

SOCIO-ECONOMIC RANKINGS OF THE PHILIPPINE PROVINCES: METHODOLOGY AND APPLICATIONS

By

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1. *Choice of the Indicators*

The rankings proposed in this paper are based on the values assumed by indices which are supposed to represent economical development (*ecdv*), agricultural development (*agd*), industrial development (*indv*) and social development (*sodv*). Different indices provide different rankings. Comparison of the different rankings helps understand the meaning of the indices.

When countries are to be compared from the point of view of *ecdv* the index often used is the gross national product, (G.N.P.) However, no such index exists for units like provinces. Moreover, the G.N.P. is an integrated index resulting from many economical factors where intercorrelations will be shown later.

It is not our intention to define the expression "economical development" (*ecdv*). We merely assume that the *ecdv* of a province could be reflected by a set of indicators, as for example income, total employment, agricultural and mineral production. Which indicators have to be considered is a technical and practical problem. Two different sets of indicators would result in two different pictures of the *ecdv*. On the other hand, it is meaningless to describe *ecdv* through indicators about which no reliable data are available.

Recent data about each province were available on population density, literacy, labor force, total employment, manufacturing employment, number of private cars, number of

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trucks, hospital bed capacity, kilometers of paved roads, cultivated areas, value of agricultural and mineral production and income. A precise description of these indicators is given in Section 2.

Data on manufacturing and motor vehicles come from 1968 and 1969 compilations. All others are based on 1970 censuses and surveys. They were made available by the kind assistance of the Bureau of Census and Statistics, the Bureau of Agricultural Economics, the Bureau of Animal Industry, the Bureau of Public Works and the Presidential Advisory Council.

All indicators mentioned above were grouped together to give a picture of the *ecdv*.

Industrial development (*indv*) is described by a subset of the mentioned indicators made up of manufacturing employment, mineral production, total employment and population density.

Agricultural production, cultivated areas, labor force and number of trucks have been selected to depict agricultural development (*agdv*).

Social development (*sodv*) is reflected by another subset of indicators, namely, kilometers of paved roads, hospital bed capacity, number of private cars and literacy rate.

2. Description of the Indicators

Raw data are presented in Table 1. The notations used are:

- X_1 : "population density", i.e., number of persons per hectare.
- X_2 : "literacy rate", i.e., the proportion in the province population of 10 years old and over who can read and write.
- X_3 : "labor force", i.e., the proportion in the province population of persons 10 years old and over.
- X_4 : "total employment", i.e., the proportion of employed people among those who are economically active (employed and unemployed).
- X_5 : "manufacturing employment", i.e., proportion of

those 10 years old and over who are employed in manufacturing.

- X_6 } "cars", "trucks", "hospital beds", respectively, i.e.,
 X_7 } : numbers per thousand population of private cars,
 X_8 } trucks, available hospital beds, respectively.
 X_9 : "paved roads", i.e., the total number of kilometers of paved roads per thousand hectares.
 X_{10} : "cultivated area", i.e., the total number of cultivated hectares divided by the total province area.
 X_{11} } "agricultural production" and "mineral production",
 X_{12} } : respectively, i.e., the total values (in pesos) of year-ly production in the province in agriculture, mining respectively.
 X_{13} : "income", i.e., total value (in pesos) of taxes, aids and loans collected by the province in one year.

Provinces are listed alphabetically and numbered in that order from 1 to 54.

3. How Data Are Transformed

Data of Table 1 are transformed in order to normalize and standardize them. (a) Percentages (as in Columns 1a, 2a, 3a, 4a, 5a, 10a) are normalized by the arcsin \sqrt{x} transformation where x is the percentage. Then, resulting data are standardized (the mean is subtracted and the difference is divided by the standard deviation); (b) Data in Columns 6a, 7a, 8a, 9a, 11a, 12a, 13a, are only standardized and denoted by Z_{ij} in the b-columns.

The resulting data are presented in Table 1 and denoted by z_{ij} , $i = 1, 2, \dots, 13$, $j = 1, 2, \dots, 54$. The x_{ij} are obtained the following way.

Let X_i be the indicator in Columns, 1, 2, 3, 4, 5 or 10. Then x_{ij} is the value assumed by X_i at province j ; see Table 1. If x_{ij} is a percentage, it is first replaced by $y_{ij} = \arcsin \sqrt{x_{ij}}$. Then the sample mean and the sample standard deviation of the y_{ij} , $j = 1, 2, \dots, 54$ are computed, i.e.,

$$\bar{y}_i = \frac{1}{54} \sum_j y_{ij},$$

$$s_i = \left[\frac{1}{54} \sum_j (y_{ij} - \bar{y}_i)^2 \right]^{1/2}$$

Finally, y_{ij} is replaced by

$$z_{ij} = \frac{y_{ij} - \bar{y}_i}{s_i}$$

If x_{ij} is not in per cent, then x_{ij} is replaced by

$$z_{ij} = \frac{x_{ij} - \bar{x}_i}{s_i}, \text{ where } \bar{x}_i = \frac{1}{54} \sum_d x_{id}, s_i = \left[\frac{1}{54} \sum_j (x_{ij} - \bar{x}_i)^2 \right]^{1/2}$$

It should be noted that for every column, i.e., for every i ,

$$\sum_j z_{ij} = 0 \quad \sum_j z_{ij}^2 = 1.$$

4. *Correlations Between Indicators*

Table 2 gives the correlation coefficients between indicators, i.e., for indicators X_k, X_l ($k, l = 1, 2, \dots, 13$)

$$r_{kl} = \sum_j z_{kj} z_{lj}$$

Since each correlation coefficient is computed from samples of 54 pairs, significance level are less than $|.268|$ and $|.348|$ at 5% and 1%, respectively. Although small correlation coefficients could have been replaced by zero, computations were carried out on original data.

