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Poverty Lines, Income Inequality, and Gravity Centers of Population and Income in Korea

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Estimations of poverty income levels in Korea have not been active in the past primarily due to difficulties in access to statistical data and apathetic attitude of public sectors. Income inequality measures, however, cover relatively long period of time, even though there are some controversial aspects mainly related with technical points. The regional variation of income and population are also identified by locating gravity centers, and it is found that income variations were approximately followed by population variation over time.

Ⅰ. Introduction

This study attempts to conduct, first of all, a comprehensive survey on poverty income line estimations and income inequality measures in Korea; second, to investigate factors affecting these estimations and measurements; and third, to interrelate findings from the investigation among these factors and with others, if any other elements emerge as important causes. In addition, this study further calculate the changes in gravity center points of income and population in Korea over the period of the recent ten years.

Studies on estimating poverty thresholds and income inequality have not been active in Korea, perhaps primarily due to difficulties involved in access to data and general

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euphoria embedded in public mentality which had not allowed a keen realization that poverty studies are in fact very relevant in Korea as in other developing and developed countries [10]. After experiencing huge strides of economic development in Korea both the government and private sectors seem to have been immersed in a deep complacency that in one way or another discouraged exposing poverty and inequality hidden behind the economy.

It is an undeniable fact that Korea had once been extremely poor while income and wealth distributions contrastingly very fair during the periods of 1950 ~ 1960, because of two factors : firstly, the Korean War, which entirely destroyed industrial basis as well as completely equalized income and wealth distribution in urban sectors, and secondly, the land reform which started 1949 again completely equalized ownership and holding of arable land in rural sectors, while the rampant inflation during the war and the postwar recovery period practically nullified the real value of land certificates which had been given to the former landlords in exchange of sequestered land. Even though there is no statistical evidence of almost complete equality in income and wealth distribution in Korea during this period, it has been generally accepted consensus that nobody was rich but everybody was poor immediately after the Korean War.

The deep-rooted belief that income and wealth distribution in Korea has afterward gradually been deteriorated, perhaps due to industrial development and corruption in public sectors has acceleratingly contributed to a strong formation of unfairness feeling among general population in Korea, even despite the fact that every indicator of income distribution inequality in Korea is significantly better than that of neighboring Asian countries except Taiwan and Japan [11]. Furthermore, there has been a strong sentiment among people that since income distribution inequality statistics are mostly estimated from tax statistics, which do not include income of tax exempt low income brackets and income generated from the underground economy, the measures are inevitably highly biased toward equality. Such disbelief against income distribution statistics has further been exacerbated by rampant economic corruption prevailed during three consecutive military regimes and ensuing civilian regime. The banking sector in Korea, which has completely been swayed by political control, eventually led the Korean economy into an unprecedent economic chaos. During this process of gradual but unequivocal moribundity of the Korean economy, an enormous chasm was hiddenly formulated in income and wealth distribution, unilaterally in favor of the ruling class [7].

Studies of poverty line income measurement and income distribution in Korea are still a difficult task. However, the impact of poverty and income distribution inequality on the other aspects of socio-economic behavior seems to be substantial. The incessant internal and external population migration in Korea may be construed to be a succinctly resulting phenomenon caused by poverty and income distribution. Excessive urban concentration of population and subsequent disintegration of rural sector, which everyone has experienced during the past forty years or so, may be cited as one of these examples.

Ⅱ. The Poverty Line Income and Income Inequality

One of the first attempt to measure minimum cost of subsistence in Korea, except ones estimated by the Japanese Colonial Government before 1945, was the minimum cost of living estimated by the National Textile Workers Union in 1969. This estimation was evidently made in order to estimate minimum wage level for the union members [4]. In 1973, the Social Security Investigation Commission under the Ministry of Health and Social Affairs firstly announced the minimum cost of living, which may be considered as the first official estimation of the minimum cost of living. In 1979, the Korean Federation of Labor Unions again estimated the minimum cost of living for urban five-member households. Only in 1979, the Korea Development Institute launched an extensive project to estimate poverty income lines and completed a time series of yearly poverty income levels beginning from 1965 and covering up to 1981. This Korean Development Institute series is the longest one ever made until then. However, as expected, labor union estimates were found to be greater than the KDI series, and the KDI series greater than the government estimates. This result was inevitable since labor unions are consistently eager to attain the highest possible minimum wage, while the government, in order to meet budget appropriation for the poor relief, had to lower the poverty income line as low as possible so that only extremely low percentile income brackets could be covered with limited amount of national budget.

