(\sum_h x_h^{J\to L}-\sum_h x_h^{L\to J}\Big)/2$$

$Q_2^{J,L}$ represents the change in the average position of regions J with L region.

where $X^{J\to L}=\sum_h x_h^{J\to L}$

$x_h^{J\to L}$: h sector's value of J region's export to L region.

The second balance is the following definition: $Q_2^{J,L}=0$ over all regions J, L.

(3) The Third Balance

$Q_{3,h}^{J}$ is designated as the third variation of region J and it is the following definitional equation:

$$a_{n+1,n+1}=\sum_i^n\sum_j^n a_{i,j}=\sum_i^n\sum_j^n c_{i,j}$$

$$\begin{cases} b_{i,j}=(c_{i,j}-c_{j,i})/2 & (i,j=1,\cdots,n) \\ b_{i,n+1}=\sum_j^n b_{i,j} & (i=1,\cdots,n) \\ b_{n+1,j}=\sum_i^n b_{i,j} & (j=1,\cdots,n) \\ b_{n+1,n+1}=\sum_i^n\sum_j^n b_{i,j}=0 \end{cases}$$

A represents the average interregional input-output coefficients and B represents the variation of interregional input-output coefficients. And we can clarify the balance of trade position of any region, depending upon whether the value of its exports exceeds or falls short of the value of its imports. We shall refer to the method as Hermite Matrix Analysis because a Hermitian matrix in which the elements are real is conformable for a symmetric matrix.

4. HERMITE INVERSE MATRIX ANALYSIS

This chapter represents an attempt to examine in more detail the structure of an interregional repercussion with most of the emphasis of the simplest two-region case. Specifically, we are interested in the insights gained into the balance of interregional repercussion by using Hermite Inverse Matrix Analysis.

This matrix method is based on the new method combined Hermite Matrix and Inverse Matrix which shows the total effects of interregional propagation.

Denote the two regions by superscripts I and II. Then $\boldsymbol{A}^{\mathrm{I\,I}}$ will represent the matrix of intraregional input-output coefficients in region I, and $\boldsymbol{A}^{\mathrm{II\,II}}$ has a similar interpretation for the region II. Also, $\boldsymbol{A}^{\mathrm{I\,II}}$ shows per unit inputs from each sector in region I to each sector in region II and $\boldsymbol{A}^{\mathrm{II\,I}}$ indicates shipments in the opposite direction.

Thus, letting $A=\left[\begin{array}{c:c}\boldsymbol{A}^{\mathrm{I\,I}} & \boldsymbol{A}^{\mathrm{I\,II}} \\ \hdashline \boldsymbol{A}^{\mathrm{II\,I}} & \boldsymbol{A}^{\mathrm{II\,II}}\end{array}\right]$, the two-region system can be written by using Hermite Matrix as follows:

$$A=\left[\begin{array}{c:c}\boldsymbol{A}^{\mathrm{I\,I}} & \boldsymbol{A}^{\mathrm{I\,II}} \\ \hdashline \boldsymbol{A}^{\mathrm{II\,I}} & \boldsymbol{A}^{\mathrm{II\,II}}\end{array}\right] =\left[\begin{array}{c:c}A^{\mathrm{I\,I}}+A'^{\mathrm{I\,I}} & A^{\mathrm{I\,II}}+A'^{\mathrm{I\,II}} \\ \hdashline A^{\mathrm{II\,I}}+A'^{\mathrm{II\,I}} & A^{\mathrm{II\,II}}+A'^{\mathrm{II\,II}}\end{array}\right]$$

where

$$A^{\mathrm{I\,I}}=(\boldsymbol{A}^{\mathrm{I\,I}}+\boldsymbol{A}'^{\mathrm{I\,I}})/2\,,\qquad A'^{\mathrm{I\,I}}=(\boldsymbol{A}^{\mathrm{I\,I}}-\boldsymbol{A}'^{\mathrm{I\,I}})/2$$

$$A^{\mathrm{I\,II}}=(\boldsymbol{A}^{\mathrm{I\,II}}+\boldsymbol{A}'^{\mathrm{II\,I}})/2\,,\qquad A'^{\mathrm{I\,II}}=(\boldsymbol{A}^{\mathrm{I\,II}}-\boldsymbol{A}'^{\mathrm{II\,I}})/2$$

$A^{\mathrm{II\,II}}$ and $A'^{\mathrm{II\,II}}$ have a similar interpretation for region II. Also, $\boldsymbol{A}^{\mathrm{II\,I}}$ and $A'^{\mathrm{II\,I}}$ indicates shipments in the opposite direction.

