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Abstract	The development of advertising in recent years has increased the need to understand what macroscopic character it has from a socio-economic viewpoint. Since advertising is functioning within society as a sub-system of the total social system, it has close relations with other sub-systems of society. As regards the relation between advertising and society, traditionally study has been advanced as a problem of what influence the former has on the latter. It has been research of the flow of influences from advertising to society, in other words socio-economic effects of advertising, with N. H. Borden's positive research making its representative one. In such study of the flow it has been assumed that advertising is an independent factor separated from various properties and conditions of society, the soil and groundwork of its development, and that the relation is solely the flow of effects from advertising to society. In the reality, however, advertising is not such a solitary existence but one subject to outside circumstances. That is, in the relation between advertising and society there are flows of influence from the latter to the former side by side with those from the former to the latter, say a relation of interaction. This means that even study of advertising-to-society influences must be developed based on the consideration of socio-economic properties and conditions defining advertising. This paper is an exploring research intended to investigate the relation between the two, especially the influence of society on advertising on such problem consciousness. Thus our fundamental theme is to clarify the intensity and nature of the relation between advertising and society, and further to examine to what extent social properties explain advertising. The flow of our analyses is as shown in Chart 1.
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ADVERTISING AND SOCIAL INDICATORS

by

Takeshi Shimizu

The development of advertising in recent years has increased the need to understand what macroscopic character it has from a socio-economic viewpoint. Since advertising is functioning within society as a sub-system of the total social system, it has close relations with other sub-systems of society. As regards the relation between advertising and society, traditionally study has been advanced as a problem of what influence the former has on the latter. It has been research of the flow of influences from advertising to society, in other words socio-economic effects of advertising, with N. H. Borden's positive research making its representative one. In such study of the flow it has been assumed that advertising is an independent factor separated from various properties and conditions of society, the soil and groundwork of its development, and that the relation is solely the flow of effects from advertising to society.

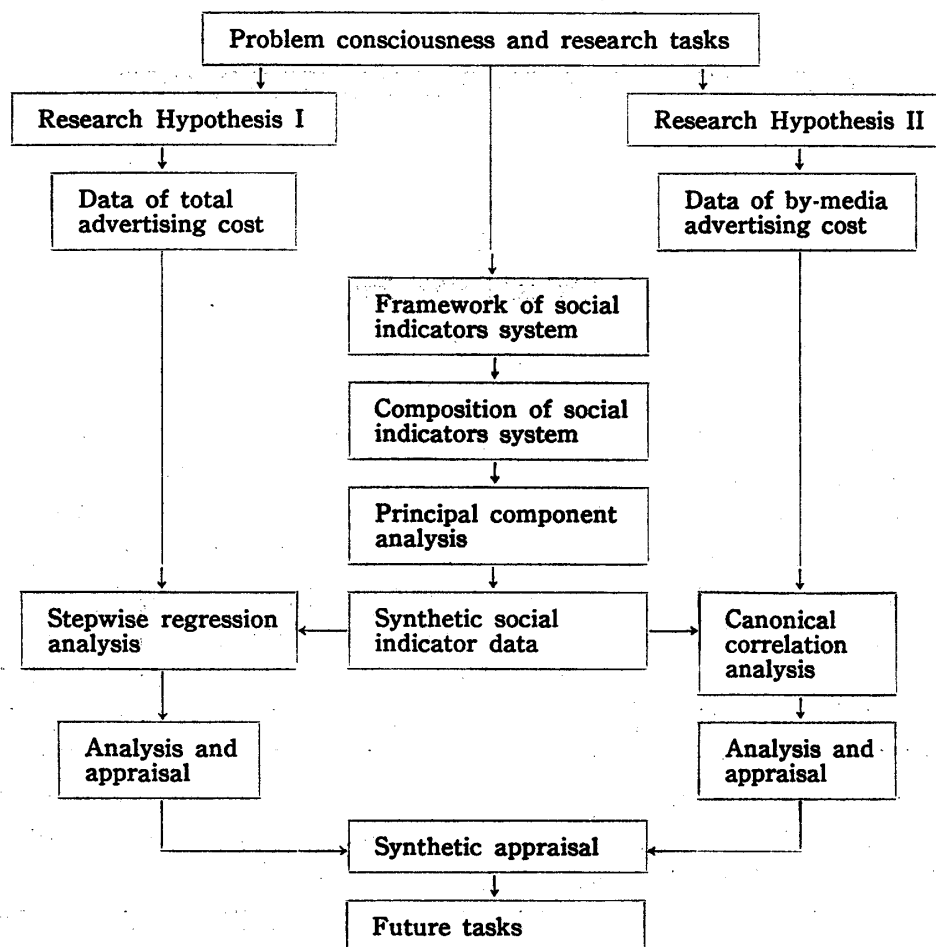
In the reality, however, advertising is not such a solitary existence but one subject to outside circumstances. That is, in the relation between advertising and society there are flows of influence from the latter to the former side by side with those from the former to the latter, say a relation of interaction. This means that even study of advertising-to-society influences must be developed based on the consideration of socio-economic properties and conditions defining advertising. This paper is an exploring research intended to investigate the relation between the two, especially the influence of society on advertising on such problem consciousness. Thus our fundamental theme is to clarify the intensity and nature of the relation between advertising and society, and further to examine to what extent social properties explain advertising. The flow of our analyses is as shown in Chart 1.

