Model-building of the Relationships between Inter-regional Economic Disparity and Internal Migration: The Case of Korea*

Kim, An-Jae**

CONTENTS

I. General Review on the Theories of Relationships between Economic Disparity and Internal Migration
II. Approach to Model-building of the Relationships between Inter-regional Economic Disparity and Internal Migration in the Case of Korea
III. The Relationships between National Economic Status and Total Internal Migration
IV. The Relationships between Regional Economic Growth and Regional Migration
V. The Relationships between Inter-regional Economic Disparity and Inter-regional Migration Vector
Bibliography

I. General Review on the Theories of Relationships Between Economic Disparity and Internal Migration

The Benefits of Aggregation

The spatial development of the counrty, but is also affected by these economic and social changes. The most important elements of the economic and social changes which interact with inter-regional unbalanced development are the movements of materials and population.

In general, the movements of materials and population take place from relatively low areas to relatively high areas in terms of product per unit of time. Therefore, materials and population are readily concentrated in a limited number of spatial points. That is, the regions in which materials and population are more concentrated may produce greater

* This article is a revised one of the chapter four in the Ph.D. dissertation presented to the Ohio State University in Cincinnati in August 1976.

** Assistant Professor, Graduate School of Environmental Studies, Seoul National University.

benefits than the regions being less concentrated with such materials and population. This is the benefits of aggregation based on the principle of economies of scale.

The concentrated regions with materials and labor forces not only produce high benefits, but also have an acceleration effect or a chain reaction by which the regions pull more materials and population.(1) The formation and growth of cities are attributed to the principle of aggregation, and the growth pole theory is also based on the principle of aggregation benefits. When the aggregation of labor force, capital and information are-formed in various ways on the base of mutually functional dependency through divisions of labor, space and time, we can expect a high degree of developmental potential in human society.(2)

Economic Growth and Population Migration

Figure 1 illustrates the relationship between per capita GNP and urbanization through the world. From this figure, we can understand that the relationship is positive. That is, a close correlation exists between urbanization and the stages of development or per capita income level, which can be viewed as indicative of the degree of industrialization(3)

In general, we can assume that economic growth is an important factor which has contributed to an increase of population concentration. This hypothesis is consistent with the empirical observation that there are economies of scale in population concentration. These findings were made with respect to a number of developed and developing countries.(4)

(1) See An-Jae Kim, "A Study on the Balanced Growth of Regional Economies". *Journal of the Korean Public Administration Association*, 6(1972), p.99.

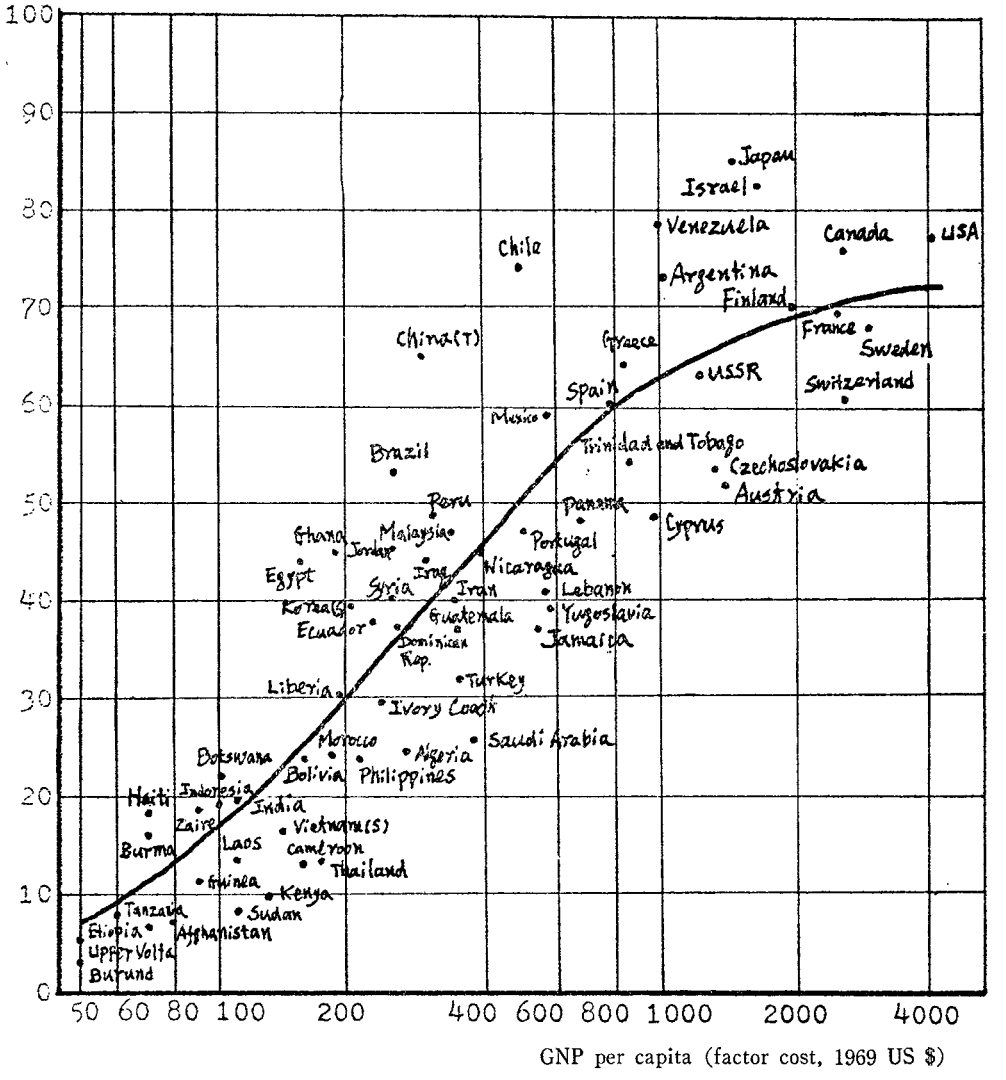
(2) Hujii Takashi, "An Economic Theory of the High Density Aggregation: On the Economic Progress" (Translated into Korean by An-Jae Kim), *Journal of Public Administration*, 6:2 (Dec. 1968), p.204.

(3) Fu-chen Lo and Kamal Salih, *Growth Poles and Regional Policy in Open Dualistic Economies: Western Theory and Asian Reality*, Paper for the Seminar on Industrialization Strategy and Growth Pole Approach (Nagoya: The United Nations Centre for Regional Development, Nov. 1975, mimeographed), p.12.

(4) For these studies, see the following references:

- William Alonso, "Urban and Regional Imbalances in Economic Development", *Economic Development and Cultural Change*, 17 (Oct. 1968), pp.1-14.
- William Alonso, "The Economics of Urban Size", *Regional Science Association Papers*, 26(1971), pp.67-83.
- Victor R. Ruchs, *Differentials in Hourly Earnings by Region and City Size*, 1959, National Bureau of Economic Research Occasional Paper, No.101 (New York: Columbia University Press, 1967).
- Daniel Shefer, "Localization Economies in SMSA's: A Production Function Analysis", *Journal of Regional Science*, 13(Apr. 1973), pp.55-64.
- Koichi Mera, "On the Urban Agglomeration an Economic Efficiency". *Economic Development and Cultural Change*, 21 (Jan. 1973), pp.309-324.
- Koichi Mera, *Income Distribution and Regional Development*(Tokyo: University of Tokyo Press, 1975).

Fig. 1. Degree of Urbanization Compared with GNP Per Capita



Source: World Bank, *Urbanization, Sector Working Paper* (Jun. 1972), p.73.

On the relationships between economic growth and population migration, Simon Kuznets and Dorothy S. Thomas presented several theories as follows:[5]

First, given a country's fixed area, the mere increase in population will, in absence of

(5) See Simon Kuznets and Dorothy S. Thomas, "Internal Migration and Economic Growth", *The Bobbs-Merrill Reprint Series in the Social Sciences*, S-439, pp.3-7.

technological change, modify the population-land ratio and affect unequally the economy in the various parts of the country. The population will then tend to migrate in adjustment to such unequal economic impact.

Second, more population in thinly settled areas, resulting from population growth but still assuming no technological change, is likely to uncover natural resources other than land valuable to the settled areas. This should stimulate further migration.

Third, by far the greatest and most pervasive effect of economic growth on internal migration is through the differential effect of technological progress on economic opportunities associated with different locations.

Fourth, population redistribution in response to the differential impact of economic growth on economic opportunities in different parts of the country could presumably be carried through either by differing rates of natural increase or by internal migration. But, given the magnitude and rate of differential impacts that accompany modern economic growth, the adjustment to them through differing rates of natural increase can at best be extremely limited; and at worst only aggravate the problem. In consequence, it is internal migration that provides the main mechanism of adjustment; and it is internal migration that accouuts for most of the poputation redistribution indispensable as an accompaniment to econmic growth.

In addition, Kuznets and Thomas raised two other theories on the relationships between population and the economy.(6) The first was suggested by the impression that in many of the developed coutries internal migration, large as it was absolutely, was still not large enough, in terms of the necessary response to economic differentials. The second point is that the negative correlation between regional rates of natural increase and rates of increase of economic opportunities has a variety of important consequences for the organization of economic activity: and, thereby, for the efficiency and growth of a country's economy.

Bernard Okun constructed two simultaneous equation models in order to explore the inter-relationships between inter-state net migration, the level and growth of service income per capita, and other relevant variables in the case of the Uuited States of America for the period 1940 to 1950. The main conclusions of his study are as follows:(7)

(6) See *Ibid.*, pp.7-9.

(7) See Bernard Okun, "Inter-state Population Migration and State Income Inequality: A Simultaneous Equation Approach", *Economic Development and Cultural Change*, 16:2 (Jan. 1968), pp.297-313.

First, the migration function revealed that migrants tended to flow from low to high service-income per capita states.

Second, a net influx of migrants tended to contribute positively to the change in service-income per capita. That is, inter-state migration was a force for the widening of inter-state differences in service-income per capita.

Third, states with low service-income per capita tended to experience numerically greater percentage point declines in the percentage of the labor force engaged in agriculture.

Movement of Factors and Economic Differentials

The differentials of regional economic growth are a function of resource potential of the region and of movement of economic factors among regions. According to Horst Siebert's special models by virtue of mathematical formulas, the relationships between inter-regional growth differentials and economic factors can be described as below:[8]

1. Growth differences between regions will be higher, the stronger the differences in the rate of inventions and the lower the mobility of technical knowledge.

2. The greater the accumulation of capital and the higher the increase of labor supply of a region compared to other regions, the greater its rate of growth.

3. The greater the weight of a factor in the production function, the higher the growth rate of the region with an increase in that specific factor.

4. The more immobile an internal growth determinant, the greater the growth differential. The greater the inter-regional mobility of an internal growth factor, the lower the growth differential.

5. The more mobile the scarce factor of a region and the less mobile the abundant factor, the greater the inter-regional growth difference.

6. A growth differential can exist only if differing factor mobilities prevail. A permanent growth differential presupposes some immobility of at least one factor. Historically, natural resources can be regarded as this factor.

7. The more immobile external economies are inter-regionally, the greater the growth differential.

8. The stronger the tendencies to equalize regional social characteristics, such as social structures, attitudes, behavior, and institutions, the greater the mobility of factors and

(8) See Horst Siebert, *Regional Economic Growth: Theory and Policy* (Scranton, Penn: International Textbook Co., 1969), pp.134-152.

the smaller the growth differences between regions.

9. The stronger technical change in the inter-regional transportation systems, the greater the mobility of factors and the smaller the growth differential.

10. A growth differential caused by the immobility of factors may be reinforced or weakened by the movement of commodities. The reinforcing effect is a function of changes in the terms of trade.