We define the notations of partitioned matrices as follows:

$\boldsymbol{B}^{\mathrm{I}}=[I-\boldsymbol{A}^{\mathrm{I\,I}}]^{-1}$: total direct and indirect production coefficients in region I.

$\boldsymbol{B}^{\mathrm{II}}=[I-\boldsymbol{A}^{\mathrm{II\,II}}]^{-1}$: total direct and indirect production coefficients in region II.

$$\boldsymbol{C}^{\mathrm{II\,I}}=\boldsymbol{A}^{\mathrm{II\,I}}\cdot\boldsymbol{B}^{\mathrm{I}}=(A^{\mathrm{II\,I}}+A'^{\mathrm{II\,I}})\cdot\boldsymbol{B}^{\mathrm{I}} =A^{\mathrm{II\,I}}\cdot\boldsymbol{B}^{\mathrm{I}}+A'^{\mathrm{II\,I}}\cdot\boldsymbol{B}^{\mathrm{I}}$$

$\boldsymbol{C}^{\mathrm{II\,I}}$: total input coefficients from region II necessary to sustain production in region I.

$C^{\mathrm{II\,I}}=A^{\mathrm{II\,I}}\cdot\boldsymbol{B}^{\mathrm{I}}$: total average input coefficients from region II necessary to sustain production in region I.

$C'^{\mathrm{II\,I}}=A'^{\mathrm{II\,I}}\cdot\boldsymbol{B}^{\mathrm{I}}$: total input variation coefficients from region II necessary to sustain production in region I.

$$\boldsymbol{C}^{\mathrm{I\,II}}=\boldsymbol{A}^{\mathrm{I\,II}}\cdot\boldsymbol{B}^{\mathrm{II}}=(A^{\mathrm{I\,II}}+A'^{\mathrm{I\,II}})\cdot\boldsymbol{B}^{\mathrm{II}} =A^{\mathrm{I\,II}}\cdot\boldsymbol{B}^{\mathrm{II}}+A'^{\mathrm{I\,II}}\cdot\boldsymbol{B}^{\mathrm{II}}$$

$$C^{\mathrm{I\,II}}=A^{\mathrm{I\,II}}\cdot\boldsymbol{B}^{\mathrm{II}}\,,\qquad C'^{\mathrm{I\,II}}=A'^{\mathrm{I\,II}}\cdot\boldsymbol{B}^{\mathrm{II}}$$

$\boldsymbol{C}^{\mathrm{I\,II}}$, $C^{\mathrm{I\,II}}$ and $C'^{\mathrm{I\,II}}$ have a similar interpretation replacing region I and region II each other.

$$\boldsymbol{D}^{\mathrm{I\,II}}=\boldsymbol{B}^{\mathrm{I}}\cdot\boldsymbol{A}^{\mathrm{I\,II}}=\boldsymbol{B}^{\mathrm{I}}\cdot(A^{\mathrm{I\,II}}+A'^{\mathrm{I\,II}}) =\boldsymbol{B}^{\mathrm{I}}\cdot A^{\mathrm{I\,II}}+\boldsymbol{B}^{\mathrm{I}}\cdot A'^{\mathrm{I\,II}}$$

$\boldsymbol{D}^{\mathrm{I\,II}}$: total production coefficients in region I to meet the total requirements of region II.

$D^{\mathrm{I\,II}}=\boldsymbol{B}^{\mathrm{I}}\cdot A^{\mathrm{I\,II}}$: total average production coefficients in region I to meet the requirements of region II.

$D'^{\mathrm{I\,II}}=\boldsymbol{B}^{\mathrm{I}}\cdot A'^{\mathrm{I\,II}}$: total production variation coefficients in region I to meet the requirements of region II.

$$\boldsymbol{D}^{\mathrm{II\,I}}=\boldsymbol{B}^{\mathrm{II}}\cdot\boldsymbol{A}^{\mathrm{II\,I}}=\boldsymbol{B}^{\mathrm{II}}\cdot(A^{\mathrm{II\,I}}+A'^{\mathrm{II\,I}}) =\boldsymbol{B}^{\mathrm{II}}\cdot A^{\mathrm{II\,I}}+\boldsymbol{B}^{\mathrm{II}}\cdot A'^{\mathrm{II\,I}}$$

$\boldsymbol{D}^{\mathrm{II\,I}}$, $D^{\mathrm{II\,I}}$ and $D'^{\mathrm{II\,I}}$ have a similar interpretation replacing region I and region II each other.