PART 2. *Rankings of the Provinces According to
Economic Development*

5. *Approximate Ranking Based on Scores*

We recall that indicators in the set listed in Section 2 are supposed to represent the *ecdv* of each province.

For each indicator, provinces are ranked according to decreasing value of the indicator and given scores which are precisely their ranks.

For each province, ranks are summed up and then again provinces are arranged according to decreasing values of these sums.

Table 3 gives the ranking obtained in the manner described.

6. *Ranking Based on Unweighted Distances*

For each indicator X_i , the province with minimum z_{ij} is selected; that minimum value is denoted by z_{i0} i.e., $z_{i0} = \min z_{ij}$. The province with minimum z_{ij} can be called the "minimum" with respect to X_i . Then z_{ij} is replaced by $d_{ij} = z_{ij} - z_{i0}$. Notice that all d_{ij} 's are strictly positive except one, $d_{i0} = 0$. For each indicator X_i , d_{ij} is the distance of province j from the minimum province.

For each province, the d_{ij} 's are summed up and provinces are arranged according to decreasing values of these sums.

Table 3 gives the ranking provided by this method.

7. *Ranking Based on Weighted Distances*

In Sections 6 and 7 intercorrelations of the indicators are not taken into account. If, for example, X_1 and X_2 are correlated, then in the sum $d_{i1} + d_{i2}$, the common effect of X_1 and X_2 is considered twice: once in d_{i1} and a second time in d_{i2} , and therefore too much emphasis is given to that common effect. In order to reduce duplication, triplication, ... of common effect

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$d_{1j}, d_{2j}, d_{3j} \dots$ in $\sum_{i=1}^3 d_{ij}$ of Section 6, are replaced by

$d_{1j}, d_{2j} (1 - r_{21}), d_{3j} (1 - r_{31}) (1 - r_{32})$, respectively. It should be pointed out that the *resulting sum depends on the order in which the indicators are considered*. Since it is supposed that the set of indicators represent at least one factor (namely, *ecdv*), indicators ought to be arranged according to their increasing correlations with that factor. Following component analysis model, these correlations are proportional to the direction cosines of the principal axis of the ellipsoid of dispersion in R^3 . There are 54 points and a fairly good approximation to the principal axis is given by the line joining the two points which are farthest from each other. It was observed that Rizal, Mountain Province and Batanes are "close" to each other and "far" from Bukidnon, Masbate, Sulu, Palawan and Zamboanga del Norte (which are "close" to each other). A fictitious "province" is set up by averaging the z 's for Rizal, Mountain Province and Batanes whose coordinates are then $\bar{z}_1^{-(1)}, \bar{z}_2^{-(1)}, \dots, \bar{z}_{13}^{-(1)}$. Similarly, the mean coordinates of the second group are denoted by $\bar{z}_1^{-(2)}, \bar{z}_2^{-(2)}, \dots, \bar{z}_{13}^{-(2)}$. Finally, the indicators are arranged according to decreasing

$$\bar{z}_j^{-(1)} \quad \bar{z}_j^{-(2)}$$

The following order is obtained for the indicators:

- total employment
- income
- mineral production
- hospital beds
- private cars
- population density
- trucks
- manufacturing employment
- agricultural production
- paved roads
- cultivated area
- literacy rate
- labor force

For each province j the index I_j (called Ivanovic index, after the name of its inventor [1]) is computed from the formula:

$$I_j = d_{1j} + d_{2j} (1 - r_{21}) + d_{3j} (1 - r_{31}) (1 - r_{32}) + \dots \\ + d_{13j} (1 - r_{13,1}) (1 - r_{13,2}) \dots (1 - r_{13,12}),$$

where the first index in d_{ij} and the indices in r_{kl} run over the indicators in the order given above.

Provinces are arranged according to decreasing I_j . Table 3 gives the new ranking.

8. Comparison of Rankings

Rankings are numbered in the same manner as the sections where they are described. In Table 3, provinces (listed alphabetically) are given their ranks according to the method of ranking.

Using rank correlation method it is now possible to compare rankings with each other. For example, let us compare rankings 5 and 6. Call x_i, y_i the ranks for the provinces in rankings 5 and 6, respectively, ($i = 1, 2, \dots, 54$). Then set $d_i = x_i - y_i$ and compute $s = \sum d_i^2$. Then, compute

$$r = 1 - \frac{6s}{n(n^2-1)} = 1 - .0000381 s \quad (\text{if } n = 54)$$

and, eventually, compute

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} = \frac{r\sqrt{52}}{\sqrt{1-r^2}} \quad (\text{if } n = 54)$$

If $|t|$ is greater than 2 it is to be feared that the two rankings are significantly different.

Values of t obtained in comparing the rankings are listed below.

Rankings	:	t
5 - 6		3.5
5 - 7		8.0
6 - 7		10.5

It is to be noted that ranking 7 differs notably from rankings 5 and 6 which can be considered identical.

PART 3. *Rankings of the Provinces According to Industrial Development (indv), Social Development (sodv) and Agricultural Development (agdv).*

9. *Choice of the Indicators*

As stated in Section 1, three sets of four indicators each are selected to reflect *indv*, *sodv* and *agdv*, respectively:

- (1) Manufacturing employment,
Mineral production,
Total employment,
Density,

are supposed to represent *indv*.

- (2) Paved roads,
Hospital beds,
Private cars,
Literacy rate,

are supposed to represent *sodv*.

- (3) Agricultural production,
Cultivated areas,
Labor force,
Trucks,

are supposed to represent *agdv*.

Description of indicators can be found in Section 2. The choice of the indicators probably looks a bit arbitrary. It can be argued that other indicators would be preferable. Those arguments are meaningless since the indicators used here are the only ones available, and most recent.