Internal Migration and Regional Economic Change

Intenal migration and inter-regional unbalanced development interact with each other. It is perhaps obvious that inter-regional unbalanced development affects internal migration, but not so obvious that the latter affects the former.(9) However, Myrdal asserts that internal mobility widens inter-regional inequality. The localities and regions where economic activity is expanding will attract net immigration from other parts of the country. As migration is always selective, at least with respect to the migrant's age, this movement by itself tends to favor the rapidly growing communities and disfavor the others.(10)

The influences of migration on regional inequality may be found investigating the degrees of benefits or losses of sending and receiving regions appered by migration. The influences that internal migration gives to regional inequality in terms of per capita income may be better understood from the study conducted by Bernard Okun and Richard W. Richardson.(11)

First, we will see the migration flow from low stagnant regions to low growing regions. Low stagnant regions are quite likely, over time, to experience a net outflow of population. This outflow would in the short and probably in the long run prove beneficial to the region, whether it is in an advanced or in an underdeveloped country. when this outflow is in the direction of low growing regions, this will tend in the short run to retard the rate of growth of the latter regions, though in the long run the result may be either retardation or acceleration of the growth rate. We may therefore conclude that in the short run, migration from low stagnant to low growing regions tends to diminish the rate of widening inequality between the low stagnant and low growing regions. In the

(9) An-Jae Kim, "A Study on the Balanced Growth of Regional Economy", *op. cit.*, p.99.

(10) Gunnar Myrdal, *Economic Theory and Underdeveloped Regions* (London: Duckworth, 1957), p.27.

(11) See Bernard Okun and Richard W. Richardson, "Regional Income Inequality and Internal Population Migration", in John Friedmann and William Alonso, eds., *Regional Development and Planning: A Reader* (Cambridge: The MIT Press, 1969), pp.303-318.

long run, out-migration is of benefit to the originating low stagnant region, but at the sametime may prove to be either an aid or a detriment to the receiving low growing region. Thus, it is not certain whether in the long run migration will contribute to a widening or a narrowing of inequality in per capita incomes between the low stagnant and low growing regions.

A second important stream of migration flows from the low stagnant to the high growing regions. In the short run, the inflow of persons of probable "low quality" in terms of educational and occupational status to the high growing region tends to depress per capita income there, while the outflow from the low stagnant region reduces its excess labor supply, tending here to raise per capita income. It is evident, therefore, that in the short run migration from low stagnant to high growing regions will tend to narrow inequality between these regions. In the long run, however, because net in-migration probably is of benefit in the aspect of labor supply to the high growing region. nothing definite can be concluded regarding the effects upon inequality of per capita income.

A third important migratory stream flows from the high stagnant to the high growing regions. The out-migrants may tend to be of relatively "high quality" in terms of occupation and education; hence, in this case, quality deterioration in the labor force of the high stagnant region is linked to quality improvement in the labor force of the high growing region. It follows that this migration will tend to accelerate the growing inequality in per capita income between the high stagnant and high growing regions.

Finally, a migratory stream may flow from the low growing to the high growing regions. This case is the most difficult to assess in terms of its effects on per capita income inequality. In the short run, this movement probably contributes to lesser inequality. This is based on the assumption that the quality of the in-migrants is such as to depress the average level of labor productivity of the high growing region, thus tending to depress per capita income. On the other hand, the out-migration is not likely to prove detrimental to the low growing region, particularly since there may be a partially compensating inflow from the low stagnant region. Moreover, in the short run, with limited capital available, the low growing region is unlikely to experience a relative scarcity of labor.

Through the many studies conducted so far, we can understand that no general proposition can be formulated concerning the effect of internal migration on regional inequa-

lity. Therefore, it is more desirable that it should be formulated in particular cases with consideration of regional characteristics and migration vectors.

II. Approach to Model-building of the Relationships Between Inter-regional Economic Disparity and Internal Migration in the Case of Korea

Many factors affect movement or interaction of persons and materials in space. If social phenomena are conceived as occurring between geographic areas or points, each of these factors can be categorized as (1) an origin factor, (2) a destination factor, or (3) a linkage factor.(12) Origin factors are characteristics of an origin that usually indicate the capacity of an origin to interact with all possible destinations. Destination factors are characteristics of a destination that account for the relative magnitude of the interaction of the destination with all origins. Linkage factors are characteristics of the relationships between a particular origin and destination.

In this study, the factors of origin and destination are per capita value added of each region, and as a linkage factor the number of migrants between origin and destination is used. As a convenience of comparison, all the regions are categorized into nine classes by "low", "middle" and "high" on the basis of level and growth rate of per capita value added of each region.(13) The relationships between inter-regional economic disparity and internal migration will be modelled by formulating migration vectors among the regional groups which are classified as this.

Additionally, we will establish models of two other cases: one is on the relationships between national economic growth and total migration volume, and the other is on the relationships between regional economic growth and regional migration volume. The former aims at forming a model of the relationships between annual increase in national average per capita value added and total migration volume, and also between annual increase in mean deviation of inter-regional disparity and inter-regional migration volume. The latter aims at establishing a model between the increase in provincial per capita

(12) John H. Niedercorn and B.V. Bechdolt, Jr., "An Economic Derivation of the 'Gravity Law' of Spatial Interaction", *Journal of Regional Science*, 9:2 (Aug. 1969), p.273.

(13) This regional classification is a modification of the four categories conducted by B. Okun and R.W. Richardson: (1) low per capita income and stagnant, (2) high per capita income and stagnant, (3) low per capita income and growing, and (4) high per capita income and growing. (See B. Okun and R. W. Richardson, *op. cit.*, pp.307-308).

value added and the change in provincial net migration.

The years in the time series used for economic growth and the time series for migration were selected differently 1964, 1968 and 1970 were selected, and the years 1961-1966, 1969 and 1971 are subjects for the case of migration. The period 1961-1966 will be represented by the year 1965. The reasons for lagging migration one year behind economic growth stem from the recognition that economic growth has had a much greater influence on migration than the latter has on the former in Korea, and that migration does not occur simultaneously with changes in economic conditions, but lags behind such changes.

The only reason we used the three years in each case of economic change and migration stems from a limitation of data, especially the data of migration. Since we used only three years, the regression equations built will have a weak basis. Therefore, it may be dangerous to project or estimate values in certain years with these regression models. Nevertheless, our attempt to build regression equations with such limited data will yield three contributions. First, it will suggest rough or approximate relationships between economic change and migration. Second, our model-building of these relationships will provide a preliminary basis for a more accurate modelling based on additional data will become available in the future. Third, we will be developing a methodology for identifying relationships among economic growth, spatial disparity and migration.

III. The Relationships Between National Economic Status and Total Internal Migration

The Relationships between National Economic Growth and Total Internal Migration

The intention of this part is to investigate how internal migration changes in response to an improvement of national economic level. The improvement of national economic level, so-called national economic growth, is presented by an indicator of par capita value added of gross product, and the internal migration is shown by the total number of in-migrants or out-migrants which have occurred within the country. The internal migration will have two indicators for finding the relationships with national economic growth. One is the absolute number of migration and the other is its ratio to total population multiplied by thousand residents.

Table 1 shows per capita value added, inter-regional disparity and migration from 1960 to 1972. Figure 2 illustrates their trends through the years selected. From these data, we will establish some adequate regression equations for their inter-relationships.[14]

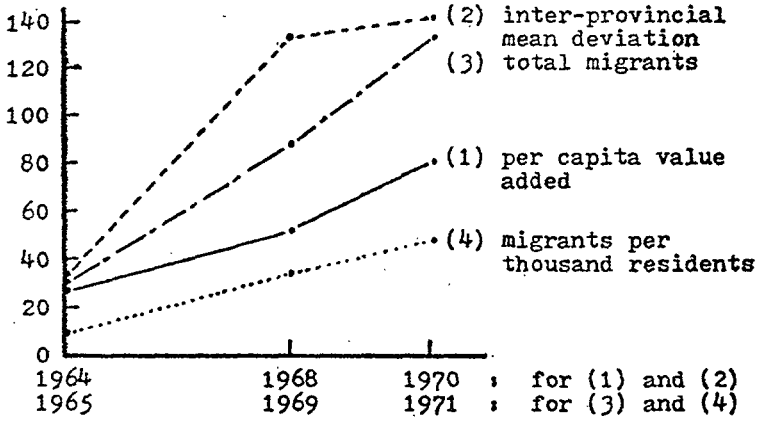
Table 1. National Per Capita Value Added, Inter-provincial Disparity and Inter-provincial Migration:1960-72

Year	Per capita value added (in Won)	Inter-provincial disparity		Migration (in person)	
		Mean deviation	Weighted coeff. of variation	Total migrants	Migrants/ thousand persons
1960	9,371	27.40	0.44	—	—
1962	12,498	30.27	0.39	—	—
1964	23.792	29.53	0.21	—	—
1965	—	—	—	267,003	9.15
1966	35,353	94.27	0.47	—	—
1968	52,601	131.80	0.47	—	—
1969	—	—	—	825,854	27.12
1970	81,421	139.32	0.37	1,266,468	40.25
1971	—	—	—	1,332,073	41.69
1972	115,574	260.44	0.27	1,068,571	32.71

Source: Calculated by the writer from Sources 1, 3, 6, 9, 10, 11 and 12 (See Bibliography for sources).

Fig. 2. Trends of Per Capita Value Added, Inter-provincial Disparity and Migration

Per capita value added (in thousand Won) (1)
Inter-provincial mean deviation (2)
Total migrants (in thousand persons) (3)
Migrants per thousand (in person) (4)



Source: Table 1.

(14) For regression modelling, see N.R. Draper and H. Smith, *Applied Regression Analysis* (New York: John Wiley and Sons, Inc., 1966).

1. The Relationship between Per Capita Value Added and Total Migration

From Figure 2, we can find that per capita value added and total migrants have grown in proportion to each other. Table 1 and Figure 2 show that there exists a linear form between per capita value added and total migrants. Therefore. we can make a linear regression model by defining per capita value added as an independent variable and total migrants as a dependent variable. The result is the following form:

$$Y_1 = -171.3 + 18.6X_1 \ ; \ R^2 = 9.9996$$

where Y_1 ; total migrants in thousand persons

X_1 : per capita value added in thousand Won

In this sample regression equation, the standard error of estimate is 14.7 and the standard error of the X_1's coefficient is 0.36. Since the computed value of student's t for the X_1's coefficient is 51.667 and the critical values of t at the 5 percent level of significance are ± 12.706, the value of X_1's coefficient was tested to be significant. The corresponding 95 percent confidence interval for the X_1's coefficient of population is 14.0 to 23.2. (15)

2. The Relationship between Per Capita Value Added and Migrants Per Thousand Residents

The per capita value added and the number of migrants per thousand residents show a linear relationship. This linear regression equation has the following form:

$$Y_2 = -3.46 + 0.56X_1 : R^2 = 0.9982$$

where Y_2 : migrants per thousand residents

X_1 : per capita value added in thousand Won

The standard error of estimate of this regression equation is 2.47 and the standard error of the X_1's coefficient is 0.06. Since the computed value of t, 9.333, is larger than the critical value of c, 6.314, at the 10 percent level of significance, the value of the X_1's coefficient is significant at the 10 percent level of significance. Therefore, the

(15) The following formulas and statistic were used for this testing:

$\hat{\sigma}_{yx} = \sqrt{\dfrac{\sum y_i^2 - a\sum y_i - b\sum x_i y_i}{n-2}}$: standard error of estimate

$\hat{\sigma}_b = \dfrac{\hat{\sigma}_{yx}}{\sqrt{\sum x_i^2 - (\sum x_i)^2/n}}$: standard error of the x's coefficient, b

$t = \dfrac{b-B}{\hat{\sigma}_b}$: testing statistic for the X's coefficient of population, B

$b - Z_\alpha \cdot \hat{\sigma}_b < B < b + Z_\alpha \cdot \hat{\sigma}_b$: confidence interval for B

corresponding 90 percent confidence interval for the X_1's coefficient of population is 0.18 to 0.94.

