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REGIONAL DIFFERENCES IN LEVELS OF INCOME AND INTERNAL MIGRATION

(Preliminary)

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TABLE OF CONTENTS

Part I. Economic Factors and Functions of Migration

The Population Branch of the United Nations has once concluded after reviewing various research results on social and economic factors affecting population migration that "the preponderance of economic motives for international migration is generally recognized".[1/] Economic factors of migration are varied in kinds. Among them, what can most inclusively indicate the economic condition of the areas is the level of living of the population of these areas in the broadest sense of the term. Assumption is made that the population migrates from the area of relatively low level of living to the area of relatively high level, namely, that the economic function of migration is the balancing movement of population distribution to alleviate the regional disparities in population distribution or levels of living.

This assumption is by no means new but has either expressd expressedly or latently been followed during the course of the history of population theories. Ryozaburo Minami and Yasuma Takata had genealogically dated the assumption back to T.R. Malthus (Thomas Robert Malthus, Principle, 6th edition, 1826)[2/ 3/]

1/ United Nations, The Determinants and Consequences of Population Trends, Population Studies, No. 17, New York, 1953, p. 132.

If this assumption that the economic function of migration is the balancing movement of regional disparities in levels of living is correct, the degree of unevenness in population distribution against levels of living or "degree of economic unevenness" should be lower as compared with the degree of unevenness of population distribution against area or "degree of physical unevenness" of population distribution. Also, by comparing (1) the degree of economic unevenness on the assumption of no internal migration and (2) that of actual population distribution, rough measurement of levelling-off effects in levels of living by migration could be possible.

If the economic function of migration is the balancing movement of regional differences in levels of living, the ultimate stage should be such a pattern of regional distribution of population where the levels of living in each area is equal or the realization of such population distribution equally relevant to the regional distribution of levels of living. The equal population distribution, according to this

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2/ Ryozaburo Minami, The Study of Population Principle -- A Conception for the Establishment of Demography, 1943, p. 249 fg. and General Demography -- Study of Principles of Population, 1960, p. 235 fg.

3/ Yasuma Takata, "Theory of Population Migration", Ryozaburo Minami, ed., Population Encychropaedia, 1957, pp. 121-122.

assumption is the stop line of migration and the migration of actual population will constantly continue the movement to approach the equal population distribution, following the "law of minimum resistance" under many kinds of resistance expected to vary in different areas.[4] The difference between the theoretical population and the actual population in the equal distribution can indicate, on the present assumption, a kind of economic potential of migration. If, then, the difference between the theoretical population and the actual population in the equal distribution can be called as "absolute potential", the ratio of the absolute potential to the actual population can be called "relative population".[5]

Namely, if the theoretical population in i prefecture at a certain time on the assumption of equal population distribution is $\underline{P'_i}$, and its actual population is $\underline{P_i}$, the absolute potential $\underline{Z}$ is:

$$\underline{Z} = \underline{P'_i} - \underline{P_i}, \qquad (1)$$

4/ There remains some room for further theoretical demonstration of this assumption.
Ryozaburo Minami and Akira Ono, "Labor Migration and Wage Disparities - Reconsideration of the theoretical assumption" (rep.), Hitotsubashi University Theoretical Economics Research Series, No.2, April 1962.
Keisuke Suzuki, "Law of Regional Limit Income Equality and 'Equal Population Distribution (Minoru Tachi)' ", Medicine and Biology, Vol.58, No.3, 5 February 1961, pp. 111-113.
Riichiro Nishigori and Keisuke Suzuki, "Revised 'Law of Regional Limit Income Equality'", ibid., Vol.58, No.4, 20 February 1961, pp.130-133.

5/ Minoru Tachi, "Function of Internal Migration", Minoru Tachi ed., Migration in Japan, Keisei Sensho, 1961, p.146 fg.

and the relative potential ζ is:

$$\zeta = (P_i - P_i)/P_i$$
$$= \frac{P_i}{Y_i} \cdot \frac{P}{Y} - 1 \qquad (2)$$

Here P denotes the total population and Y national income.

Part II. Unevenness of Population Distribution

There are various methods for measuring degree of unevenness of regional population distribution. An application is made here of the Lorenz curve which does not assume any distribution law, and comparative measurement is made of the physical and economic dissimilarities of regional population distribution of post-war Japan.

Table 1. Closed Area between Lorenz Curve and Diagonal Line (λ) Indicating Physical and Economic Unevenness of Population Distribution.

Year	λ_1 (1)	λ_2 (2)
1948	21.3 %	7.7 %
1950	21.6	12.1
1955	22.4	7.0
1959	-	8.9
1960	23.5	-

The column (1) of Table 1 shows the values of the closed area between Lorenz curve and diagonal line (λ_1), obtained

by cumulation of the population density in the order from the lowest to the highest, on the basis of prefectual population and area size from the censuses for the census years and from the estimates by the Bureau of Statistics of the Office of the Prime Minister for the inter-census years. The value of λ_1 continuously increases from 21.3% in 1948 to 23.5% in 1960. This means that the distribution imbalance shows relatively sizable and obvious expansion reflecting the urbanization of population.

Followingly, as the index of the regional levels of living in the broad sense, prefectural distribution of real distribution income is taken and the closed area λ_2 of Lorenz curve of population distribution as against it is calculated and shown in column (2) of Table 1. Data for the distribution income for all the prefectures in "White Paper on National Income" edited by the Economic Planning Agency are available only for three years of 1957-9. However, prefectural income data for the period of 1948-54 1/ are available at the Institute of National Economic Research as their estimate made for the Bureau of National Development of the Economic Planning Agency and, for the later years, data are available at the Economic

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1/ National Development Bureau, Economic Planning Agency, Results of Prefectural Distribution Income Estimates in Post-War Period (1948-1954), printing, 1958.