The name given to the factor which each set of indicators is to represent may be questioned. These factors could have been called (a), (b) and (c) or (1), (2) and (3). Although manufacturing employment, mineral production, labor force and density are indicators of *indv*, (1) they are not the only

ones which represent *indv* and, (2) they represent most likely more than one factor. The same can be said about *sodv* and *agdv*.

10. *Approximated Rankings Based on Scores*

The same method described in Section 5 is applied to each of the sets: (1), (2) and (3), of Section 9.

Table 4 gives the rankings of the provinces provided by this method.

11. *Rankings Based on Principal Component Analysis*

Under the assumption that the sets of indicators listed in Section 9 reflect one factor each, this unique factor is supposed to be represented by a linear function of the indicators. More precisely, let μ_i and σ_i be the (population) mean and standard deviation of indicator X_i . Then, let

$$Z_i = \frac{X_i - \mu_i}{\sigma_i}$$

be the i^{th} standardized indicator of which z_{ij} is an observation in province j (see Section 3). Denote by U the (unique) factor represented by the first set of indicators in Section 9. Therefore, under our assumption and terminology, U represents *indv*. A linear transformation of the type

$$U = 1_1 Z_5 + 1_2 Z_{12} + 1_3 Z_3 + 1_4 Z_1$$

is sought for, where Z_5 , Z_{12} , Z_3 and Z_1 are (standardized) manufacturing employment, mineral production, labor force and density, respectively. Renumbering the Z 's allows them to be written more conveniently as:

$$U = \sum 1_i Z'_i$$

where $Z'_1 = Z_5$, $Z'_2 = Z_{12}$, $Z'_3 = Z_3$, $Z'_4 = Z_1$. The coefficients 1_1 , 1_2 , 1_3 and 1_4 are chosen so that the sum of squares of the distances of the observed points $(z'_{1j}, z'_{2j}, z'_{3j}, z'_{4j})$ from the line

$$\frac{z'_1}{1_1} = \frac{z'_2}{1_2} = \frac{z'_3}{1_3} = \frac{z'_4}{1_4}$$

is minimum. Method of computation is described in Kendall (1957),

If *sodv* denoted by V and *agdv* by W, then m_1, m_2, m_3, m_4 and n_1, n_2, n_3, n_4 are obtained similarly so that

$$V = \sum m_i z''_{i1},$$

$$W = \sum n_i z''_{i1},$$

where $Z''_1 = Z_9, Z''_2 = Z_8, Z''_3 = Z_6, Z''_4 = Z_2$ and $Z'''_1 = Z_{11}, Z'''_2 = Z_{10}, Z'''_3, Z'''_4 = Z_7$.

The l, m, n coefficients are listed below:

l_1 (migr. employment)	: .661	m_1 (literacy rate)	: .429	n_1 (agric. production)	: -.272
l_2 (Mineral production)	: .333	m_2 (beds)	: .513	n_2 (cultd. areas)	: .527
l_3 (density)	: .503	m_3 (paved roads)	: .454	n_3 (trucks)	: .725
l_4 (total employment)	: .446	m_4 (cars)	: .589	n_4 (labor force)	: .357

Then, provinces are arranged according to decreasing values

- of - $u_j = \sum l_i z'_{ij}$, which provide a ranking for indv,
- $v_j = \sum m_i z'_{ij}$, which provide a ranking for agdv.

These rankings are reproduced in Table 4.

12. Rankings Based on Unweighted Distances

In Section 6 a distance d_{ij} is computed (for each indicator i) from province j to the province with minimum value z_{ij} . The d values are summed up for each province which are then arranged according to decreasing sums.

This procedure is applied separately for each set (1), (2) and (3) of indicators described in Section 9. It provides the rankings reproduced in Table 4.

13. *Rankings Based on Weighted Distances*

The same index as in Section 7 is applied to each of the three sets of indicators described in Section 9.

The indicators are arranged in decreasing order according to the values of the 1's, m's and n's, respectively. The rankings are reproduced in Table 4.

14. *Comparisons of the Rankings*

Table 4 rankings are compared the same way as in Section 8. The table hereafter shows the t values based on Spearman correlation coefficients.

INDICATOR	R a n k i n g s					
	10 - 11	10 - 12	10 - 13	11 - 12	11 - 13	12 - 13
<i>Agdv</i>	2.16	1.78	1.50	-1.30	-5.85	15.29
<i>Sodv</i>	9.30	3.51	3.90	3.86	4.45	11.30
<i>Indv</i>	8.07	3.80	3.90	3.40	3.79	19.30

It is to be noted again that there is a highly significant difference between Ranking 13 and the others (except for *agdv*). An unexpected result is the large discrepancy between Rankings 10 and 11 (except for *agdv*) as ranking 10 is supposed to be an approximation of ranking 11.

Table 1. RAW DATA x_{ij} (SECTION 2). TRANSFORMED DATA z_{ij} (SECTION 3)