The Relationships between Inter-provincial Economic Disparity and Total Internal Migration

1. The Relationship between Inter-provincial Mean Deviation and Total Migration

From Table 1 and Figure 2, we can find that the relationship between inter-provincial mean deviation of per capita value added and total migration is regarded as an exponential function of the form $y=ke^{ax}$. The regression equation which was built has the following form:

$$Y_1=180.5e^{.0.013X_2} \; ; \; R^2=0.9376$$

where Y_1: total migrants in thousand persons

X_2: inter-provincial mean deviation of per capita value added

The standard errors of estimate and the X_2's coefficient are 0.155 and 0.0018. respectively. Since the computed value of t for the X_2's coefficient is 7.2626, the X_2's coefficient is significant at the 10 percent level of significance and its corresponding 90 percent confidence interval of population is 0.0017 to 0.0243. (16)

2. The Relationship between Inter-provincial Mean Deviation and Migrants per Thousand Persons

It is observed that there appears to be an exponential relationship between inter-provincial mean deviation of per capita value added and the number of migrants per thousand residents. The following equation is the exponential regression equation of this relationship:

$$Y_2=6.32e^{0.01241X_2} \; ; \; R^2=0.9596$$

where Y_2: migrants per thousand residents

X_2: inter-provincial mean deviation of per capita value added

In this regression equation, the standard errors of estimate and the X_2's coefficient are 0.1313 and 0.001513, respectively. The value of the X_2's coefficient is significant at the 10 percent level of significance, because its computed value and the critical value of t are 82.02 and 6.314 at the level of significance. Therefore, the 90 percent confidence interval

(16) The test of significance for this equation can use the formulas and statistic being used in a linear regression equation, because the exponential equation can be transformed to $\ln Y=\ln k+aX$

for the X_2's coefficient of population is 0.00286 to 0.02196.

IV. The Relationships Between Regional Economic Growth and Regional Migration

The provincial per capita value added and its index and ratio are presented in Table 2. The index is based on 1964 and the ratio is to the national average of per capita value added. The absolute number and its indices of gross net migrants and net migrants per thousand residents by province are rearranged in Table 3.

We define Y_i as the number of net migrants per thousand residents of province i, and X_i as per capita value added of province i in thousand Won. Since each of the eleven regions, two special cities and nine provinces, corresponds to a linear curve or a parabolic curve in the relationship of Y_i and X_i, all the regions can be classified into the following groups by judging the data in Table 2 and Table 3.

(1) Regions corresponding to the form $Y_i=a+bX_i$,

. $b>0$: Gyeonggi

. $b<0$: Gangweon, Chungnam, Jeonnam and Gyeongbuk

(2) Regions corresponding to the form $Y_i=a+bX_i+cX_i^2$

. $c>0$: Chungbuk, Jeonbuk, Gyeongnam and Jeju

. $c<0$: Seoul and Busan

Table 2. Provincial Per Capita Value Added and Their Indices and Ratios

Province	Per capita value added (in Won)			Index based on 1964 (in %)			Ratio to national average (in %)		
	1964	1968	1970	1964	1968	1970	1964	1968	1970
Seoul	36,555	106,205	138,422	100	290.5	328.7	153.6	201.9	170.0
Busan	26,433	86,947	118,699	100	328.9	449.1	111.1	165.3	145.8
Gyeonggi	27,859	46,763	76,218	100	188.1	306.6	104.5	88.9	93.6
Gangweon	21,269	42,036	64,264	100	197.6	302.1	89.4	79.9	78.9
Chungbuk	22,533	44,602	69,915	100	197.9	310.3	94.7	84.8	85.9
Chungnam	21,025	44,064	63,898	100	209.6	303.9	88.4	83.8	78.5
Jeonbuk	23,809	37,308	61,359	100	156.7	257.7	100.1	70.9	75.4
Jeonnam	20,673	31,928	56,494	100	154.4	273.3	86.9	60.7	69.4
Gyeongbuk	21,113	39,949	61,671	100	189.2	292.0	88.7	75.9	75.7
Gyeongnam	20,029	43,648	73,612	100	217.9	367.5	84.2	83.0	90.4
Jeju	23,112	47,839	65,684	100	207.0	284.2	97.1	90.0	80.7
National average	23,792	52,601	81,421	100	221.1	342.2	100.0	100.0	100.0

Source: Calculated from Sources 6, 9, 10 and 12.

Table 3. Gross Net Migrants and Net Migrants Per Thousand Persons and Their Indices by Province (Unit: person; % in index)

Province	Province Gross net migrants and index			Net migrants per thousand persons and index		
	1961-66 yearly	1969	1971	1961-66 yearly	1969	1971
Seoul	102,459 (100)	243,901 (238.0)	252,689 (246.6)	27.91 (100)	51.05 (182.9)	44.19 (158.3)
Busan	10,459 (100)	64,110 (613.0)	61,430 (587.3)	7.30 (100)	38.26 (524.1)	31.60 (432.9)
Gyeonggi	−6,544 (−100)	23,043 (352.1)	121,277 (1853.3)	−2.36 (−100)	7.34 (311.0)	35.16 (1498.8)
Gangweon	1,415 (100)	−20,874 (−1475.2)	−34,994 (−2473.1)	0.87 (100)	−11.53 (−1325)	−18.90 (−2172.4)
Chungbuk	−9,764 (−100)	−35,980 (−368.5)	−44,692 (−457.7)	−6.39 (−100)	−23.90 (−374.0)	−30.01 (−469.6)
Chungnam	−25,868 (−100)	−45,150 (−114.5)	−50,341 (−194.6)	−15.46 (−100)	−15.66 (−101.3)	−17.61 (−113.9)
Jeonbuk	−11,986 (−100)	−57,620 (−480.7)	−73,495 (−613.2)	−4.76 (−100)	−23.85 (−501.1)	−30.81 (−647.3)
Jeonnam	−17,281 (−100)	−53,903 (−311.9)	−85,649 (−495.6)	−4.23 (−100)	−13.06 (−308.7)	−21.32 (−504.0)
Gyeongbuk	−21,882 (−100)	−38,415 (−175.6)	−57,379 (−262.2)	−4.89 (−100)	−8.39 (−171.6)	−12.46 (−254.8)
Gyeongnam	−24,966 (−100)	−75,324 (−305.4)	−83,934 (−340.3)	−7.72 (−100)	−23.81 (−308.4)	−27.03 (−350.1)
Jeju	3,661 (100)	−3,788 (−103.5)	−3,912 (−106.6)	10.48 (100)	−10.23 (−97.6)	−10.48 (−100.0)

Source: Calculated from Sources 1, 3 and 11.

From the given data, each province has the following regression equation on the relationship between the number of net migrants per thousand residents and per capita value added in thousand Won. In these equations, the definition of symbols is as follows:

Y_i: the number of net migrants per thousand residents of province i

X_i: per capita value added of province i in thousand Won

R^2: coefficient of determination

$\hat{\sigma}_{yx}$: standard error of estimate

$\hat{\sigma}_b$ and $\hat{\sigma}_c$: standard errors of the X_i's coefficient in a linear equation and the X_i^2's coefficient in a parabolic equation, respectively

t : computed value of student's t for the X_i's or X_i^2's coefficient

t_α : critical value at the α level of significance

Seoul City: $Y_1 = -5.74 + 1.12X_1 - 0.0055X_1^2$

- $R^2 = 0.6724$
- $\hat{\sigma}_{yx} = 0.2876$
- $\hat{\sigma}_c = 0.000023$

• $t = -241.228$

• $t_{0.01} = \pm 63.657$

• 99% confidence interval for the X_1^2's coefficient: -0.0069 to -0.0041

Busan City: $Y_2 = -24.11 + 1.40X_2 - 0.0078X_2^2$

• $R^2 = 0.7242$

• $\hat{\sigma}_{yx} = 0.4690$

• $\hat{\sigma}_c = 0.000049$

• $t = -157.57$

• $t_{0.01} = \pm 63.657$

• 99% confidence interval for the X_2^2's coefficient: -0.0011 to -0.0046

Gyeonggi Province: $Y_3 = -23.20 + 0.75X_3$

• $R^2 = 0.9565$

• $\hat{\sigma}_{yx} = 5.9160$

• $\hat{\sigma}_b = 0.1625$

• $t = 4.5538$

• $t_{0.2} = \pm 3.078$

• 80% confidence interval for the X_3's coefficient: 0.24 to 1.24

Gangweon Province: $Y_4 = 9.68 - 0.46X_4$

• $R^2 = 0.9702$

• $\hat{\sigma}_{yx} = 1.8708$

• $\hat{\sigma}_b = 0.0615$

• $t = -7.4785$

• $t_{0.1} = \pm 6.314$

• 90% confidence interval for the X_4's coefficient: -0.85 to -0.07

Chungbuk Province: $Y_5 = 23.24 - 1.58X_5 + 0.012X_5^2$

• $R^2 = 0.9063$

• $\hat{\sigma}_{yx} = 1.5000$

• $\hat{\sigma}_c = 0.000476$

• $t = 25.20$

• $t_{0.05} = \pm 12.706$

• 95% confidence interval for the X_5^2's coefficient: 0.006 to 0.018

Chungnam Province: $Y_6 = -14.21 - 0.04808X_6$

• $R^2 = 0.7744$

- $\hat{\sigma}_{yx}=0.2025$
- $\hat{\sigma}_b=0.006669$
- $t=-7.2095$
- $t_{0.1}=\pm 6.314$
- 90% confidence interval for the X_6's coefficient: -0.09019 to -0.00597

Jeonbuk Province : $Y_7=56.28-3.28X_7+0.0303X_7^2$

- $R^2=0.8263$
- $\hat{\sigma}_{yx}=0.2236$
- $\hat{\sigma}_c=0.00009505$
- $t=318.78$
- $t_{0.01}=\pm 63.657$
- 99% confidence interval for the X_7^2's coefficient: 0.0242 to 0.0364

Jeonnam Province : $Y_8=3.64-0.457X_8$

- $R^2=0.9428$
- $\hat{\sigma}_{yx}=1.6613$
- $\hat{\sigma}_b=0.0641$
- $t=-7.1295$
- $t_{0.1}=\pm 6.314$
- 90% confidence interval for the X_8's coefficient: -0.8617 to -0.0523

Gyeongbuk Province : $Y_9=-0.93-0.188X_9$

- $R^2=0.9960$
- $\hat{\sigma}_{yx}=0.3003$
- $\hat{\sigma}_c=0.01048$
- $t=-17.9103$
- $t_{0.05}=\pm 12.706$
- 95% confidence interval for the X_9's coefficient: -0.3208 to -0.0546

Gyeongnam Province : $Y_{10}=15.22-1.36X_{10}+0.0107X_{10}^2$

- $R^2=0.8208$
- $\hat{\sigma}_{yx}=0.1414$
- $\hat{\sigma}_c=0.0000388$
- $t=275.77$
- $t_{0.01}=\pm 63.657$
- 99% confidence interval for the X_{10}^2's coefficient: 0.0082 to 0.0132

Jeju Province : $Y_{11}=51.05-2.20X_{11}+0.0192X_{11}^2$

- $R^2=0.8317$
- $\hat{\sigma}_{yx}=1.1000$
- $\hat{\sigma}_c=0.0004108$
- $t=46.74$
- $t_{0.02}=\pm 31.821$
- 98% confidence interval for the X_{11}^2's coefficient: 0.0061 to 0.0323

5. The Relationships Between Inter-regional Economic Disparity and Inter-regional Migration Vector

Reorganization of Data

This section intends to find what relationships might exist between inter-provincial economic disparity and inter-provincial migration vector. Inter-provincial economic disparity here in means the differences of pairs of provinces in terms of economic levels which are represented by per capita value added of total product.

For the provincial per capita value added, the three years 1964, 1968 and 1970 were selected, and the 1961-1966 annual average and years 1969 and 1971 were chosen for the inter-provincial migration. Table 4 presents the relationships between these two factors among provinces. By the gravity theory that migration is a function of both population of sending areas and population of receiving areas, the coefficients of in-migration and out-migration are recorded in Table 4.

Classification of Regions

1. Regional Classification by Economic Level and Economic Growth Rate

All regions, the two special cities and nine provinces, will be classified into groups using the criteria of their economic levels and economic growth rates. The economic level is represented by per capita value added of total product, and the economic growth rate is defined as an increase index of per capita value added. The necessary data for regional classification are shown in Table 5.

First, the regional classification by economic level is conducted using the mean and standard deviation of the provincial per capita value added for all regions.