$G^{\mathrm{I\,II}}=[I-\boldsymbol{D}^{\mathrm{I\,II}}\cdot\boldsymbol{D}^{\mathrm{II\,I}}]^{-1}\cdot\boldsymbol{B}^{\mathrm{I}}$: total effect coefficients in region I.

$G^{\mathrm{II\,I}}=[I-\boldsymbol{D}^{\mathrm{II\,I}}\cdot\boldsymbol{D}^{\mathrm{I\,II}}]^{-1}\cdot\boldsymbol{B}^{\mathrm{II}}$: total effect coefficients in region II.

With respect to the detail conception of interregional propagation, the reder may refer to the papers[4),5)] and books[6),7),9),10),12)].

Next, we shall represent the transformation in

$$Q_{3,h}^{J}=(\sum_{L\neq J} x_h^{J\to L}-\sum_{K\neq J} x_h^{K\to J})/2$$

The third balance is the following definition: $Q_{3,h}^{J}=0$ over all regions J by sector h.

(4) The Fourth Balance

$Q_{4,h}^{J,L}$ is designated as the fourth variation between regions J and L by sector h and it is the following definitional equation:

$$Q_{4,h}^{J,L}=(x_h^{J\to L}-x_h^{L\to J})/2$$

$$x_h^{J\to L}=\sum_f \omega_{h,f}^{J\to L}$$

$\omega_{h,f}^{J\to L}$: h sector's export value of region J to f sector of region L.

The fourth balance is the following definition: $Q_{4,h}^{J,L}=0$ over all regions J, L by sector h.

(5) The Fifth Balance

$Q_{5,h,f}^{J,L}$ is designated as the fifth variation betweeen h sector of region J and f sector of region L. And it is the following definitional equation:

$$Q_{5,h,f}^{J,L}=(\omega_{h,f}^{J\to L}-\omega_{f,h}^{L\to J})/2$$

The fifth balance is the following definition: $Q_{5,h,f}^{J,L}=0$ over all regions J, L and all sectors h, f.

It is clear from the definition of five kinds of balance that the following theorems can be developed.

Theorem 1

If the second balance is satisfied, then the first balance is satisfied. But the converse is not satisfied.

Theorem 2

If the fourth balance is satisfied, then the third balance is satisfied. But the converse is not satisfied.

Theorem 3

If the third balance is satisfied over all sectors, then the first balance is satisfied. But the converse is not satisfied.

Theorem 4

If the fourth balance is satisfied over all sectors, then the second balance is satisfied. But the converse is not satisfied.

Theorem 5

If the fifth balance is satisfied, then all other balances are satisfied. Namely, the fifth balance is the strongest one and the converse is not satisfied.

With respect to the general equilibrium of economic subsystem in a multiregional setting, the reader may refer to the book[3].

3. HERMITE MATRIX ANALYSIS

In this chapter, we shall represent the new mathematical standard method to analyze the interregional balance. It is one of matrix methods which indicates how the balance disparts. This matrix method is based on the following theorem.

Theorem 6

Any square matrix can be written as the sum of a symmetric and a skew-symmetric matrix. Let C be a square matrix, then $C=A+B$ [11].

where A: a symmetric matrix.
B: a skew-symmetric matrix.

From this theorem, the following corollary is satisfied.

Corollary 1

Let C be the following square matrix, A be the following symmetric matrix, and let B be the following skew-symmetric matrix.

$$C=\begin{pmatrix} c_{1,1} & \cdots & c_{1,n} & c_{1,n+1} \\ \vdots & \ddots & \vdots & \vdots \\ c_{n,1} & \cdots & c_{n,n} & c_{n,n+1} \\ c_{n+1,1} & \cdots & c_{n+1,n} & c_{n+1,n+1} \end{pmatrix}$$