〈Table 1〉 Various Poverty Lines Estimated in Korea

(unit : thousand current Won, %)

Year	Official (1)		Yoon (2)		Hyun & Na (3)	
	Poverty Line	Percentage	Poverty Line	Percentage	Poverty Line	Percentage
1985	34.0	5.6	59.8	18.3	-	-
1986	38.0	5.3	65.1	16.4	-	-
1987	43.0	5.7	77.1	16.8	-	-
1988	44.0	5.5	74.2	14.5	-	-
1989	46.0	5.5	79.5	10.0	-	-
1990	48.0	5.3	85.0	7.1	-	-
1991	55.0	5.2	90.8	3.9	131.8	7.6
1992	80.0	5.0	138.0	4.3	-	-
1993	130.0	4.5	163.8	5.4	-	-
1994	160.0	4.3	267.0	16.4	-	-
1995	190.0	3.9	275.3	12.3	-	-

(1) The actual income lines applied as one of criteria for granting official subsidies to poor households by Ministry of Public Health and Welfare, Republic of Korea Government.

(2) Relative poverty income lines estimated by Yoon according to the Leyden method (See [8]).

(3) Poverty income line estimated by the commodity basket approach (See [3]).

Each of three estimates of poverty income lines were basically estimated from absolutely necessary commodity bundles with which a poor household could be biologically survive. However, except the KDI series, the remaining two estimates do not disclose the detailed procedure by which these estimates are obtained. Therefore, it may not be hard to conjecture that the official estimates are significantly under-biased while the labor union estimates upper-biased.

Since the commodity bundle approach was adopted in estimating the minimum cost of living, these estimates of poverty lines in Korea are substantially lower than that of the United States, Canada and Japan for this comparable period of time. This issue of comparability of the poverty lines of two countries or more here becomes clear, and the so-called absolute poverty income lines conceptually loses its absoluteness. Due to the incomparability of absolute poverty lines and differences in gross purchasing power parity indexes between a set of nations, it became necessary to estimate subjective but relative poverty income lines. Even though the so-called Leyden methods [1] do not completely solve the incomparability problem, the methods seem to cover systematically the various aspects of relativity in poorness.

When everybody was so poor that young children used to walk more than five km

〈Table 2〉 Various Income Distribution Inequality Measures in Korea

Year	Official (1)	Yoon (2)	Yoon (3)
1985	0.312	0.365	0.318
1986	-	0.360	0.313
1987	0.307	0.377	0.309
1988	0.301	0.351	0.300
1989	-	0.339	0.309
1990	0.295	0.339	0.302
1991	0.287	0.321	0.294
1992	0.284	0.290	0.290
1993	0.282	0.289	0.287
1994	0.285	0.302	-
1995	0.284	0.304	-

(1) Official Gini coefficients estimated by National Statistical Office for urban households income.

(2) Variance of lognormal distributions of urban household income estimated by S. B. Yoon (See [8]).

(3) Gini coefficients estimated by K. J. Yoon for all households income (See [5]).

one way for their schooling, nobody felt poor then. However, if only a few children or single child walked that distance for their schooling because they could not afford public transportation, these walking children would feel extremely and strongly their own poorness. This situation is particularly acute in a country like Korea, which has experienced a rapid economic development and industrialization. Even though the substance cost may be enough to sustain surviving livelihood, it would not be in any way a measure to demarcate poverty from non-poverty. This argument may provide a rationale for attempting to measure poverty income level subjectively but relatively based on one's utility function.