Table 4. Inter-provincial Migration with Its Coefficients in 1961-66, 1969 and 1971 in Relation with Provincial Per Capita Value Added in 1964, 1968 and 1970

(Unit: person in migration; Won in value added)

From \ Per capita value added \ To		Seoul (SD)			Busan (BS)		
		36,555	106,205	138,422	26,433	86,947	118,699
SL	36,555(1964) 106,205(1968) 138,422(1970)				4,086* (2.86)* (1.08)*	10,588** (6.32)** (2.22)**	11,130*** (5.73)*** (1.90)***
BS	26,433(1964) 86,947(1968) 118,699(1970)	12,376 (3.25) (8.66)	3,701 (2.87) (8.18)	30,144 (5.51) (15.51)			
GG	24,859(1964) 46,763(1968) 76,218(1970)	22,103 (6.00) (7.11)	60,492 (12.66) (19.28)	95,423 (16.31) (27.67)	939 (0.66) (0.30)	4,549 (2.72) (1.45)	5,309 (2.73) (1.54)
GW	21,269(1964) 42,036(1968) 64,264(1970)	7,163 (1.88) (3.91)	26,140 (5.74) (14.44)	38,588 (6.60) (20.84)	777 (0.54) (0.42)	3,447 (2.06) (1.90)	4,008 (2.06) (2.15)
CB	22,533(1964) 44,602(1968) 69,915(1970)	8,911 (2.34) (5.75)	27,107 (5.68) (17.89)	39,139 (6.69) (26.28)	0 (0.00) (0.00)	2,647 (1.58) (1.75)	3,073 (1.58) (2.06)
CN	21,025(1964) 44,064(1968) 63,898(1970)	25,444 (6.69) (8.76)	46,399 (9.71) (16.08)	63,565 (10.86) (22.24)	862 (0.60) (0.30)	4,008 (2.39) (1.39)	4,599 (2.37) (1.61)
JB	23,809(1964) 37,308(1968) 61,359(1970)	12,438 (3.27) (4.93)	45,340 (9.49) (18.76)	63,688 (10.89) (26.34)	388 (0.27) (0.15)	4,236 (2.53) (1.75)	7,100 (3.65) (2.94)
JN	20,673(1964) 31,928(1968) 56,494(1970)	15,010 (3.95) (3.71)	49,315 (10.32) (11.95)	70,920 (12.12) (17.65)	1,554 (1.09) (0.38)	6,629 (3.96) (1.61)	10,964 (5.64) (2.73)
GB	21,113(1964) 39,949(1968) 61,641(1970)	14,751 (3.88) (3.30)	41,465 (8.68) (9.06)	63,329 (10.82) (13.75)	7,656 (5.35) (1.71)	20,647 (12.32) (4.51)	26,649 (13.71) (5.79)
GN	20,029(1964) 43,648(1968) 73,612(1970)	6,573 (1.73) (2.07)	28,159 (5.90) (8.90)	43,468 (7.43) (14.00)	18,204 (12.73) (5.73)	46,717 (27.88) (14.77)	69,686 (34.30) (21.47)
JJ	23,112(1964) 47,839(1968) 65,684(1970)	279 (0.07) (0.83)	2,717 (0.57) (7.34)	4,885 (0.83) (13.09)	194 (0.14) (0.58)	1,321 (0.79) (3.57)	2,177 (1.12) (5.83)

Table 4. (Continued)

From \ Per capita value added \ To		Gyeonggi (GG)			Gangweon (GW)		
		24,859	46,763	76,213	21,269	42,036	64,264
SL	36,555(1964) 106,205(1968) 138,422(1970)	9,175 (2.95) (2.42)	39,749 (12.67) (8.32)	150,313 (43.58) (25.69)	1,796 (0.98) (0.47)	7,079 (3.91) (1.48)	12,885 (6.96) (2.20)
BS	26,433(1964) 86,947(1968) 118,699(1970)	2,937 (0.95) (2.05)	3,921 (1.25) (2.34)	6,543 (1.90) (3.37)	1,433 (0.78) (1.00)	1,913 (1.06) (1.14)	2,291 (1.24) (1.18)
GG	24,859(1964) 46,763(1968) 76,218(1970)				4,671 (2.55) (1.50)	6,541 (3.61) (2.08)	10,196 (5.51) (2.96)
GW	21,269(1964) 42,036(1968) 64,264(1970)	1,833 (0.59) (1.00)	11,339 (3.61) (6.26)	18,593 (5.39) (10.04)			
CB	22,533(1964) 44,602(1968) 69,915(1970)	1,399 (0.45) (0.90)	7,604 (2.42) (5.02)	13,937 (4.04) (9.36)	1,146 (0.63) (0.74)	4,284 (2.37) (2.83)	6,671 (3.60) (4.48)
CN	21,025(1964) 44,064(1968) 63,898(1970)	3,582 (1.15) (1.23)	17,200 (5.48) (5.96)	23,202 (6.73) (8.12)	233 (0.13) (0.08)	3,867 (2.14) (1.34)	3,940 (2.13) (1.38)
JB	23,809(1964) 37,308(1968) 61,359(1970)	768 (0.25) (0.30)	8,199 (2.61) (3.39)	16,009 (4.64) (6.62)	993 (0.54) (0.39)	2,956 (1.63) (1.23)	2,618 (1.41) (1.08)
JN	20,673(1964) 31,928(1968) 56,494(1970)	2,413 (0.78) (0.60)	9,856 (3.14) (2.39)	18,408 (5.34) (4.58)	361 (0.20) (0.09)	4,620 (2.55) (1.12)	3,010 (1.63) (0.75)
GB	21,113(1964) 39,949(1968) 61,641(1970)	3,011 (0.97) (0.67)	10,140 (3.23) (2.22)	13,239 (3.84) (2.88)	4,566 (2.49) (1.02)	7,315 (4.04) (1.60)	10,512 (5.68) (2.28)
GN	20,029(1964) 43,648(1968) 73,612(1970)	940 (0.30) (0.30)	6,287 (2.00) (1.99)	9,269 (2.69) (2.98)	2,257 (1.23) (0.19)	3,600 (1.99) (1.14)	3,418 (1.85) (1.10)
JJ	23,112(1964) 47,839(1968) 65,684(1970)	0 (0.00) (0.00)	581 (0.17) (1.57)	817 (0.24) (2.19)	0 (0.00) (0.00)	532 (0.29) (1.44)	191 (0.10) (0.51)

Table 4. (Continued)

From \ To (Per capita value added)		Chungbuk (CB)			Chungnam (CN)		
		22,533	44,602	69,915	21,025	44,064	63,898
SL	36,555(1964) 106,205(1968) 138,422(1970)	374 (0.24) (0.10)	3,188 (2.10) (0.67)	9,457 (6.35) (1.62)	1,718 (0.59) (0.45)	8,296 (2.88) (1.74)	18,943 (6.63) (3.24)
BS	26,433(1964) 86,947(1968) 118,699(1970)	286 (0.19) (0.20)	468 (0.31) (0.28)	1,285 (0.86) (0.66)	146 (0.05) (0.10)	1,151 (0.40) (0.69)	1.994 (0.68) (1.03)
GG	24,859(1964) 46,763(1968) 76,218(1970)	286 (0.18) (0.09)	2,432 (1.61) (0.78)	5,159 (3.46) (1.50)	2,717 (0.94) (0.87)	4,864 (1.69) (1.55)	10,372 (3.63) (3.01)
GW	21,269(1964) 42,036(1968) 64,264(1970)	3,753 (2.42) (2.05)	4,659 (3.08) (2.57)	8,567 (5.75) (4.62)	585 (0.20) (0.32)	2,881 (1.00) (1.59)	3,726 (1.30) (2.01)
CB	22,533(1964) 44,602(1968) 69,915(1970)				2,656 (0.91) (1.71)	7,721 (2.68) (5.10)	12,393 (4.34) (8.32)
CN	21,025(1964) 44,064(1968) 63,898(1970)	1,154 (0.75) (0.40)	3,665 (2.42) (1.27)	6,459 (4.36) (2.27)			
JB	23,809(1964) 37,308(1968) 61,359(1970)	421 (0.27) (0.17)	1,084 (0.72) (0.45)	1,463 (0.98) (0.61)	1,545 (0.53) (0.61)	6,153 (2.13) (2.55)	8,101 (2.83) (3.35)
JN	20,673(1964) 31,928(1968) 56,494(1970)	0 (0.00) (0.00)	860 (0.57) (0.21)	1,108 (0.74) (0.28)	1,211 (0.42) (0.30)	2,991 (1.04) (0.72)	4,154 (1.45) (1.03)
GB	21,113(1964) 39,949(1968) 61,641(1970)	2,723 (1.76) (0.61)	3,199 (2.11) (0.70)	5,340 (3.59) (1.16)	247 (0.09) (0.06)	3,943 (1.37) (8.61)	4,893 (1.71) (1.06)
GN	20,029(1964) 43,648(1968) 73,612(1970)	0 (0.00) (0.00)	731 (0.48) (0.23)	1,246 (0.84) (0.40)	0 (0.00) (0.00)	2,017 (0.70) (0.64)	2,524 (0.88) (0.81)
JJ	23,112(1964) 47,839(1968) 65,684(1970)	0 (0.00) (0.00)	52 (0.04) (0.14)	59 (0.04) (0.16)	0 (0.00) (0.00)	127 (0.04) (0.34)	155 (0.05) (0.42)

Table 4. (Continued)

From \ Per capita value added \ To		Jeonbuk (JB)			Jeonnam (JN)		
		23,809	37,308	61,359	20,673	31,928	56,494
SL	36,555(1964) 106,205(1968) 138,422(1970)	1,024 (0.41) (0.27)	5,224 (2.16) (1.10)	13,192 (5.46) (2.25)	1,870 (0.46) (0.49)	7,127 (1.73) (1.49)	16,755 (4.17) (2.86)
BS	26,433(1964) 86,947(1968) 118,699(1970)	0 (0.00) (0.00)	740 (0.31) (0.44)	1,481 (0.61) (0.76)	785 (0.19) (0.55)	1,616 (0.39) (0.96)	3,034 (0.76) (1.56)
GG	24,859(1964) 46,763(1968) 76,218(1970)	194 (0.08) (0.06)	2,879 (1.19) (0.92)	4,050 (1.67) (1.17)	591 (0.15) (0.19)	2,675 (0.65) (0.85)	4,917 (1.22) (1.43)
GW	21,269(1964) 42,036(1968) 64,264(1970)	247 (0.10) (0.14)	1,341 (0.56) (0.74)	1,485 (0.61) (0.80)	0 (0.00) (0.00)	1,908 (0.46) (1.05)	1,910 (0.48) (1.03)
CB	22,533(1964) 44,602(1968) 69,915(1970)	0 (0.00) (0.00)	945 (0.39) (0.62)	1,148 (0.47) (0.77)	676 (0.17) (0.44)	1,369 (0.33) (0.90)	1,057 (0.26) (0.71)
CN	21,025(1964) 44,064(1968) 63,898(1970)	4,532 (1.80) (1.56)	2,595 (1.07) (0.96)	5,174 (2.14) (1.81)	591 (0.15) (0.20)	2,588 (0.63) (0.90)	1,934 (0.48) (0.68)
JB	23,809(1964) 37,308(1968) 61,359(1970)				2,244 (0.55) (0.89)	6,123 (1.48) (2.53)	8,126 (2.02) (3.36)
JN	20,673(1964) 31,928(1968) 56,494(1970)	1,671 (0.66) (0.41)	4,979 (2.06) (1.21)	8,923 (3.69) (2.22)			
GB	21,113(1964) 39,949(1968) 61,641(1970)	194 (0.08) (0.04)	1,449 (0.60) (0.32)	1,701 (0.70) (0.37)	0 (0.00) (0.00)	3,699 (0.90) (0.81)	2,102 (0.52) (0.46)
GN	20,029(1964) 43,648(1968) 73,612(1970)	295 (0.12) (0.09)	1,519 (0.63) (0.48)	1,572 (0.65) (0.51)	287 (0.07) (0.09)	4,488 (1.09) (1.42)	2,631 (0.65) (0.85)
JJ	23,112(1964) 47,839(1968) 65,684(1970)	0 (0.00) (0.00)	115 (0.05) (0.31)	202 (0.08) (0.54)	0 (0.00) (0.00)	648 (0.16) (1.75)	965 (0.24) (2.59)