Planning Agency except for a few prefectures. The value of λ_2 in Table 1 shows the result of the highest to the lowest cumulation of per capita real distribution income by converting the above materials, properly adjusted, into real income 2/ by means of national consumer's price index used in the "White Paper on Economy" edited by the Economic Planning Agency, taking the basis at 1950 which is assumed as the year when the Japanese economy started relatively normal growth after the post-war confusion. The value of λ_2 fluctuates considerably from year to year and the range is from 7% in 1955 to 12% in 1950. However, comparing with λ_1, except 1950, λ_2 amounts only one third of λ_1. This fact indicates that the economic unevenness of population distribution is much smaller than physical unevenness and already suggests that the economic function of migration is the balancing movement of population distribution with regional distribution of income.

Assuming that the economic function of migration is the balancing movement, the rough balancing effect of migration with income disparities can be measured by comparing λ'_2, closed area of Lorenz curve of the closed population distribution in

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2/ Minoru Tachi, 1948-1959 Estimate of Prefectual Distribution Income (Preliminary), printing, revised edition, November 1962.

prefectures on the assumption of no migration and prefectural real income, with λ_2 calculated for actual population. If the income balancing effect of migration is denoted as ε,

$$\varepsilon = (\lambda'_2 - \lambda_2) / \lambda_2$$

Table 2 shows that migration alleviated the income disparities by almost 7% of λ_2 even during the period of 1948-50 when in-migration control to 6 large cities, housing shortage and food shortage were preventing migration. In 1950-55, the urban in-migration control was abolished and food and housing conditions improved and repulsive urban concentration of population started. During this period, income balancing effect jumped up closely to 26%. During nine years from 1950 to 1959, the income balancing effect of migration reached as high as 34%. This fact may also be a proof that the migration function is the balancing of regional disparities of income.3/

3/ Minoru Tachi, "Changes in regional distribution of population and income in post-war Japan", Annual Report of the Institute of Population Problems, No.4, 1959.
Minoru Tachi and Misako Oyama, "Potential of Japan's internal migration", Same Annual Report, No.5, 1960.

Table 2. Income Balancing Effect of Migration.

Year	λ_2'	λ_2	ε
1948 - 50	12.7 %	12.1 %	6.6 %
1950 - 55	8.8	7.0	25.7
1955 - 59	10.2	8.9	14.6
1950 - 59	11.9	8.9	33.7

Part III. Economic Potential of Migration and Actual Migration

The calculation of inter-prefectural migration potentials was attempted by means of the formulas (1) and (2) above mentioned and to simplify the results, the averages for 2 periods of 1950-54 and 1955-59 are shown in Table 3.

During 1950-54, the speed of reconstruction still varied greatly from prefecture to prefecture depending on the differences in the extent of war damage and in social, economic and political conditions for reconstruction. Repatriation of urban population dispersed to rural areas had not yet terminated. By 1950, most of over 6 million repatriates from overseas returned to rural areas which caused temporary expansion of population in agricultural prefectures. However, as the control of urban in-migration was in effect until the end of March 1950 and the above-mentioned preventive factors were controlling the urban re-concentration of population.

In this period, the theoretical population on the assumption of equal population distribution surpassed the actual population and the migration potential was in plus quantity. The areas with the potential of population accommodation were only 12 including the prefectures with 6 large cities of Tokyo, Osaka, Kanagawa, Hyogo, Kyoto, and Aichi and Yamaguchi, Niigata, Hokkaido, Shiga, Toyama and Fukuoka. Among them, the potential of population intake of Tokyo is prominently high, exceeding the actual population at its 102%. Osaka follows this but in much difference with Tokyo with the relative potential of 57%. Thirty-seven percent of Kanagawa, 23% of Hyogo, 16% of Kyoto and 15% of Aichi follow Osaka and the potentials of population intake of Niigata and other prefectures are extremely small, almost at the level of the maintenance of actual population.

Tabie 3. Inter-Prefectural Migration Potentials.

	1950-54 annual average				1955-59 annual average			
	Theoretical population (1)	Actual population (2)	Absolute potential (1)-(2) (3)	Relative potential (3)/(2) (4)	Theoretical population (5)	Actual population (6)	Absolute potential (7)	Relative potential (7)/(6) (8)
Total	85,789	85,789	±12,680	± 14.8	91,119	1,119	± 11,458	± 12.6
1 Hokkaido	4,623	4,485	140	3.1	4,751	4,909	- 158	- 3.2
2 Aomori	844	1,321	- 477	- 36.1	1,002	1,411	- 409	- 29.0
3 Iwate	730	1,384	- 654	- 17.3	977	1,445	- 468	- 32.4
4 Miyagi	1,090	1,681	- 591	- 35.2	1,334	1,745	- 411	- 23.6
5 Akita	958	1,321	- 363	- 27.5	1,002	1,348	- 346	- 25.7
6 Yamagata	1,026	1,352	- 326	- 24.1	1,017	1,348	- 331	- 24.6
7 Fukushima	1,481	2,077	- 596	- 28.7	1,552	2,094	- 542	- 25.9
8 Ibaraki	1,157	2,052	- 895	- 43.6	1,571	2,070	- 499	- 24.1
9 Tochigi	1,118	1,551	- 433	- 27.9	1,226	1,540	- 314	- 20.4
10 Gunma	1,154	1,609	- 455	- 28.3	1,227	1,608	- 381	- 23.7
11 Saitama	2,071	2,196	- 125	- 5.7	2,018	2,317	- 299	- 12.9
12 Chiba	1,877	2,167	- 290	- 13.4	1,828	2,240	- 412	- 18.4
13 Tokyo	14,261	7,042	7,219	102.5	14,715	8,674	6,041	69.6
14 Kanagawa	3,661	2,673	988	37.0	3,963	3,091	872	28.2
15 Niigata	2,565	2,462	103	4.2	1,985	2,463	- 478	- 19.4
16 Toyama	1,028	1,018	10	1.0	974	1,022	- 48	- 4.7
17 Ishikawa	807	959	- 152	- 15.8	864	969	- 105	- 10.8
18 Fukui	636	752	- 116	- 17.4	655	754	- 99	- 13.1
19 Yamanashi	514	809	- 295	- 36.5	584	797	- 213	- 26.7
20 Nagano	1,527	2,045	- 518	- 25.3	1,669	2,003	- 334	- 16.7
21 Gifu	1,218	1,569	- 351	- 32.4	1,351	1,595	- 244	- 15.3

