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Illustrative Analysis: Socio-Economic Determinants of Contraceptive Use in Thailand

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The World Fertility Survey is an international research programme whose purpose is to assess the current state of human fertility throughout the world. This is being done principally through promoting and supporting nationally representative, internationally comparable, and scientifically designed and conducted sample surveys of fertility behaviour in as many countries as possible.
The WFS is being undertaken, with the collaboration of the United Nations, by the International Statistical Institute in cooperation with the International Union for the Scientific Study of Population. Financial support is provided principally by the United Nations Fund for Population Activities and the United States Agency for International Development.
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Preface

One of the main concerns of the World Fertility Survey has been the analysis of the data collected by the participating countries. It was decided at the outset that, in order to obtain quickly some basic results on a comparable basis, each country would produce soon after the field work a 'First Country Report', consisting of a large number of cross-tabulations, with a short accompanying text. Precise guidelines for the preparation of the tables were produced and made available to the participating countries.

It was also recognised, however, that at later stages many countries would wish to study in greater depth some of the topics covered in their first reports, or indeed new but related subjects, using more refined analytic techniques. In order to assist the countries at this stage a general *Strategy for the Analysis of WFS Data* was outlined, a series of 'Technical Bulletins' was started, dealing with specific methodological issues arising in the analysis, and a list entitled 'Selected Topics for Further Analysis of WFS Data' was prepared, to serve as a basis for selecting research topics and assigning priorities.

It soon became evident that many of the participating countries would require assistance and more detailed guidelines for further analysis of their data. Acting upon a recommendation of its Programme Steering Committee, the WFS then launched the present series of 'Illustrative Analyses' of selected topics. The main purpose of the series is to illustrate the application of certain demographic and statistical techniques in the analysis of WFS data, thereby encouraging other researchers and other countries to undertake similar work.

In view of the potentially large number of research topics which could be undertaken, some selection was necessary. After consultation with the participating countries, 12 subjects which are believed to be of top priority and of considerable interest to the countries themselves were selected. The topics chosen for the series span the areas of fertility estimation, levels, trends and determinants, marital formation and dissolution, breastfeeding, sterilization, contraceptive use, fertility preferences, family structure, and infant and child mortality.

It was envisaged that each study would include a brief literature review, summarizing important developments in the subject studied, a clear statement of the substantive and methodological approach adopted in the analysis, and a detailed illustration of the application of such an approach to the data from one of the participating countries, but with emphasis on the general applicability of the analysis. Such studies were conducted in close collaboration with the country concerned, where possible with the active participation of national staff.

It should perhaps be emphasized that the studies in the 'Illustrative Analysis' series are meant to be didactic examples rather than prescriptive models of research and should therefore not be viewed as cookbook recipes to be followed indiscriminately. In many cases the investigators have had to choose a particular course of action from several possible, sometimes equally sound, approaches. In some instances this choice has been made more difficult by the fact that demographers or statisticians disagree among themselves as to the approach most appropriate for a particular problem. In the present series we have, quite intentionally, resisted the temptation to enter the ongoing debates on all such issues. Instead, and in view of the urgency with which countries require guidelines for analysis, an attempt has been made to present what we believe to be a basically sound approach to each problem, spelling out clearly its drawbacks and limitations.

In this difficult task the WFS has been aided by an *ad hoc* advisory committee consisting of Ansley Coale (Chairman), Mercedes Concepción, Gwendolyn Johnson-Acsádi and Henri Leridon, to whom we express our gratitude. Thanks are also due to the referees who have generously donated their time to review the manuscripts and to the consultants who have contributed to the series.

Many members of the WFS staff made valuable contributions to this project, which was co-ordinated by V.C. Chidambaram and German Rodriguez.

Sir Maurice Kendall
WFS Project Director

July 1979

1 Introduction and Broad Aims of the Analysis

The present study, using data from the 1977 Survey of Fertility in Thailand, analyses socio-economic determinants of contraceptive use in Thailand.

Its starting point is the preliminary findings contained in Volumes I and II of the 'Survey of Fertility in Thailand: Country Report', published in 1977 jointly by the Institute of Population Studies, Chulalongkorn University, and the Population Survey Division, National Statistical Office. The objective is to ascertain, and to try to quantify, the relationship between various socio-economic characteristics of Thai couples and their contraceptive behaviour in a manner that illustrates the application of certain analytical techniques and their associated problems. The focus is exclusively on differentials in use and no attempt is made to explain the overall level of contraceptive practice in Thailand. To place this study in its broad context, the history of family planning in Thailand and a description of the methodology and relevant preliminary findings of the fertility survey are reviewed briefly before the details of the present analysis are discussed.

