A MULTI-VARIATE ANALYSIS OF CHILDREN-EVER-BORN FOR CURRENTLY-MARRIED WOMEN[1)]

*Sang Tae Park**

The purpose of this paper is to study the effect of residential background on fertility measured in terms of children-ever-born to currently-married women aged 25–44. Most data on differential fertility are difficult to interpret because it is not certain whether the differences observed are attributable to the classifying variable or to some other variables associated with it. The question pursued in this study is to assess how much variation in fertility can be accounted for by each factor in gross terms without controlling associated factors and in net terms when associated factors are controlled. The data used here are almost exclusively from the 1971 Korea National Fertility-Abortion Survey.

The indicator of fertility used is children-ever-born (CEB) rather than the synthetical cohort rates derived from data for a fixed period of time. Statistical technique used for this analysis is the multiple classification analysis which is a form of multivariate methods. The results of this analysis indicate that the cumulative impact of education, occupation, and residential background factors has been substantial in the recent past. The analysis implies that advances in education, industrialization, and urbanization have been important factors in the decline of fertility in Korea in recent decades. The author predicts that these factors will continue to exert a strong influence towards moderation of fertility in association with a late average age at marriage, a decreasing desire for large families, and increasing practice of birth control.

I. INTRODUCTION

Most data on differential fertility are difficult to interpret because it is not certain whether the differences observed are attributable to the classifying variable or to some other variables associated with it. The question pursued here is to assess how much variation in fertility can be accounted for by each factor in gross terms without controlling associated factors and in net terms when associated factors are controlled. In this way the relative importance of each factor or group of factors can be ascertained and compared with the factor of residential background.

There are not many sources of data on these factors at the national level. For this reason the data used here are again exclusively from the KIFP National Fertility Survey of 1971.[2)] Most of the factors considered there are for currently-married persons. Therefore the present analysis is limited to currently-married women.[3)]

We will begin with a discussion of multiple classification analysis, which is the statistical technique employed here. An examination of the factors affecting fertility is presented in section 3 in order to discover those which are most relevant. Sections 4 and 5 present the gross and net effects of the factors and the fertility variances explained by each.

*Professor of Sociology, Chun-Nam National University, Gwang-Ju, Korea, and Research Associate of the PDSC, Seoul National University.

1) This paper is a revised version of a chapter presented in Sang Tae Park, Urbanization and Fertility in Korea, 1960–70, an unpublished Ph.D. Dissertation, University of Pennsylvania, March 1978. The author would like to express his sincere thanks to Professors John D. Du rand and Vincent H. Whitney for their kind suggestions and encouragements.

2) The author would like to acknowledge the Population Council, New York, and the Korean Institute for Family Planning for their provision of computer tapes of the 1971 Korea Fertility-Abortion Survey data.

3) For a list of factors used, see p. 32.

II. MULTIPLE CLASSIFICATION ANALYSIS

Multiple classification analysis (hereafter MCA) has many advantages for such analysis as the present one in which most of the factors are nominal variables. The following statement summarizes the advantages and limitations of this technique:

> [MCA] is a technique for examining the interrelationship between several predictor variables and a dependent variable within the context of an additive model. Unlike simpler forms of other multivariate methods, the technique can handle predictors with no better than nominal measurement, and interrelationships of any form among predictors or between a predictor and the dependent variable. The dependent variable, however, should be an intervally scaled (or a numerical) variable without extreme skewness, or a dichotomous variable with two frequencies which are not extremely unequal.
> The statistics printed by the program show how each predictor relates to the dependent variable, both before and after adjusting for the effects of other predictors, and how all the predictors considered together relate to the dependent variable. (Andrews *et al.*, 1973, p.1)

As Andrews states, the MCA accepts predictors in nominal scales. Therefore, the linearity assumption, which is required in conventional multiple regression analysis, is not necessary. The MCA is an extension of dummy variable multiple regression analysis, in which each explanatory variable is represented by membership in categories.

In an additive model the sum of the net effects of predictors equals the overall effect of these predictors on the dependent variable. In other words, there is no interaction between the predictors; they have orthogonal relationships with each other. However, this is not true of the factors affecting fertility. For instance, we know that most of the factors such as education, occupation, residence, and age are interrelated. Therefore, the joint effect of the predictors may be smaller or greater than the sum of their net effects. To minimize such interactions we have made some composite variables. However, we shall see that the overall effects are mostly smaller than the sums of the net effects because of interactions.

The computer package program used is the SPSS version of an MCA program. Unlike the OSIRIS program of the University of Michigan (see Andrews *et al.*, 1973, Appendix A), which accepts a large number of predictors, the SPSS accepts up to five independent factors as predictors and up to five variables as covariates. In a program of this design the term *covariate* is used to designate a metric independent variable and the term *factor* is used to designate a nonmetric, categorical independent variable, as in the less complex analysis of variance. Although the metric covariates are inserted into a design to remove extraneous variation from the dependent variable, thereby increasing measurement precision, the effects of covariates and factors can be considered as being of equal interest and there is no causal priority between them (Nie *et al.*, 1975, Chapter 22).

III. SELECTED FACTORS AFFECTING FERTILITY

Factors affecting fertility are many. For present analytical purposes the factors are placed into three major groups, demographic, attitudinal, and social-economic-residential. The primary reason for such a grouping is to see the effects of each group as a whole on ferility in addition to the effect of each single factor within each group, with all the other factors controlled. The variables are selected and grouped without applying any particular formal model. The approach may be viewed as heuristic, for we adopted the guiding principle that the fertilty of individuals is a result of the combined workings of demographic, attitudinal, and social-economic-residential factors. All the factors are interrelated to a greater or lesser

degree. Strictly speaking, there is no single factor which belongs only to one particular group. For example, age is a biological factor when we view aging as a physiological process, but it becomes a demographic factor when it is analyzed in relation to the basic population processes. Religion may by dealt with as a status factor, but it may also be viewed as a cultural factor in an anthropological framework; and religiosity, a concept referring to religious participation, may be used as a motivational-attitudinal factor when it is considered in a psychological framework.