〈Table 1〉 shows the various poverty lines measured by different methods. The highest measure was found to be obtained by the commodity basket approach as shown Column (3), and the lowest expectedly by the government measurement. The table indicates that despite the fact that the poverty income levels have continuously heightened, the share of poor population has constantly shown a declining trend except the last two year estimations by Yoon [8].

〈Table 2〉 shows again the various income distribution measures estimated by various authors. The three series, though not matched perfectly, exhibit gradually improving situation of size-income distribution in Korea except a couple of years at the end of series. A brief remark on size-income distribution seems to be needed here. As it

is widely discussed among economists in Korea, the size-income distribution of the past thirty years do not indicate any significant patternal trend, for example, as suggested by Kuznets [2]. However, the most recent ten years have shown a very strong evidence that the income distribution is significantly improved. The previous study also shows that income distribution and relative poverty line income are highly positively correlated [8].

Ⅲ. Population and Income Gravity Centers

Beginning from 1986, the Korean government started officially to estimate gross domestic regional product for each of provinces (*do*) and special cities (*tulpyolshi, chikhalshi, kwangyokshi,* etc). This new time series of statistics has enabled economists to study regional income distribution. The earliest attempt of this type of studies can be found in Yoon [10]. Along with the time series statistics of population, the annual gravity centers of population and income may be statistically located to see in what manner these gravity center points have been changing over period of time. These points of population income gravity centers would indicate not only migration patterns but also dynamic regional distribution patterns of income.

When one adopts a hypothesis that income difference of two regions eventually induce migration between the two regions, the change in gravity center points of population caused by migration is also affected by changes in that of income, if not imminently, perhaps with time lags of certain lengths.

In measuring gravity center points of both population and income, the following assumptions were made. First, since there is no statistics of gross domestic regional product at the level of *kun* (county) or below, gross domestic regional product of a province, or a special city, is assumed evenly spread over the entire dimension of the province or city disregarding the density or viscosity of village, town or community. In other words, per square kilometer of the province or the special city contains the same average amount of gross domestic regional product. This means that each square kilometer of the province is assumed to have $GRDP_i / D_i$ of gross domestic regional product, where $GRDP_i$ indicates gross domestic regional product of the i^{th} province and D_i, the territorial dimension in terms of square kilometers of the i^{th} province.

〈Table 3〉 Income and Population Gravity Centers

(unit : km)

Year	Income			Population		
	Parallel	Longitude	Distance	Parallel	Longitude	Distance
1986	36°53′	127°12′		36°41′	127°12′	
1987	36°55′	127°11′	3.99	36°45′	127°12′	7.36
1988	36°55′	127°11′	0.00	36°48′	127°12′	5.52
1989	36°57′	127°12′	3.99	36°51′	127°14′	6.33
1990	36°59′	127°11′	3.99	36°50′	127°13′	2.41
1991	36°59′	127°11′	0.00	36°52′	127°13′	3.68
1992	36°57′	127°11′	3.68	36°55′	127°13′	5.52
1993	37°00′	127°11′	5.52	36°56′	127°13′	1.84
1994	36°56′	127°11′	7.36	36°57′	127°13′	1.84
1995	36°55′	127°11′	1.84	36°58′	127°13′	1.84
Mean Distance	3.37			4.04		