Section I. Tasks of Research and Preparation of Data

—Principal Component Analysis—

Starting from problem consciousness as above, next the problem is how to set the measures of properties for advertising and society. Primarily advertising activities involve two aspects of quantity and quality, but this research was confined to the quantitative aspect alone, and let it be represented by total ad-

Chart 1. Flow of Analysis



vertising cost and by-media advertising cost. On another hand as the measure for social properties and conditions we prepared many individual indicators exhibiting social activities and living. Thus in concrete the tasks of research became explanation of the relations between (I) total advertising cost and social indicators and (II) by-media advertising cost and social indicators. These two tasks are developed as research hypotheses respectively in the following sections.

The first step to clarify the research tasks and hypotheses is to prepare data about advertising cost and social indicators. For statistical analysis for this sake either time series or cross section data of some form may be used. In this research we conducted analyses on cross section data on a prefectural base, that is, for Japan's forty seven Prefectures, *ken*. We used estimated data of total advertising cost as for task I and those divided into four advertising media as for task II (both on prefectural and per capita bases).¹⁾

On another hand as for social indicators several steps of preparatory work

1) The data of prefectural advertising cost used here are estimates by a research project undertaken by the Japan Academy of Advertising which the writer joined.

were necessary. First in order to arrange numerous social indicators systematically, not as random gathering, a kind of conceptual framework had to be constructed. Our theoretical framework of the social indicators system finally set for this aim is shown as the outer frames of Chart 2. That is, on one axis (left-hand column) we provided three compartments of major categories comprising social goals, goaling (or goal-pursuing) activities and basic social conditions. And further we divided each category into respective sub-categories, that is: the category of social goals into four sub-categories of welfare, education-culture, public peace-security and income-consumption; goaling activities into production-distribution and transportation-communication; and basic social conditions implies items concerning population. On the other axis (upper row) we specified two aspects of fundamental structure-environment of life and consciousness-behavior of life. By these two axes a matrix to make the framework of the social indicators system was composed.

Next, using a statistical book *Minryoku 1977*²⁾ we constructed or picked up fifty social indicators and positioned them in respectively pertinent categories. These indicators are to represent the socio-economic situations of prefectures each, which in the below are called individual social indicators. As the result of this positioning the social indicators system of Chart 2 was composed, in which we paid following considerations.

- 1) We constructed and selected indicators on reviewing the results of past relevant studies and taking account of relation with the purpose of this research.

- 2) By combining indicators in the *Minryoku* we worked out new ones and thus enlarged the amplitude of selection. The numeral ratio of petty retail shops is an example.

- 3) We standardized the values of indicators in the form of per capita, per household or ratios.

- 4) The construction, selection and positioning of indicators were performed in conformity with the said conceptual framework.

However, since the social indicators system thus composed contained as many as fifty indicators, examination of relations of each and all of them with advertising cost was not only to require a vast volume of work but also to raise methodologically difficult problems. In addition there were large possibility of correlations among the fifty. And an operation became necessary to summarize information implied in the fifty indicators into a small number of analytically controllable and non-correlative ones. For this summarising we conducted principal component analysis.

In adopting this principal component analysis we thought of two ways. One was to conduct it on the whole social indicators system comprising fifty individual indicators. Another was to do it dividing into the categories contained in the conceptual framework. By examining the correlation matrix of the fifty

2) *Minryoku 1977* (nation's power), Asahi Shimbunsha.

Chart 2. Social Indicators System

		Fundamental structure and environment of life	Consciousness and behavior of life
Social goals	Welfare	1. Number of social welfare facilities 2. Number of hospital beds 3. Number of dwellers per room	32. Participants of consumer organizations 33. Number of ill deaths
	Education-culture	4. Number of primary-middle school teachers 5. Number of libraries	34. Rate of college application 35. Rate of election voting
	Peace-security	6. Number of criminal cases 7. Number of traffic accidents	36. Value of life insurance 37. Do of fire insurance
	Income-consumption	8. Monthly disposable income 9. Initial salary	38. Consumption expenditure 39. Ratio of food expenditure 40. Ratio of miscellaneous expenses
Goaling activities	Production-distribution	10. Ratio of primary industry employees 11. Do of secondary industry 12. Do of tertiary industry 13. Unemployment rate 14. Ratio of petty retail shops 15. Number of cosmetic shops 16. Do of retail shops 17. Do of supermarkets 18. Annual sales per wholesale retail shop 19. Do per supermarket 20. Do per department store 21. Ratio of department store sales 22. Do of supermarkets 23. Numer of advertising agencies 24. Number of employees per establishment 25. Annual factory shipment	41. Deposit balance per capita 42. Ratio of 4-wheeler ownership 43. Department store sales per capita 44. Supermarket sales per capita 45. Cosmetic shops sales per capita
	Transportation-communication	26. Number of telephone subscription 27. Road pavement ratio	46. Nnnumber of overseas travelers 47. Frequency of transport facility utilization 48. Number of mail per capita
Basic social conditions	Population	28. Males-females ratio 29. Population growth rate 30. Population density 31. Persons per household	49. Intra-prefecture population moves 50. Rate of population outflow