Table 4. (Continued)

From \ Per capita value added \ To		Gyeongbuk (GB)			Gyeongnam (GH)		
		21,113	39,949	61,641	20,029	43,648	73,612
SL	36,555(1964) 106,205(1968) 138,422(1970)	1,591 (0.36) (0.42)	10,012 (2.19) (2.10)	16,459 (3.57) (2.81)	295 (0.09) (0.08)	4,963 (1.57) (1.04)	10,001 (3.22) (1.71)
BS	26,433(1964) 86,947(1968) 118,699(1970)	1,733 (0.39) (1.21)	5,841 (1.28) (3.49)	10,233 (2.22) (5.26)	3,930 (1.24) (2.75)	10,839 (3.43) (6.47)	22,405 (7.21) (11.53)
GG	24,859(1964) 46,763(1968) 76,218(1970)	675 (0.15) (0.22)	4,836 (1.06) (1.54)	7,241 (1.57) (2.10)	426 (0.13) (0.14)	2,373 (0.75) (0.76)	5,956 (1.92) (1.93)
GW	21,269(1964) 42,036(1968) 64,264(1970)	1,056 (0.24) (0.58)	9,328 (2.04) (5.15)	10,880 (2.36) (5.88)	627 (0.20) (0.34)	2,395 (0.76) (1.32)	2,791 (0.90) (1.50)
CB	22,533(1964) 44,602(1968) 69,915(1970)	953 (0.21) (0.62)	3,680 (0.80) (2.43)	6,115 (1.33) (4.11)	3,023 (0.95) (1.95)	912 (0.29) (0.60)	1,227 (0.40) (0.82)
CN	21,025(1964) 44,064(1968) 63,898(1970)	101 (0.02) (0.04)	3,617 (0.79) (1.25)	5,354 (1.16) (1.87)	194 (0.06) (0.07)	1,159 (0.37) (0.40)	3,058 (0.98) (1.07)
JB	23,809(1964) 37,308(1968) 61,359(1970)	1,059 (0.24) (0.42)	3,845 (0.84) (1.59)	3,799 (0.83) (1.57)	287 (0.09) (0.11)	1,367 (0.43) (0.57)	2,132 (0.69) (0.88)
JN	20,673(1964) 31,928(1968) 56,494(1970)	567 (0.13) (0.14)	3,900 (0.85) (0.95)	4,778 (1.04) (1.19)	93 (0.03) (0.02)	2,301 (0.73) (0.56)	4,633 (1.49) (1.15)
GB	21,113(1964) 39,949(1968) 61,641(1970)				1,675 (0.53) (0.37)	12,424 (3.93) (2.72)	15,586 (0.02) (3.38)
GN	20,029(1964) 43,648(1968) 73,612(1970)	5,299 (1.18) (1.67)	20,585 (4.50) (6.51)	20,981 (4.56) (6.76)			
JJ	23,112(1964) 47,839(1968) 65,684(1970)	0 (0.00) (0.00)	405 (0.09) (1.10)	619 (0.13) (1.66)	520 (0.16) (1.54)	323 (0.10) (0.87)	479 (0.15) (1.28)

Table 4. (Continued)

From \ To	Per capita value added	Jeju (JJ) 23,112	47,839	65,684
SL	36,555(1964) 106,205(1968) 138,422(1970)	660 (1.96) (0.17)	708 (1.91) (0.15)	1,325 (3.55) (0.23)
BS	26,433(1964) 86,947(1968) 118,699(1970)	575 (1.24) (0.40)	489 (1.32) (0.29)	885 (2.29) (0.44)
GG	24,859(1964) 46,763(1968) 76,218(1970)	0 (0.00) (0.00)	192 (0.52) (0.96)	430 (1.15) (0.12)
GW	21,269(1964) 42,036(1968) 64,264(1970)	0 (0.00) (0.00)	143 (0.39) (0.08)	188 (0.50) (0.10)
CB	22,533(1964) 44,602(1968) 69,915(1970)	0 (0.00) (0.00)	49 (0.13) (0.03)	111 (0.30) (0.07)
CN	21,025(1964) 44,064(1968) 63,898(1970)	0 (0.00) (0.00)	196 (0.53) (0.07)	275 (0.74) (0.10)
JB	23,809(1964) 37,308(1968) 61,359(1970)	0 (0.00) (0.00)	103 (0.28) (0.04)	387 (1.04) (0.16)
JN	20,673(1964) 31,928(1968) 56,494(1970)	1,445 (4.28) (0.36)	693 (1.87) (0.17)	2,182 (5.85) (0.54)
GB	21,113(1964) 39,949(1968) 61,641(1970)	93 (0.28) (0.02)	183 (0.44) (0.04)	487 (1.30) (0.11)
GN	20,029(1964) 43,648(1968) 73,612(1970)	1,881 (5.58) (0.59)	277 (0.75) (0.09)	397 (1.06) (0.13)

Note : (1) * 1961-1966 annual average, ** 1969, *** 1971 : migrants

(2) The upper and the lower number in ( ) are the coefficients of in—and out-migration, respectively.

Source : Calculated from Sources 3, 6, 7, 9, 10, 11 and 12.

Table 5. Provincial Per Capita Value Added and Its Index with All Provinces' Mean and Standard Deviation.

Province	Per capita value added Xi (in Won)			Index based on 1964 Yi (in Won)		
	1964	1968	1970	1964	1968	1970
Seoul	36,555	106,205	138,422	100	290.5	378.7
Busan	26,433	86,947	118,699	100	328.9	449.1
Gyeonggi	24,859	46,763	76,218	100	188.1	306.6
Gangweon	21,269	42,036	64,264	100	197.6	302.1
Chungbuk	22,533	44,602	69,915	100	197.9	310.3
Chungnam	21,025	44,064	63,898	100	209.6	303.9
Jeonbuk	23,809	37,308	61,359	100	156.7	257.7
Jeonnam	20,673	31,928	56,494	100	154.4	273.3
Gyeongbuk	21,113	39,949	61,641	100	189.2	292.0
Gyeongnam	20,029	43,648	23,612	100	217.9	367.5
Jeju	23,112	47,839	65,684	100	207.0	284.2
Mean	23,765	51,844	77,291	100	212.5	319.7
Standard deviation	4,448	22,073	25,112	0	50.4	64.6

Source : Calculated and reformed from Table 2.

Three levels, high, middle and low, are defined as below:

High level (HL) : $X_i \geq M_x$

Middle level(ML) : $M_x - \frac{\sigma_x}{2} \leq X_i < M_x$

Low level (LL) : $X_i < M_x - \frac{\sigma_x}{2}$

where X_i : per pacita value added of province i

M_x : arithmetic mean of per capita values added of eleven provinces

σ_x : standard deviation of per capita values added of eleven provinces

The rationale of these limits for classification is based on the facts that the variates of Seoul and Busan are extremely high and that there are not great gaps among the variates of the nine provinces.

Using the criteria defined above, all the eleven regions were classified into groups in each year as shown in Table 6.

In 1968 as the middle year among three years studied, the high level group consists of the two special cities of Seoul and Busan, the middle level group has the six provinces of Gyeonggi, Gangweon, Chungbuk, Chungnam, Gyeongnam and Jeju, and the low level group is composed of the three provinces of Jeonbuk, Jeonnam and Gyeongbuk.

Next, the regional classification by economic growth rate was accomplished using the

Table 6. Regional Classification by Economic Level

Year	High level(HL)		Middle level(ML)		Low level(LL)	
	Limits	Province	Limits	Province	Limits	Province
1964	X≥23,765	Seoul Busan Gyeonggi Jeonbuk	21,541 ≤X< 23,765	Chungbuk Jeju	X<21,541	Gangweon Chungnam Jeonnam Gyeongbuk Gyeongnam
1968	Y≥51,844	Seoul Busan	40,808 ≤X< 51,844	Gyeonggi Gangweon Chungbuk Chungnam Gyeongnam Jeju	X<40,808	Jeonbuk Jeonnam Gyeongbuk
1970	X≥77,291	Seoul Busan	64,735 ≤X< 77,291	Gyeonggi Chungbuk Gyeongnam Jeju	X<64,735	Gangweon Chungnam Jeonbuk Jeonnam Gyeongbuk

Source : Classified from Table 5 by the criteria defined.

annual increase indices of provincial per capita value added. From the indices in Table 5, the limits of high, middle and low growth can be defined as follows:

High growth (HG) : $Y_i \geq M_y$

Middle growth(MG) : $M_y - \frac{\sigma_y}{2} \leq Y_i < M_y$

Low growth (LG) : $Y_i < M_y - \frac{\sigma_y}{2}$

where Y_i : index based on 1964 of per capita value added

M_y : arithmetic mean of the eleven provinces' indices

σ_y : standard deviation of the eleven provinces' indices

The results are presented in Table 7. In 1970 which is the last year in the two years studied, the three regions of Seoul, Busan and Gyeongnam are in the high group. the five regions of Gyeonggi, Gangweon, Chungbuk, Chungnam and Gyeongbuk correspond to the middle growth group, and the three regions of Jeonbuk, Jeonnam and Jeju stay in the low growth group.

Table 6 and Table 7 can be synthesized to a table which has a matrix form showing the regional classification by economic level and by economic growth rate. It is presented in Table 8 and on Figure 3. These results show that Seoul and Busan have been not only in high economic level, but in high economic growth stage, while Jeonbuk and Jeonnam have systed in low economic level and low economic growth stage. Gyeongnam shows a high economic growth rate in a middle economic level, and Gyeongbuk indicates a middle economic growth rate from a low economic level.

Table 7. Regional Classification by Economic Growth Rate.

Year	High growth (HG)		Middle growth (MG)		Low growth (LG)	
	Limits	Province	Limits	Province	Limits	Province
1968	Y≥212.5	Seoul Busan Gyeongnam	187.3 ≤Y< 212.5	Gyeonggi Gangweon Chungbuk Chungnam Gyeongbuk Jeju	Y<187.3	Jeonbuk Jeonnam
1970	Y≥319.7	Seoul Busan Gyeongnam	287.4 ≤Y< 319.7	Gyeonggi Gangweon Chungbuk Chungnam Gyeongbuk	Y<287.4	Jeonbuk Jeonnam Jeju

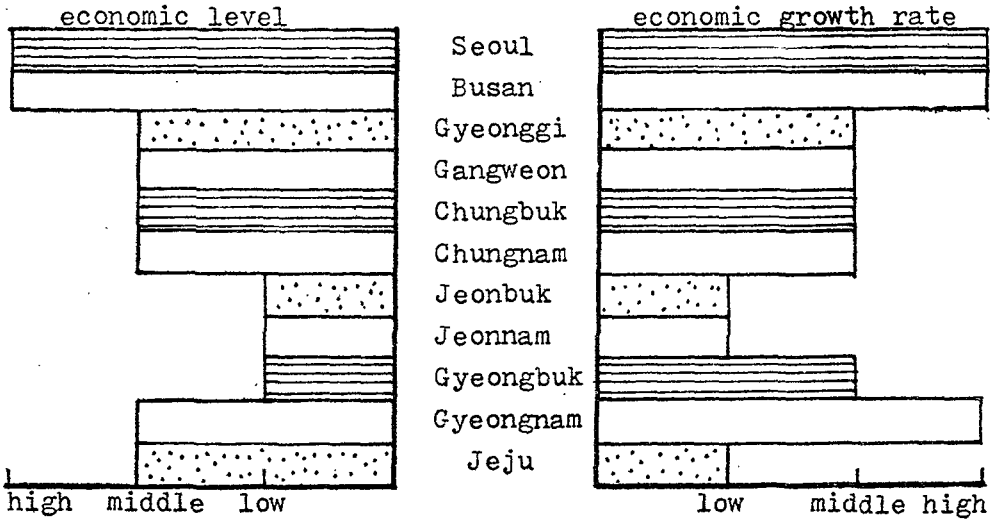
Source : Classified from Table 5 by the criteria defined.