2 A Brief Historical Account of Population Policy and Family Planning in Thailand

In the first half of this century, Thailand's official stance on population was predominantly pronatalist. However, concern about the rapid growth of the population was felt among some government officials and scholars. Thus, in 1963 the First National Seminar on Population was convened, and one of its major recommendations was the establishment of a pilot programme on family planning that would include both operational and research components. This pilot project, named the Potharam Study, was launched in 1964 and continued to 1969. A second and third seminar were held in 1966 and 1968. As the result of the third seminar a long series of recommendations on the population issue was submitted to the government. The cabinet referred this question to the National Economic Development Board, now the National Economic and Social Development Board (NESDB), which in conjunction with the Ministry of Public Health and the Institute of Population Studies, prepared a comprehensive report for the Cabinet on the adverse effects on economic and social development of the high rate of population growth and strongly recommended the adoption of a population policy. In March 1970, the Cabinet accepted the report and announced a National Population Policy. The policy statement gave support to voluntary family planning in order to resolve the various problems related to the high rate of population growth. More specifically, the aim was to reduce the annual population growth rate from above 3.0 per cent to approximately 2.5 per cent by 1976.

In fact, family planning activities had been growing steadily for at least five years prior to the adoption of an official government policy. In 1965, a large post partum programme was initiated in four Bangkok hospitals, and in 1968 the Ministry of Public Health started a Family Health Project to test the acceptability of family planning among both the rural and urban populations. Under this Project, large numbers of medical and para-medical staff received training, and family planning services were made available at government health clinics.

The period after the adoption of an official policy was characterized by further consolidation and expansion of services and the beginning of wide-spread use of mass media to disseminate awareness of family planning. In mid-1970, auxiliary midwives were allowed to prescribe oral contraceptives, and by the end of that year a total of about 3,500 clinics offered family planning services. In 1972, two new types of personnel were recruited by the programme. Family planning workers were trained to assist in clinics, while a cadre of home visitors was introduced to strengthen motivational efforts at the community level. A number of government-sponsored special projects were also launched, including the expansion of the post partum programme to hospitals outside Bangkok. Several important pilot projects in particular parts of the country were initiated.

The commercial sector has always been an important supplier of contraceptives, particularly of pills, and it is estimated that between 1964 and 1975 the level of commercial distribution rose eight fold. Various studies conducted in the 1970's suggest that approximately one-third of current users obtain supplies from the private sector.

Achievements of the programme have been monitored, both by means of service statistics and by surveys. As Table 1 shows, the number of new acceptors rose dramatically from an annual average of 47,000 in the period 1965-1968; to 130,000, 229,000 and 408,000 in 1969, 1970 and 1971, respectively. Between 1971 and 1974 the level of acceptance was relatively stable. Over the ten-year period, the importance of the IUD declined relative to the pill and sterilization, while acceptance of other methods, though increasing, remained minor.

Table 1 New Acceptors, by Method and by Year, 1965-1974

Year	IUD	Pill	Steri-lization	Other	Total
1965-68	121,458	17,861	47,574	–	186,893
1969	54,496	60,459	15,264	–	130,219
1970	74,404	132,387	18,648	3,139	228,578
1971	86,034	294,607	23,546	3,648	407,835
1972	90,128	327,582	32,668	6,316	456,694
1973	93,449	286,674	49,606	10,447	422,176
1974	89,739	305,244	80,482	19,014	494,479
1965-74	609,708	1,406,814	267,788	42,564	2,324,074

Source: Family Health Division, Ministry of Public Health

That contraceptive use has paralleled the increase in acceptance is confirmed by survey results. The prevalence of current use among married women of childbearing age rose from 14 per cent in 1969-70 to 26 per cent in 1972-73 and again to 37 per cent in 1975. This nearly trebling in level of use over a six-year period is one of the most rapid on record. As Table 2 indicates, the major increase has occurred in the rural areas, where contraceptive practice was at a low level of 11 per cent in the late sixties. The urban increase, from a much higher base, has been more modest, and the net effect has been to reduce the rural-urban gap.