(For full description of items see Chart 3.)

indicators, however, high correlations were found not only between indicators of the same category but also between those of different categories. For example, indicator No. 18 (annual sales per wholesale-retail shop) showed not only a correlation of 0.82 with No. 20 (annual sales per department store) of the same category but also with that of 0.84 with No. 30 (population density) and again that of 0.85 with No. 41 (per capita deposit balance) of different categories. This means that the principal components of the categories each obtained through principal component analysis have mutual inter-category relations, and hence involve possibility to raise the problem of multicollinearity in subsequent analyses. Because our intention was to examine the explanatory power of the whole social indicators system representing social features rather than that of social indicators by the categories, it was necessary to conduct this analysis on the whole system consisting of fifty indicators. By putting the correlation matrix of fifty indicators on principal component analysis, results were obtained as shown in Chart 3. In the chart the factor loadings of the first to sixth principal components are exhibited. The factor loading represents the correlation coefficient between each principal component and each indicator, and the sum of squared values of fifty indicators for each principal component makes its eigenvalue. And the quotient of dividing factor loading by the square root of the eigenvalue is the principal component coefficient (eigenvector).

Because the fifty social indicators were standardized using the correlation matrix, the variance of each one is 1 and the number of indicators equals total variance. Accordingly the proportion of total variance of principal component 1 is $\frac{16.81}{50} = 0.34$. Thus one single component 1 summarizes 34% of the total variance of the fifty indicators. Similarly the six principal components summarize 74% of the total variance of all indicators.

Observing the magnitude and signs of factor loadings, we may interpret the character of the principal components as follows. Firstly as to component 1 we must note that both plus and minus signs are mixed, for often making input of raw data all the principal component coefficients of the first principal component become plus and hence the factor of size is extracted. In this research by the above-mentioned standardization of data the so-called shape factor was produced.

With principal component 1 many individual indicators have a high loading. To pick up those with an absolute value above 0.7, indicators Nos. 4, 9, 10, 18, 20, 26, 28, 30, 33, 34, 35, 41, 43, 46 and 47 come under them. This principal component score is high for Tokyo, Osaka, Kanagawa, Aichi and Kyoto, by which this component 1 may be interpreted to be a factor of *urbanization*. In regions where this property is high, as common tendencies, school teachers and primary industry employees are small; initial salary of college graduates, annual sales per wholesale-retail shop and those per department store are high; telephone subscription and male population are numerous; population density, the college

Chart 3. Factor Loadings of Principal Components

variable	(1)	(2)	(3)	(4)	(5)	(6)
1. Number of social welfare facilities /10 thou. persons	-.61	.38	-.26	-.06	-.12	-.10
2. Number of hospital beds/1.7thou. persons	-.38	.61	-.07	-.05	-.24	-.47
3. Number of dwellers/room	.45	-.33	.55	.28	.01	.14
4. Number of primary-middle school teachers/100 pupils	-.74	.40	-.00	.04	-.11	-.23
5. Number of libraries/1 mil. persons	-.30	.46	-.29	.03	-.05	.00
6. Number of criminal cases/100 thou. persons	.68	.24	.24	-.09	-.24	-.11
7. Number of traffic accidents/1 thou. persons	-.01	.22	-.31	-.57	-.13	-.10
8. Monthly disposable income/worker's household	-.12	-.07	-.37	.29	-.35	.60
9. Initial salary of male college graduate	.79	-.12	-.07	-.29	.20	-.04
10. Ratio of primary industry employees	-.87	.00	.13	.30	-.00	-.08
11. Do of secondary industry	.57	-.18	-.49	-.42	.29	.18
12. Do of tertiary industry	.65	.22	.44	.06	-.37	-.09
13. Unemployment rate	-.06	.25	.74	-.14	-.48	-.09
14. Ratio of petty retail shops	-.51	.16	.54	-.34	-.13	.22
15. Number of cosmetic shops/1 mil. persons	.26	.44	.25	-.70	-.20	.18
16. Do of retail shops	-.58	.52	.25	-.31	.02	.29
17. Do of supermarkets	-.24	.29	-.48	-.03	-.00	-.40
18. Annual sales/wholesale-retail shop	.78	.45	-.05	.23	.22	.03
19. Do/supermarket	.49	-.36	-.21	-.08	-.16	.02
20. Do/department store	.79	.30	.01	.03	.17	-.15
21. Ratio of department store sales (to total retail sales)	.21	-.58	-.05	.03	-.60	-.10
22. Do of supermarket sales	-.15	-.61	-.30	-.06	-.47	-.17
23. Number of advertising agencies/1 mil. persons	.58	.61	-.15	.21	.08	.18
24. Number of employees/establishment	.27	-.39	-.28	-.16	-.11	-.08
25. Annual shipment amount/factory	.35	-.43	-.14	-.02	-.35	-.11
26. Number of telephone subscription/100 persons	.73	.23	-.40	-.02	.08	-.15
27. Ratio of road pavement	.51	.43	-.05	-.16	-.38	.23
28. Males-females ratio	.76	-.44	.03	.12	.25	.07
29. Rate of population growth	.54	-.68	.02	-.19	-.07	-.04
30. Population density (sq. km)	.84	.22	.02	.26	-.02	.12
31. Number of persons/household	-.61	-.30	.04	-.07	.36	.50
32. Number of participants of consumer organizations/100 persons	-.28	.41	-.40	-.15	-.18	.24
33. Number of ill deaths/100 thou. persons	-.77	.35	-.23	-.16	-.17	-.11
34. Rate of college application	.81	.15	-.10	-.36	-.21	.03
35. Rate of election voting	-.76	.08	-.16	-.01	-.07	.15
36. Value of ordinary life insurance /contract	.24	.09	.44	-.30	-.10	.25
37. Do of fire insurance	.47	-.30	.10	-.57	.08	.21