where

$$c_{i,n+1}=\sum_j^n c_{i,j} \qquad (i=1,\cdots,n)$$

$$c_{n+1,j}=\sum_i^n c_{i,j} \qquad (j=1,\cdots,n)$$

$$c_{n+1,n+1}=\sum_i^n \sum_j^n c_{i,j} \qquad (i,j=1,\cdots,n)$$

$$A=\begin{pmatrix} a_{1,1} & \cdots & a_{1,n} & a_{1,n+1} \\ \vdots & \ddots & \vdots & \vdots \\ a_{n,1} & \cdots & a_{n,n} & a_{n,n+1} \\ a_{n+1,1} & \cdots & a_{n+1,n} & a_{n+1,n+1} \end{pmatrix}$$

$$B=\begin{pmatrix} b_{1,1} & \cdots & b_{1,n} & b_{1,n+1} \\ \vdots & \ddots & \vdots & \vdots \\ b_{n,1} & \cdots & b_{n,n} & b_{n,n+1} \\ b_{n+1,1} & \cdots & b_{n+1,n} & b_{n+1,n+1} \end{pmatrix}$$

Then, the following equations are satisfied.

$$\begin{cases} a_{i,j}=(c_{i,j}+c_{j,i})/2 & (i,j=1,\cdots,n) \\ a_{i,n+1}=\sum_j^n a_{i,j} & (i=1,\cdots,n) \\ a_{n+1,j}=\sum_i^n a_{i,j} & (j=1,\cdots,n) \end{cases}$$

which the interregional input-output coefficient matrix by sector is transformed into the interregional input-output coefficient matrix by region. This transformation is designated as *I-R* transformation. *R-I* transformation represents the converse mentioned above.

I-R transformation

A: interregional input-output coefficient matrix by sector.

B: interregional input-output coefficient matrix by region.

R: matrix having 1 or 0 elements.

There exists a matrix R which satisfies the following equation:

$$R' \cdot A \cdot R = B$$

Theorem 7

If A and B are the matrices which consist of N sectors and each sector with N elements, then there exists R matrix having the following elements.

$$R = \{b_{i,j}^{n,m}\} \qquad b_{i,j}^{n,m} = \begin{cases} b_{i,j}^{n,m} = 1 & (n=j,\ m=i) \\ b_{i,j}^{n,m} = 0 & \text{(others)} \end{cases}$$

$$(i, j, n, m = 1, \cdots, N)$$

It may be clear that the input coefficients are only reorganized by *I-R* (*R-I*) transformation. Then the following theorem can be developed.

Theorem 8

The values of input coefficients are not changed by *I-R* (*R-I*) transformation.

5. INTERREGIONAL TRADE: SOME EXPERIMENTAL RESULTS

We have obtained the interregional input-output table with 10 sectors having 9 by 9 intraregional and interregional coefficient matrices in 1960, and 9 regions having 10 by 10 intraregional and interregional coefficient matrices in 1965. The classifications of regions and sectors are shown in Tables 1 and 2.

First, we shall discuss the first balance problem using the data of Interregional Total Inputs and Total Outputs and compare the results in 1960 and 1965 using Hermite Matrix Analysis. The results are shown in Fig. 1. And also, the results of data of Interregional Intermediate Total Inputs and Total Outputs are shown in Fig. 2.

From the facts presented in the graphs, the remarkable feature is the expansions of variations of Hokkaido, Kanto, Tokai and Kyushu in 1965.

Table 1

Numbers	Regions	Prefectures
HOK	Hokkaido	Hokkaido
TOH	Tohoku	Aomori, Iwate, Miyagi, Akita, Yamagata, Fukushima
KAN	Kanto	Niigata, Ibaraki, Tochigi, Gumma, Saitama, Chiba, Tokyo, Kanagawa, Yamanashi, Nagano, Shizuoka
TOK	Tokai	Gifu, Aichi, Mie
HKU	Hokuriku	Toyama, Ishikawa
KIN	Kinki	Fukui, Shiga, Kyoto, Osaka, Hyogo, Nara,a Wakayama
CHU	Chugoku	Tottori, Shimane, Okayama, Hiroshima, Yamaguchi
SHI	Shikoku	Tokushima, Kagawa, Ehime, Kochi
KYU	Kyushu	Fukuoka, Saga, Nagasaki, Kumamoto, Oita, Miyazaki, Kagoshima

Table 2

Numbers	Sectors
01	Agriculture, forestory and fisheries
02	Mining
03	Textile products
04	Chemicals
05	Metal and Metal products
06	Machinery
07	Miscellaneous manufacturing
08	Construction
09	Transportation and Warehousing
10	The Others

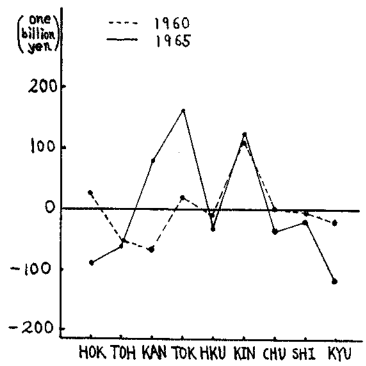

Fig. 1 The Regional Variations of Total Products.