Table 2 Percentage of Currently Married Women Aged 15-44 Practising Contraception, by Residence, 1969-70, 1972-73, and 1975

Residence	*Longitudinal Study* Round 1 1969-70	Round 2 1972-73	Fertility Survey 1975
Total	14	26	37
Urban	33	45	49
Rural	11	23	35

Source: Debavalya, N. and J. Knodel (1978) Table 7

The striking coincidence of the vast expansion of the family planning programme and the increase in use strongly suggests that the programme itself has been largely instrumental in bringing about the change of behaviour. The recent area analysis by Debavalya and Knodel, which relates

[1] A more detailed account may be found in Economic and Social Commission for Asia and the Pacific (1976) Country Monograph Series, No. 3, Ch. VI.

programme input in terms of acceptors and cycles of pills distributed to the percentage of women who reported ever-use of a method in the SOFT survey tends to support this interpretation.

Furthermore, there is evidence from these same three surveys of a major decline in marital fertility. Between Round 1 of the Longitudinal Study and the SOFT survey, age-standardized marital fertility rates fell by about 20 per cent in rural areas and by 10 per cent in urban areas (Debavalya and Knodel, 1978). Thus, the convergence in levels of contraception appears to have brought about a convergence in rural-urban fertility. It may be concluded with reasonable confidence that a rapid transition to lower fertility is occurring in Thailand and that the family planning programme is playing a key role in this process.

In this context, a study of the determinants of contraceptive use is particularly relevant to an understanding of the wider issue of fertility change.

3 An Outline of the Survey

The Survey of Fertility in Thailand (SOFT) consisted of four separate surveys: (1) *Household Survey* designed to collect data on households, their characteristics and economic status, including family income and household and business assets; (2) *Husbands' Survey* designed to provide data on husbands' views on family size; child-rearing conditions and children's education; advantages and disadvantages of large and small families; expectations of financial and other help from children; and finally on husbands' knowledge and use of contraceptive methods; (3) *Fertility Survey* in which ever-married women who were under 50 years of age and residing in households were interviewed, with a questionnaire almost identical to the WFS Core Questionnaire; and (4) *Community Survey* to provide data on the general characteristics and socio-economic conditions at the village level, including availability of organizational and institutional services of various kinds. These community level data have not yet been analysed and are not included in this study.

The sample consisted of 4,465 households selected with equal probability from 267 clusters, and was a subsample of listings of households prepared for Round III of the Survey of Population Change, then in progress. Interviewing for the Household and Husbands' Surveys was conducted during March and April 1975 by 98 male enumerators and 44 supervisors working under technical staff of the NSO. The Fertility and Community Surveys were conducted during April to June 1975 by 60 female interviewers with 16 field supervisors and 15 field editors, working under the IPS. Response rates were as follows: Household Survey, 96 per cent; Husbands' Survey, 92 per cent; and Fertility Survey, 88 per cent. To compensate for differential non-response and small deviations from equal probability of selection, the survey data were weighted. The 4,465 sample households yielded 3,300 husband interviews and 3,820 female interviews. The husbands' and wives' questionnaires were matched manually case by case so that wives' fertility could be studied in relation to the husbands' fertility preferences, ideas about costs and benefits of children, knowledge and practice of contraception, etc. Complete matching could not be achieved. Because of additivity of non-response from the two interviews organized and conducted independently, the number of completed and matched 'couple-interviews' was 2,967.

As mentioned above, the Fertility Questionnaire closely resembled the WFS Core and consisted of seven sections, of which only two are of major interest in this study. In Section 3, knowledge and ever-use of contraception was ascertained, based on a list of eleven methods, which are shown in Table 3. After an open-ended question in which respondents were asked to mention methods that they had heard of, the list of methods was read out and, for each in turn, the respondent was asked whether she had heard of it and, if so, whether she had ever used it. In the case of male methods (e.g. condom) or couple methods (e.g. rhythm), the question on use was phrased as 'Did you and your husband ever use . . .?'

Though knowledge of male and female sterilization was elicited in Section 3, questions to find out whether the respondent or her husband had been sterilized for contraceptive purposes came later in Section 5. In Section 5 ever-users of contraception were also asked whether they were currently using and, if not, whether they had used a method since the birth of their last child. In either case, the specific method was also ascertained. Finally, never-users were asked whether they intended to use in the future. It should be stressed that, unlike in some other WFS surveys, no information was obtained about source of methods, distance from nearest outlet, use in the last closed birth interval, timing or nature of the first method used, length of use, or date of sterilization. Lack of such information limits the scope of further analysis.