22 Shizucka	2,160	2,542	− 382	− 15.0	2,621	2,692	− 71	− 2.6
23 Aichi	4,084	3,559	525	14.8	4,724	3,939	785	19.9
24 Mie	1,121	1,477	− 356	− 24.1	1,211	1,485	− 274	− 18.5
25 Shiga	881	858	23	2.7	750	849	− 99	− 11.7
26 Kyctc	2,173	1,871	302	16.1	2,141	1,965	176	9.0
27 Osaka	6,602	4,207	2,395	56.9	7,397	4,934	2,463	49.9
28 Hycgo	4,244	3,462	782	22.6	4,646	3,732	914	24.5
29 Nara	689	770	− 81	− 10.5	699	773	− 74	− 9.6
30 Wakayama	619	990	− 371	− 37.5	897	1,007	− 110	− 10.9
31 Tcttori	402	604	− 202	− 33.4	458	613	− 154	− 25.2
32 Shimane	592	916	− 324	− 35.4	680	923	− 232	− 25.1
33 Okayama	1,519	1,679	− 160	− 9.5	1,412	1,691	− 279	− 16.5
34 Hircshima	1,826	2,113	− 287	− 13.6	1,924	2,172	− 248	− 11.4
35 Yamaguchi	1,763	1,572	191	12.2	1,411	1,625	− 214	− 13.2
36 Tckushima	540	877	− 337	− 38.5	630	869	− 239	− 27.5
37 Kagawa	787	943	− 156	− 16.5	866	941	− 75	− 8.0
38 Ehime	955	1,530	− 575	− 37.6	1,241	1,539	− 298	− 19.4
39 Kcchi	489	875	− 386	− 44.1	681	880	− 199	− 22.6
40 Fukucka	3,709	3,707	2	0.1	4,165	3,958	207	5.2
41 Saga	850	960	− 110	− 11.5	725	970	− 245	− 25.3
42 Nagasaki	1,446	1,700	− 254	− 14.9	1,364	1,770	− 406	− 22.9
43 Kumarotc	1,410	1,844	− 434	− 23.5	1,336	1,905	− 569	− 29.9
44 Oita	980	1,259	− 279	− 22.2	1,021	1,273	− 252	− 19.8
45 Miyazaki	654	1,106	− 452	− 40.9	743	1,148	− 405	− 35.3
46 Kagcshima	948	1,845	− 897	− 48.6	1,111	2,027	− 916	− 45.2

The rest of 34 prefectures excluding these 12 prefectures show the out-migration potential, ranging from -49% of Kagoshima to -6% of Saitama. Generally, the out-migration potentials are great in such extremely agricultural prefectures in Tohoku, South Kyushu, Shikoku and Sanin areas. Thus, in order that the equal population distribution be realized, Tokyo and other 11 prefectures must take in about 1.27 million or about 15% of the total population from other 34 prefectures.1/

During the period of 1955-59, various specific conditions owing to the war in each prefecture were gradually diminished and both industrialized and agricultural areas started rapid economic development, elvating the levels of income. The control of urban concentration of population was also gradually moderated.

In this period, the prefectures with positive migration potentials came down to seven including the prefectures with 6 large cities and Fukuoka where the reconstruction of iron and steel industries developed. Leaving these seven prefectures out of 12 such prefectures in the preceeding period, other 5 prefectures fell off to show the potentials of out-migration.

1/ Annual average inter-prefectural migration volume of 1950-54 is about 500,000.

The prefectures with out-migratory potentials increased to 39 but the areas with high negative potentials were still in such areas where industrialization is slow as Tohoku, South Kyushu, Shikoku and Sanin. Compared with the preceding period, the specific conditions after the war became less remarkable in this period and considerable income increase was effected in relatively less developed areas, somewhat reducing the regional disparities of income between prefectures.2/ However, with the appreciable concentration of population in the above seven prefectures, income concentration was even more notable.

If the migration function is the balancing movement of regional disparities of income, the net migration rate 3/ (social increase rate) of the actual population in each area or the population increase rate should correspond with the migration potentials.

2/ Minoru Tachi, Annual Report, op. cit., No. 4.

3/ Minoru Tachi, Formal Demography: Analytical Methodology of Demographic Phenomena, 1960 p.747.

On chart 1, relative potentials of prefectural migration in the average of 1950-54 (column (4) of Table 3) were taken on the x axis, the net migration rate of actual population of 1950-55 on the y axis and the relation is shown. The numbers at the dots in the Chart denote the prefecture number as shown in Table 3. The regression line of y to x is drawn also on the Chart. According to this Chart, the net migration rate of the actual population shows good homologous relation to the relative potential of migration, having +0.86 as simple correlation coefficient. What is noted in the Chart is the fact that four prefectures of Yamaguchi, Toyama, Shiga and Niigata show excess outflow of the actual population in spite of their having the population intake potentials. A mention has already been made that these prefectures turned to have the population outflow potentials in the next period.

The correlation of the relative potential of migration and the actual population increase rate in this period is also substantially high and the following result was obtained.4/

4/ Minoru Tachi and Misako Oyama, "Migration potential and actual migration of population", Annual Report of the Institute of Population Problems, No.6, 1961.