PROVINCE	Density (Per Hectare)		Literacy Rate		Labor Force		Employed	
	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)
	x_{ij}	z_{ij}	x_{ij}	z_{ij}	x_{ij}	z_{ij}	x_{ij}	z_{ij}
Abra	0.37	-.49495	78.98	-.53833	72.10	1.56016	88.70	-1.20818
Agusan	0.39	-.48821	86.25	.37333	74.79	2.77040	94.10	.84095
Aklan	1.45	-.13131	78.81	-.56166	70.16	.72337	87.56	-1.56806
Albay	2.64	.26936	87.02	.48660	66.83	.72199	91.16	-.33417
Antique	1.15	-.23232	77.52	-.71166	70.05	.64038	89.53	-.94010
Bataan	1.57	.09091	91.04	1.09833	67.85	-.30013	94.57	1.06863
Batanes	0.54	-.43771	92.06	1.28833	70.97	1.07607	97.22	2.46777
Batangas	2.93	.36700	54.25	-.11833	70.96	1.07607	88.60	-1.24123
Bohol	1.66	-.06061	81.20	-.27500	71.77	1.42185	94.63	1.06863
Bukidnon	0.50	-.45118	78.45	-.60666	63.78	-1.97372	96.59	2.10054
Bulacan	3.13	.43434	93.51	1.54666	69.99	.64038	91.74	.24604
Cagayan	0.65	-.40067	80.79	-.32333	68.04	-.21715	59.53	-.94010
Cam. Norte	1.24	-.20202	92.21	1.30500	65.69	-1.18533	90.98	-.44434
Cam. Sur	1.80	-.01347	87.59	.57166	66.59	-.80497	91.69	-.14321
Capiz	1.50	-.11448	76.55	-.82500	68.67	.08022	91.27	-.29745
Catanduanes	1.07	-.25926	88.14	.64500	67.53	-.43153	92.57	.20564
Cavite	4.04	.74074	90.29	.98333	71.17	1.15905	91.02	-.40762
Cebu	3.21	.46128	78.45	-.60666	70.66	.94467	92.86	.33050
Cotabato	0.48	-.45791	64.89	-2.04666	65.98	-1.06085	95.23	1.35507
Davao	0.75	-.36700	82.12	-.16333	66.81	-.72199	94.65	1.06863
Ilocos Norte	1.01	-.27946	79.93	-.50166	73.90	2.36237	91.50	-.22033
Ilocos Sur	1.49	-.11784	80.66	-.33500	73.12	2.00276	90.74	-.51779
Iloilo	2.19	.11784	86.27	.38833	70.36	.81327	91.50	-.22033
Isabela	0.61	-.41414	51.92	-.18833	66.43	-.89488	91.95	-.02937
La Union	2.50	.22222	86.66	.44333	70.57	.90318	92.81	.29011
Laguna	3.98	.72054	92.09	1.28833	69.32	.33609	92.84	.29011
Leyte	1.34	-.16835	78.44	-.60666	68.13	-.17565	92.22	.04773
Marinduque	1.50	-.11448	90.72	1.06500	67.68	-.34163	88.23	-1.37343
Masbate	1.22	-.20875	78.14	-.64166	64.83	-1.55878	90.81	-.48106
Misamis Occ.	1.65	-.53872	82.50	-.11333	69.20	.29460	91.51	-.22033
Misamis Or.	1.38	-.36700	86.11	.36000	67.79	-.30013	92.35	.08813
Mt. Province	0.41	-.06397	63.36	-1.47500	67.16	-.55601	96.45	1.98670
Negros Occ.	1.90	-.15488	81.83	-.26166	68.18	-.13416	93.31	.49575
Negros Or.	1.24	-.48148	72.76	-1.23166	69.14	.25311	92.20	.04777
Nueva Ecija	1.61	.02020	88.90	.76500	67.62	-.39004	83.39	-2.82398
Nueva Vizcaya	0.32	-.20202	80.15	-.40666	68.09	-.17565	91.72	-.14321
Occ. Mindoro	0.24	-.07744	86.77	.45833	66.67	-.76348	90.86	.44434
Or. Mindoro	0.75	-.51178	86.85	.45833	66.89	-.68049	92.24	.04773
Palawan	0.16	-.56566	77.22	-.74500	67.12	-.59751	93.02	.37090
Pampanga	4.16	.78114	89.22	.81000	66.31	-.93637	91.77	-.10849
Pangasinan	2.58	.24916	86.04	.34666	69.86	.59889	88.42	-1.30733
Quezon	0.82	-.34343	91.65	1.20000	68.02	-.21715	94.03	.79688
Rizal	22.28	6.88215	95.82	2.11000	72.57	1.78146	93.07	.41129
Romblon	1.23	-.20539	82.93	-.06333	66.82	-.72199	86.93	-1.78840
Samar	0.76	-.36364	81.21	-.82500	66.70	-.76348	93.87	.75281
Sorsogon	1.99	.05050	88.90	.61500	65.13	-1.43430	92.76	.29011
South Cotabato	0.62	-.41077	80.09	-.40666	65.88	-1.10235	95.08	1.30733
Sulu	1.58	-.08754	46.57	-3.81666	67.74	-.34163	87.66	-1.56800
Surigao del Norte	1.84	—	83.83	.05333	68.03	-.21715	92.91	.33050
Surigao del Sur	0.79	-.35353	83.35	-.01166	67.73	-.34163	91.72	-.14321
Tarlac	1.83	-.00337	87.45	.54333	68.50	—	90.81	-.48106
Zambales	0.92	-.30976	93.12	1.47000	69.45	.38450	89.19	-1.04292
Zamboanga del Norte	0.24	-.53872	72.72	-1.24166	66.17	-.97786	95.06	1.30733
Zamboanga del Sur	1.20	-.21550	72.51	1.26333	66.73	-.76348	93.86	.75281

Table 1. RAW DATA x_{ij} (SECTION 2), TRANSFORMED DATA z_{ij} (SECTION 3) (Cont'd)