1) Socio-Economic and Residential Background Factors

The selection of the social and economic indicators is based on a United Nations publication which summarizes statistical evidence of associations between social and economic variables and fertility derived from studies in many countries over time (United Nations, 1973, PP. 96-105). The variables include urban-rural residence, educational status, economic status, occupational groups, employment of women, religion, and ethnic groups. All these indicators are available from the 1971 Korea Fertility-Abortion Survey except ethnic groups, which are not relevant to Korea because the ethnic populations other than Korean are very small less than one per thousand of the total population. The list of factors considered in the United Nations report is by no means exhaustive. For example mass media variables are frequently used in fertility studies. However, newspaper readership was the only variable on exposure to mass media included in the 1971 Korea Fertility-Abortion Survey. Instead, the survey focused on exposure to government family planning programs such as frequency of home visits received, attendance at group meetings, and visits to health centers. This was because the purpose of the survey was primarily to evaluate the efficiency and effectiveness of the government family planning programs. Of six social and economic variables, working status of women is dropped since preliminary trials show that it has the least effect on fertility in terms of eta square value (zero order correlation). However, the fact that the eta coefficient shown by the KIFP data is least for this variable does not necessarily mean that in Korea the employment status of women has the least impact of all factors on fertility. The data on employment status were gathered with reference to a specific period, *i.e.*, for the five years preceding the survey. This is arbitrary in the sense that the coefficient does not reflect the cumulative impact lifetime participation in the labor force on number of children-ever-born. Education of husband and wife are combined into one variable in view of the high correlaton between these two.[1)] Occupation of husband is a composite variable reflecting the stated occupation of husband and his employment status. Thus, the couple's residential background, educational level, material property, occupation of husband, and religion of wife are variables which are grouped together in our analysis.

2) Demographic Factors

Among various demographic factors available from KIFP data, three—marital status, age, and age at marriage—have been selected for analysis. These are thought to be most important in explaining fertility variances.

Marital status is used for selection since we are dealing here only with currently married couples.

Age of women is, no doubt, the most important single demographic factor in explaining variance in the number of children-ever-born (CEB). Moon, for example, found that age alone accounted for 67 percent of the variance in CEB among all women aged 15–54 in

1) The Pearsonian correlation coefficient between the education of husbands and the education of wives aged 35-44 is .66 at the .001 significance level.

the 1971 KIFP Survey (Moon, 1973, p. 18). Despite the fact that we have limited our analysis to women aged 25–44 (25–34 and 35–44 separately), it seems likely that age will still account for a large part of the variance within each of the two ten-year age groups. Therefore, age is considered an independent factor and at the same time a controlling factor.

It has been shown that postponement of age at marriage has contributed substantially to the recent reduction of fertility in Korea. Based on the same data we have used from the 1971 Korea Fertility-Abortion Survey and applying their computer simulation model, Mode and Littman found that among Korean women who had never practiced modern contraception, abortion, or sterilization, those who married early (low ages) would have an average of 5.99 live-births, those who married somewhat later (medium ages) would average 5.27 live-births, and those who married late (high ages) would have an average of 4.93 live-births at the end of their reproductive period. The low, medium, and high ages at marrige in the simulation model corresponded to the age-at-marriage distributions of the cohorts in the age groups 45-49, 30-34, and 25-29 in 1971. Thus these authors found that rising age at marriage alone could reduce the average number of live births from six to five (Mode and Littman, 1975,p. 25). Although a rising age at marriage does not always exert an influence on completed fertility,[1] it might be expected to do so in countries such as Korea where most women marry near the age of maximum fecundity.[2] However, a rising age at marriage has little effect on fertility in a society where fertility is strictly controlled and the desired size of families is low. Therefore, the impact of changes in age at marriage on cumulative fertility will differ among different age groups as well as among countries with different fertility norms and control practices.

It is pertinent here to indicate why other factors which may be important in the explanation of fertility, and some of which are available from the data set, have not been included in the present analysis. For currently married women duration of marriage, or total time actually spent within marital union, is in most cases a function of present age and at marriage; therefore, its inclusion as an additional variable in our analysis would be redundant.

Another important factor which can affect fertility is subfecundity, which is defined here as sub-normal capacity to reproduce.[3] There are three types of subfecundity--coital inability, conception failure, and the inability to carry a conceptus to a live birth. Subfecundity is diffiicult to measure. The data relating to fecundity and subfecundity presented in Table 1 are not appropriate as indicators of subfecundity because the information is based on the respondents' judgments concerning their reproductive ability at the time of the survey. Moreover, a large number of women categorized as sterile were actually beyond menopause. We can see from Table 2a that few women in the age group 25–44 had not had either a pregnancy or a child born alive. Thus, there is a negligible incidence of primary sterility. However, primary sterility is only one factor in subfecundity and it is possible that

1) A study in India concluded that the postponement of age at marriage had not reduced completed fertility significantly because rising age at marriage did not extend the ages where fecundity is restricted (see K.C. Basabarajappa and M.I. Belvalgidad, "Changes in Age at Marriage of Females and Their Effects on the Birth Control in India," *Eugenics Quarterly,* Vol. 14, No. 1 (March 1976), pp. 14-26)

2) For a recent evaluation of the evidence on peak and declining ages with respect to fecundity, see Rose E. Frisch, "Population, Food Intake, and Fertiliy," *Science,* Vol. 199, No. 4324 (6 January 1978), pp. 23-30, especially the age curves of "procreative power" for male and female, p. 23 and p.26.

3) For a discussion of subfecundity from the demographic perspective, see Joseph A. McFalls, Jr., *Psychopathology: Its Impact on Individual and Population Fecundity,* Ph. D. dissertation, University of Pennsylvania, 1977, pp. i-xlviii.