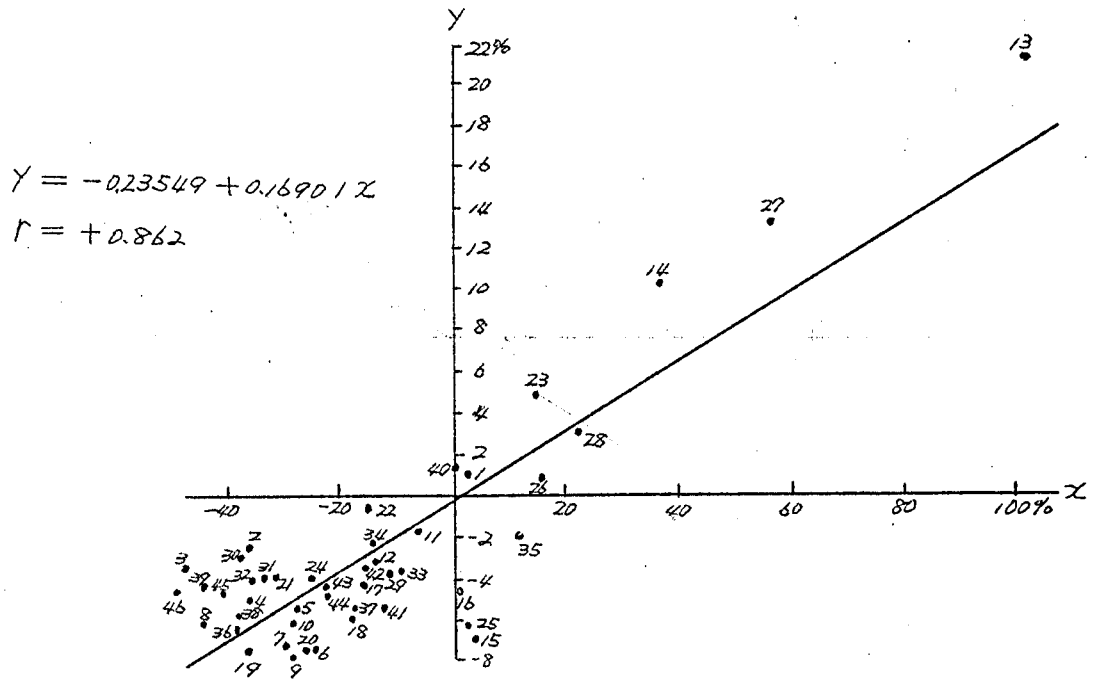
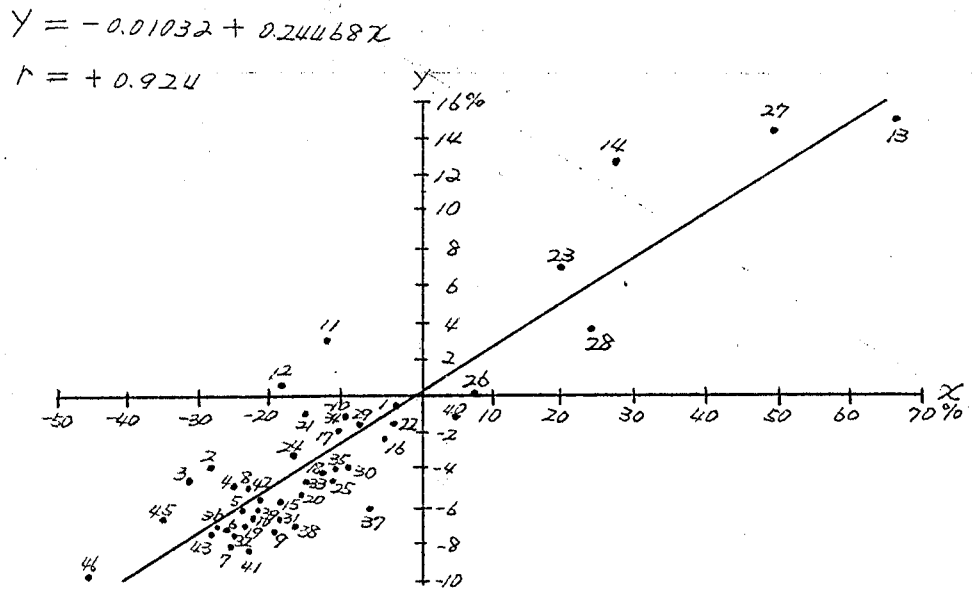


Chart 1. Correlation of the Relative Potential of 1950-54 Average Prefectural Migration and the Net Migration Rate of 1950-55 Actual Population.

Chart 2. Correlation of the Relative Potential of 1955-59 Average Prefectural Migration and the Net Migration Rate of 1955-60 Actual Population.



$$y = 6.60438 + 0.14909$$

simple correlation coefficient, $r = +0.728$

Further, the relation between the net migration rate of the male labor force as the major components of migrants and the relative potential of migration resembles very closely to the Chart 1 and the following result was obtained between the two.5/

$$y = 0.47050 + 0.21586x$$

$$r = +0.849$$

In Chart 2, the relation is shown between the relative potential of 1955-59 average prefectural migration (column (8) of Table 3.) taken on the x axis and the net migration rate of 1955-60 actual population taken on the y axis.

5/ Minoru Tachi and Yoichi Okazaki, "Pattern of labor force migration between regions", Oriental Economy, special summer edition, No.3, June 1961.

Yoichi Okazaki, "Regional migration of male labor force -- measurement and some observations", Annual Report of the Institute of Population Problems, No.7, 1962.

This Chart shows the extremely high correlation of the net migration rate of the actual population to the relative potential of migration, with the simple correlation coefficient at + 0.924. What attracts attention in the Chart are that Fukuoka shows the excess outflow of the actual population in spite of its population intake potential and that Saitama and Chiba with their potentials of population outflow show excess inflow of the actual population. This excess inflow of Saitama and Chiba can be considered to be caused by the suburban expansion of Tokyo.