variable	(1)	(2)	(3)	(4)	(5)	(6)
38. Monthly consumption expenditure /worker's household	.23	-.08	-.35	.42	-.37	.48
39. Ratio of food expenditure (to total consumption)	.50	-.13	.16	-.18	.45	-.32
40. Do of miscellaneous expenses	-.38	-.03	-.16	.04	-.23	.56
41. Balance of deposits per capita	.76	.47	-.25	-.00	.11	.10
42. Ratio of 4-wheeler ownership	-.36	-.04	-.38	-.52	.33	.16
43. Sales of department stores per capita	.86	.24	-.06	.22	-.12	.00
44. Do of supermarkets	.40	-.18	-.67	-.09	-.25	-.25
45. Do of cosmetic shops	.65	.34	.03	-.46	-.03	.04
46. Number of overseas travelers/100 thou. persons	.89	.05	.05	.01	-.03	.25
47. Annual frequency of transport facility utilization	.90	.15	-.04	.28	-.07	.05
48. Number of mail reception per capita	.69	.55	-.15	.28	.04	.03
49. Intra-prefecture population moves	.50	.24	.39	.11	-.07	-.25
50. Rate of population outflow	-.20	.08	-.11	.24	.21	.17
Eigenvalue	16.81	6.59	4.41	3.52	2.85	2.73
Cummulative proportion of total variance	.34	.47	.56	.63	.69	.74

application rate, the deposit balance, per capita department store sales, overseas travelers and transport facility utilization are all high; and the rates of ill deaths and election voting are low. These are the most basic factors extending over all the fields of the social indicators system, and in view of its proportion of total variance, the highest 34%, this component may be said the fundamental one of synthetic social indicators.

As to principal component 2, indicators No. 2, 16, 21, 23, 29, 48 and 50 have a high factor loading of an absolute value of above 0.5. And to look by the conceptual framework these are composed mainly of two fields, basic social conditions and goaling activities. Its principal component score is high in Tokyo, Kochi, Osaka, Ishikawa and Kagawa, while low in Chiba and Kanagawa. Regions with a high principal component score of this component have demographic features of large population outflow and low population growth. On the other hand the numbers of hospital beds and advertising agencies are large; the ratios of department store and super-market sales are low. By these tendencies this principal component 2 may be considered as a factor of *saturation*.

As to principal component 3 the factor loading is high with indicators Nos. 3, 13, 14 and 44, followed by 11, 12 and 17. Its score is large for Okinawa, Aomori, Nagasaki, Kagoshima and Kumamoto. Accordingly this component 3 may be a factor of *pettiness*. Composition of this factor of pettiness is centered on indicators involved in the category of goaling activities. In regions where this score is high, unemployment, the number of per-room persons, of petty retail shops and of tertiary industry employees are high, while supermarket

sales, and the number of secondary industry employees are low.

Indicators with a high factor loading with principal component 4 are Nos. 6, 37 and 42, and this can be regarded as a factor of *public peace-security*. Beside these indicators, however, the loading is high also with Nos. 15 and 45, concerning cosmetic shops. Since cosmetic shops sell also medicines and other sanitary goods, this component 4 may be said a factor of peace-security in the sense of including a health-sanitation property. In Japan's north-eastern regions with a high score of this component, typically low are the car ownership ratio, traffic accident number, fire insurance amount as well as the number and sales of cosmetics shops.

As regards principal component 5 a high loading is seen mainly with the indicators of goaling activities such as Nos. 13, 21, 22, and 39, and the principal component score is large in Gumma, Aichi, Niigata, Gifu and Iwate. In these regions sales of big retailers (department stores and supermarkets) are low; the unemployment rate is not high but the Engel coefficient is high. Thus this component is regarded as a factor of *backwardness*.

Indicators with a high factor loading for principal component 6 are Nos. 8, 31 and 40. By the high disposable income and miscellaneous expense ratio this component appears to be a factor showing affluency because this principal component is abstracted from the income-consumption field. However, in view of the fact that these two indicators are on a household-unit and the loading of number of persons per-household is alike high, this component 6 should be said a factor of *household-size*. That a high loading score is seen for Okinawa, Yamaguchi and Yamagata also verifies this.