Table 1 **Self-Judgment on Fecundity for Currently-Married Women Aged 35-44, by Residence, 1971**

Self judgment	Urban*		Rural*		Total	
	Number	Percent	Number	Percent	Number	Percent
Fecund	380	57.2	785	66.0	1165	62.9
Don't know	92	13.9	173	14.6	265	14.3
Tubal ligation	47	7.1	37	3.1	84	4.5
Other operation	18	2.7	14	1.2	32	1.7
Natural sterility**	98	14.7	150	12.6	248	13.4
Others	29	4.4	30	2.5	59	3.2
Total	664	100.0	1189	100.0	1853	100.0

* Urban includes cities only. Rural includes towns as well as rural villages.

** Mostly menopause.

Source: Korean Intitute for Family Planning, *Report on 1971 Fertility Abortion Survey* (Seoul: KIFP, 1973), pp. 54-55.

many of the women were subfecund in other respects. Unfortunately, data on secondary sterility and other fecundity impairments are not available for the women in our sample.

Historical population studies have emphasized the importance of breast feeding, postpartum amenorrhea, and infant mortality in explaining fertility variations. However, a study by Knodel and van de Walle, covering some regions of Europe prior to their fertility decline, demonstrated that the importance of lactation and postpartum amenorrhea as controls disappeared when infant mortality was held constant while a high correlation between infant mortality and fertility levels persisted. These authors concluded that there was little opportunity for infant mortality to influence fertility by curtailing lactation and postpartum amenorrhea (Knodel and van de Walle, 1967). It may be inferred from the finding that infant mortality is also associated with other factors affecting fertility, particularly attitude and motivation. In fact, a more recent study by Knodel, using data from various regions of Europe and the United States during various periods from 1895 to 1947, shows that infant mortality was higher among artificially-fed children than among breast-fed children in all of the regions. Recent rapid abandonment of breast feeding in parts of the world, where contraception is not in common use, may mean both higher birth rates and, especially among the poor, higher infant death rates. The author concludes that higher infant mortality rates may reduce rapid population growth temporarily, however, in the long run higher infant mortality rates could retard the spread of family planning practice. Thus, the demographic impact will depend upon how coincidental the changes in mortality and fertility are (Knodel, 1977).

The number of children reported in our survey data as having died is not the same as the number of children born alive who died within one year of birth (Tables 2a and 2b). A considerable number of women had lost one or more children aged over one year. In view of the imperfectness of the data, inclusion of infant mortality as a variable is not possible in the present analysis.

3) Attitudinal Factors

KAP studies—that is studies of knowledge of, attitude toward, and practice of family planning—have now been conducted in countries around the world and almost all fertility surveys deal with various indicators of KAP.

Answers to questions on knowledge of birth control methods may be treated as attitudinal (or motivational) factors when a proper scoring technique is developed or adopted. The majority of women in our sample had heard of one or more methods of birth control

Table 2a **Percent Distribution of Ever-Married Women, Aged 35–44, By Number of Children-Ever-Born, Number of Living Children, Number of Dead Children, and Number of Induced Abortions by Residence, 1971**

Descriptions	City	Town	Rural	Total
Number of pregnancies				
0	1.8	0.7	1.0	1.3
1–2	8.5	3.9	5.4	6.4
3–4	21.1	9.8	10.9	14.6
5–6	28.7	41.1	34.3	32.8
7+	39.9	44.4	48.6	44.9
Number of children ever born				
0	2.3	0.7	1.2	1.6
1	6.5	1.3	2.6	3.9
2–3	23.1	6.6	10.4	14.9
4–5	42.2	45.7	31.8	36.7
6+	25.8	45.8	53.9	42.8
Number of living children				
0	3.5	0.7	1.4	2.1
1	7.3	2.6	3.6	4.9
2–3	28.6	13.7	14.5	19.7
4–5	46.5	55.6	47.2	47.6
6+	13.7	26.9	32.8	25.2
Don't know	0.4	0.7	0.5	0.5
Number of dead children				
0	65.9	56.9	51.0	56.6
1	22.5	25.5	29.3	26.5
2	8.4	10.5	12.2	10.6
3+	4.1	7.2	7.6	6.1
Number of induced abortions				
0	50.4	55.6	74.9	64.4
1	16.6	19.6	13.6	15.2
2	13.5	11.1	5.7	9.0
3+	19.5	13.9	5.8	11.3
Total number of women	772	153	1152	2077

Source: 1971 Korea Fertility-Abortion Survey (tape)

including induced abortions. As Table 3 indicates, no women in Seoul, the country's largest city, gave a lack of knowledge of at least one method as a reason for not practicing birth control currently.

There are some data on attitudes of individuals toward contraception and family size in the 1971 Korea Fertility-Abortion Survey. However, data on attitudes toward family planning are not available. Presumably the lack of such data is due to the ambiguity of the concept and to difficulties in constructing a question on general attitude toward family planning.[1] There are two variables available on attitude toward family size; the additional number of children wanted and the ideal number of children. Desired family size is generally the combination of number of children already born and number of additional children wanted although some parents may actually desire fewer children than they already have. However, when we have nearly completed fertility, the desired number of children becomes roughly equal to CEB. There are no data on the number of unwanted CEB, and in any event few parents are likely to exclude them from their expressed desired number of children.

1) However, attitude toward induced abortion is reported in the survey.

Table 2b **Average Number of Pregnancies, Children-Ever-Born, Living Children, Dead Children, and Induced Abortions for Ever-Married Women Aged 15–54 by Five-Year Age Groups and by Residence, 1971**

