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Some Remarks on Regional Distributions of Income and Wealth in Korea

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The per capita regional income and wealth distributions in Korea are highly equal over time, and the shifts in rankings of both per capita income and wealth levels are extensive, even though the differences are minimal. A production function estimated from regional cross-section statistics shows a rigid elasticity of substitution between labor and capital in Korea.

Ⅰ. Introduction

This paper intends to measure recent regional income and wealth distributions in Korea. My previous study estimated the regional income distribution in Korea covering the ten-year period of 1986~1995 [3]. The study showed that the regional income distribution in Korea was fairly equal, and no significant difference was witnessed in income distribution among the regions in Korea, saliently contrasted to the cases of South East Asian Countries. Furthermore, the trend of equality in income distribution has not shown any significant change over the period of time under study. This paper adds the measurements of regional income distributions of the ensuing two years, 1996 and 1997, based on the recent publication of income statistics [4].

There were two national wealth surveys conducted in Korea, for the year 1987 and 1997, respectively, and the recent survey, which covers 1997, has just been published

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[5]. A further attempt is made in this paper to measure regional wealth distribution in Korea for these two years of 1987 and 1997 and to relate income and wealth distributions to each other. The regional distributions of other assets are also measured in the same manner in order to investigate regional concentrations. Using regional variables, a cross-section production function is estimated in a CES form to measure the elasticity of substitution between capital and labor. The result is further used in analysing the productivity of the wealth.

Ⅱ. Income and Wealth Distributions

In measuring both regional income and wealth distributions, the following Rasche, Gaffney, Koo and Obst(RGKO) equation is used as in the previous study [2].

$$y = [1-(1-x)^{\alpha}]^{\beta} \tag{1}$$

It is a well-known fact that the Gini coefficient is estimated from the above equation as

$$g = 1-2\int_0^1 [1-(1-x)^{\alpha}]^{\beta} dx \tag{2}$$

Estimated results are shown in 〈Table 1〉. As shown in the Table, the results are more or less the same with the previous years with slight decrease in Gini coefficients from 0.1106 in 1995 to 0.0915 in 1996 and 0.0959 in 1997, respectively. In the Table for an easy reference 1995 statistics are also included. Since no significant change is found in 1996 and 1997, it may easily be stated that there is still the same trend continued over the recent two years in regional income distribution.

〈Table 1〉 Gini Coefficients of Regional Income Distribution

Year	α (t - value)	β (t - value)	r^2	g
1995	0.8544(64.6488)	1.0638(72.5166)	0.9996	0.1106
1996	0.9178(227.6054)	1.0988(233.2023)	0.9999	0.0915
1997	0.9177(195.4191)	1.1093(201.0866)	0.9999	0.0959

〈Table 2〉 1997 Wealth Distribution

	GDP	GTA	NRFA	GTA/GDP	NRFA/GDP
Seoul	97,946,893	676,313.6	347,368.3	6.90	3.55
Pusan	27,759,757	204,211.4	91,960.1	7.36	3.31
Taegu	16,065,791	116,541.9	55,572.9	7.25	3.46
Inchon	21,148,848	136,752.8	62,882.4	6.47	2.97
Kwangju	9,986,204	66,376.2	32,088.6	6.65	3.21
Taejon	9,734,964	67,531.5	36,249.9	6.94	3.72
Kyunggi	78,471,709	611,982.5	282,008.0	7.80	3.59
Kangwon	12,374,051	111,650.4	55,582.8	9.02	4.49
Chungbuk	15,325,459	121,365.4	57,213.9	7.92	3.78
Chungnam	19,375,019	157,916.2	90,896.9	8.15	4.69
Chonbuk	15,459,265	115,014.8	59,816.5	7.44	3.87
Chonnam	23,158,037	157,800.2	77,518.4	6.81	3.35
Kyungbuk	28,849,256	256,799.5	116,204.7	8.90	4.03
Kyungnam	52,073,449	299,340.0	148,242.8	5.75	2.85
Cheju	4,466,286	28,873.0	15,121.6	6.46	3.39
Total	432,194,988	3,128,457.4	1,528,628.0	7.24	3.54

주: GDP(Gross Domestic Product) : million Won.
GTA(Gross Total Asset) : billion Won.
NRFA(Net Reproducable Fixed Asset) : billion Won.