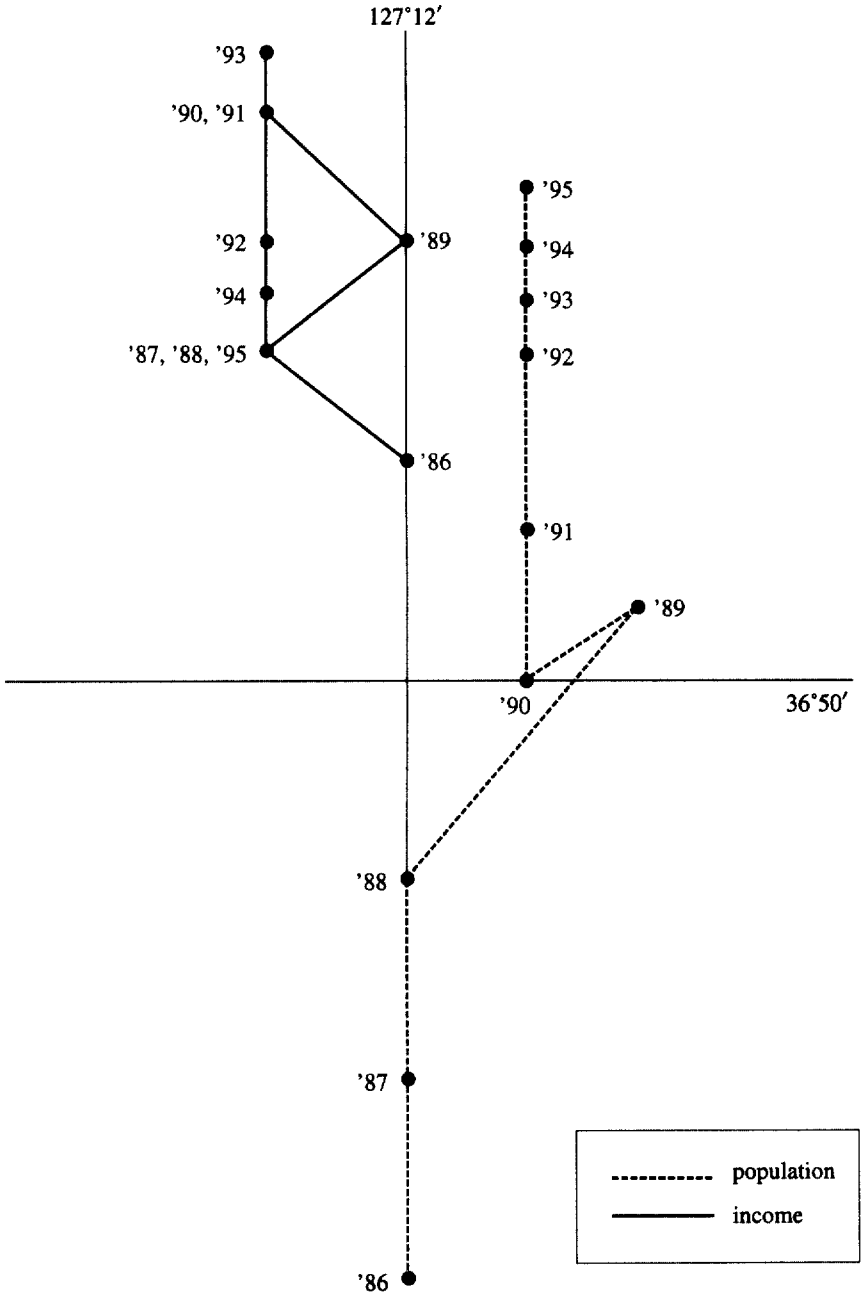
Second, the same assumption was made with regard to population. This means that the population density was assumed to be equal everywhere in the province. These two assumptions may cause biases in estimating location of gravity center points.

In order to estimate the location of the gravity center points of both population and income, the following procedure, were taken. First, in finding the horizontal gravity center point every degree of longitude from the easternmost to the westernmost limit of Republic of Korea territory excluding islands was divided into five subsections of 12 minutes width. Second, every degree of latitude was also divided in same manner from the northernmost to the southernmost limit of the territory of Republic of Korea. Now, we have number of $12' \times 12'$ squares covering the entire territory of the Republic as a large grid.

Third, beginning from the easternmost limit the, the population and income were horizontally accumulated. When the accumulated sum reached the half level of population or income, the point was taken the horizontal gravity center line. Fourth, the same procedure was employed vertically to decide the vertical gravity center line. Since, in this way, the two coordinate values were obtained, the crossing point could safely be considered to be the gravity center point.