PROVINCE	Manufacturing Employment		C a r s (Per 100,000 Population)		T r u c k s		Hospital Beds	
	(5a) x_{ij}	(5b) z_{ij}	(6a) x_{ij}	(6b) z_{ij}	(7a) x_{ij}	(7b) z_{ij}	(8a) x_{ij}	(8b) z_{ij}
Abra	0.86	.52327	268	-.21474	141	-.61975	365	-.44631
Agusan	1.62	1.18586	675	-.31175	1,048	1.61085	680	-.16629
Aklan	0.10	-.66938	87	-.31952	135	-.63450	569	-.26565
Albay	0.14	-.55725	191	-.31434	237	-.38356	778	-.07596
Antique	0.09	-.69996	74	-.46569	128	-.65172	657	-.18435
Bataan	1.26	.94121	513	-.10219	641	.60991	347	-.46437
Batanes	7.26	4.04349	91	-.44370	127	-.65418	4,401	3.19390
Batangas	0.49	.00781	245	-.24449	389	-.00984	871	.00532
Bohol	0.16	-.50628	105	-.42559	109	-.69844	632	-.21145
Bukidnon	0.02	-1.00917	147	-.37126	396	.00738	283	-.52760
Bulacan	2.46	1.80767	465	.04010	464	.17461	476	-.34694
Cagayan	0.63	.26163	98	-.43465	226	-.41070	573	-.35598
Cam. Norte	0.11	-.63880	130	-.39325	252	-.34676	610	-.22952
Cam. Sur	0.17	-.48250	124	-.40101	111	-.69352	603	-.23855
Capiz	0.07	-.76792	187	-.31952	190	-.54843	1,219	.32147
Catanduanes	0.05	-.84947	30	-.52261	96	-.73041	771	-.08499
Cavite	0.33	-.16649	623	-.24449	626	.57302	493	-.33791
Cebu	0.58	.20047	544	.14229	400	.01721	1,263	.35760
Cotabato	0.49	.07815	86	-.45017	76	-.77960	591	-.24758
Davao	0.48	.06455	1,941	1.94944	1,442	2.57982	65	-.19339
Ilocos Norte	0.04	-.89364	422	-.01552	335	-.14264	314	-.50030
Ilocos Sur	0.17	-.48250	256	-.23026	347	-.11313	1,112	.22211
Iloilo	0.23	-.34998	319	-.14876	340	-.13034	708	-.13919
Isabela	0.27	-.27183	162	-.35186	174	.53859	460	-.36501
La Union	0.40	-.05096	—	.27424	—	2.21396	980	.10469
Laguna	1.17	.85287	457	.02975	537	.35414	594	-.24758
Leyte	0.15	-.53007	132	-.39066	169	-.55088	701	-.16629
Marinduque	0.05	-.84947	139	-.51097	280	-.27790	347	-.46437
Masbate	0.01	-1.09072	22	-.53296	59	-.82141	377	-.43727
Misamis Occ.	0.45	.02378	164	-.34927	416	.05656	1,033	.14985
Misamis Or.	2.17	1.61399	458	.03105	433	.09837	474	-.35598
Mt. Province	1.22	.85287	3,579	4.06833	2,072	4.12918	6,544	5.12692
Negros Occ.	1.55	1.10771	527	.12030	558	.40579	800	-.05790
Negros Or.	0.51	.10533	87	-.44887	125	-.65909	703	-.14822
Nueva Ecija	0.06	-.80869	257	-.22896	348	-.11067	376	-.43727
Nueva Vizcaya	0.47	.05096	164	-.34927	344	-.12051	563	-.27468
Occ. Mindoro	0.19	.43493	367	-.08667	938	1.31573	392	-.42824
Or. Mindoro	0.08	-.73394	55	-.45146	200	-.47465	341	-.47340
Palawan	0.09	-.69996	94	-.43982	194	-.48940	591	-.24758
Pampanga	0.64	.27522	2,389	2.52896	689	.72796	627	-.21145
Pangasinan	0.11	-.63880	218	-.27941	302	-.22380	573	-.26565
Quezon	0.78	.43832	180	-.32857	253	-.34430	604	-.23855
Rizal	5.32	3.23819	3,955	4.55472	1,761	3.36436	478	3.53715
Romblon	0.10	-.66938	53	-.49286	84	-.75993	598	-.23855
Samar	0.04	-.89364	73	-.46698	96	-.73041	47	-.35598
Sorsogon	0.02	1.00917	57	-.48768	75	-.78206	426	-.39211
South Cotabato	1.13	.76112	210	-.28976	188	-.50416	161	-.63599
Sulu	0.03	-.94801	64	-.47863	63	-.81157	387	-.42824
Surigao del Norte	0.15	-.53007	96	-.43723	185	-.51154	805	-.04886
Surigao del Sur	1.20	.85287	62	-.48121	185	-.51154	522	-.31081
Tarlac	0.40	-.05096	347	-.11254	366	-.06640	682	-.16629
Zambales	0.10	-.66938	838	.60022	1,022	1.54691	915	-.05049
Zamboanga del Norte	0.18	-.45871	116	-.41136	153	-.59023	440	-.38308
Zamboanga del Sur	0.52	.11892	274	-.20697	231	-.39841	561	-.27468

* No decimal point.

Table 1. RAW DATA x_{ij} (SECTION 2), TRANSFORMED
DATA z_{ij} (SECTION 3) (Cont'd)