The actual population increase rate corresponds fairly well to the relative potential of migration during this period as follows:

$$y = 4.41582 + 0.24020x$$

$$r = + 0.884.$$

Also, the following relationship is seen between the relative potential of migration and the net migration rate of the male labor force. 5/

$$y = 0.48991 + 0.37417x$$

$$r = + 0.938.$$

Part IV. Regional Distribution of Income and the Economic Potential of Migration

As seen in the above formula (2), the determinants of the economic relative potential of migration are the four factors of the actual total population, national income, regional population distribution and regional distribution of income. These can be summed into the regional per capita distribution income and per capita national income. Firstly, observation is made here of the relationship between the economic relative potential of migration and the regional distribution of per capita real distribution income.

For the period of 1955-59, per capita real distribution income by prefectures is taken as $\underline{x}$ and the relative potential of migration as $\underline{y}$ and obtained,

$$y = 100.01242 + 1.54817x$$

simple correlation coefficient, $r_{12} = + 0.999.$

For 1950-54, the following results were obtained in the similar way:

$$y = 100.46372 + 2.15298x$$

$$r_{12} = + 0.998.$$

The above are methodologically expected results.

In this connection, it can be considered that the labor productivity of the primary industry is considerably lower than that of the secondary and the tertiary industries (Table 4) and we may assume that the regional distribution of income will correspond to the regional industrial structure, particularly to the weight of the primary industry.

When the percentage of the total working population who are engaged in primary industries on the basis of the 1955 Census in taken on the x axis and 1955-59 average prefectural per capita real distribution icome on the y, extremely high correlation can be obtained as the following:

$$y = 99.83623 - 0.91681x$$

simple correlation coefficient, $r_{23} = -0.945$.

The same for 1950-54 is as follows:

$$y = 83.47797 - 0.81877x$$

$$r_{23} = -0.895.$$

Thus, a complimentary relation can also be assumed between the relative potential of migration and the regional distribution of the industrial structure.[1/]

1/ There are several studies made concerning the relationship between the actual migration and the regional differences of industrial structure. e.g., Toshio Kuroda, "Analysis of recent trends of internal migration in Japan", Annual Report of the Institute of Population Problems, No.6, 1961.

And, with the prefectural percentage of primary workers of 1955 as $\underline{x}$ and the relative potential of 1955-59 average migration as $\underline{y}$,

$$y = 54.55128 - 1.41939x$$

$$r_{13} = -0.945$$

is obtained and similarly for 1950-54,

$$y = 78.90036 - 1.75595x$$

$$r_{13} = -0.890$$

is obtained.

If the above relation for the period of 1955-59 are summarized,

$$r_{12} = +0.999, \quad r_{13} = -0.945, \quad r_{23} = -0.945.$$

Accordingly, the multiple correlation coefficient is,

$$R^2_{1.23} = 0.998,$$

being extremely high. The partial correlation coefficients are,

$$r_{123} = +0.991, \quad r_{132} = -0.065,$$

indicating that the direct determinants of the relative potential of migration are almost entirely the regional distribution of per capita real distribution income.

For 1950-54, coefficients are,

$$r_{12} = +0.998, \quad r_{13} = -0.890, \quad r_{23} = -0.895,$$

$$R^2_{1.23} = 0.996, \quad r_{123} = +0.990, \quad r_{132} = +0.113$$

indicating the same facts as above.

Table 4. Comparison of Labor Productivity by Major Industrial Group.

Group	Nominal production income (1)	Population engaged (2)	Productivity (3)	Index of (3) (4)
		1955		
	billion yen	1,000 persons	1,000 yen	%
primary	1,520	16,169	94	55
secondary	2,061	9,228	223	130
tertiary	3,159	13,945	227	132
all industry	6,739	39,342	171	100
		1950		
primary	879	17,224	51	54
secondary	1,075	7,601	141	148
tertiary	1,430	10,668	134	141
all industry	3,384	35,493	95	100

Source: (1) 1959 White Paper on National Income, Economic Planning Agency.

(2) Working population of 14 years of age and over by national census.

Part V. Economic Growth and the Economic Potential of Migration

As referred above, another remaining factor to determine the economic potential of migration is the change of per capita national income. In elaborating this point a little further, economic growth and the relationship between the regional disparities of the income level and the economic potential of migration will be briefly observed here.

Chart 3 shows the nominal GNP values obtained from the Economic Planning Agency converted into the real value on the basis of 1950 consumer's price (Table 5 column (1)), expressed in the standard deviation units (Table 5 column (2)) of cyclical changes eliminating the rectilineal trend and indicated the cyclical changes (Table 5 column (4)) of the relative potential of inter-prefectural migration calculated in a similar fashion (Table 5 column (3)). A complementary and inverse relationship can be observed between these two cycles but it is attention drawing that this relationship becomes diametrically changed by making 1953 as the turning point. In other words, there had not been obvious covariance relationship between the curves of cyclical change of real GNP and of relative migration potentials up until 1952. However, since 1953, a distinct covariance relationship can be noticed between the two. This change in covariance relationship started in 1953 is the fact worthy of careful attention and it may probably be due to deep-rooted internal changes of the Japanese economic structure but this topic is beyond the scope of the present paper.

A few remarks are to be made in relation to the change in the real GNP and the change in regional disparities of per capita real distribution income. It is not necessarily easy to measure the regional disparities of per capita real

distribution income by a single index. Here standard deviation is calculated and on Chart 4, the cycle of the above-mentioned real GNP and the cycle of per capita real distribution income by prefectures (Table 5 column (6)) similarly calcucated are shown. Here again, a change in covariance relationship took place starting in 1953.

Nextly, the relationship between the cycle of the standard deviation of the relative potential of prefectural migration (Table 5 column (8)) and that of the same per capita real distribution income (Table 5 column (6)) is studied. Chart 5 describes both cycles in which extremely high correlation can be noticed between the two cyclical changes throughout the period observed.

It is supposed, therefore, that the economic growth changes the regional disparities of prefectural real distribution income per capita and that it also affects the regional differences of the economic potential of migration.

Chart 3. Cyclical Changes of Real GNP and the Economic Potential of Internal Migration.