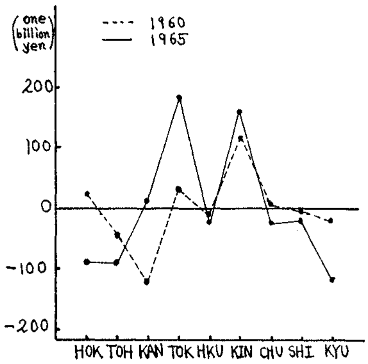

Fig. 2 The Regional Variations of Intermediate Products.

It is clear that the Total Outputs of Kanto and Tokai increase remarkably and Hokkaido and Kyushu decrease than the Total Inputs. Next, to clarify the cause of these changes, we shall calculate the standard weight vector[8] which satisfies the following conditions.

$$\omega_S = \frac{R_S^{-1} \cdot r_c}{\sqrt{r_c' \cdot R_S^{-1} \cdot r_c}}$$

ω_S: standard weight vector.
R_S: matrix of correlation coefficients between each sectors.
r_c : covariance vector between criterion composite and predictor composite.
r_c': transpose of vector r_c.

The result is shown in Fig. 3. And the standard weight values of Agriculture, forestry and

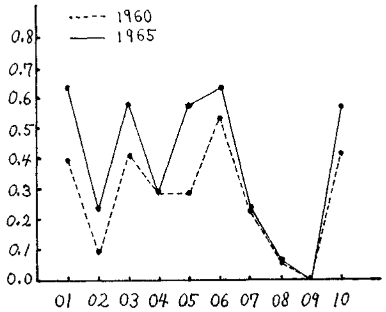

Fig. 3 The Standard Weight Vector by Sectors.

fisheries (01), Textile products (03), Metal and metal products (05), Machinery (06) and The Others (10) show the high values and these industries indicate the main factors. The graphs in Fig. 4 to Fig. 8 represent the variations of trades of these industries.

In addition, we shall attempt to examine the correlation between the values of Interregional Inputs-Outputs (1965) and Interzonal Flow of Goods (1965). The results by region are shown in Table 3 and the ones by sector are shown in Table 4. b is the coefficient of the least-

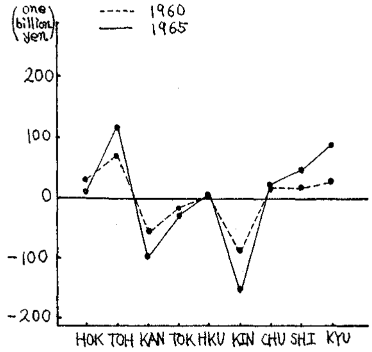

Fig. 4 The Regional Variations of Agriculture, Forestry and Fisheries Products.

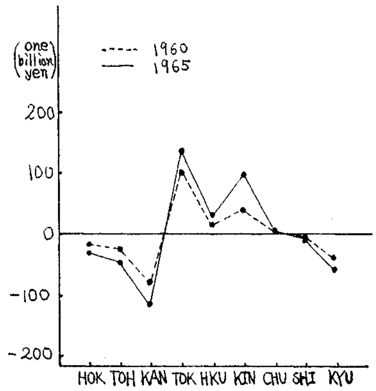

Fig. 5 The Regional Variations of Textile Products.

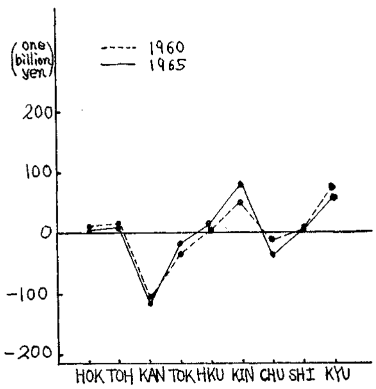

Fig. 6 The Regional Variations of Metal and Metal Products.