The six principal components here extracted are what should be called synthetic social indicators presented by linear combination of fifty individual indicators for each. That the cumulative proportion of total variance of up to component 6 shows 0.74 means that 74% of information implied in fifty individual indicators is summarized in six synthetic ones. Although there is a loss of 26% of information such transformation of fifty indicators to six ones renders subsequent analysis easier. Then our next problem is to what extent explanation of advertising cost is possible by the selected six principal components.

Section II. Total Advertising Cost and Social Indicators

—Stepwise Regression Analysis—

In the foregoing section firstly the data of prefectural and per capita advertising cost have been prepared, and on another hand by conducting principal component analysis six synthetic social indicators have been constructed from fifty individual social indicators. Thus the preparatory step for explicating our tasks has been completed.

The next step is investigation of tasks I and II by means of prepared data. In this section task I is taken up, in the next section task II, and then com-

prehensive consideration covering both is attempted.

The aim in this section is to clarify the intensity and the nature of relation between total advertising cost (prefectural and per capita) and social indicators. To express as research hypotheses it is:

Hypothesis I: Total advertising cost is the function of social indicators.

Corollary I-1: Between total advertising cost and social indicators there exist statistically significant and intense relations.

Corollary I-2: Between total advertising cost and social indicators there are particular patterns of relation.

Here total advertising cost is represented by one variable, while social indicators consist of the six principal components extracted in the previous section. Accordingly, in respect of Hypothesis I, necessary analysis is to conduct multiple regression analysis taking total advertising cost for the dependent variable and the six components for the independent variables.

It is said that the main purpose of multiple regression analysis is either (1) to predict values of dependent variables as against given values of independent variables, or (2) to recognize and explain relations among variables. The difference between (1) and (2) is that of weights of concern rather than that of techniques of analysis. In (1) the main concern is prediction about dependent variables as exact as possible, while in (2) it is to estimate to what extent dependent variables are influenced by independent variables presuming some theoretical relation between the two. Accordingly the focus of analysis in (1) is the residuals while in (2) the regression coefficients. The aim of analysis in this section corresponds to that of (2). That is to say, the main concern is explanation of total advertising cost by means of social indicators—to find out the nature and extent of effects of the latter on the former—rather than prediction of advertising cost by prefectures and per capita.

So we decided to conduct regression analysis on such recognition but here a problem is that the correlation between principal components and dependent variables in regression analysis does not always becomes higher in order of the independent variables, that is, principal components 1, . . . , 6. For instance, by principal component analysis the contribution of component 1 (urbanization) is 34% and that of component 2 (saturation) is 13%, yet as a factor to explain variations of total advertising cost, component 2 with a smaller volume of information as a social indicator might be more important. Therefore it cannot always be said that a multiple regression analysis using all the six principal components significantly has higher explanatory power than that using fewer components. Furthermore it is said more desirable from the principle of parsimony to develop a model most simple with a small number of variables so long as a certain level of explanatory power is preserved.³⁾ Hence, now being provided with six variables as candidates of independent variables, a necessary

3) G. Zaltman & P. C. Burger, *Marketing Research*, p. 463.

work is to take up all possible cases of partial combination—cases of one variable, two variables and so on—, execute regression analysis independently on them, compare the results, and thus specify a regression equation that has high explanatory power and conforms with parsimony.

In this research, however, such possible cases amount to $2^6-1=63$ and so individual analysis on all cases is difficult. Thus it became necessary to adopt—instead of usual regression analysis—stepwise regression analysis in which only such variables as have high explanatory power above a certain level are picked up one by one.

This stepwise regression analysis has a merit in that it leads to selection of variables with most independent explanatory power only and thus enables analysis to evade the problem of multicollinearity. On the other hand in case the number of candidate independent variables is large compared with that of samples, in other words the number of observed values is smaller than three times of that of variables, there is born possibility of accidental introduction of some variable in the regression equation.⁴⁾ However, in this research by 47 samples and 6 candidate variables such possibility may be regarded as small.

Now in this stepwise regression analysis we took total advertising cost (by prefectures and per capita) for the dependent variable y , and set the six synthetic social indicators (urbanization, saturation, pettiness, peace-security, backwardness and household-size as the independent variables x_1, \dots, x_6 . Since this research aimed at recognition and explanation as mentioned already, both the dependent and independent variables were standardized at mean 0 and variance 1. And since all the candidate independent variables are principal components extracted through principal component analysis they were mutually non-correlative.

Regarding the relation between y and x , the signs of coefficients may be set as follows presuming hypothetical relations. First as for independent variable x_1 , urbanization, whose character is shown by its factor loadings as described in the previous section, the factors of annual sales per wholesale-retail shop, those per department store, and per-capita sales of department store are considered to have direct relations notably with advertising cost. Hence it is expected that as the urbanization is higher, advertising cost becomes larger, with its regression coefficient being a plus one.

As to independent variable x_2 (saturation), since the factors of population moves (decline of population growth and increase of population outflow) have direct effects on the calculation itself of observed values of the dependent variable (per-capita cost), it must have an appreciably intense plus relation. Again the number of retail shops and of advertising agencies per 1 million persons are expected to show plus correlations. On the contrary a decline in the factors of the ratios of department store and supermarket sales is supposed to lead to a

4) *Ibid.*, p. 463, p. 466.

decrease in advertising cost, hence a minus correlation. The result of offsetting between these plus and minus correlations is difficult to predict a priori. Regarding independent variable x_3 (pettiness) the ratio of petty retail shops, the number of supermarkets and sales of supermarkets are considered to be directly co-relative to advertising cost, in which the higher the pettiness, the smaller becomes the cost, hence a minus sign. As to x_4 (peace-security) presumption is difficult because no variables with direct relation with advertising are involved. Probably x_4 takes a plus sign but its intensity will not be so high.