〈Table 3〉 Gini Coefficients of Regional GTA

Year	α (t-value)	β (t-value)	r^2	g
1987	0.8603(142.5627)	1.0829(161.6347)	0.9999	0.1164
1997	0.9357(164.0653)	1.1315(152.7548)	0.9999	0.0960

〈Table 4〉 Gini Coefficients of Regional NRFA

Year	α (t-value)	β (t-value)	r^2	g
1997	0.9387(127.9626)	1.1505(124.3127)	0.9999	0.1028

In measuring regional wealth distributions, two basic concepts are used. Gross total asset(GTA) includes gross reproducable fixed asset, gross stock and net foreign claims, and GTA is revalued in terms of net total asset after deducting depreciation. Gross reproducable fixed asset and gross stock are revalued in net term in the same manner. The 1997 survey results and other related statistics by regions in Korea are shown in 〈Table 2〉. From 〈Table 2〉, Gini coefficients for regional distribution of GTA and net

〈Table 5〉 Ranking of GDP, GTA and NRFA(per capita)

	1987		1997		
	GDP	GTA	GDP	GTA	NRFA
Seoul	11	13	10	8	9
Pusan	9	8	2	4	2
Taegu	5	6	1	1	1
Inchon	13	12	8	6	4
Kwangju	7	1	4	2	3
Taejon	-	-	3	3	5
Kyunggi	12	10	9	9	8
Kangwon	6	5	6	10	11
Chungbuk	8	9	13	13	13
Chungnam	2	4	11	14	15
Chonbuk	1	2	5	7	7
Chonnam	4	7	14	11	10
Kyungbuk	10	11	12	15	14
Kyungnam	14	14	15	12	12
Cheju	3	3	7	5	6

reproducable fixed asset(NRFA) are derived and shown in Tables 3 and 4.

As expected, estimated Gini coefficients show the same patterns in both cases of GTA and NRFA, and there in no significant difference between the two years of 1987 and 1997. These patterns are again the same with the regional income distribution. In sum regional income and wealth distributions exhibit the same pattern in Korea over the period of the recent decade and are considered equal.

Per capita value of regional GDP, regional GTA and regional NRFA are ranked as in 〈Table 5〉 to compare with each other. As it is observed, the biggest shifts in GDP ranking between 1987 and 1997 are made in case of Chonnam from 4 to 14, which indicates that the fourth poor province, Chonnam, in 1987 became the second richest in 1997. On the other hand, Pusan, which was the nineth in 1987, became the second poorest in 1997. Kangwon province showed no change at all during these ten years, remaining at the sixth ranking in both year. The biggest shift in GTA ranking is observed in case of Chungnam province from the fourth in 1987 to the fourteenth in 1997. Again Taegu and Pusan became poorer in terms of GTA by shifting from sixth and eighth in 1987 to the poorest and the fourth poorest in 1997, respectively.

The calculated rank correlation coefficients between GDP and GTA, and GDP and

〈Table 6〉 Rank Correlation Coefficients

Year	GDP and GTA(t-value)	GDP and NRFA(t-value)
1987	0.8593(5.8209)	-
1997	0.8643(6.1953)	0.8250(5.2635)

〈Table 7〉 Gini Coefficients of Some Assets(1997)

Assets	automobiles	hospital	deposit at deposit banks
α(t-value)	0.9809(310.7552)	0.9151(148.7046)	0.5265(84.7333)
β(t-value)	1.1231(355.3228)	1.1260(156.6925)	1.0912(111.9020)
r^2	0.9999	0.9999	0.9997
g	0.0679	0.1049	0.3581

NRFA are shown a in 〈Table 6〉. As expected, the obtained rank correlation coefficients show highly positive relation between income and wealth with strong statistical significance.