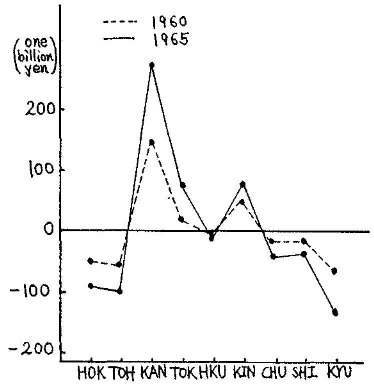

Fig. 7 The Regional Variations of Machinery Products.

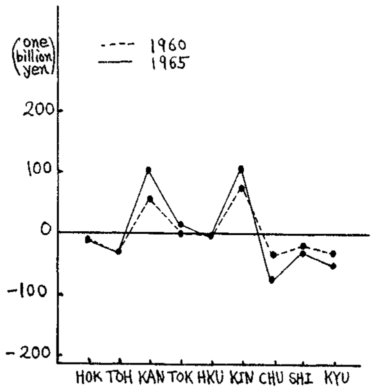

Fig. 8 The Regional Variations of The Others Products.

squares regression ($Y=a+b*X$) of Interzonal Flow of Goods (Y) on Interregional Inputs-Outputs (X).

Table 3

Regions	Correlation Coefficients	Coefficients b $\left(\frac{\text{ten thousand ton}}{\text{one billion yen}}\right)$
Hokkaido	0.96341	4.32142
Tohoku	0.97589	2.53077
Kanto	0.73823	0.89151
Tokai	0.97760	1.37252
Hokuriku	0.99658	1.38439
Kinki	0.83546	0.64722
Chugoku	0.76035	2.69217
Shikoku	0.85001	4.96314
Kyushu	0.85776	3.21192

Table 4

Sectors	Correlation Coefficients	Coefficients b $\left(\frac{\text{ten thousand ton}}{\text{one billion yen}}\right)$
Agriculture, forestry and fisheries	0.79116	2.27475
Mining	0.86654	26.11579
Textile products	0.60534	0.10024
Chemicals	0.78602	3.28062
Metal and Metal products	0.89535	1.29215
Machinery	0.85957	0.19043
Miscellaneous manufacturing	0.72383	0.90637

It may appear to be clear from these tables that the coefficients (b) of Kanto and Kinki show the low values less than 1 and other regions show the high values more than 1, and the coefficients (b) of Textile products (03) and Machinery (06) show the low values less than 0.2. By comparing these graphes and tables, the following points may be concluded. Kanto mainly imports Agriculture, forestry and fisheries (01), Mining (02), Textile products (03) and Metal and metal products (05), and exports Machinery (06) and The Others (10). And Kinki and Tokai mainly import Agriculture, forestry and fisheries (01) and Chemicals (04), and export Textile products (03), Machinery (06) and The Others (10).

Next, we shall attempt to examine in more detail the structure of an interregional repercussion with the two-region case. Specifically, these regions are Hokkaido and other region except Hokkaido and are designated as the region I and region II. Each region has 10 by 10 intraregional and interregional coefficient matrices.

Then, we shall compute the partitioned matrices such as $\boldsymbol{B}^{\mathrm{I}}$, $\boldsymbol{B}^{\mathrm{II}}$, $C'^{\mathrm{II}\ \mathrm{I}}$, $C'^{\mathrm{I}\ \mathrm{II}}$, $D'^{\mathrm{I}\ \mathrm{II}}$, $D'^{\mathrm{II}\ \mathrm{I}}$, $G^{\mathrm{I}\ \mathrm{II}}$ and $G^{\mathrm{II}\ \mathrm{I}}$ mentioned in the chapter 4. These results are shown in Fig. 9 to Fig. 16. In each figure, the solid line represents the sum of entries of each column and the dotted line represents the sum of entries of each row.

From the facts presented in Fig. 9 and Fig. 10, only the Metal and metal products (05) in region I ($\boldsymbol{B}^{\mathrm{I}}$) is equal to the one in region II ($\boldsymbol{B}^{\mathrm{II}}$) and in the other sectors, $\boldsymbol{B}^{\mathrm{II}}$ is greater than $\boldsymbol{B}^{\mathrm{I}}$. The facts presented in Fig. 11 to Fig. 14 indicate the reliance on other region. The reliances of Textile products (03), Machinery (06) and Construction (08) in region I show high degrees, but the reliances of all sectors in region II show low degrees.