PROVINCE	Paved Roads * (Per 100,000 Hec.)		Cultivated Area (Per Hectare)	
	(9a)	(9b)	(10a)	(10b)
	x_{ij}	z_{ij}	x_{ij}	z_{ij}
Abra	15	-1.22751	17.39	-1.124
Agusan	23	-1.18518	5.83	-1.856
Aklan	30	-1.14815	38.76	-.176
Albay	429	.96220	83.20	1.686
Antique	222	-.13217	50.24	.273
Bataan	339	.48639	36.20	-.281
Batanes	216	-.16389	45.63	.094
Batangas	463	1.14195	85.99	1.839
Bohol	576	1.73936	68.82	1.020
Bukidnon	87	-.84656	15.25	-1.240
Bulacan	376	.68200	44.22	.038
Cagayan	127	-.63442	23.65	-.823
Camarines Norte	355	.57098	57.90	.576
Camarines Sur	240	-.03701	75.10	1.295
Capiz	373	.66614	82.30	1.640
Catanduanes	262	.07930	58.10	.584
Cavite	468	1.16838	93.20	2.307
Cebu	294	.24848	66.90	.941
Cotabato	48	-1.05291	40.55	-.109
Davao	98	-.78836	20.06	-.988
Ilocos Norte	265	.09516	58.45	.596
Ilocos Sur	228	-.10045	39.62	-.144
Iloilo	289	.06343	63.66	.809
Isabela	178	-.36479	33.70	-.384
La Union	512	1.40100	26.07	-.710
Laguna	609	1.91383	77.21	1.391
Leyte	136	-.58684	45.92	.106
Marinduque	321	.39122	76.50	1.359
Masbate	98	-.78773	57.60	.563
Misamis Occidental	440	1.02035	62.69	.768
Misamis Oriental	234	.06873	40.46	-.109
Mountain Province	34	-1.12698	17.23	-1.135
Negros Occidental	275	.14803	51.41	.320
Negros Oriental	163	-.44409	38.39	-.193
Nueva Ecija	343	.50753	61.20	.708
Nueva Vizcaya	67	-.95238	12.48	-1.394
Occidental Mindoro	74	-.91534	11.90	-1.430
Oriental Mindoro	149	-.51811	41.90	-.053
Palawan	29	-1.15344	4.50	-1.971
Pampanga	209	-.20090	64.06	.825
Pangasinan	557	1.63891	3.18	-2.104
Quezon	83	-.86704	44.70	.058
Rizal	1,061	4.30346	46.44	.125
Romblon	355	.57098	30.11	-.535
Samar	47	-1.05820	30.32	-.527
Sorsogon	283	1.90325	64.36	.837
South Cotabato	74	-.91534	40.89	-.092
Sulu	111	-.71901	39.44	-.152
Surigao del Norte	184	-.33307	41.61	-.065
Surigao del Sur	129	-.62384	23.78	-.813
Tarlac	229	-.09516	56.65	.525
Zambales	186	-.32249	6.79	-1.775
Zamboanga del Norte	209	-.20090	25.95	-.719
Zamboanga del Sur	160	-.45995	33.60	-.388

Table 1. RAW DATA x_{ij} (SECTION 2), TRANSFORMED DATA z_{ij} (SECTION 3) (Cont'd)

PROVINCE	Agric'l Production (Value)		Mineral Production (Value)		I n c o m e Value	
	(11a)	(11b)	(12a)	(12b)	(13a)	(13b)
	(Pesos) x_{ij}	z_{ij}	(Pesos) x_{ij}	z_{ij}	(Pesos) x_{ij}	z_{ij}
Abra	10,179,490	-.40101	—	-.31424	1,482,911.46	-.27935
Agusan	15,963,192	-.32749	10,312,400	-.10199	3,353,073.64	-.20002
Aklan	41,779,518	-.46966	78,417	-.31262	2,244,558.01	-.24705
Albay	18,702,554	-.29266	54,201	-.31312	5,125,410.59	-.12484
Antique	4,634,788	-.47150	83,760	-.31251	2,405,376.09	-.24022
Bataan	9,000,329	-.41600	242,880	-.30924	3,291,961.87	-.20262
Batanes	1,071,685	-.51680	500	-.31423	337,173.19	-.32795
Batangas	47,871,859	-.07817	881,620	-.29609	8,790,788.58	-.03063
Bohol	21,744,531	-.25399	137,739	-.31140	5,215,621.11	-.12102
Bukidnon	24,884,465	-.21407	6,523	-.31410	3,967,228.08	-.17397
Bulacan	25,398,265	-.20754	31,303	-.33006	8,558,500.71	-.02078
Cagayan	29,260,603	-.15843	15,778	-.31391	5,499,001.39	-.10900
Camarines Norte	12,310,462	-.37392	30,905,028	.32185	2,865,511.83	-.22071
Camarines Sur	32,566,253	-.11641	154,622	-.31105	5,855,004.99	-.09390
Capiz	12,076,773	-.37689	30,756	-.31360	2,911,062.52	-.21877
Catanduanes	12,921,805	-.36615	320	-.31423	6,695,875.79	-.05823
Cavite	21,902,017	-.25198	638,389	-.30110	3,744,365.81	-.18343
Cebu	32,844,684	-.11287	252,811,731	4.88915	7,365,486.08	-.02982
Cotabato	23,427,174	-.23259	1,725,108	-.27873	8,466,711.29	-.01689
Davao	99,778,060	.73806	8,312,422	-.14315	9,627,455.04	.06612
Ilocos Norte	30,615,616	-.14121	485,095	-.30425	3,014,448.64	-.21439
Ilocos Sur	20,911,294	-.26458	27,044	-.31368	3,296,563.68	-.20242
Iloilo	15,167,150	-.33761	1,972,491	-.27364	7,752,588.82	-.01340
Isabela	48,843,407	.09052	5,498,730	-.20106	5,637,066.41	-.10314
La Union	7,329,659	-.43724	37,231,780	.45207	4,120,777.17	-.16746
Laguna	42,300,770	.00735	86,480	-.31246	4,533,353.80	-.14996
Leyte	52,744,697	-.14012	202,098	-.31008	9,103,785.86	.04391
Marinduque	6,942,800	-.44216	3,515,789	-.24187	1,368,975.71	-.28419
Masbate	20,895,045	-.26479	142,260	-.31131	3,264,433.93	-.20378
Misamis Occ.	21,804,191	-.25323	11,503	-.31400	2,405,549.56	-.24022
Misamis Oriental	42,056,415	.00424	158,153	-.31098	3,754,086.95	-.18301
Mountain Province	10,937,535	-.39137	255,288,441	4.94012	7,970,928.57	-.00414
Negros Occ.	119,351,326	.98690	71,712,511	1.16175	12,470,358.17	-.18672
Negros Oriental	532,787,111	6.24295	12,358	-.31398	4,493,529.78	-.15165
Nueva Ecija	63,848,081	.28128	182,036	-.31049	6,648,226.71	-.06025
Nueva Vizcaya	13,008,980	-.36504	660	-.31422	2,518,371.10	-.23543
Occ. Mindoro	6,367,940	-.44947	5,300,006	-.20515	2,116,541.19	-.25248
Oriental Mindoro	18,746,247	-.29210	2,360	-.31419	2,847,812.30	-.22146
Palawan	12,895,671	-.36648	26,457,530	.23031	3,353,825.65	-.19999
Pampanga	47,858,774	.07800	720,852	-.29940	6,575,797.03	-.06332
Pangasinan	48,293,732	.08354	3,198,845	-.24840	8,961,200.64	.03786
Quezon	64,134,233	.28492	3,656,042	-.23899	8,521,595.56	.01921
Rizal	18,008,900	-.30072	17,308,513	.04201	178,765,509.80	7.24070
Romblon	6,311,221	-.45019	102,656	-.31212	1,041,878.80	-.29806
Samar	70,619,946	2.95916	202,098	-.31404	8,183,906.00	.00489
Sorsogon	274,487,806	.36737	9,425	-.31008	3,774,381.41	-.18215
South Cotabato	23,427,174	-.28459	862,554	-.31423	4,554,786.55	-.14905
Sulu	19,336,909	-.34393	405	-.06472	3,098,210.35	-.21083
Surigao del Norte	14,669,521	-.37865	12,123,030	-.30542	4,690,776.75	-.14328
Surigao del Sur	11,938,772	.01325	428,092	-.31372	2,735,460.84	-.22622
Tarlac	42,765,008	-.23259	24,840	-.29648	5,011,709.54	-.12967
Zambales	6,855,660	-.44327	32,132,413	.34711	2,964,525.31	-.21651
Zamboanga del Norte	15,289,978	-.33604	226,854	-.30957	3,644,810.95	-.18765
Zamboanga del Sur	40,103,736	-.02058	7,465,117	-.16059	4,704,922.07	-.14268