Descriptions	Age								
	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	Total
Average number of pregnancies									
Total	0.87	1.63	2.90	4.67	6.03	6.65	6.84	7.05	5.08
Urban	1.00	1.62	2.75	4.52	5.80	6.24	6.78	6.65	4.70
Town	1.00	1.41	2.90	4.54	6.25	7.06	6.83	6.85	5.07
Rural	0.80	1.67	3.05	4.83	6.15	6.88	6.88	7.27	5.37
Average number of children ever born									
Total	0.23	1.09	2.24	3.64	4.75	5.53	6.08	6.44	4.17
Urban	0.27	0.94	1.93	3.10	4.02	4.65	5.61	5.80	3.46
Town	0.50	0.87	2.34	3.84	4.85	5.80	6.02	6.44	4.21
Rural	0.17	1.28	2.53	4.12	5.20	6.10	6.38	6.76	4.70
Average number of living children									
Total	0.26	1.05	2.09	3.32	4.20	4.63	4.75	4.84	3.54
Urban	0.30	0.91	1.82	2.88	3.60	3.99	4.50	4.46	3.01
Town	0.50	0.85	2.19	3.46	4.47	4.78	4.68	5.18	3.62
Rural	0.17	1.21	2.34	3.69	4.56	5.05	4.91	4.99	3.93
Average number of dead children									
Total	0.00	0.05	0.15	0.33	0.54	0.91	1.34	1.61	0.63
Urban	0.00	0.02	0.11	0.21	0.42	0.68	1.13	1.35	0.45
Town	0.00	0.03	0.14	0.38	0.38	1.03	1.32	1.27	0.58
Rural	0.00	0.07	0.19	0.43	0.64	1.06	1.48	1.78	0.78
Average Number of induced abortions									
Total	0.06	0.16	0.28	0.62	0.92	0.78	0.43	0.16	0.53
Urban	0.18	0.26	0.40	0.98	1.42	1.21	0.82	0.35	0.83
Town	—	0.18	0.17	0.37	1.11	0.91	0.51	—	0.52
Rural	0.03	0.05	0.17	0.31	0.57	0.45	0.17	0.07	0.30

Source: 1971 Korea Fertility-Abortion Survey (tape)

Table 3 **Precentages of Currently-Married Women Aged 15–54 Who Stated "Don't Know the Method" as a reason for not Practicing Contraception at time of Survey, by Residence, 1971**

Age	Percent				Sample frequency			
	Seoul	Other Urban	Rural	Total	Seoul	Other Urban	Rural	Total
15–19	0	0	0	0	8	3	36	47
20–24	0	1	3	2	120	136	291	547
25–29	0	1	2	2	227	261	582	1,070
30–34	0	4	4	3	220	291	649	1,160
35–39	0	3	3	2	167	211	686	1,064
40–44	0	2	4	3	119	167	502	788
45–49	0	1	3	2	81	110	360	551
50–54	0	3	2	2	42	67	285	394
Total	0	2	3	2	984	1,246	3,391	5,621

Source: Korean Institute for Family Planning, *Report on 1971 Fertility-Abortion Survey* (Seoul:KIFP, 1973), pp.104-105.

Ideal number of children, another variable with respect to family size, is used in our analysis. Data on the ideal number of children result from the survey question, "Generally, without consideration of your own personal situation, how many children do you think is the appropriate number for a woman to have?" (Moon, *et al.*, 1972, Appendix 3, p. 166). Ideal number of children has been criticized on the basis of its high correlation with actual or completed family size. In other words, it is argued that the ideal tends to be what has actually occured (Hauser, 1967). For women aged 35–44 in our sample, there is a Pearsonian correlation coefficient of 0.36 (significant at the 0.001 level) between children-ever-born and ideal number of children. This indicates only a moderate degree of correlation.

While the practice of birth control, including induced abortion, influences fertility, it is also influenced by CEB. Many women resort either to contraceptives or to abortions in order to limit family size and not simply for spacing their births. Although we have data on birth control practices,[1] this variable is not included in the analysis on account of the circular relationship.

IV. GROSS AND NET DEVIATIONS

The eight independent variables and one dependent variable which we have used in our analysis are as follows:

Independent variables:

I. Demographic factors

Marital status (currently married women only)

1. Age of woman (25–34 and 35–44 separately)
2. Age at marriage of woman

II. Attitudinal factor

3. Ideal number of children

III. Social, economic, and residential factors

4. Educational level of couple
5. Occupation of husband
6. Material property
7. Religion
8. Residential background of couple

Dependent variable:

9. Number of children-ever-born

The results of the MCA analysis are presented in Table 4 for the wives aged 25–34 and 35-44 separately. The MCA calculates for each category of an independent variable gross and net deviations from the grand mean of the dependent variable. The gross deviation represents the extent to which respondents in a given category are above or below the average of the dependent variable. It is similar to the zero order relation in conventional correlation analysis. The net deviation indicates to what extent respondents in a given category of the independent variables are above or below average for the dependent variable, children-ever-born, after controlling for the effects of the other specified independent variables.

The grand mean is 3.28 CEB for women aged 25-34 and 4.88 for women aged 35-44. Despite the fact that we limited our observation to women in two ten-year age groups as a way to control the age effects, age within each ten-year group is still one of the most powerful factors. It shows large deviations both in gross and net terms. The direction of deviation

1) For the proportions of women who have ever practiced contraception or induced abortions classified according to social, economic, and residential characteristics, see Table 6.

Table 4 **Gross and Net Effects of Demographic, Attitudinal, and Social-Economic-Residential Factors on Number of Children-Ever-Born for Currently-Married Women Aged 25–34 and 35–44**

Factors	25–34			35–44		
	Number of women	Deviations from mean		Number of women	Deviations from mean	
		Gross	Net[a]		Gross	Net[a]
Age			A. Demographic factors			
25–34 / 35–44						
25 / 35	188	−0.90	−0.86	235	−0.48	−0.26
26 / 36	210	−0.80	−0.77	209	−0.34	−0.20
27 / 37	230	−0.74	−0.63	240	−0.23	−0.12
28 / 38	207	−0.52	−0.44	169	−0.02	0.03
29 / 39	235	−0.16	−0.17	211	0.21	0.20
30 / 40	226	−0.02	−0.04	181	0.15	0.07
31 / 41	213	0.37	0.32	167	0.11	0.01
32 / 42	245	0.63	0.57	147	0.27	0.12
33 / 43	236	0.75	0.71	143	0.36	0.15
34 / 44	243	1.02	0.95	153	0.41	0.21
Age at marriage						
15 and under	38	1.35	1.18	233	0.67	0.59
16–17	201	0.98	0.85	547	0.32	0.27
18–19	519	0.56	0.49	526	0.07	0.09
20 and over	1475	−0.37	−0.32	549	−0.67	−0.61
Total number and mean	2233	3.28		1855	4.88	

Deviations: net[a] controlling the other factor in the demographic group.