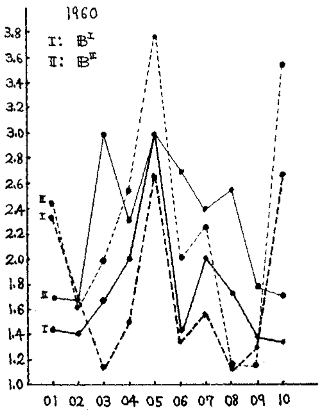

Fig. 9 The Total Direct and Indirect Production Coefficients $(\boldsymbol{B}^{\mathrm{I}}, \boldsymbol{B}^{\mathrm{II}})$ in 1960.

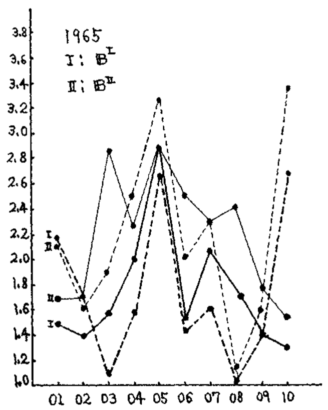

Fig. 10 The Total Direct and Indirect Production Coefficients $(\boldsymbol{B}^{\mathrm{I}}, \boldsymbol{B}^{\mathrm{II}})$ in 1965.

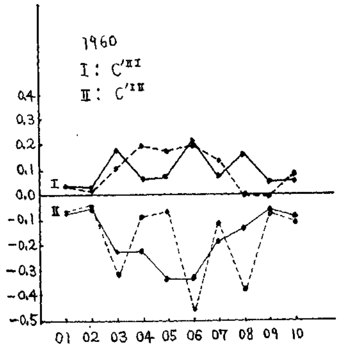

Fig. 11 The Total Input Variation Coefficients $(C'^{\mathrm{I\ II}}, C'^{\mathrm{II\ I}})$ in 1960.

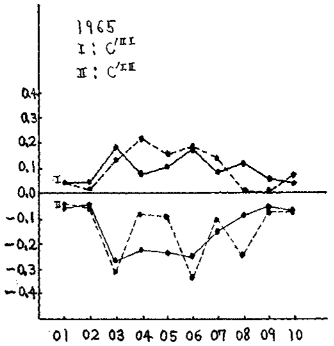

Fig. 12 The Total Input Variation Coefficients $(C'^{\mathrm{I\ II}}, C'^{\mathrm{II\ I}})$ in 1965.

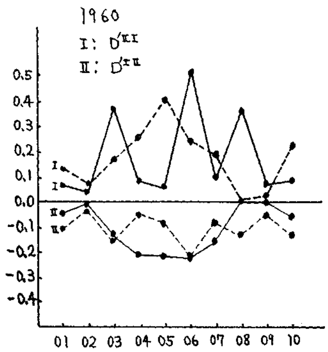

Fig. 13 The Total Production Variation Coefficiets $(D'^{\mathrm{I\ II}}, D'^{\mathrm{II\ I}})$ in 1960.

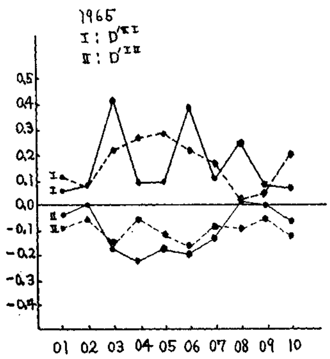

Fig. 14 The Total Production Variation Coefficients $(D'^{\mathrm{I\ II}}, D'^{\mathrm{II\ I}})$ in 1965.

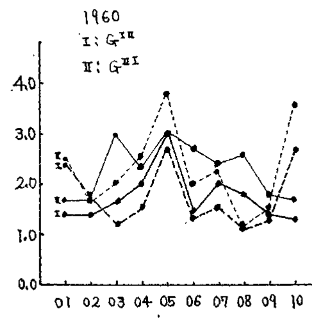

Fig. 15 The Total Effect Coefficients $(G^{\mathrm{I\ II}}, G^{\mathrm{II\ I}})$ in 1960.

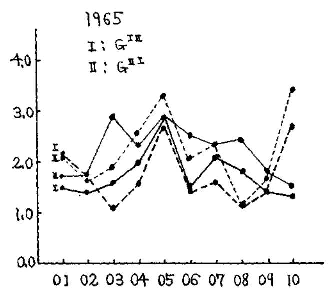

Fig. 16 The Total Effect Coefficients $(G^{\mathrm{I\ II}}, G^{\mathrm{II\ I}})$ in 1965.