Table 2. CORRELATION COEFFICIENTS (SECTION 4)

INDICATORS	Density	Literacy Rate	Labor Force	Total Employed	Manufacturing Employed	Cars	Trucks
Density	1.000	.377	.297	—	.456	.670	.516
Literacy Rate	.377	1.000	—	.678	.390	.330	—
Labor Force	.297	—	1.000	—	.271	—	—
Total Employed	—	.676	—	1.000	.437	—	.262
Mfg. Employed	.456	.390	.271	.437	1.000	.590	.390
Cars	.670	.330	—	—	.590	1.000	.875
Trucks	.516	—	—	.262	.390	.875	1.000
Hospital Beds	.470	—	—	.376	.547	.704	.667
Paved Roads	.720	.497	.305	—	.282	.282	—
Cultivated Area	—	—	—	—	—	—	.265
Agricultural Prod.	—	—	—	—	—	—	—
Mineral Production	—	—	—	—	—	.648	.478
Income	.968	.289	—	—	.432	.647	.477

Table 2. CORRELATION COEFFICIENTS (SECTION 4) (Cont'd)

INDICATORS	Hospital Beds	Paved Roads	Cultivated Area	Agricultural Production	Mineral Production	Income
Density	.470	.720	—	—	—	.968
Literacy Rate	—	.497	—	—	—	.289
Labor Force	—	.305	—	—	—	—
Total Employed	.376	—	—	—	—	—
Mfg. Employed	.547	.282	—	—	—	.432
Cars	.704	.282	—	—	.648	.647
Trucks	.667	—	.265	—	.478	.477
Hospital Beds	1.000	—	—	—	.540	.488
Paved Roads	—	1.000	.474	—	—	.579
Cultivated Area	—	.474	1.000	—	—	—
Agricultural Prod.	—	—	—	1.000	—	—
Mineral Production	.540	—	—	—	1.000	—
Income	.488	.579	—	—	—	1.000

TABLE 3*

PROVINCES	RANKINGS ACCORDING TO ECDV		
	Section 5 (Scores)	Section 6 (Distances)	Section 7 (Weighted Distances)
Abra	53	52	48
Agusan	19	48	46
Aklan	50	41	41
Albay	18	35	37
Antique	45	27	31
Bataan	16	32	32
Batanes	32	21	49
Batangas	6	33	45
Bohol	19	37	40
Bukidnon	46	54	54
Bulacan	2	29	25
Cagayan	40	28	29
Camarines Norte	30	36	27
Camarines Sur	25	12	13
Capiz	33	34	38
Catanduanes	36	24	18
Cavite	8	47	43
Cebu	3	3	2
Cotabato	39	50	34
Davao	11	10	36
Ilocos Norte	29	26	19
Ilocos Sur	27	20	22
Iloilo	10	13	23
Isabela	34	14	10
La Union	9	16	20
Laguna	5	30	24
Leyte	26	11	7
Marinduque	37	51	52
Masbate	54	46	26
Misamis Occ.	28	17	21
Misamis Or.	21	6	8
Mt. Province	12	2	4
Negros Occ.	4	7	6
Negros Or.	38	4	1
Nueva Ecija	16	43	53
Nueva Vizcaya	43	19	30
Occ. Mindoro	35	31	39
Or. Mindoro	48	15	11
Palawan	49	49	44
Pampanga	7	8	14
Pangasinan	15	40	50
Quezon	13	18	9
Rizal	1	1	3
Romblon	52	38	47
Samar	46	23	5
Sorsogon	22	42	28
So. Cotabato	41	39	33
Sulu	51	53	35
Surigao del Norte	31	10	12
Surigao del Sur	42	22	15
Tarlac	14	5	17
Zambales	24	44	51
Zamboanga del Norte	44	45	42
Zamboanga del Sur	23	25	16