Turning now to the Husbands' Questionnaire, knowledge and ever-use of contraceptive methods were obtained in a manner analogous to that used in the Fertility Survey, though withdrawal, douche and 'other' methods were omitted from the list. The precise phrasing of the question on use was: 'Did you or your wife ever use . . .?' No items on current use, use in the open interval or future intentions were included in the Husbands' Questionnaire.

4 Summary of Main Findings on Contraceptive Knowledge and Use from the Survey

4.1. KNOWLEDGE OF CONTRACEPTION

In presenting results in the Country Report, a major distinction was drawn between efficient or scientific methods, characterized by the recency of their discovery of application, and inefficient or traditional methods. The former category included all the methods promoted by the Thai family planning programme.

Ninety-six per cent of the women interviewed had heard of at least one efficient contraceptive method and less than one-half of one per cent had heard about an inefficient method only.

As Table 3 shows, knowledge of the efficient contraceptive methods was very high, with nearly all women having heard of the pill, the IUD and female sterilization, and with a little less than three-quarters having heard of the injection and male sterilization. About half had heard of the condom. The methods less commonly known were the other female scientific ones (e.g. diaphragm, foam and jelly), with only about one-fifth of the women having heard of them.

Variations in the level of contraceptive knowledge among different socio-economic groups are minimal. Knowledge among women is higher in urban than in rural areas but, even among rural women, only 4 per cent have not heard of any method of contraception. Among women with no education, about 10 per cent have not heard of any method, and among those with one to four years of completed schooling, 2 per cent have not heard of any method. Thereafter the percentages decline, reaching zero for women with eleven and more years of education. Regional differences are also small, with the lowest level of knowledge in the southern region, where one in ten women has never heard of any method, and with the highest in Bangkok Metropolis, where less than one per cent of the women have never heard of any method. The other three regions fall in between, with less than 5 per cent of the women not having heard of any method.

Though it should be stressed that the survey's criterion of 'knowledge' is a superficial one and does not imply knowledge of how to use a method or of sources of supply, nevertheless it may be concluded that observed patterns of use among certains sectors of the population cannot simply be explained by ignorance of family planning.

4.2 EVER-USE OF CONTRACEPTION

Forty-five per cent of ever-married women had ever used any method of contraception, out of which 6 per cent had only used an inefficient method. Experience of contraception was relatively low among the very young, among older age groups, and among women with very small or with very large families. Women between the ages of 25 and 34 had the highest proportion of ever-users. Table 4 shows that there is a marked rural-urban gap that is particularly large for women under 25 years of age, suggesting that urban women are more likely to initiate contraception relatively early in life.

Marked differences also exist between regions, with the highest level of ever-use in Bangkok Metropolis and the lowest in the South. Ever-use related to education shows the expected pattern: increasing from 32 per cent for women with no formal education to 75 per cent for those with eleven or more years of education. These educational differentials are more pronounced among older than among younger women.

4.3. THE VALIDITY OF DATA ON EVER-USE

Existence of a Husbands' Survey and careful matching of individual records offers a rare opportunity to gain some insight into the validity of survey responses on contraceptive use. Considering only the 2,352 couples with both spouses married only once, reporting of ever-use by the wife and the husband was remarkably similar. Forty-five per cent of the husbands reported ever-use of an efficient method, compared to 43 per cent of the wives. An addi-

Table 3 Knowledge and Use of Specific Contraceptive Methods

Method	Percent		
	Ever-Married Women		Currently Married Non-Pregnant Women Currently Using
	Had Heard of	Had Used	
Efficient			
Pill	92	26	15
IUD	86	9	7
Injection	70	5	2
Condom	48	4	1
Female Sterilization	87	6	7
Male Sterilization	70	2	2
Inefficient			
Douche, Rhythm, Withdrawal, Abstinence, and Folk Methods	54	15	3

Source: SOFT Report, Vol. 1, Tables 41, 45 and 51

Table 4 Percentage of Ever-Married Women Who Had Ever Used a Contraceptive Method, by Age and by Selected Background Variables

Background Variable	Age Group				
	Total	Under 25	25-34	35-44	45-49
Total	45	38	56	47	25
Residence					
Urban	60	61	66	61	38
Rural	43	34	54	44	23
Region of Residence					
North	52	46	70	49	24
North-East	36	24	46	40	14
South	28	27	34	26	19
Central[1]	55	49	66	57	34
Bangkok Metropolis	62	(68)	64	64	(43)
Years of School Completed					
None	32	39	38	35	15
1 to 4	46	36	56	49	28
5 to 10	63	48	77	(70)	(41)
11 and over	75	*	(70)	(86)	*

[1] Excludes Bangkok Metropolis

Note: In this and subsequent tables from the SOFT Report an asterisk (*) denotes cells where the denominator is less than 20 respondents and parentheses ( ) denote cells where the denominator is less than 50 respondents.