From the facts presented in Fig. 15 and Fig. 16, only the Metal and metal products (05) in region I ($G^{I\ II}$) is equal to the one in region II ($G^{II\ I}$) and in the other sectors, $G^{II\ I}$ is greater than $G^{I\ II}$

6. CONCLUSION

In summary, we have investigated the classifications of interregional balance and the mathematical standard methods for the analysis of interregional balance: Hermite Matrix and Hermite Inverse Matrix Methods. By using these methods, we can formulate a more detail interregional trade.

From the facts obtained in the Interregional Input-Output Tables in 1960 and 1965, the following points may be concluded.

First, from the facts presented in Fig. 1 and Fig. 2, it seems to be clear that the Total Outputs of Kanto and Tokai increase remarkably and Hokkaido and Kyushu decrease than the Total Inputs in 1965. By calculating the standard weight vector, the cause of these changes is the disparities of Agriculture, forestry and fisheries (01), Textile products (03), Metal and metal products (05), Machinery (06), and The Others (10). Specifically, Kanto, Kinki and Tokai import the low degree products and process the high degree products.

Second, with respect to the detail examinations of the interregional repercussion with Hokkaido, we have computed the several partitioned matrices. And the following results were obtained. The total direct and indirect production and total effect coefficients in region I are equal to the ones in region II in Metal and metal products (05), but in the other sectors, the ones in region II are greater than the ones in region I.

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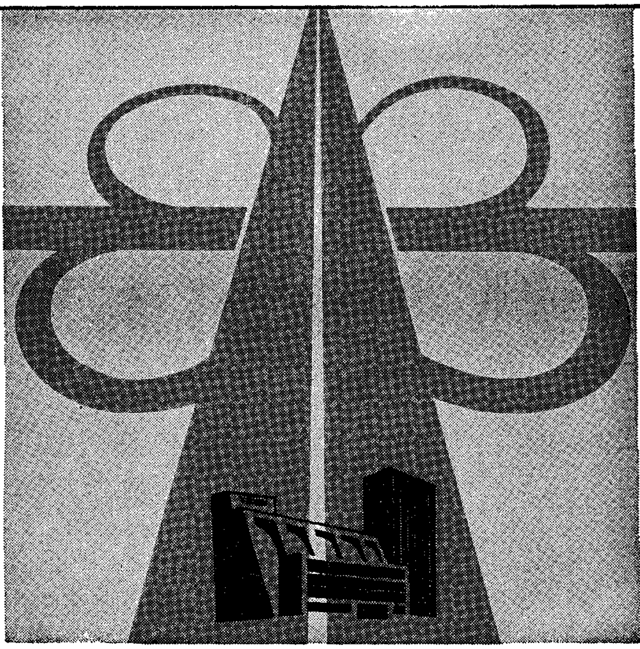

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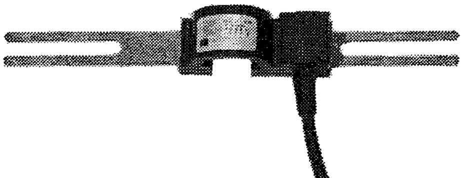

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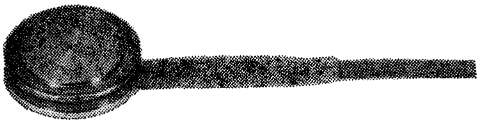

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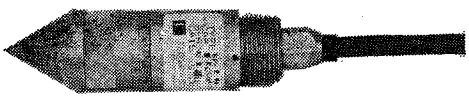

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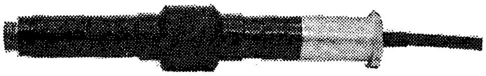

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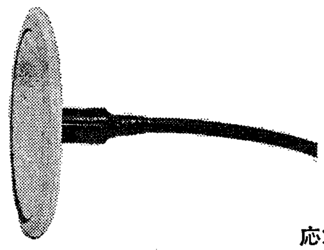

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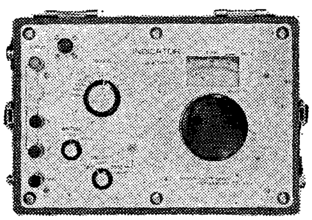

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