As for x_5 (backwardness) direct relations are supposable notably with the ratios of department store and supermarket sales and food expenditure per worker's household, that is, the higher the backwardness, the smaller is the advertising cost, thus a minus sign.

Lastly x_6 (household-size) consists of consumption expenditure, miscellaneous expenses and income per worker's household. To look from these factors only, an intense plus relation with advertising cost is supposable. However, since this factor holds a high correlation also with per-household persons, per-capita income and consumption are not so large, and hence a priori definition of the relation with advertising cost is difficult.

Chart 4 shows final summary of the stepwise regression analysis. By the chart social indicators—independent variables to explain total advertising cost—are introduced in the regression equation in order of urbanization (principal component 1), pettiness (3) and the saturation (2), order different from that of principal components. The determination coefficient is a high of 67.9% by component 1 only, 83.3% by combining component 3, and reaches 89.6% by adding component 2. Because the factors of peace-security (component 4), backwardness (5) and household-size (6) do not satisfy the level of significance for introduction, the analysis stopped at the third step. It was found that a multiple regression equation with principal components 1, 2 and 3 as the independent variables explains total advertising cost most squarely.

Chart 4. Summary of Stepwise Regression Analysis

No. of step	No. of introduced variable	R	R^2	Incremental of R^2	F value at introduction
1	1	0.824	0.679	0.679	95.4
2	3	0.913	0.833	0.154	40.2
3	2	0.936	0.876	0.043	15.0

The regression equation at the final step is:

$$y = -0.015 + 0.814x_1 + 0.208x_2 - 0.391x_3$$

(15.158) (3.875) (-7.286)

Explanatory power or fitness of a regression equation is measured by the determination coefficient corresponding to the squared value of the multiple correlation coefficient. In this research the result is that three synthetic indi-

cators explain 87.6% of the variance of total advertising cost, and hence the precision may be said high. This means in other words that 87% of the variance of advertising cost was explained by a volume of information corresponding to 56% of the social indicators system. And the determination coefficient is significant at a 0.1% level. The adjusted determination coefficient is 86.7%, alike significant at a 0.1% level. Therefore the result of analysis above may be said to support Hypothesis Corollary I-1.

On another hand, to examine the relation between the three selected independent variables and total advertising cost, t value shown below the regression coefficients are good, and all are significant at a 1% level. To look the signs of the regression coefficients, urbanization x_1 is plus and pettiness x_3 is minus, directions of effects as was presumed. Contrastively saturation x_2 shows a minus result of offsetting.

Next, to observe the degrees of importance by noting the magnitude of the regression coefficients, first the following point must be paid attention. Since the independent variables x_1 , x_2 and x_3 are mutually non-correlative as the result of stepwise regression analysis, their partial regression coefficients coincide with single regression coefficients; by the standardization of y and x partial regression coefficients as the so-called β coefficient coincide with single correlation coefficients; and further the constant term is the mean of y and near zero.

As the result the importance of each independent variable is expressed by the absolute value of the partial regression coefficient, being respectively 0.8, 0.2 and 0.4. So it is understood that on total advertising cost urbanization has influence four times as great as saturation and two times as pettiness. On another hand to calculate for care the regression coefficient for three indicators excluded because of insufficient significance— x_4 (peace-security), x_5 (backwardness) and x_6 (household-size)—these are respectively 0.51, -0.024 and -0.061 , small values, and all are insignificant at a 5% level. This tells that these three indicators have little influence on total advertising cost. That x_1 , x_2 and x_3 have a pattern of significant relation with advertising may be said to back Hypothesis Corollary I-2.

Section III. Advertising Cost by Media and Social Indicators

—Canonical Correlation Analysis—

The regression analysis in the foregoing section was intended to clarify the relation between total advertising cost including four advertising media (by prefectures and per capita) and social indicators, and the result proved that the latter have high explanatory power over the former in conformity with Hypothesis.

However, even in case total advertising cost is at the same level for different prefectures, usually appreciable differences are found as for advertising cost classified by media, and so for our purpose it is necessary to analyze internal

structure of advertising cost dividing by the medium. Thus what is required next is to explicate the nature and intensity of relation between by-media advertising cost and social indicators.

Hypothesis II: By-media advertising cost is the function of social indicators.

Corollary II-1: Between by-media advertising cost and social indicators there exist statistically significant and intense relations.

Corollary II-2: Between by-media advertising cost and social indicators there are particular patterns of relation.