Table 4 Continued

Factors	25–34				35–44			
	Number of women	Deviations from mean			Number of women	Deviations from mean		
		Gross	Net[a]	Net[b]		Gross	Net[a]	Net[b]
			B. Attitudinal factor					
Ideal number of children								
Three and under	1223	−0.38	n.a.	−0.22	658	−0.47	n.a.	−0.39
Four	571	0.27	n.a.	0.14	556	−0.02	n.a.	−0.02
Five and over	439	0.71	n.a.	0.44	641	0.51	n.a.	0.41
Total number and mean	2233	3.28			1855	4.88		

Deviations: Net[a] controlling other factor in attitudinal group—not applicable.
Net[b] controlling the factors in demographic group.

Table 4 Continued

Factors	25–34					35–44				
	Number of women	Deviations from mean				Number of women	Deviations from mean			
		Gross	Net[a]	Net[b]	Net[c]		Gross	Net[a]	Net[b]	Net[c]
C. Social-economic-residential factors										
Education of woman and husband*										
Both no education	105	0.89	0.72	0.29	0.21	301	0.56	0.35	0.11	0.08
Primary or less	687	0.47	0.32	0.19	0.16	698	0.23	0.12	0.07	0.06
Middle or less	478	−0.10	−0.09	−0.02	−0.03	347	−0.18	−0.10	−0.04	−0.04
High or less	610	−0.29	−0.21	−0.12	−0.10	328	−0.37	−0.20	−0.05	−0.04
College or less	348	−0.55	−0.35	−0.21	−0.18	178	−0.82	−0.48	−0.26	−0.20
Occupation of husband										
Farmer, fisherman	631	0.50	0.18	0.14	0.08	742	0.43	0.19	0.18	0.12
Other non-professional	1,068	−0.11	−0.07	−0.05	−0.02	751	−0.17	−0.12	−0.11	−0.07
Professional and wage earning clerical and sales workers	529	−0.37	−0.06	−0.07	−0.05	359	−0.53	−0.15	−0.14	−0.10
Material property										
Low (0–2)	728	0.29	0.03	−0.05	−0.05	623	0.30	0.02	0.05	0.05
Middle (3–5)	1,060	−0.09	−0.04	−0.01	0.00	843	−0.02	−0.00	−0.02	−0.02
High (6+)	440	−0.27	0.05	0.09	0.10	386	−0.46	−0.03	−0.05	−0.04
Religion										
No religion	1,477	0.07	−0.01	0.01	0.01	1,208	0.11	0.00	0.01	0.01
Buddhist and Confucian	466	−0.01	0.12	0.00	0.00	433	−0.14	0.04	0.02	0.02
Christian	285	−0.35	−0.13	−0.06	−0.05	201	−0.37	−0.10	−0.10	−0.08
Residential background of woman and husband										
Both rural	1,126	0.29	0.12	0.07	0.06	1,101	0.28	0.14	0.12	−0.10
Both town, or one town, the other rural	204	0.03	0.09	0.12	0.10	161	0.05	0.12	0.15	0.15
One urban, the other rural or town	512	−0.27	−0.14	−0.06	−0.04	346	−0.41	−0.25	−0.21	−0.19
Both urban	386	−0.51	−0.23	−0.20	−0.17	244	−0.70	−0.38	−0.33	−0.26
Total number and mean	2,228			3.18		1,852			4.88	

Deviations: Net[a] controlling other factors in SER group;
Net[b] controlling other factors in SER and demographic groups;
Net[c] controlling all other factors.

* The highest level of education received by either or both partners.

Source: 1971 Korea Fertility-Abortion Survey (tape).

by age is of course positive. In Table 4 net^a deviations refer to control of the other demographic variable only, *i.e.*, age at marriage, and not of attitudinal, social, economic, and residential factors. As expected, the deviations are more prominent in the younger age group, 25-34. The net^a deviations decrease slightly in the 25-34 age group and considerably in the 35-44 age group. In other words, the apparent effect of age on the average number of CEB is exaggerated by its association with age at marriage.

The negative impact of increasing age at marriage on the CEB is shown to be equally important in both age groups at the gross level. In terms of net^a, when the present age is controlled, the deviations are reduced slightly in both age groups. This indicates that age at marriage exerts influence on CEB not simply because of its association with age.

Ideal number of children (INC) in gross terms shows a strong positive relationship with CEB in both age groups. The deviations of CEB are smaller in the younger age group and greater in the older age group than the gross deviations of CEB according to age or age at marriage. However, in net^b deviations, where demographic factors are controlled but social-economic-residential (SER) factors are left uncontrolled, the CEB deviations according to INC are decreased considerably in the 25-34 age group whereas the deviations are reduced only slightly in the 35-44 age group. The result seems to be due in part to stronger intervention of demographic factors in the younger than in the older age group and in another part to the recursive influence of CEB on INC itself, *i.e.*, INC is influenced by the present number of CEB.

At the gross level, all five SER factors, education, occupation, material property, religion, and residential background, have consistent negative influences on CEB for both the younger and the older age group. These types of net effects are presented for these factors, net^a controlling only other factors in the SER group, net^b controlling demographic factors as well as other SER factors, and net^c controlling all other factors including INC.

The relation of the educational level of the couples to CEB is strong in net^a in both age groups although its strength is somewhat reduced when other SER factors are controlled. In net^b, when demographic factors as well as other SER factors are controlled, the effect of education is reduced considerably; however, it still exerts significant influence in both age groups. In net^c, when all other factors including INC are controlled, the effect of education is further reduced compared with its effect at the net^c level in both age groups. However, there are substantial deviations even at net^c level.