Source: SOFT Report, Vol. 1, Table 46.

tional 4 per cent of the husbands as against 6 per cent of the wives reported use of an inefficient method only. Such close correspondence in the aggregate levels of reporting contraceptive use is remarkable and serves to enhance confidence in the data.

Consistency between individual husbands and wives remains reasonably high – there was agreement for 82 per cent of couples concerning ever-use or non-use of any efficient method. On the assumption of no false over-reporting and of the absence of cases where *both* husband and wife forgot or concealed use, the 'true' level of use is about 10 per cent higher than estimates based on the testimony of husband or wife alone. Of course, neither of these assumptions if fully justified, though their effects operate in opposing directions and therefore tend to cancel each other.

Consistency between spouses in reported ever-use of the five most important methods was also examined in the Country Report. The level of agreement was approximately the same for the pill, IUD, female sterilization and injection, but the data suggest that women are twice as likely to underreport use of the condom than use of the other four methods.

While no firm conclusions concerning the validity of survey data can be drawn from this comparison between husbands' and wives responses, it does seem unlikely that major defects are present. Furthermore, it is probable that much of the observed inconsistency concerns methods that were used briefly or in the less recent past and that estimates of current use are of superior quality.

4.4. CURRENT USE OF CONTRACEPTION

Data on current use are restricted to currently married non-pregnant women though, unlike some WFS surveys, women considering themselves to be infecund are retained in the denominator. Thirty-seven per cent of these women are currently using some method of contraception; of these current users, 41 per cent are currently using the pill, 18 per cent the IUD and 18 per cent female sterilization. Use of the other methods is much less common. Over 90 per cent of current users rely on efficient methods.

The highest proportions protected by contraception were found in the intermediate age and family-size groups. When family size is controlled, there is little difference in use between women under the age of 25 and those aged 25-34, but the level of use drops in the two higher age groups. This pattern may well be caused by an increasing number of infecund women among the older age groups for whom contraception is unnecessary.

As can be seen by comparing Tables 4 and 6, socio-economic differentials for current use were similar to those for ever-use. Rural-urban differentials were in the expected direction at all family sizes, though the magnitude of differences varied somewhat irregularly. Regional differences were again pronounced, with current practice of contraception significantly lower in the North-east and in the South than in the rest of Thailand.

Similarly, educational differences were pronounced, and in the expected direction, with 27 per cent of the women with no education using contraceptives compared to over 50 per cent of those with eleven or more years of educa-

Table 5 Percentage of Currently Married Non-Pregnant Women Currently Using Any Contraceptive Method, Including Sterilization, by Age and by Number of Living Children

Age Group	Total	Number of Living Children									
		0	1	2	3	4	5	6	7	8	9+
Total	37	9	36	12	45	47	39	33	33	27	20
Under 25	34	10	37	41	49	*	*	*	*	*	*
25-34	47	10	44	49	51	53	46	(41)	*	*	*
35-44	37	(4)		30	39	50	43	39	41	36	27
45 and over	13	*	*	(5)	(13)	26	18	13	(0)	12	14

Note: An asterisk (*) denotes cells where the denominator is less than 20 respondents and parentheses ( ) denote cells where the denominator is less than 50 respondents.

Source: SOFT Report Vol. 1, Table 50.

Table 6 Percentage of Currently Married, Non-Pregnant Women Currently Using Any Contraceptive Method, Including Sterilization, by Number of Living Children and by Selected Background Variables