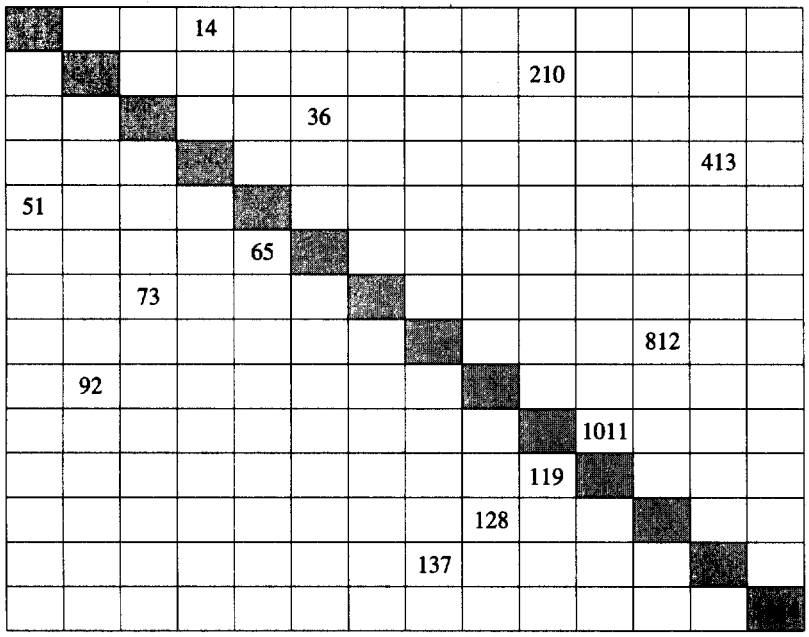
Based on 〈Table 5〉, two Transition Matrices are obtained as in 〈Figure 1〉 and 〈Figure 2〉, and two Rank Shift Index(RSI) are also calculated as Equation (3) [3]. The Transition Matrix shows the shift in ranking between two years of 1987 and 1997. When ij moves far from the diagonal to a upward position, it means the province became richer, and when ij moves far from the diagonal to a downward position, the province became poorer.

$$RHI = \frac{\Sigma(i-j)^2}{(n^3-n)/3}$$
$$= 0.3495 \text{ (GDP)}$$
$$= 0.3187 \text{ (GTA)} \qquad (3)$$

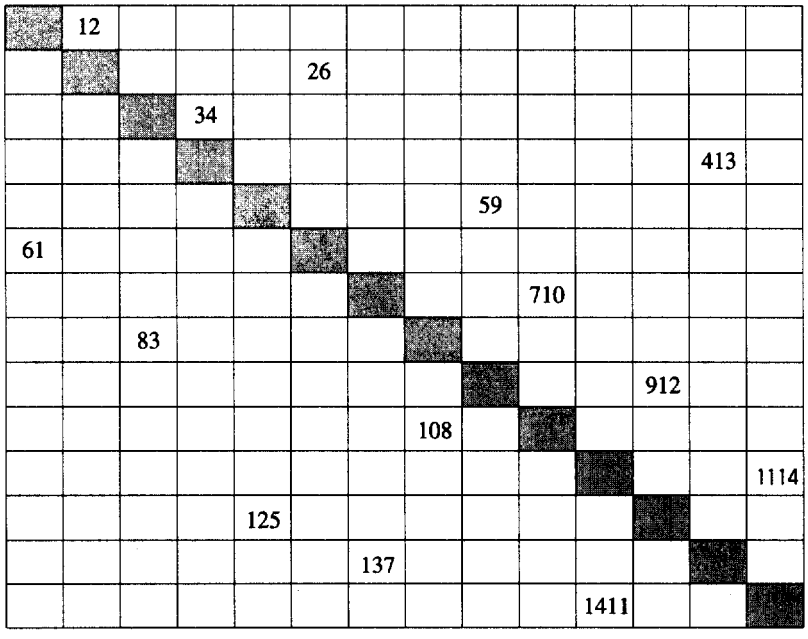
Even though, regional income and wealth are fairly distributed over provinces and over time, the shifts in ranking for both income and wealth in the decade under study have rather been extensive. This aspect is also corroborated by other asset distributions.

In order to investigate distributions of other assets, regional distributions of automobiles, hospitals and deposit in banking systems are additionally measured in Gini coefficients in the same manner, and the estimated results are shown in 〈Table 7〉. The basic necessary statistics are collected from the National Statistics Office [4].

〈Figure 1〉 1987~1997 GDP Ranking Transition Matrix



〈Figure 2〉 1987~1997 GTA Ranking Transition Matrix



As observed, automobiles and hospitals are almost completely fairly distributed over provinces and cities, whereas banking deposit distribution is rather skewed than other two. This is expected since large banking operations are centered around urban districts, while automobile ownship and medical benefits are fairly equally distributed over the nation.