The deviations by occupation of husband at the gross level show a strong relation of CEB with occupation. The effect of occupation is very much reduced at the net^a level, which indicates that the apparent effect of occupation at the gross level was in large part the result of its high association with other factors in SER group, inevitably with education, and residential background. At net^b and net^c levels the deviations are noticeable compared with those of material property and religion.

The deviation of CEB in relation to ownership of material property at the gross level are smaller than those in relation to the level of education and occupational categories. Moreover, at the net^a, net^b, and net^c levels, deviations for material property disappear almost entirely in both age groups. The deviations at all net levels are minor and possibly random, implying that material property ownership *per se* has little or no effect on CEB.

The apparent effect of religion at the gross level is not negligible. The difference in mean number of CEB between the Christians and the group without and specified religious affiliation is 0.42 (the difference between 0.07 and −0.35) CEB per woman in the 25–34 age group and 0.48 (between 0.11 and −0.37) per woman in the 35–44 age group. However, the relationship between religion and CEB disappears almost entirely in net^a, net^b, and net^c deviations. Thus, use of the MCA technique shows that religion, like material property, apparently has in itself little influence on fertility.

The relationship between residential background and CEB is strong at the gross level. The effect is reduced conspicuously at the net[a] level when other factors including education are controlled. Albeit reduced, the pattern of the net deviations is consistent, showing the negative influence of urban background on CEB in both age group. The negative impact does not disappear in net[b] deviations, where demographic factors also are controlled, nor in net[c] deviations, where all other factors are controlled. The cumulative impact of urban residence is apparent especially in the net[b] and net[c] deviations among women age 35–44.

V. EXPLAINED VARIANCE

Having discussed the pattern of relationship between the independent variables and CEB, we now take up the questions of the extent to which each factor is related to fertility in statistical terms and of how much variance is explained by each and all of the factors.

In table 5 three types of statistics are presented for this purpose. First, eta indicates the ability of the factor explain the variance in the dependent variable. The square of eta is analogous to the correlation ratio and therefore indicates the proportion of the total sum of squares of deviations explainable by this factor.

Second, betas in the table are identical with the betas in regression analysis, where the square of a beta coefficient may be regarded as the sum of squares attributable to the factor relative to the total sum of squares. Thus it is tempting to interpret the beta coefficient (when squared) in terms of the percentage of variance explained. This is valid in MCA when all the factors are correlated not with each other but only with the dependent variable. Since we know that this is not the case here, the betas are used to indicate the relative importance of the factors in explaining the dependent variable, CEB, when the other factors specified are held constant.

Finally, multiple R is a summary statistic for each group for all factors combined. The adjusted R is analogous to the multiple correlation coefficient in a regression analysis. The square of the adjusted R is a measure of the amount of variance in the dependent variable explained by a given group of factors acting together.

In terms of eta coefficients, it is noted that the correlations of CEB with demographic and attitudinal factors are stronger than with socio-economic and residential factors for the younger age group, 25–34. However, in the older age group, 35–44, the relationships of CEB with education, occupation, and residential background are no less significant than the relationships with demographic factors. This demonstrates the importance of the cumulative impact of SER factors which appear to have influenced both age at marriage and INC.

Partial beta[a] shows the relative importance of the given factors within each group. The impact of age is very strong in the younger age group despite the fact that we are observing only the effect of age within the ten-year age groups. As expected the beta[a] coefficient of age in the older age group is very much smaller. The influence of age at marrage is important even when present age is controlled in both age groups.

In the social, economic, and residential grouping, the importance of the factors expressed in terms of beta[a] is greatest for education and substantial also for residential background and occupation. Material property and religion do not show sizeable effects on CEB when other factors including education, occupation, and residential background are controlled. This holds for both age groups. The influence of residential background is more important than that of any other factors in the SER group except education.

The total amount of variance explained by the SER group of factors, as measured by the adjusted R^2, is 14.7 percent in the 25-34 age group and 14.4 percent in the 35–44 age group, whereas the squares of R for the demographic factors are 45.0 percent in the 25-34 age group and 14.9 in the 35-44 age group. The 14 or 15 percent of the variation

Table 5 **Coefficients of Eta, Betas, and Explained Variance (R^2) in Children-Ever-Born for Currently-Married Women Aged 25-34 and 35-44**

Independent variables	Eta		β^a		β^b		β^c	
	25–34	35–44	25–34	35–44	25–34	35–44	25–34	35–44
Demographic factors								
Age	0.55	0.23	0.51	0.13	0.50	0.14	0.48	0.14
Age at marriage	0.44	0.37	0.38	0.33	0.31	0.21	0.29	0.20
R^2 (adjusted) %			45.0	14.9				
Attitudinal factor					—	—		
Ideal number of children	0.37	0.32					0.18	0.21
R^2 (adjusted) %					—	—		
Socio-economic and residential factors								
Education of woman and husband	0.35	0.32	0.25	0.19	0.13	0.08	0.11	0.06
Occupation of husband	0.27	0.29	0.09	0.12	0.07	0.11	0.05	0.08
Material property	0.18	0·21	0.03	0.01	0.04	0.03	0.04	0.03
Religion	0.11	0.13	0.06	0.03	0.02	0.03	0.02	0.02
Residential backgrounds of woman and husband	0.27	0.29	0.12	0.16	0.09	0.14	0.07	0.12
R^2 (adjusted) %			14.7	14.4				
R^2 (adjusted) for all factors %					48.5	20.5	51.2	23.8

[a]: partial betas when other factors in the same group are held constant.
[b]: partial betas when other factors in the demographic, socio-economic, and residential groups are held constant.
[c]: partial betas when all other factors are held constant.

explained by the SER group of factors may at first glance seem to be small. However, in predicting such behavior as fertility, which the result of complex responses to multiple factors, it is a sizeable proportion of the total variation to be explained.

Beta^b coefficients are presented in Table 5 to show the relative importance of SER factors when demographic factors as well as other factors in the SER group are controlled. The impact of SER factors on fertility is reduced compared to that of beta^a. The relative importance of education and residential background in the younger age group is unchanged; however, in the age group the beta^b coefficient for residential background stands out as the highest, followed by occupation.