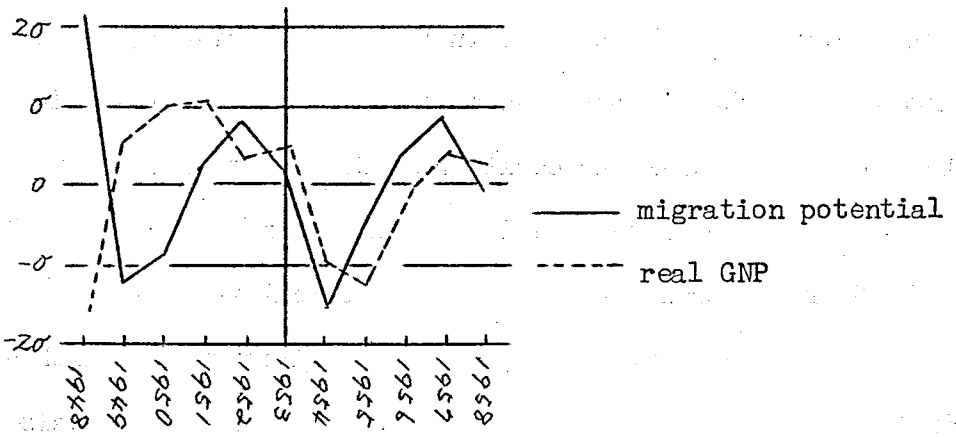
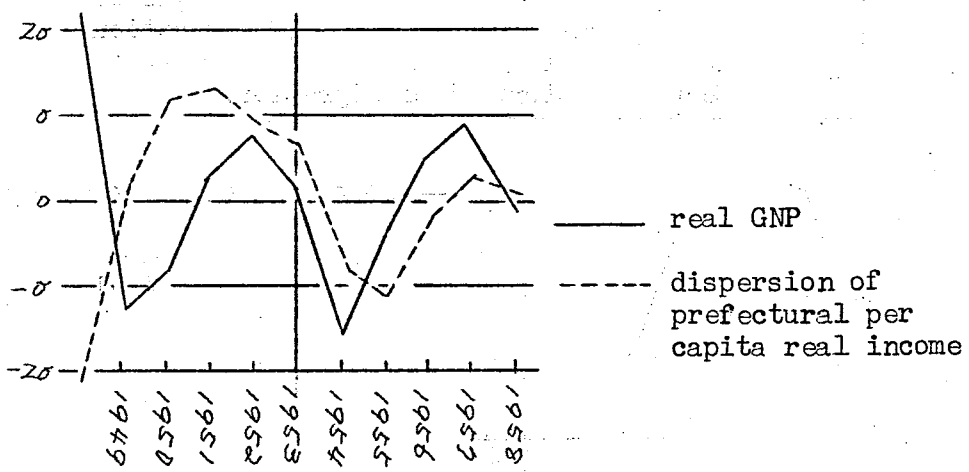


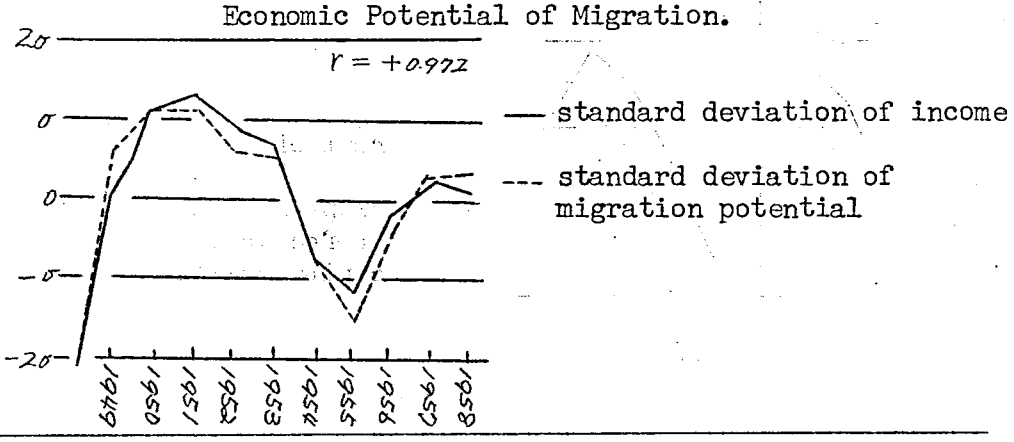
Chart 4. Cyclical Changes of Real GNP and the Dispersion of Prefectural Per Capita Real Distribution Income.



Part VI. Regional Differences in Population Reproductivity and the Economic Potential of Migration

Generally, in the economically developed countires reproductivity has been lower in the area of high levels of living and higher in the area of low levels of living. In Chart 6, prefectural per capita real distribution income for 1955-59 is taken on the x axis and the net reproduction rate of 1955 prefectural female population calculated by the Institute of Population Problems of the Ministry of Health and Welfare as an index of population reproduction on the basis of the Vital Statistics Report and the Prefectural Life Table by Haruo Mizushima[1/] is taken on the y axis and the inter-relation is examined. As shown clearly on the Chart, obvious correlation is noticed between the two.

Chart 5. Relationship between Cyclical Changes of Prefectural Per Capita Real Distribution Income and the Dispersion of Relative Economic Potential of Migration.



1/ Haruo Mizushima, Prefectural Life Tables, 1921-1956, 1961.

Table 5. GNP, Prefectural Per Capita Real Distribution Income and the Ecnomic Potential of Migration 1948-1958.