Here both by-media advertising cost and social indicators consist of plural variables. As the method of analyzing mutual relations between two sets of variables the following ones are alternatives: (1) to calculate single correlation coefficients for each and all pairs of variables of the two sets; (2) to put all variables of the two sets on factor analysis en bloc, and find out relations between the two sets through examination of factor loadings; (3) to conduct principal component analysis separately on the two sets of variable each and then observe correlations between the principal components of both; (4) to repeat multiple regression analysis between each variable of one set and variables of another set, and next inversely repeat this.⁵⁾

Among these four method, (1) is unsuitable because in the field of marketing or advertising a large number of variables are complexly interwound and these are not always mutually independent but often correlative. And it is difficult to examine all of such numerous correlations simultaneously and synthetically and to generalize their contents and properties.⁶⁾ As to method (2), since all variables are put on principal component analysis en bloc there is no guarantee that relations between the two sets are always found. In other words there is possibility that high factor loadings appear only with variables of one set and hence internal relations within one set only are obtained. In method (3) plural principal components independently extracted are sure to be independent within each set, yet there is possibility of correlation between those of different sets, for example, between component 1 of the first set and component 2 of the second, and so problems of interpretation may arise. For method (4) it poses a problem how to combine numerous results computed through repetition and to set forth relations comprehensively.

For the sake of finding out relations between two sets of variables, beside these method it is possible to use canonical correlation analysis which already in 1935 Harold Hotelling advocated. By Hotelling this analysis is identical with conducting principal component analysis independently on two sets of variables and next, by rotation of the component structure, setting the weight of each variable so that the correlation between the components of one set and those

5) W. E. Cooley & P. R. Lohns, *Multivariate Data Analysis*, p. 155.

6) G. A. Churchill, Jr., *Marketing Research*, p. 510.

of the other become highest.⁷⁾ Accordingly it is a technique of seeking correlative principal components separately for two sets of variables, and hence sits on the extension line of the said method (3). However, by this canonical analysis the variables of both sets are transformed to new variates, i.e. canonical variates, that should show the largest correlation between the two sets, by rotation of component structure. That is to say, whereas in principal component analysis the principal components are obtained by rectangular transformation of the primary coordinate, in canonical correlation analysis these are sought by oblique transformation, and hence even canonical variates different in the dimension between the first and second sets become non-correlative, aloof from the interpretation problem. Next, this analysis, in case one of the two sets has only one variable, coincides with the algorism to find multiple regressions in method (4), and so may be said an expanded model of multiple regression analysis, and in addition its particularity lies in that it analyzes two variable groups simultaneously and synthetically.

The aim of such canonical correlation analysis is said some one or combination of some ones of the following.⁸⁾

- 1) To test whether two sets of variables are independent.
- 2) To determine what variable of one group is most contributive to the relation between two groups.
- 3) To find out such linear combination of dependent and independent variables as makes correlation largest.
- 4) As to each sample, from the linear combination score of one variable group, to infer that of the other group.

Since the purpose here is to grasp the intensity and nature of comprehensive and macro-level mutual relations between by-media advertising cost and social indicators, the above aims 1, 2) and 3) are relevant to this research. Therefore we decided to apply this method in order to test our Hypothesis.

On one hand for the dependent variables we set four kinds of advertising media—television, newspaper, radio, magazine—, and on the other hand as the independent variables the above-described six principal components—urbanization, saturation, pettiness, backwardness, public peace-security, and household-size.

The result of analysis is as shown in Chart 5, presenting canonical correlations, canonical roots, χ^2 values, degrees of freedom, and weights of variables each. To look canonical correlations, they are 0.960, 0.804, 0.690 and 0.296 respectively for the first to fourth variates. The canonical root is the squared value of each correlation. Among these four the first correlation surpasses every one of the correlation coefficients in the regression analysis described in the previous section, and is greater than every one of the absolute values of 4×6

7) J. H. Myers & E. Tauber, *Market Structure Analysis*, p. 84.

8) P. Green, *Research for Marketing Decisions*, p. 496.

pieces of simple correlations in the correlation matrix. By testing significance⁹⁾ on these correlations the first to third ones were highly significant at 0.005 but the fourth was remarkably lacking in significance. Accordingly the fourth variate is ignorable, and so subsequent analyses were confined to the first three. Thus three significant dimensions were found that relate by-media advertising cost and social indicators.

This test of significance of canonical correlations tells presence of some relation between by-media advertising cost and social indicators. However, it is necessary to know the degrees of intensity of the relations. As a measure for this usually canonical roots as the estimates of variance shared by two variable groups are used. This is akin to the step of seeking determination coefficients by taking squared values of multiple correlation coefficients as a measure of variations of independent variables combined with variations of dependent variables in regression analysis. It is seen by Chart 5 that the first to third canonical variates have relations of appreciable intensity, notably the first variate.

The above result reveals presence of significant, intense and comprehensive relations between the variable group of by-media advertising cost and that of social indicators, supporting Hypothesis Corollary II-1.

Following examination of the presence and intensity of relations between the two variable groups, our next step is investigation of the character or patterns of such relations as Corollary II-2. As a measure for this generally canonical weight (canonical coefficient) calculated for each standardized variable is used. The sign of this weight shows direction of impact of the variable, and the magnitude shows intensity of impact.

To examine the weights of variables in the first, second and third canonical variates, comprehensive patterns of relations between by-media cost and social indicators are as follows.