〈Table 3〉 shows the two sets of gravity center points of population and income over the period of ten years 1986 through 1995. As it is easily found, during these ten-year

〈Figure 1〉 Changes in Gravity Centers



〈Table 4〉 The Movement Statistics of Gravity Centers

Year	Income	Population
1986~1987	(0.02, −0.01, 3.99)	(0.04, 0.00, 7.36)
1987~1988	(0.00, 0.00, 0.00)	(0.03, 0.00, 5.52)
1988~1989	(0.02, 0.01, 3.99)	(0.03, 0.02, 6.33)
1989~1990	(0.02, −0.01, 3.99)	(−0.01, −0.01, 2.41)
1990~1991	(0.00, 0.00, 0.00)	(0.02, 0.00, 3.68)
1991~1992	(−0.02, 0.00, 3.68)	(0.03, 0.00, 5.52)
1992~1993	(0.03, 0.00, 5.52)	(0.01, 0.00, 1.84)
1993~1994	(−0.04, 0.00, 7.36)	(0.01, 0.00, 1.84)
1994~1995	(−0.01, 0.00, 1.84)	(0.01, 0.00, 1.84)

period there were not very significant change both in income and population gravity centers. The maximum variances of parallel and longitude in case of income were about seven minutes and one minute, respectively, with mean annual distance of 3.37 km, while the case of population was slightly wider than income, maximum variance being 17 minutes in parallel and one minute in longitude. In both case there were more extensive change in parallel than longitude, which means that south-north movements both in income and population were more active than east-west movements.

The two gravity centers of income and population in 1995 are located very closely nearby to each other in a area of the southwestern direction from Ansung City capital, a myon called Miyang. And all the remaining movements of two gravity centers in these ten year period were confined within this narrow area. The movements are depicted in 〈Figure 1〉. While the movement of the population centers shows NNE direction, that of income was a zigzag without a salient trend.

Finally, in order to investigate the relationship between movements of two gravity centers of income and population, canonical correlation coefficients were calculated between the two sets of centers.

In order to estimate canonical correlation between the movements of income and population two sets of time series vectors of income and population were calculated as shown 〈Table 4〉. In the table, we have two sets of 1×3 horizontal vectors. The first elements of two vectors indicate the changes of gravity center points in longitude in terms of minutes, the second elements the changes in lateral in terms of minutes, and the third elements absolute distances of changes in terms of km. When the first two elements of two vectors show the same signs, it means the gravity center point moved in

the same direction. When the signs are opposite, it means that the gravity center point moved to the opposite direction either vertically or horizontally.

The first canonical correlation coefficient obtained between the two sets of vectors of changes in income and population gravity centers was calculated at 0.9509, which is very high and, therefore, significantly indicates that the movements of income and population are closely related. This supports the hypothesis that the regional variation of income induced that of population in Korea.

Ⅳ. Summary and Concluding Remarks

Even though the measurements of poverty income thresholds have not been active in Korea, there were some attempts, mainly based the commodity bundle approach and there so-called Leyden method. These estimates shows a very similar ascending trend if not completely matched to each other. The government series is found to be the lowest, while the highest series is labour union estimates. However, there is no officially determined poverty income line in Korea, except officially announced annual income criterion by which national budget relief fund is appropriated.

Size-income distribution statistics shows relative fairness in income distribution in Korea, compared with other Southeast Asian countries. However, there is a strong disbelief against this statistical evidence of relatively equal income distribution in Korea among the general public, simply due to the facts that the estimates did not cover underground economic activities, corruption, low income bracket, etc. Furthermore, the historical characteristics of the Korean development process do not guarantee a strong conviction that the current income distribution is fair.

Even though the regional income distribution is extremely fair among provinces and cities, there is a strong and significant statistical evidence that changes in regional population movements are highly correlated with changes in regional income variations. This hypothesis is supported statistically by measuring the so-called annual income and population gravity center points.

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