Table 8. Regional Classification by Economic Level and Economic Growth Rate

Classification		Economic level (1968)		
		High (HL)	Middle (ML)	Low (LL)
Economic growth rate (1970 based on 1964)	High (HG)	Seoul Busan	Gyeongnam	—
	Middle (MG)	—	Gyeonggi, Gangweon Chungbuk, Chungnam	Gyeongbuk
	Low (LG)	—	Jeju	Jeonbuk Jeonnam

Source : Synthesized from Table 6 and 7.

Fig. 3. Economic Level and Economic Growth Rate of Each Provoice



Source : Table 8.

2. Regional Classification by Population Migration

All the regions were also classified by the number and the changing rate of net migrants. The data from the years 1969 and 1971 were chosen as the basis of an assumed one-year-lag in migration with respect to economic level and economic growth rate.

The limits of classification can be fixed in consideration of the distribution of variates as follows:

(1) Limits of groups by net migration volume (1969):

In-excessive migration (IM) : $X_i \geq 0$

Weak out-excessive migration(OMw) : $-20 \leq X_i < 0$

Strong out-excessive migration(OMs) : $X_i < -20$

where X_i : the number of net migrants per thousand residents of province i

(2) Limits of groups by net migration changing rate(1971) :

Positive increase rate (PI) : $Y_i \geq 100$

Weak negative increase rate (NIw) : $-500 \leq Y_i < 100$

Strong negative increase rate(NIs) : $Y_i < -500$

where Y_i : index of net migration of province i in 1971 based on 1961—1966

By these criteria, all the eleven provincial units are classified as shown in Table 9 and on Figure 4. This information indicates that the three regions of Seoul, Busan and Gyeonggi are in the strongest and most positive group and Jeonbuk is in the weakest group in terms of migration.

Table 9. Regional Classification by the Number and the Changing Rate of Net Migrants

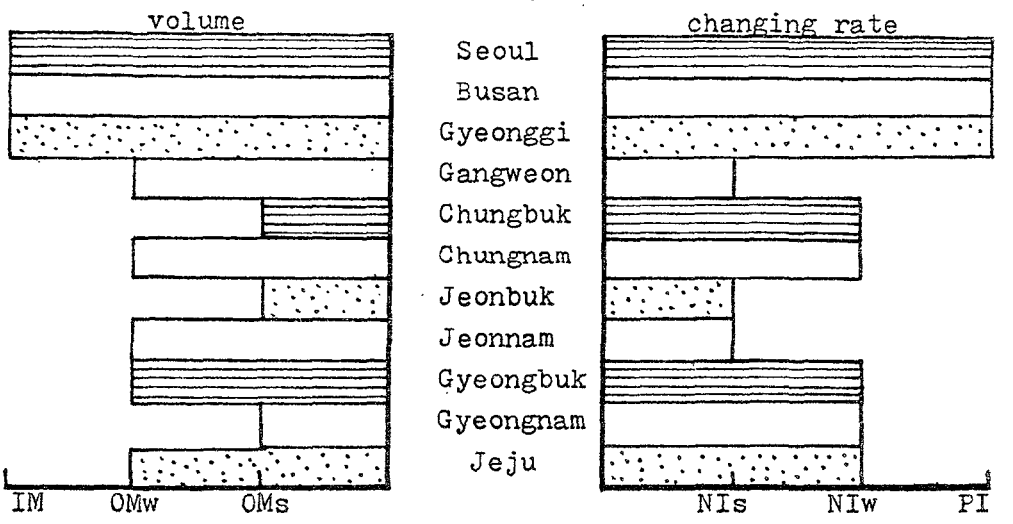
Classification		Net migration (1969)		
		In-excessive (IM)	Weak out-excessive(OMw)	Strong out-excessive(OMs)
Changing rate of net migrants (1971 based on 1961—66)	Positive (PI)	Seoul Busan Gyeonggi	—	—
	Weak negative (NIw)	—	Chungnam Gyeongbuk Jeju	Chungbuk Gyeongnam
	Strong negative (NIs)	—	Gangweon Jeonnam	Jeonbuk

Source : Classified from Table 3 by the criteria defined.

The Relationships between Inter-regional Economic Disparity and Migration Vector

In this part, we will investigate the inter-relationships between inter-provincial migration vector and provincial economic status. At first, in order to find the difference between economic level and the direction of net migration flow of each two provinces in the eleven

Fig. 4. Volume and Changing Rate of Net Migration



Source : Table 9

provinces, we compare 55 sets ($_{11}C_2=11!/2!9!$). The result is shown in Table 10.

In order to simplify Table 10, the directions of over-out-migration among provinces are represented in Table 11. For example, between Seoul and Busan, where the former is higher than the latter in per capita value added, the number of out-migrants from Busan to Seoul is greater than the number of out-migrants from Seoul to Busan; and as an another example, the number of out-migrants from Busan to Gyeonggi is greater than the number of out-migrants from Gyeonggi to Busan, while Busan is higher than Gyeonggi in per capita value added through the subjective years.

From Table 11, we can classify all cases into the following two groups:

(1) Flows of net migration from low to high income areas:

Low income regions	High income regions
• All provinces(all years)	⟶Seoul
• All provinces(all years) with exception of Seoul (all years), Gyeonggi(all years) and Gangweon(1961—66)	⟶Busan
• All provinces(all years) with exception of Seoul(all years), Busan(all years) and Gangweon (1961—66)	⟶Gyeonggi
• Jeonbuk(1969, 71), Jeonnam (1969) and Gyeongbuk(196—66)	⟶Gangweon

Table 10. Difference and Direction of Per Capita Value Added and Out-migrants per Thousand Residents among Provinces

(Unit: Won in value added; person/1,000 in migration)

Area	Difference of	Year	Busan (BS)	Gyeonggi (GG)	Gangweon (GW)	Chungbuk (CB)	Chungnam (CN)	Jeonbuk (JB)	Jeonnam (JN)	Gyeong-buk (GB)	Gyeong-nam (GN)	Jeju (JJ)
Seoul	value added/ person	1964	>10,122	>11,696	>15,286	>14,022	>15,530	>12,746	>14,442	>15,442	>16,526	>13,443
		1968	>99,258	>59,442	>64,169	>61,603	>62,141	>68,897	>74,277	>66,256	>62,557	>58,366
		1970	>10,723	>62,204	>74,158	>68,507	>74,524	>77,063	>81,928	>76,781	>64,810	>72,738
	out-migrants	61—66	← 7.58	← 4.70	← 3.44	← 5.65	← 8.31	← 4.66	← 3.22	← 2.88	← 1.99	← 0.60
		1969	← 5.96	←10.95	←12.96	←17.22	←14.35	←17.66	←10.46	← 6.97	← 7.86	← 7.25
		1971	←13.60	← 1.98	←18.64	←24.66	←19.00	←24.09	←14.79	←10.94	←12.29	←12.86
BS	value added/ person	1964		> 1,574	> 5,164	> 3,900	> 5,408	> 2,624	> 5,760	> 5,320	> 6,404	> 3,321
		1968		>40,211	>44,911	>42,372	>42,883	>49,639	>55,019	>46,998	>43,299	>39,108
		1970		>42,481	>54,435	>48,784	>54,801	>57,340	>62,205	>57,058	>45,087	>53,019
	out-migrants	61—66		→ 1.75	→ 0.58	0	← 0.20	0	→ 0.17	← 0.50	← 2.98	← 0.17
		1969		→ 0.89	← 0.76	← 1.47	← 0.70	← 1.31	← 0.64	← 1.03	← 8.30	← 3.23
		1971		→ 1.83	← 0.97	← 1.40	← 0.58	← 2.18	← 1.17	← 0.52	← 9.95	← 5.08
GG	value added/ person	1964			> 3,590	> 2,326	> 3,834	> 1,050	> 4,188	> 3,746	> 4,830	> 1,747
		1968			> 4,727	> 2,161	> 2,699	> 9,455	>14,835	> 6,714	> 3,115	< 1,076
		1970			>11,954	> 6,303	>12,324	>14,859	>19,724	>14,577	> 2,606	>10,534
	out-migrants	61—66			→ 0.50	← 0.81	← 0.36	← 0.24	← 0.41	← 0.46	← 0.16	0
		1969			← 4.18	← 4.24	← 4.41	← 2.48	← 1.54	← 0.68	← 1.23	← 0.61
		1971			← 7.08	← 7.86	← 5.11	← 7.80	← 3.16	← 0.78	← 1.26	← 2.07
GW	value added/ person	1964				< 1,264	> 244	< 2,540	< 596	> 156	> 1,240	< 1,843
		1968				< 2,566	< 2,028	> 4,728	>10,108	> 2,087	< 1,612	< 5,803
		1970				< 5,651	> 366	> 2,905	> 7,770	> 2,623	< 9,348	< 1,420
	out-migrants	61—66				→ 1.31	→ 0.38	← 0.26	0	← 0.44	→ 0.16	0
		1969				← 0.25	→ 0.25	← 0.48	← 0.07	→ 3.55	→ 0.19	← 1.36
		1971				→ 0.14	→ 0.63	← 0.28	→ 0.28	→ 3.59	→ 0.40	← 0.41
CB	value added/ person	1964					> 1,508	< 1,276	> 1,866	> 1,420	> 2,504	< 579
		1968					> 538	> 7,294	>12,674	> 4,653	> 954	< 3,237
		1970					> 6,017	> 8,556	>13,421	> 8,274	< 3,697	> 4,231
	out-migrants	61—66					→ 1.32	0	0	→ 0.01	0	0
		1969					→ 3.83	→ 0.18	→ 0.70	→ 1.73	→ 0.37	← 0.11
		1971					→ 6.05	→ 0.17	→ 0.43	→ 2.95	→ 0.42	← 0.08

Table 10. (Continue)

Area	Difference of	Year	Busan (BS)	Gyeonggi (GG)	Gangweon (GW)	Chungbuk (CB)	Chungnam (CN)	Jeonbuk (JB)	Jeonnam (JN)	Gyeong-buk (GB)	Gyeong-nam (GN)	Jeju (JJ)
CN	value added/ person	1964						< 2,784	> 352	< 88	> 996	< 2,087
		1968						> 6,756	> 12,136	> 4,115	> 416	< 3,775
		1970						> 2,538	> 7,404	> 2,257	< 9,714	< 1,786
	out-migrants	61—66						→ 0.95	← 0.10	← 0.02	0	0
		1969						← 1.65	→ 0.17	← 7.36	← 0.24	← 0.28
		1971						← 1.54	← 0.36	→ 0.81	→ 0.26	← 0.32
JB	value added/ person	1964							> 3,136	> 2,696	> 3,780	> 697
		1968							> 5,380	< 2,641	< 6,340	< 10,531
		1970							> 4,865	< 282	< 12,253	< 4,325
	out-migrants	61—66							→ 0.48	→ 0.38	→ 0.02	0
		1969							→ 1.33	→ 1.28	→ 0.09	← 0.27
		1971							→ 1.14	→ 1.20	→ 0.38	← 0.38
JN	value added/ person	1964								< 440	> 644	< 2,439
		1968								< 8,021	< 11,720	< 15,911
		1970								< 5,147	< 17,118	< 9,190
	out-migrants	61—66								0	← 0.07	0
		1969								→ 0.14	← 0.86	← 1.58
		1971								→ 0.73	→ 0.31	← 2.04
GB	value added/ person	1964									> 1,084	< 1,999
		1968									< 3,699	< 7,890
		1970									< 11,971	< 4,043
	out-migrants	61—66									← 1.29	0
		1969									← 3.79	← 1.06
		1971									← 3.37	← 1.55
GN	value added/ nerson	1964										< 3,083
		1968										< 4,191
		1970										> 7,928
	out-migrants	61—66										← 0.95
		1969										← 0.78
		1971										← 1.16

Note : (1) $A \overset{B}{\leftarrow}$ indicates that the province A is more than the province B by the amount recorded in provincial per capita value added.