First to look the weights of the first variate, among the dependent variables the magazine cost is plus and highest, and among the independent variables the urbanization is plus and highest. Thus magazine advertising and urbanization have a plus correlation, that is in regions high in this cost tend to be high in urbanization. As for the second variate it can be regarded that regions with great magazine advertising and small newspaper advertising tend to be high in saturation and peace-security. Within this, magazine advertising has a plus correlation especially with saturation, and newspaper advertising has a minus correlation especially with peace-security. As to the third variate TV advertising cost has minus correlations with pettiness and household-size, which is interpreted to tell that in regions of small TV advertising cost the pettiness and household-size are high.

The above analysis may be said to show presence of some certain patterns of relation between by-media advertising cost and social indicators conforming

9) C. Okuno et al., *Taheiryō Kaisekihō*, p. 379.

Chart 5. Result of Canonical Correlation Analysis

Item	Canonical variate			
	1	2	3	4
Canonical correlation	.960*	.804*	.690*	.296
Canonical root	.921	.646	.476	.087
χ^2 value	175.4	72.4	30.4	3.8
Degree of freedom	24	15	8	3
Dependent variable				
1. TV ad. cost	.072	.299	— .981	— .071
2. Newspaper "	.249	—1.113	— .180	—1.846
3. Radio "	.194	— .424	— .199	2.154
4. Magazine "	.605	1.334	.669	— .261
Independent variables				
5. Urbanization	.876	— .369	.256	.081
6. Saturation	.346	.721	— .081	.338
7. Pettiness	— .266	.071	.803	.474
8. Peace-security	.146	.483	.077	— .108
9. Backwardness	.052	.321	.285	— .720
10. Household-size	— .018	— .080	.442	— .353

* Significant at 0.005.

with Corollary II-2.

Summary and Further Tasks

The aim of this research was to explicate the relation between prefectural advertising cost and social indicators. The main concern was on to what extent and how the latter can explain the former. As the procedure of analysis first we constructed the theoretical and conceptual framework of the system of social indicators, second picked out fifty individual social indicators according to the framework, and third conducted principal component analysis in order to summarize the fifty indicators into a small number of composed synthetic indicators, by which we extracted six principal components (urbanization, saturation, pettiness, backwardness, peace-security and household-size). Fourth we performed regression analysis taking prefectural total advertising cost for the dependent variable and six principal components (synthetic indicators) for the independent variables, by which it was found that three synthetic indicators (urbanization, saturation and pettiness) can sufficiently explain total cost. Fifth in order to find out the relation between by-media advertising cost as internal structure of total cost and social indicators, we conducted canonical correlation analysis, through which the above-described patterns of relation were known to be present.

Thus by the result of these analyses it was confirmed that both Hypotheses I and II are supportable and that advertising cost is the function of social

indicators. This points out that, as has been mentioned above concerning our problem consciousness, it is inappropriate to analyze only the flows of influences from advertising to society independently of the inverse flow, and it is important in studying influences of advertising to take into account that advertising exists within society and is affected by various properties of society. Lastly a remark must be added about future tasks of research. These are relevant to the techniques of analysis employed in this study. The techniques were principal component analysis, multiple regression analysis and canonical correlation analysis. Among these three multiple correlation analysis is the oldest one of statistical methods introduced into marketing research, and principal component analysis also has the history of application in marketing. On the contrary it is only recent that canonical correlation analysis has been introduced. Therefore we should like to present some words on its character in order to clarify tomorrow's tasks.

As regards the causes of such delay of application of this method, the first is that its presence itself is not well known, and the second may be that this technique, which treats comprehensive relations between variable groups, lacks exact measures of relations between individual variables and their intensity. And as the third cause, which relates to the second, difficulty of interpretation of outputs may be pointed out. Although in recent years new developments are seen as for the second and third points, these were heavy problems encountered in this research.

In respect of these problems this canonical correlation analysis, at its present stage of development, should be regarded as useful as a technique of exploring research in quite unknown fields where beforehand knowledge and information about the relation between two sets of variables are almost absent.¹⁰⁾ It should be said what gives an insight into the magnitude and patterns of relation, and it is to be hoped that, after much information has been obtained by this exploring method, the tentative conclusions reached are analyzed by other methods in more detail and confirmed. In this sense the object of this research is considered to be a quite uncultivated field requiring exploring study.

However, the three dimensions of relation obtained here—between magazine advertising cost and urbanization, between newspaper-magazine cost and saturation, between TV cost and pettiness-household-size—must be looked as tentative conclusions, which have a meaning as a material to be succeeded to later study and specific examination. Interpretation and understanding of the relations of three dimensions extracted by canonical analysis and further clarification of causal relations beyond correlations will be advanced on that step. This is a future task remaining.

(Addition) This paper consists of two parts: one representing the portion

10) J. N. Sheth, *Multivariate Methods for Market and Survey Research*, p. 129.

with which the writer was charged in a research project of the Japan Academy of Advertising, "In Search of Social Indicators for Advertising," and another the writer developed after the finish of this project. Section I corresponds with the former and Sections II and III the latter. Hence whole responsibility for description is with the writer.

For calculations the BMD program of the Information Processing Center of Keio University was used, and many thanks shall be expressed to the help of students in my seminar class for calculation work and data collection.