In terms of beta^c, when all other factors including INC are controlled, the relative importance of each of the SER factors holds the same tendency as in terms of beta^b; however, the impact of each of the SER factors is reduced very much. Looking over the beta^c coefficients, one can see that the importance of age, age at marriage, and ideal number of children in both age groups is unquestioned. The reduced coefficients of SER factors indicate that the apparent effects of SER factors on CEB are due mostly to their associations with the demographic factors and ideal number of children. However, we do not exclude the possibility of a recursive impact of CEB on the factors themselves.

Finally, the amount of variance in CEB explained by all factors, excluding INC as mea-

Table 6 **Percentages of Women Reporting That They Had Ever Used Contraceptives and/or Induced Abortions* according to Socio-Economic and Residential Characteristics for Currently-Married Women Aged 25–34 and 35–44, 1971**

	25–34	35–44
Education of woman and husband**		
Both no education	44	49
Primary	43	64
Middle	51	72
High	54	72
College	57	80
Occupation of husband		
Farmer, fisherman	43	60
Other non-professional	52	66
Professional and wage earning clerical and sales worker	55	79
Material property		
Low (0–2)	43	53
Middle (3−5)	51	62
High (6+)	59	80
Religion		
No religion	46	62
Buddhism and Confucianism	59	69
Christianity	59	77
Residential backgrounds of woman and husband		
Both rural	45	63
Both town or one town, the other rural	47	63
One urban, the other rural or town	47	68
Both urban	61	76
Area of current residence		
Urban (including town)	52	72
Rural	47	61
Total	50	66

* Includes women who had ever used either contraceptives or induced abortion only.

** The highest level of education received by either or both partners.

Source: 1971 Korea Fertility-Abortion Survey (tape).

sured by R^2, is 48.5 percent in the 25–34 age group and 20.5 percent in the 35–44 age group. The square of R for the factors including INC is 51.2 percent in the 25–34 age groups and 23.8 percent in the 35–44 age group. The small percentages of variance explained in the 35–44 age group are mainly due to the reduced impact of age and age at marriage in this age group.

VI. FINAL COMMENT

In this paper we have attempted to understand the relative importance of each factor and each group of factors affecting CEB based on the cross-sectional data of the 1971 Korea Fertility-Abortion Survey. We did not try to study changes over time in completed marital fertility nor the roles of various factors in such changes. Therefore, our findings may not provide a firm basis for predicting the impact of the SER factors on the trend of fertility in the future.

Although we did not include the practice of birth control methods in the MCA analysis on account of the possible circular influence of CEB on the practice of birth control, this factor deserves notice in a discussion on the impact of SER factors in the future. Available data on the use of birth control methods for the women in our sample are presented in Table 6. The percentages of couples having ever used birth control methods indicate that there were substantial differences in 1971 among couples in the various categories of SER status. Such differences indicate that in Korea SER characteristics are likely to remain in the near future as powerful factors affecting fertility in association not only with demographic and attitudinal factors but also with use of birth control methods.

There is another indication that the differences in CEB between upper and lower SES strata may be reduced to some extent in the future. The percentages of couples reporting that they had ever used birth control methods (shown in Table 6) are 50 percent in the age group 25–34 and 66 percent in the age group 35–44. These are remarkably high in comparison with the corresponding percentages in 1962, before the inception of the first nationwide family planning. One study shows that in a township near Seoul in 1962 the percentages of couples having ever used contraceptives were only eight percent in the age group 25–34 and ten percent in the age group 35–44. The same study found that an intensive program of family planning undertaken subsequently had a greater effect among the socially and economically underprivileged groups than among those in the upper strata(Bang, 1968, pp. 70-73). Therefore, it may be expected that the growing sophistication in contraceptive practice of both urban and rural residents as well as various other sectors of the population will further reduce the present group differences in fertility in the future.

VII. SUMMARY

Data on many differential fertility studies are often difficult to interpret because it is not certain whether the differences observed result from the classifying variables themselves or from other variables associated with them. For this reason we presented a multiple classification analysis designed to control influences of other variables upon the measures of fertility differences according to urban-rural residence and residential background as well as other social and economic factors such as education, occupation, material property, and religion. The result of this analysis indicated that the social, economic, and residence variables have a high correlation with the number of children-ever-born among currently-married women aged both 25–34 and 35–44. When other factors were controlled, the effects of education, occupation, and residential factors on children-ever-born were diminished but did not disappear, whereas the effects of material property and religion virtually disap-

peared. This indicates that education, occupation, and residence are themselves important factors whereas material property and religion appear to have relatively little impact on the fertility of currently-married women in Korea.

The findings from the multiple classification analysis indicate that the cumulatlve impact of education, occupation, and residential background factors has been substantial in the recent past. Although our analysis of the effect of urbanization on fertility is based on a cross-sectional survey and is limited to currently-married women aged 25-44, it implies that advances in education, industrialization, and urbanization have been important factors in the decline of fertility in Korea in recent decades. In the foreseeable future, as the level of education, industrialization, and urbanization advances, it is to be expected that these factors will continue to exert a strong influence towards moderation of fertility in association with a late average age at marriage, a decreasing desire for large families, and increasing practice of birth control.

References

Andrews, Frank M. et al., *Multiple Classification Analysis, A Report on a Computer Program for* 1975 *Multiple Regression Using Categorical Predictors* (Ann Arbor: The Institute for Social Research, The University of Michigan).

Bang, Sook, A Comparative Study of the Effectiveness of a Family Planning Program in Rural 1968 Korea, unpublished Dr. P. H. dissertation, The University of Michigan.

Basavarajappa, K. G. and M.I. Belvalgidad, "Changes in Age at Marriage of Females and Their 1967 Effects on the Birth Control in India," *Eugenics Quarterly,* Vol. 14, No.1, March, pp. 14-26.

Frisch, Rose E., "Population, Food Intake, and Fertility," *Science,* Vol. 199, No. 4324, 6 January, 1978 pp. 22–30.