Year	GNP		Migration potential		Prefectural per capita distribution income		Prefectural relative migration potential	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	real	cyclical	relative potential	cyclical	standard deviation	cyclical	standard deviation	cyclical
	billion yen		%		1,000 yen		%	
1948	3,386	+2.10	11.4	-1.67	7.1	-2.14	23.1	-1.98
1949	3,516	-1.25	16.8	+0.61	11.5	+0.08	33.0	+0.60
1950	3,947	-0.89	17.3	+0.98	13.8	+1.15	34.0	+1.16
1951	4,479	+0.28	17.0	+1.03	14.4	+1.27	32.6	+1.15
1952	4,948	+0.77	15.0	+0.34	13.9	+0.87	29.2	+1.61
1953	5,282	+0.12	14.9	+0.47	13.8	+0.69	27.7	+0.54
1954	5,458	-1.57	11.3	-1.00	10.9	-0.80	21.7	-0.86
1955	6,021	-0.44	10.4	-1.28	10.3	-1.22	18.5	-1.53
1956	6,571	+0.44	12.5	-0.13	12.7	-0.23	21.2	-0.34
1957	7,043	+0.81	13.1	+0.34	13.9	+0.22	21.9	+0.28
1958	7,294	-0.12	12.6	+0.28	13.8	+0.08	20.8	+0.34

As previously pointed out, the regional distribution of the levels of living maintain close relationship with the degree of industrialization. If the percentage of total workers engaged in primary industry for each prefecture as of 1955 is taken as x and above-mentioned net reproduction rate is taken as y, a clear corresponding relationship can be seen as follows:

$$y = 0.70603 + 0.00840x$$

$$r_{13} = +0.702.$$

If the simple correlation coefficient of the net reproduction rate ($\underline{X_1}$) and prefectural per capita real distribution income ($\underline{X_2}$) is denoted as r_{12}, and that X_2 and the percentage of total workers of those engaged in primary industries in each prefecture ($\underline{X_3}$) as r_{23}, and that of $\underline{X_1}$ and $\underline{X_3}$ as r_{13},

$$r_{12} = -0.723, \qquad r_{13} = +0.702, \qquad r_{23} = -0.945,$$

$$R^2_{1.23} = 0.519, \qquad r_{123} = -0.441 \qquad r_{132} = +0.112,$$

suggesting that the major determinant factor of the regional distribution of reproductivity levels is the income or the regional distribution of the levels of living.

If the major determinant of the regional disparities of the reproductivity is the regional difference of the levels of living, there should be correlation between the regional distribution of the economic potential of migration and that of the reproductivity. So, if the relative migration potential of 1955-59 average by prefectures is taken on the $\underline{x}$ axis and the above-mentioned net reproduction rate on the $\underline{y}$ axis, a distinct correlation can be noted as shown on the Chart 7.

Chart 6. Relationship between 1955-59 Prefectural Per Capita Real Distribution Income and the Net Reproduction Rate of 1955 Female Population.

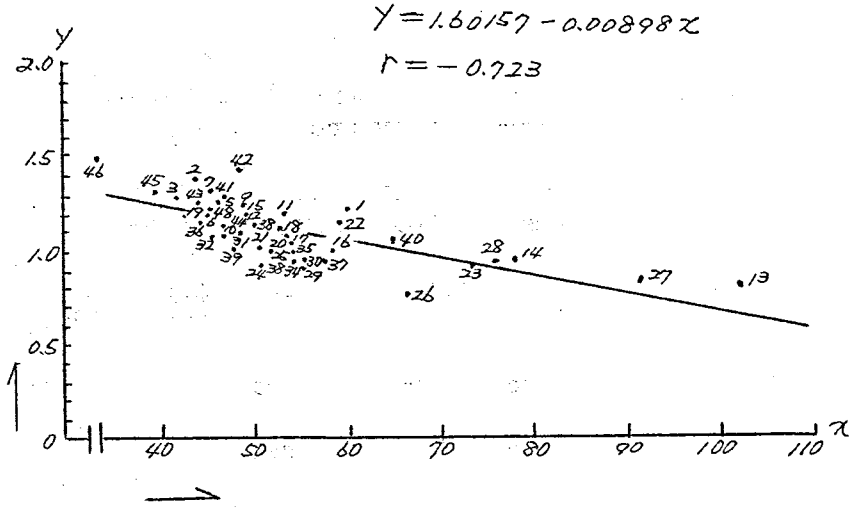
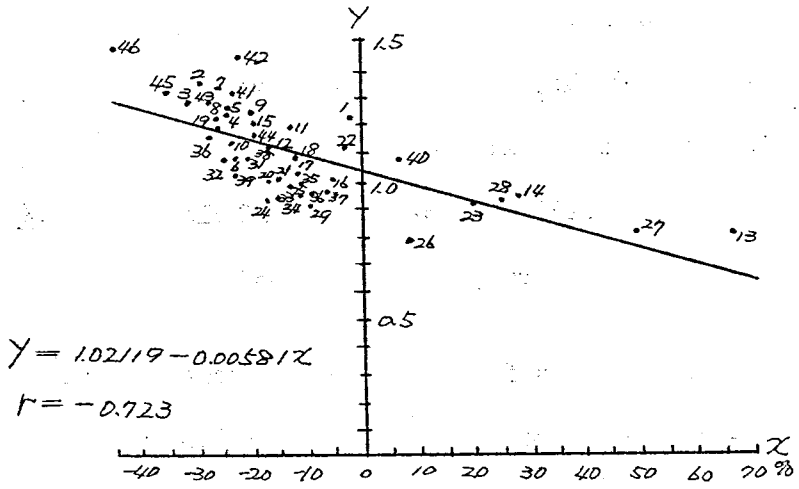


Chart 7. Relationship between the Relative Potential of 1955-59 Prefectural Migration and the Net Reproduction Rate of 1955 Female Population.



In connecting the relationships observed in Part IV and those in Part VI, the following are obtained and to be added here.

If the denotaions are made as:

$\underline{X}_1$ --- relative economic potential of 1955-58 annual average migration by prefectures,

$\underline{X}_2$ --- per capita real distribution income for prefectures, 1955-58 annual averages,

$\underline{X}_3$ --- percentage of total workers engaged in primary industries by prefectures in 1955,

$\underline{X}_4$ --- net reproduction rate of 1955 female population,

the simple correlation coefficients are,

$r_{12} = +0.999$, $r_{13} = -0.945$ $r_{14} = -0.716$

$r_{23} = -0.945$ $r_{24} = -0.716$ $r_{34} = +0.702$.