(2) $A \overset{B}{>}$ means that the number of migrants per thousand residents from B to A exceeds the number of migrants per thousand residents from A to B by the number.

Sou rce : Calculated and reformed from Table 4.

Table 11. Directions of Net Migrants among Provinces with Signs of Economic Levels

Provice	Year	BS	GG	GW	CB	CN	JB	JN	GB	GN	JJ
Seoul (SL)	61-66	←	←	←	←	←	←	←	←	←	←
	1969	←	←	←	←	←	←	←	←	←	←
	1971	←	←	←	←	←	←	←	←	←	←
Busan (BS)	61-66		(→)	(→)		←		←	←	←	←
	1969		(→)	←	←	←	←	←	←	←	←
	1971		(→)	←	←	←	←	←	←	←	←
Gyeonggi (GG)	61-66			(→)	←	←	←	←	←	←	
	1969			←	←	←	←	←	←	←	←
	1971			←	←	←	←	←	←	←	←
Gangweon (GW)	61-66				→	(→)	(←)		←	(→)	
	1969				(←)	→	←	←	(→)	→	(←)
	1971				→	(→)	←	(→)	(→)	→	(←)
Chungbuk (CB)	61-66					(→)			(→)		
	1969					(→)	(→)	(→)	(→)	(→)	(←)
	1971					(→)	(→)	(→)	(→)	→	←
Chungnam (CN)	61-66						→	←	(←)		
	1969						←	(→)	←	←	(←)
	1971						←	←	(→)	→	(←)
Jeonbuk (JB)	61-66							(→)	(→)	(→)	
	1969							(→)	→	→	(←)
	1971							(→)	→	→	(←)
Jeonnam (JN)	61-66									←	
	1969								→	(←)	(←)
	1971								→	→	(←)
Gyeongbuk (GB)	61-66									←	
	1969									(←)	(←)
	1971									(←)	(←)
Gyeognam (GN)	61-66										(←)
	1969										(←)
	1971										←

Note : (1) $A \xleftarrow{B}$ means that the net migrants flow from the province to the province A, where A is higher than B in per capita value added.

(2) $A(\xrightarrow{B})$ means that the net migrants flow from A to B, where A is higher than B in per capita value added.

Source: Reformed from Table 10.

- Gangweon(1961—66, 71) and Jeju (1971) ———→Chungbuk
- Gangweon(1969), Jeonbuk(1969, 71), Jeonnam(1961—66, 71), Gyeongbuk(1969) and Gyeongnam (1969) ———→Chungnam
- Chungnam(1961—66) ———→Jeonbuk
- Gyeongnam(1961—66) ———→Jeonnam
- Jeonbuk(1969, 71), Jeonnam(1969, 71) and Gyeongnam (1961—66) ———→Gyeongbuk
- Gangweon(1969, 71), Chungbuk (1971), Chungnam(1971), Jeonbuk (1969, 71), Jeonnam(1971) and Jeju(1971) ———→Gyeongnam

(2) Flows of net migration from high to low income areas:

High income regions		Low income regions
• Busan(all years)	——→	Gyeonggi
• Busan(1961—66), Gyeonggi(1961—66), Chungbuk (1969), Jeonbuk (1961—66) and Jeju(1969, 71)	——→	Gangweon
• Jeju(1969)	——→	Chungbuk
• Gangweon(1961—66, 71), Gyeongbuk(1961—66), Chungbuk (all years) and Jeju(1969, 71)	——→	Chungnam
• Chungbuk(1969, 71) and Jeju (1969, 71)	——→	Jeonbuk
• Gangweon(1971), Chungbuk(1969, 71), Chungnam(1969), Jeonbuk (all years), Gyeongnam(1969) and Jeju(1969, 71)	——→	Jeonnam
• Gangweon(1969, 71), Chungbuk (all years), Chungnam(1971), Jeonbuk(1961—66), Gyeongnam (1969, 71) and Jeju(1969, 71)	——→	Gyeongbuk
• Gangweon(1961—66), Chungbuk (1969), Jeonbuk(1961—66) and Jeju(1961—66, 69)	——→	Gyeongnam

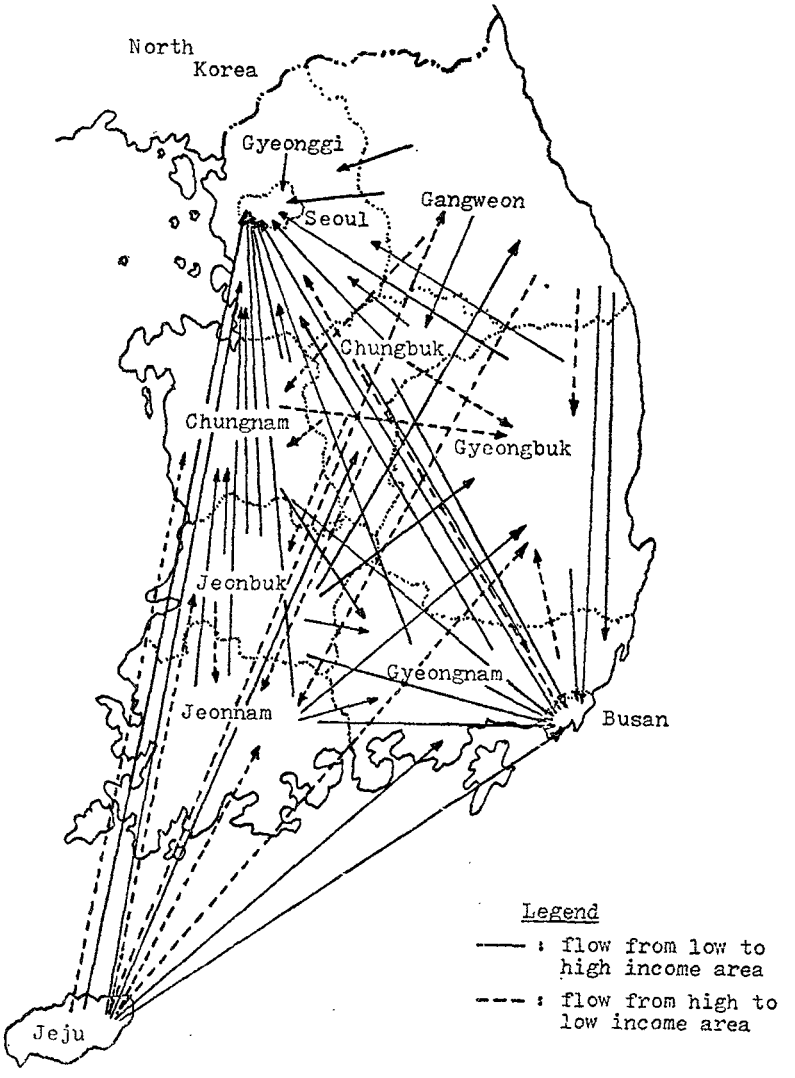
Figure 5 illustrates the flows of net migration from low(or high) to high(or low) income regions in the year 1971.

As the next step, we will find out the degree of attraction force in inter-provincial migration. For this finding, we grade four cases in terms of economic level as below:

Province concerned	Direction of net migration flow	Other province	Grading
A. low income	——→	high income	−1
B. high income	——→	low income	−2
C. low income	←——	high income	+2
D. high income	←——	low income	+1

If there is no flow, the grading is marked as zero. Through grading by this definition, each province wil have any value between +60 as maximum and −60 as minimum for the case of three years. When we define "expected flows" as the flows from a low to a high income region, and"unexpected flows" as the flows from a high to a low income region, the values of A+D and B+C will be the attraction force of expected flows and the attraction force of unexpected flows, respectively. Therefore, the total attraction force of migration of a province can be defined as the sum of expected and unexpected forces, that is, A+B+C+D.

Fig. 5. Flows of Net Migration between Low and High Income Regions: 1971



Source: Table 11.

Table 12 presents the calculation of the relative attraction forces of inter-provincial migration of all the provincial units during 1961 through 1971. Figure 6 shows these relative attraction forces of migration of each province. In the attraction force of expected net migration flows, the regions whose values are positive are Seoul, Gyeonggi and Busan, and others have negative values. In the attraction force of unexpected flows, the five provinces of Gyeonggi, Chungnam, Jeonnam, Gyeongbuk and Gyeongnam are relatively stronger than the others. The region in the highest total attraction force of migra-

tion is Seoul whose value is 30, and the lowest one is Jeju with the value of −36. The six regions of Seoul, Busan, Gyeonggi, Chungnam, Jeonnam and Gyeongbuk show the positive values of total attraction force of migration, and the other provinces have zero or negative values.

As the last step, we will investigate what relationsihps there might exist between the regional groups classified and the relative attraction forces of migration. In Table 8, when we assign numeric values to the high, middle and low status of economic level and economic growth rate, we can derive numeric scores for all the provinces.

Table 12 Relative Attraction Forces of Inter-provincial Migration of Provinces: 1961-71

Province	Grading by income level and migrated direction				Relative attraction forces of migration of		
	Low→high A	High→low B	Low←high C	High←low D	Expected flows A+D=E	Unexpected flows B+C=F	Total flows E+F
Seoul	0	0	0	+30	+30	0	+30
Busan	−3	−8	0	+21	+18	−8	+10
Gyeonggi	−3	−2	+6	+22	+19	+4	+23
Gangweon	−12	−12	+12	+4	−8	0	−8
Chungbuk	−9	−24	+2	+3	−6	−22	−28
Chungnam	−11	−4	+16	+7	−4	+12	+8
Jeonbuk	−16	−12	+8	+1	−15	−4	−19
Jeonnam	−15	0	+20	+1	−14	+20	+6
Gyeongbuk	−11	−2	+22	+5	−6	+20	+14
Gyeongnam	−12	−6	+10	+8	−4	+4	0
Jeju	−10	−26	0	0	−10	−26	−36
Total	−102	−96	+96	+102	0	0	0

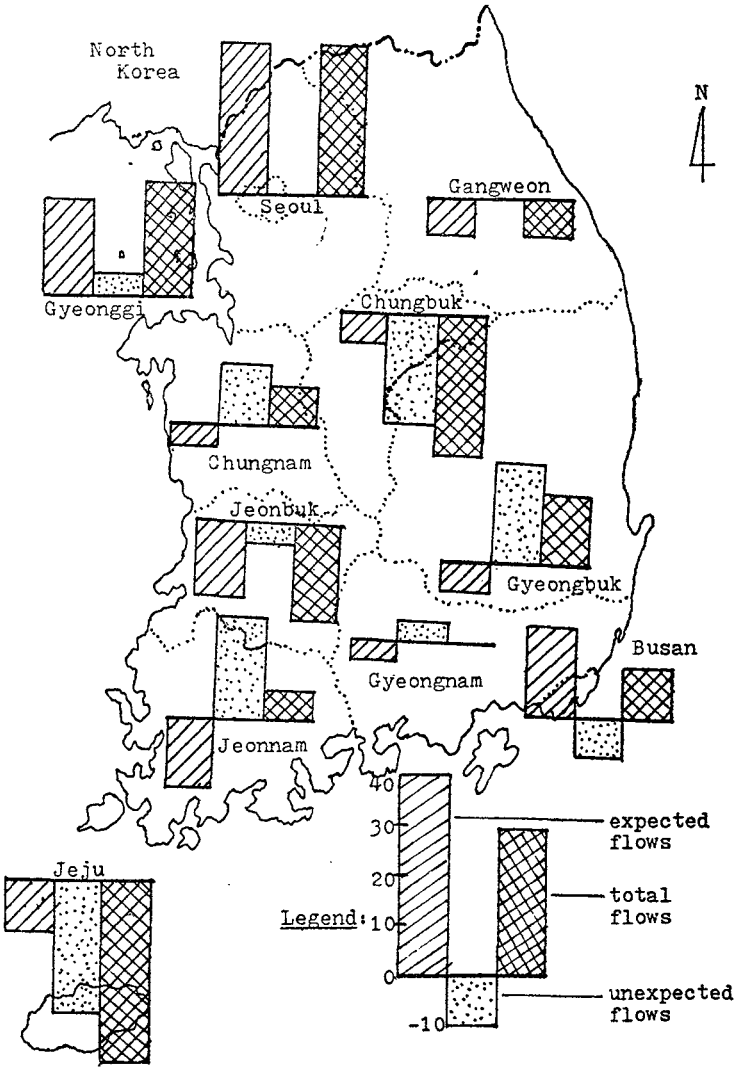
Note : In "Low(or High)⇄high(or low)", the left one is the province named at the left hand side of the table, and the right one is the other province subjected.
Source : Calculated from Table 11 with the grading criteria defined.