Hauser, Philip M., "Family Planning and Population Programs: A Book Review Article," *Demo-* 1967 *graphy,* Vol. 4, No. 1, pp. 397–414.

Knodel, John, "Breast-Feeding and Population Growth," *Science,* Vol. 198, No. 4322 (16 1977 December), pp. 1111–1115.

Knodel, John and Etienne van de Walle, "Breast-Feeding, Fertility and Infant Mortality: An An- 1967 alysis of Some Early German Data," *Population Studies,* Vol. XXI, No. 2, September, pp. 109–131.

Korean Institute for Family Planning, *Report on 1971 Fertility Abortion Survey* (Seoul: KIFP). 1973

McFalls, Joseph A., Jr., Psychopathology: Its Impact on Individual and Population Fecundity, 1977 unpublished Ph.D. dissertation, University of Pennsylvania.

Mode, Charles J. and Gary S. Litman, Implications of Fertility Patterns in the Republic of Korea: 1975 A Study by Computer Simulation, an unpublished paper for a seminar at the Population Studies Center, University of Pennsylvania, November 21.

Moon, Hyun Sang, *Factors Affecting Fertility—Using Multiple Classification Analysis,* 1971 Ferti- 1973 lity-Abortion Survey Special Report Series, No. 1 (Seoul: The Korean Institute for Family Planning, April).

Moon, Hyun Sang, *et al., Fertility and Family Planning: An Interim Report on 1971 Fertility-Abortion* 1972 *Survey* (Seoul: The Korean Institute for Family Planning).

Nie, Norman H. *et al., SPSS: Statistical Package for the Social Sciences* (New York: McGraw-Hill 1975 Book Co.).

United Nations, *The Determinants and Consequences of population Trends,* Vol. 1, Population Stu- 1973 dies No. 50. ST/SOA/Sr. A. 50 (New York: United Nations).

1971 Korea Fertility-Abortion Survey by the Korean Institue of Family Planning.
(*Raw data on tapes*)

〈國文要約〉

韓國有配偶婦人의 出生兒數에 관한 多變量分析

朴 商 台

本 硏究는 韓國有配偶婦人(25~44세)들의 出産力(出生兒數로 測定한)에 居住地背景等 社會經濟的變數들이 미친 영향을 연구하는데 그 主目的이 있다. 大部分의 差別出産力연구의 難點이자 盲點은 그 연구에 나타난 出産力의 差異가 우리가 보고자 한(혹은 區分한) 變數自體에 의한 것인지 혹은 그 變數와 關聯된(혹은 영향을 미친) 第三의 變數들 때문인지 識別하기 어렵다는 점이다. 이런 難點을 克服하고 補充하기 위하여 學者들은 多變量分析을 이용하고 있다. 多變量分析에서는 다른 關聯된 變數를 考慮하여 한 變數의 出産力에 미친 影響의 純效果까지 볼 수 있다. 이와 같이 粗效果와 純效果를 다같이 봄으로써 各 變數의 相對的 重要性을 고찰할 수 있다. 本硏究에서는 여러가지 多變量分析方法中 多變數分析을 사용했다.

우리가 出産力 연구에서 고려해야 하는 從屬變數인 出生兒數나 기타 人口學的變數의 대부분은 同間尺度임에 반하여 社會經濟的 變數는 連續性을 고려할 때 同間尺度로 만들기 어렵다. 그러나 多變數分析을 이용할 때 社會經濟的 變數같은 名目的尺度나 피임에 관한 지식, 태도와 같은 序列尺度를 그대로 사용할 수 있다.

出産力에 관한 多變量分析에서 고려되어야 할 可能한 모든 變數를 包含한 調査資料—특히 全國을 對象으로 한—는 찾아보기 힘들다. 따라서 본 연구는 1971年 家族計劃硏究院에서 실시한 全國出産力調査資料만을 이용했다. 1971年 調査資料는 어느 모로 보나 必要한 變數들을 가장 豊富하게 그리고 가장 妥當하게 다루었다고 생각된다.

本硏究에서는 夫婦의 社會經濟的 背景을 獨立變數로 사용하기 위하여 旣婚婦人보다 有配偶婦人을 硏究對象으로 하였다. 45세 이후의 有配偶婦人을 除外하고 25~44세群의 婦人만을 대상으로 한 이유는, 첫째, 最近에 變化한 出産力에 미친 영향을 보기 위함이며, 둘째, 45세 이후의 婦人들은 기억력 등의 문제로 出生兒數의 조사에 젊은 年齡層보다 그 出産力자료의 신빙성이 낮기 때문이다.

變數를 選定하고 묶음(grouping)에 있어 어떤 모델(因果關係를 미리 설정한)에 의한 形式的(formal) 接近方法보다 自省的(heuristic) 接近方法을 採擇했다. 出産力은 人口

學的, 社會經濟的 變數 등에 영향을 받는다는 原則아래서 이와 같은 自省的 接近方法을 시도함으로써 가능한 모든 變數들을 고려할 수 있으며 그 相對的 重要性을 比較할 수 있다. 또한 出産力의 指數는 出産率의 템포(tempo)에 따른 一時的 變化可能性을 제거하기 위하여 總出生率이나 一般出生率등 一定期間에 발생한 出生數를 中心으로 한 綜合出生率을 사용하지 않고 出生兒數를 사용했다.

本 硏究의 分析結果, 敎育, 男便의 職業, 그리고 居住地背景 등 數十年間에 걸쳐 한 개인에게 영향을 주는 變數들이 다른 人口學的 變數 못지 않게 出産力에 영향을 미치고 있음을 알게 되었다. 個人的 次元에서의 이러한 현상은 巨視的 次元에서 볼 때 敎育水準의 向上, 工業化, 都市化 등이 지난 一, 二十年간 우리나라 出産力의 低下에 重要한 要因이었음을 示唆하고 있다. 이들 요인들은 晩婚, 小家族으로의 選擇趣向, 避姙의 普遍化 등과 서로 作用하여 가까운 장래에도 계속 重要한 要因으로 남아 있을 것이 豫想된다.