Again, rank correlation coefficients are estimated between each of these assets and GDP, GTA and NRFA, respectively, to see which of these assets could be treated as an indication of income and wealth rankings. The obtained results are shown below :

$$r(\text{auto/GDP}) = -0.2357(-0.8745)$$
$$r(\text{auto/GTA}) = -0.7071(-0.3659)$$
$$r(\text{auto/NRFA}) = -0.6500(-3.0396)$$

$$r(\text{hospital/GDP}) = -0.3786(-1.4747)$$
$$r(\text{hospital/GTA}) = -0.7892\ (-4.6347)$$
$$r(\text{hospital/NRFA}) = -0.7750(-4.4216)$$

$$r(\text{deposit/GDP}) = -0.2857(-1.0750)$$
$$r(\text{deposit/GTA}) = -0.7143(-3.6799)$$
$$r(\text{deposit/NRFA}) = -0.7571(-4.1790)$$

The figures in parentheses are the respective Student t-statistics for the estimated rank correlation coefficients. The regional GDP ranking is not significantly represented by any of these assets. This indicates that the distribution of these assets is not related with GDP distribution at all, and disregarding the level of GDP, every province and city enjoys the level of owning these assets. However, GTA and NRFA ranking are inversely related with those of hospital and deposit. This indicates that GTA and NRFA distributions show a contrasting pattern against hospital and deposit distribution. This aspect need a further deeper research.

Ⅲ. Estimation of a CES-type Production Function

From the National Wealth Survey Statistics and regional employment statistics [6], a CES-type production function is estimated. The funtional form used is the well-known one as in Equation (4) :

$$Y = A[\alpha L^{-\rho} + (1-\alpha)K^{-\rho}]^{-\frac{1}{\rho}} e \tag{4}$$

In order to apply an iterative estimation procedure, the Equation (4) is transformed in a log form as in Equation (5)

$$y = a - \frac{1}{\rho}[\alpha L^{-\rho} + (1-\alpha)K^{-\rho}] + u \tag{5}$$

where Y : GDP in ten billion Won

y : ln Y

a : ln A

L : labor employed in thousand persons

K : NRFA in hundred billion Won

u : ln e, disturbance terms

The estimated results are obtained as below :

$a = 0.8446$ (12.1807)

$\rho = 7.7946$ (0.7163)

$\alpha = 0.8775$ (2.5304)

$r^2 = 0.9917$

$F = 776.3424$

$DW = 2.3029$

The figures in parentheses are the Student t-statistics. The above statistics show a very high statistical significance except ρ, and that it is found out that the elastisticity of

substitution between labor and capital is highly rigid as expected. As the Korean economy has become more and more industrialized, substitutability of two production factors, labor and capital, has rapidly reduced, and the production is hoghly depending upon both on labor and capital. This aspect is more or less stylized patterns found in developed industrialized nations.

In order to investigate the degree of round-about-production or capital intensity in production, GTA/GDP and NRFA/GDP ratio rankings and error term ranking are correlated. The error terms are calculated from Equation (5) as $\hat{u}$. Two rank correlation coefficients are estimated as below :

$$r(\text{GTA-GDP ratio / error}) = -0.5768(-2.5458)$$
$$r(\text{NRFA-GDP ratio / error}) = -0.7893(-3.9584)$$

As expected, GTA is less related with error terms in the estimated production function, showing -0.5768, than NRFA, which shows -0.7893. When the ratios are higher, estimated error terms are shown to be smaller in this analysis, and capital productivity is lower than the average level predicted by the fitted CES function. In other words, a high level of round-about-production or capital intensity is related to a lower level capital productivity.

Ⅳ. Summary and Conclusion

It is shown in this study that regional income and wealth distributions in Korea are highly equal over the recent decade, and the trend has not exhibited any significant change. However, even though the differences were very minimal, the shift in rankings of both per capita income and wealth levels are found out to be very extensive. These two facts clearly in dicate that there has not been any permanent poverty pocket in terms per capita GDP or wealth of provinces and cities in Korea in the most recent period of ten years.

The estimated CES-type production function based on the regional cross-section data shows a good fitting and statistically strong significance. And, furthermore, the

substitutability of two production factors, labor and capital is highly inelastic in Korea as in a typical developed and industrialized country. High capital intensity is closely related with low productivity of capital.

Finally, per capita regional distributions of automobiles, hospitals and deposits are either unrelated or inversely related with per capita regional income and wealth. This aspect is needed a further study since it is hardly logically explained.

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