* (Ranks: Section 8)

Table 4. RANKING OF PROVINCES ACCORDING TO INDUSTRIAL, SOCIAL AND AGRICULTURAL DEVELOPMENT BY DIFFERENT RANKING METHODS

PROVINCES	RANKINGS					
	Section 10*			Section 11**		
	Indust'l	Social	Agric'l	Indust'l	Social	Agric'l
Abra	44	36	32	44	45	53
Agusan	9	20	14	46	43	51
Aklan	39	34	34	24	46	22
Albay	25	8	15	25	36	46
Antique	40	31	30	38	18	39
Bataan	7	10	22	47	20	17
Batanes	21	14	30	4	11	27
Batangas	16	7	1	24	30	45
Bohol	20	19	13	34	29	49
Bukidnon	41	38	30	53	44	50
Bulacan	2	5	10	18	32	32
Cagayan	38	35	25	39	13	18
Camarines Norte	21	12	28	26	42	34
Camarines Sur	23	20	18	15	5	41
Capiz	36	17	17	27	34	38
Catanduanes	42	23	29	31	17	25
Cavite	11	4	2	14	50	54
Cebu	4	9	4	2	14	24
Cotabato	18	40	35	30	53	23
Davao	13	18	12	20	4	11
Ilocos Norte	34	25	6	35	9	30
Ilocos Sur	35	16	12	22	12	31
Iloilo	14	13	11	12	8	26
Isabela	24	28	23	9	16	21
La Union	5	5	20	5	38	14
Laguna	8	2	3	37	19	29
Leyte	22	30	17	19	27	9
Marinduque	31	27	19	48	49	35
Masbate	41	42	35	42	47	43
Misamis Occ.	43	13	9	10	33	13
Misamis Oriental	15	16	11	23	6	6
Mt. Province	3	21	26	3	2	2
Negros Occidental	4	11	5	16	7	8
Negros Oriental	37	33	16	8	39	1
Nueva Ecija	33	15	8	54	21	44
Nueva Vizcaya	32	33	31	6	40	28
Occidental Mindoro	12	26	33	17	24	42
Oriental Mindoro	45	29	27	29	31	12
Palawan	27	39	38	33	51	52
Pampanga	6	6	7	11	3	36
Pangasinan	21	14	17	41	26	47
Quezon	10	23	11	28	48	4
Rizal	1	1	6	1	1	5
Romblon	39	27	39	52	22	33
Samar	39	41	27	45	52	3
Sorsogon	7	22	20	36	37	48
South Cotabato	26	37	31	51	41	20
Sulu	28	42	36	50	54	16
Surigao del Norte	17	24	30	21	15	10
Surigao del Sur	29	34	24	32	23	19
Tarlac	19	13	11	7	10	7
Zambales	25	3	26	40	35	40
Zamboanga del Norte	30	32	37	43	28	37
Zamboanga del Sur	9	16	23	13	25	15

* Scores

** First component analysis

Table 4. RANKING OF PROVINCES ACCORDING TO INDUSTRIAL, SOCIAL AND AGRICULTURAL DEVELOPMENT BY DIFFERENT RANKING METHODS (Continued)

PROVINCES	R A N K I N G S					
	Section 12*			Section 13**		
	Indust'l	Social	Agric'l	Indust'l	Social	Agric'l
Abra	47	43	52	38	32	7
Agusan	45	31	47	9	8	1
Aklan	50	40	21	50	38	13
Albay	23	26	44	33	24	48
Antique	39	18	40	48	46	18
Bataan	43	35	13	7	9	20
Batanes	21	4	29	2	14	10
Batangas	35	19	50	31	20	22
Bohol	36	21	48	20	30	11
Bukidnon	53	41	54	23	44	49
Bulacan	18	47	28	5	10	12
Cagayan	40	24	18	39	45	26
Camarines Norte	25	44	37	40	27	47
Camarines Sur	9	5	39	34	31	50
Capiz	24	34	35	43	28	33
Catanduanes	28	14	26	41	40	39
Cavite	16	49	53	22	6	14
Cebu	2	15	30	4	11	17
Cotabato	38	52	25	16	53	46
Davao	27	6	13	17	4	21
Ilocos Norte	31	12	34	45	15	5
Ilocos Sur	22	10	38	42	25	3
Iloilo	10	8	27	29	17	16
Isabela	7	13	22	32	33	45
La Union	5	27	33	15	18	8
Laguna	32	33	23	6	7	27
Leyte	12	25	9	36	42	31
Marinduque	47	50	41	51	34	37
Masbate	37	42	43	49	51	51
Misamis Occ.	13	22	20	30	26	23
Misamis Oriental	20	9	7	10	13	30
Mt. Province	3	2	3	3	2	4
Negros Occidental	17	7	8	8	12	41
Negros Oriental	9	38	1	26	49	54
Nueva Ecija	54	20	16	54	23	43
Nueva Vizcaya	4	30	31	25	41	19
Occidental Mindoro	15	28	41	21	22	15
Oriental Mindoro	26	29	15	44	43	38
Palawan	34	45	50	35	50	25
Pampanga	11	3	6	13	3	44
Pangasinan	45	23	45	47	21	9
Quezon	33	46	5	14	29	36
Rizal	1	1	2	1	1	2
Romblon	52	15	30	53	39	34
Samar	42	48	4	37	52	53
Sorsogon	29	32	48	12	36	52
South Cotabato	51	37	23	11	35	35
Sulu	49	54	13	52	54	32
Surigao del Norte	15	53	11	27	37	29
Surigao del Sur	30	17	19	19	48	24
Tarlac	6	11	10	28	16	28
Zambales	41	19	45	46	5	6
Zamboanga del Norte	48	51	36	24	47	40
Zamboanga del Sur	19	36	14	18	19	42

* Unweighted distances

** Weighted distances