These values may be called the relative dominancy in economic status. Suppose we let the high group have the value of +10, the middle group the value of 0, and the low group the value of −10. Then, each province will have relative dominancy in economic status value ranging from +20 to −20.

Using the same scoring technique for the migration data from Table 9, each province will have a value of relative dominancy in net migration ranging between +20 and −20. Table 13 presents these relative dominancies in economic status and net migration with the relative attraction forces of migration.

From Table 13, we calculated the correlation coefficients between each of the relative dominancy in economic status and net migration, and each of the relative attraction forces

Fig. 6. Relative Attraction Forces of Inter-provincial Migration by Province: 1961-71.



Source: Table 12.

of migration. The calculated results of these coefficients are shown in Table 14.

From the correlation coefficients in Table 14, it can be said that the relative attraction force of expected migration flows has strong positive relationships with both the relative dominancies in provincial economic status and in inter-provincial net migration, and that the relative attraction force of unexpected migration flows shows no relationships with both of them. The relative attraction force of total migration flows has fairly high positive relationships with each of the relative dominancies in economic status and net

Table 13. Relative Dominancies in Economic Status and Net Migration, and Relative Attraction Forces of Migration of Each Province

Province	Relative dominancy in		Relative attraction force of		
	Economic status Y1	Net migration Y2	Expected flows X1	Unexpected flows X2	Total flows X3
Seoul	20	20	30	0	30
Busan	20	20	18	−8	10
Gyeonggi	0	20	19	4	23
Gangweon	0	−10	−8	0	−8
Chnngbuk	0	−10	−6	−22	−28
Chungnam	0	0	−4	12	8
Jeonbuk	−20	−20	−15	−4	−19
Jeonnam	−20	−10	−14	20	6
Gyeongbuk	−10	0	−6	20	14
Gyeongnam	10	−10	−4	4	0
Jeju	−10	0	−10	−26	−36

Source: • Relative dominancy in economic status: calculated from Table 8 by the criteria defined.
• Relative dominancy in net migration: calculated from Table 9 by the criteria defined.
• Relative attraction force of migration: Table 12.

Table 14. Correlation Coefficients between Provincial Relative Dominancies and Provincial Relative Attraction Forces in Terms of Economic Status and Migration

Variable		Relative attraction force of migration of		
		Expected flows (X1)	Unexpected flows (X2)	Total flows (X3)
Relative dominancy in	Economic status (Y1)	0.8005	−0.0186	0.4473
	Net migration (Y2)	0.9190	−0.0095	0.6593

Source: Calculated from Table 13.

migration.

Table 15 presents the resuts of the the test of significance for the correlation coefficients in Table 14 by t-test method, and it also shows the confidence intervals for the correlation coefficients of the population of each pair of variables.

In this test, the null hypothesis was that there is no correlation in the bivariate population: that is, $\rho=0$. The statistic t used to test this hypothesis and the formula for computing the confidence interval of correlation coefficient of bivariate population are as follows:

Table 15. Test of Significance and Confidence Interval for Population of the Correlation Coefficients in Table 14.

Case	Test of significance			Confidence interval	
	Computed t-value (t)	Critical value (t_α)	Inference on coeffi. of population(ρ)	Confidence levl	Interval
X1 and Y1	4.007	±3.250 $\alpha=0.01$	$\rho\neq0$	99%	0.185 to 0.965
X1 and Y2	6.994	±4.781 $\alpha=0.001$	$\rho\neq0$	99.9%	0.410 to 0.995
X2 and Y1	−0.056	±0.129 $\alpha=0.9$	$\rho=0$	—	—
X2 and Y2	−0.029	±0.129 $\alpha=0.9$	$\rho=0$	—	—
X3 and Y1	1.500	±1.383 $\alpha=0.2$	$\rho\neq0$	80%	0.035 to 0.735
X3 and Y2	2.631	±2.262 $\alpha=0.05$	$\rho\neq0$	95%	0.095 to 0.905

Source: Calculated from Table 13 and 14.

$$t=r\sqrt{\frac{n-2}{1-r^2}} \quad : \delta=n-2$$

$$P(z_r-Z_{\frac{\alpha}{2}}\cdot\hat{\sigma}_z<z_\rho<z_r+Z_{\frac{\alpha}{2}}\cdot\hat{\sigma}_z)=1-\alpha$$

where r : sample correlation coefficient

u : number of observations

$z_r=\frac{1}{2}\ln\left(\frac{1+r}{1-r}\right)$: z transformation

$Z=\frac{z_r-z_\rho}{\hat{\sigma}_z}$: testing statistic

$\hat{\sigma}_z=\frac{1}{\sqrt{n-3}}$: estimated standard error

BIBLIOGRAPHY

A. Textbooks and Articles

1. Alonso, William., "The Economics of Urban Size". *Regional Science Association Papers*, 26(1971).
2. Alonso, William, "Urban and Regional Imbalances in Economic Development." *Economic Developmeut and Cultural Change*, 17 (Oct. 1968).
3. Bish, Robert L. and Hugh O. Nourse, *Urban Economics and Policy Analysis*. New York: McGraw-Hill Book Co., 1975.

4. Borts, G.H., "The Equalization of Returns and Regional Economic Growth." *The American Economic Review*, 50 : 3 (Jun. 1960).
5. Bowles, S., "Migration as Investment Approach to Geographical Mobility." *Review of Economics and Statistics*, 52 : 4 (Nov. 1970).
6. Dogan, Mattei and Stein Rokkan, eds., *Quantitative Ecological Analysis in the Social Sciences*. Cambridge: The MIT Press, 1969.
7. Draper, N.R. and H. Smith, *Applied Regression Analysis*. New York: John Wiley and Sons, Inc., 1966.
8. Gans, Herbert J., *More Equality*. New York: Vintage Books, 1973.
9. Gass, Saul I. and Roger L. Sissen, *A Guide to Models in Government Planning and Operations*. Potomac, Md.: Sauger Books, 1975.
10. Haegerstrand, Torsten, *Innovation Diffusion as a Spatial Process*. Postcript and Translation by Allan Pred, Chicago: University of Chicago Press, 1967.
11. Hart, R. A., "Inter-regional Economic Migration: Some Theoretical Conservation," Part II. *Journal of Regional Science*, 15 : 3 (Dec. 1975).
12. Isard, Walter, *Introduction to Regional Science*. Englewood Cliffs: Prentice-Hall, Inc,. 1975.
13. Jackman, Robert W., *Politics and Social Equality: A Comparative Analysis*. New York: John Wiley and Sons, Inc., 1975.
14. Kim, An-Jae, "A Study on the Balanced Growth of Regional Economies" *Journal of the Korean Public Administration Association*, 6(1972).
15. Kuznets, Simon and Dorothy S. Thomas, "Internal Migration and Economic Growth" *The Bobbs-Merrill Reprint Series in the Social Sciences*, S-439, 1958.
16. Lo, Fu-chen and Kamal Salih, *Growth Poles and Regional Policy in Open Dualistic Economies: Western Theory and Asian Reality*. Paper for the Seminar on Industrialization Strategy and Growth Pole Approach, Nagoya, Japan: The United Nations Centre for Regional Development, Nov. 1975, mimeographed.
17. Mera, Koichi, *Income Distribution and Regional Development*, Tokyo: University of Tokyo Press, 1975.
18. Mera, Koichi, "On the Urban Agglomeration and Economic Efficiency." *Economic Development and Cultural Change*, 21 (Jan, 1973).
18. Myrdal, Gunnar, *Asian Drama: An Inquiry into the Poverty of Nations*, New York: Vintage Books, 1972.

19. Myrdal, Gunnar, *Economic Theory and Underdeveloped Regions*. London: Duckworth, 1957.

20. Niedercorn, John H. and B.V. Bechdolt, Jr., "An Economic Derivation of the 'Gravity Law' of Spatial Interaction." *Journal of Regional Science*, 9 : 2 (Aug. 1969).

21. Okun, Bernard and Richard W. Richardson, "Regional Income Inequality and Internal Population Migration." in John Friedmann and William Alonso, eds., *Regional Development and Planning: A Reader*. Cambridge: The MIT Press, 1969.

22. Okun, Bernard, "Inter-state Population Migration and State Income Inequality: A Simultaneous Equation Approach," *Economic Development and Cultural Change*, 19 : 2 (Jan. 1968).

23. Ronaud, Bertrand M., "Conflicts between National Growth and Regional Income Equality in Rapidly Growing Economy: The Case of Korea." *Economic Development and Cultural Change*, 21 : 3 (Apr. 1973).

24. Richardson, Harry W., *Regional Growth Theory*. London: The MacMillan Press, Ltd., 1974.

25. Rogers, Andrei, *Introduction to Multiregional Mathematical Demography*. New York: John Wiley and Sons, 1975.

26. Ruchs, Victor R., *Differentials in Hourly Earnings by Region and City Size*, 1959. National Bureau of Economic Research Occasional Paper, No. 101, New York: Columbia University Press, 1967.

27. Shefer, Daniel, "Localization Economies in SMSA's: A Production Function Analysis." *Journal of Regional Science*, 13 : 1 (Apr. 1973).

28. Siebert, Horst, *Regional Economic Growth: Theory and Policy*. Scranton, Penn.: International Textbook Co., 1969.

29. Simon, Julian L., "Population Growth May Be Good for LDCs in the Long Run: A Richer Simulation Model." *Economic Development and Cultural Change*, 24 : 2 (Jan. 1976).

30. Sinohara, Miyohei, "Some Aspects of Regional Disparity." *The Economic Studies*, 15: 4 (Dec. 1964).

31. Takashi, Hujii, "An Economic Theory of the High Density Aggregation: On the Economic Progress." Translation into Korean by An-Jae Kim, *Journal of Public Administration*, 6:2 (Dec. 1968).

32. World Bank, *Urbanization, Sector Working Paper*. Washington, D.C.: World Bank, Jun. 1972.

B. Sources of Statistics

Source 1. Economic Planning Board, *Annual Migration Statistics*. Seoul: Republic of Korea, 1971, 1972 and 1973.

Source 2. Economic Planning Board, *Census on Mining and Manufacturing Industries*. Seoul: Republic of Korea, 1966, 1968 and 1970.

Source 3. Economic Planning Board, *Korean Statistical Monthly*. Seoul: Republic of Korea, Oct. 1967 and Jan. 1970.

Source 4. Economic Planning Board, *Report of National Population and Houses*. Seoul: Republic of Korea, 1970.

Source 5. Economic Planning Board, *Report of Population Census*. Seoul: Republic of Korea, 1966.

Source 6. Economic Planning Board, *Statistical Yearbook of Korea*. Seoul: Republic of Korea, 1962, 1964, 1968, 1970, 1972 and 1974.

Source 7. Economic Planning Board, *Yearly Report of Population Migration*. Seoul: Republic of Korea, 1968, 1970, 1971, 1972 and 1973.

Source 8. Ministry of Construction, *Manufactures, Employees, Product and Value Added*. Seoul: Repubic of Korea, 1966, 1968 and 1970.

Source 9. Ministry of Home Affairs, *Annual Report of National Income*. Seoul: Republic of Korea, 1972 and 1974.

Source 10. Ministry of Home Affairs, *Regional Economic Statistics*. Seoul: Republic of Korea, 1969.

Source 11. Municipal (Provincial) Government, *Municipal (Provincial) Statistical Yearbook*. Each Municipal (Provincial) Government, 1969, 1971, 1972 and 1973.

Source 12. The Bank of Korea, *Regional Economic Statistics* Seoul: The Bank of Korea, 1973.