The multiple and partial correlation coefficients between these factors are,

$R^2_{1.234} = 0.998$, $r_{1234} = +0.991$,

$r_{1324} = -0.063$, $r_{1423} = -0.016$.

The multiple regression line is,

$$X_{1234} = -100.125 + 1.632\underline{X}_2 - 0.001\underline{X}_3 + 0.114\underline{X}_4 .$$

(standard error = 0.068)

If the denotations for the actual migration are made as,

$\underline{X}_1$ --- 1955-60 prefectural net migration rate,

$\underline{X}_2$ --- 1955-58 annual average prefectural per capita real distribution income,

$\underline{X}_3$ --- 1955 percentage of total workers engaged in primary industries by prefectures,

$\underline{X}_4$ --- net repreoduction rate of 1955 female population,

the simple correlation coefficients between the factors are,

$r_{12} = +0.919$, $r_{13} = -0.881$, $r_{14} = -0.601$,

$r_{23} = -0.945$, $r_{24} = -0.716$, $r_{34} = +0.702$.

The multiple and the partial correlation coefficients between the factors are,

$R^2_{1.234} = 0.923$,

$r_{1234} = +0.593$, $r_{13.24} = -0.129$, $r_{14.23} = +0.220$.

The multiple regression line is,

$$\underline{X}_{1.234} = -28.393 + 0.412\underline{X}_2 - 0.038\underline{X}_3 \times 4.423\underline{X}_4$$

(standard error = 2.147)

Part VII. Conclusive Remarks

So far, the author has assumed that the economic function of internal migration is the balancing movement of the regional population distribution to equalize regional disparities of the levels of living and has tried to probe into a few instances macroscopically according to the actual migration data of post-war Japan. The theoretical foundation of this assumption still leaves some points of insufficiency and the proof has by no

means been sufficient. However, the results can be summarized roughly as the following:

(1) As the index of the regional levels of living in the broadest sense of the term, per capita real distribution income was taken and the assumption was made that if the migration function was the income balancing movement, the ultimate state would be the population distribution in which the per capita real distribution income in each area (prefectures were used as the units here) became equal. Then, the difference between the theoretical population on this assumption of the equal per capita income distribution and the actual population was set as the absolute economic potential of migration and the ratio of the absolute potential to the actual population as the relative potential. At least it has been proved, though insufficiently, that these economic potentials were affecting the basis of the actual migration in post-war Japan.

(2) The method applied was to reveal the relationships between various formal determinants of the economic potential of migration. As the result, it was observed that the direct determinant of the economic potential of migration was regional disparities of per capita real distribution income and accordingly that the changes in the economic growth would affect the economic potential of migration through the changes in regional

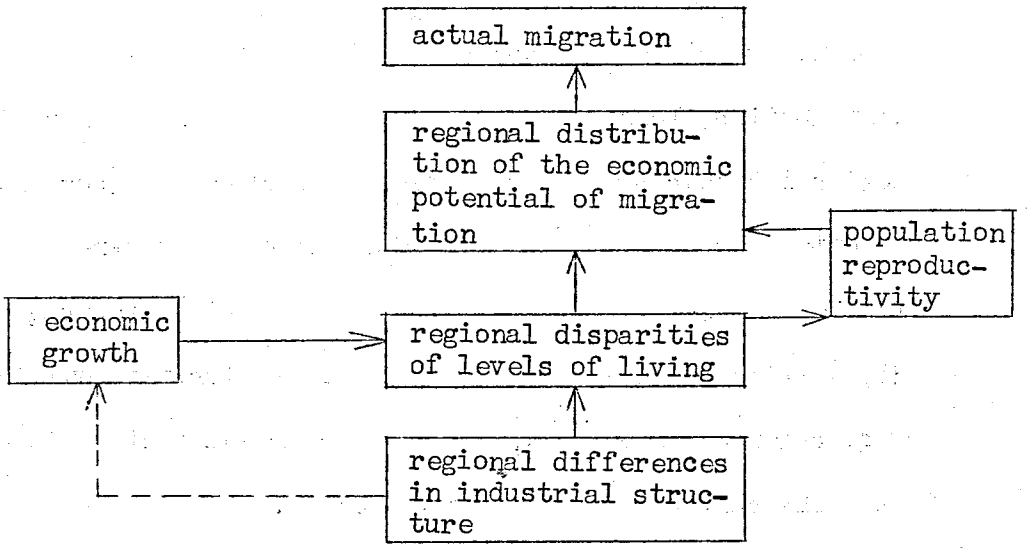
disparities of per capita real distribution income. However, during the period of 1948-52, the relationship between the improvement in economy and the regional difference of income distribution, namely, the economic potential of migration was not very obvious but since 1953, the trend became clearly notable that the rise in economic growth expanded the regional disparities of income distribution, expanding that of the economic potential of migration and that the drop in economic growth alleviated the regional disparities of income distribution, lessening the economic potential of migration. Regional disparities of the industrial structure (percentage of total workers in primary industries was used here as the index) were weak as a direct determinant of the regional disparities of the economic potential of migration but these were regarded as one of the most influencial factors to determine the regional disparities of income.

(3) The regional disparities of the population reproductivity can be considered to be regulated mainly by per capita real distribution income. Namely, in the areas where the income level is low and the potential of population outflow is high, population reproductivity is high and where the income level is high and the potential of population intake is high, reproductivity is low. Thus, the effect of the regional disparities of

income levels on that of the economic potential of migration and the effect of population reproductivity on the same are opposite and contradict against each other. This contradiction may be a factor promoting migration.

(4) The above relationships were summed up and shown as a diagram on Chart 8.

Chart 8. Diagram of economic Factors Determining Migration.



(5) In summarizing, it can be concluded that the contradiction between the space-economic structure of industry or the income level and the space-demographic structure of the population reproductivity is the fundamental factor of migration and that the balancing movement of the both is the function of migration.