Background Variable	Total	Number of Living Children							
		0	1	2	3	4	5	6	7+
Total	37	9	36	42	45	48	39	33	27
Residence									
Urban	49	(12)	(49)	52	51	49	(61)	*	(53)
Rural	35	8	33	40	44	47	36	31	25
Region of Residence									
North	44	7	53	52	60	44	42	(40)	23
North-East	30	5	19	31	34	46	37	27	26
South	18	4	19	8	22	32	(24)	(23)	(8)
Central[a]	45	(17)	36	52	56	60	43	41	37
Bangkok Metropolis	50	(13)	(60)	53	(52)	(47)	(56)	*	*
Years of School completed									
None	27	(7)	21	41	30	39	27	19	20
1 to 4	38	7	35	42	47	49	43	39	30
5 to 10	43	(17)	(43)	(44)	*	*	*	*	*
11 and over	53	*	(70)	(38)	*	*	*	*	*
Total[b]	37	10	37	41	45	47	39	34	27
Standard-of-living[b]									
Rural									
Low	27	(4)	25	36	36	38	23	22	22
Medium	30	(2)	25	34	44	38	32	29	20
High	46	17	45	46	56	62	53	41	33
Urban									
Low	36	*	*	*	46	*	*	*	*
Medium	59	*	(62)	(57)	*	*	*	*	*
High	50	*	(46)	(47)	*	(58)	*	*	*
Family Income[b]									
Level 1 (Lowest)	28	(0)	24	32	31	35	30	(27)	18
Level 2	34	(7)	35	42	40	32	33	(35)	26
Level 3	37	(8)	37	36	43	54	47	(35)	23
Level 4	42	(10)	44	46	52	54	47	(30)	28
Level 5 (Highest)	45	(12)	44	48	61	57	(43)	42	39
Size of Family Enterprise[b]									
None[c]	47	(15)	45	50	51	51	56	(59)	44
Level 1 (Smallest)	37	(4)	33	49	45	51	36	27	23
Level 2	35	*	38	36	45	38	31	(31)	23
Level 3	33	*	(53)	(26)	48	26	34	(26)	28
Level 4	32	*	(17)	35	(38)	(56)	(40)	(31)	25
Level 5 (Largest)	34	(7)	23	35	46	53	(42)	(39)	(20)

a Excluding Bangkok Metropolitan.
b Data relate to matched couples only.
c No family enterprise or residing in municipal area.

Note: An asterisk (*) denotes cells where the denominator is less than 20 respondents and parentheses ( ) denote cells where the denominator is less than 50 respondents.

Source: SOFT Report, Vol. 1, Tables 53 and 54.

tion. Family income[2] was positively associated with current use, but no consistent pattern emerges when use was tabulated by size of family entreprise. In rural areas, there was a modest difference between women with a 'low' and those with a 'medium' standard-of-living; women with a 'high' standard reported markedly higher levels of use. In urban areas, small cell sizes preclude any conclusion about the relationship between current use and standard-of-living.

The broad conclusions to be drawn from the data presented in the Country Report are as follows:
a) the popularity of efficient or scientific methods completely overshadows that of inefficient methods; b) variations in ever-use and current use of contraception across demo-

2 This and other background variables are described in section 5.3.

graphic and socio-economic sectors of the population closely resemble each other; this undoubtedly reflects the recency of the family planning programme, and c) a number of socio-economic and other background variables appear to be strongly associated with use; of these, region of residence seems to be the source of sharpest differentiation. However, as the background variables are themselves inter-correlated, it is impossible from the material presented in the report to ascertain their relative importance as determinants of contraceptive use.

Since the publication of the Country Report, Arnold and Pejaranonda (1977) have undertaken a multivariate analysis of contraceptive use, though it formed only a small part of a wider study on attitudes towards family size. Using multiple classification analysis, a regression was performed of current use of any method on a set of eight demographic and socio-economic variables plus two attitude scales, 'Index of Perceived Cost of Children' and 'Index of Perceived Utility of Children', A low R^2 value of 0.07 was obtained, indicating that only 7 per cent of the total variance was explained by all ten predictors. Though forewarned in this way that any further study of this topic might not yield eye-catching results, we felt that further exploration of the data was justified, particular in view of the fact that region of residence, a variable of major interest, was not included.

4.5 COMPARISON OF SOFT SURVEY FINDINGS WITH THOSE OF OTHER SURVEYS

A review of other studies on differentials in contraceptive practice in Thailand indicates close similarity with the findings from the SOFT Survey. Early local studies as well as Rounds 1 and 2 of the Longitudinal Study confirm the curvilinear relationship of age and family size with contraception (Knodel and Pitaktepsombati, 1975). The Bangkhen study conducted in 1968 in suburban Bangkok was one of the first to show the positive relationship between education of wife and husband and contraception (Cowgill, et al., 1969). In the Longitudinal Study, the relationship of use with educational attainment of the wife was found to be stronger in rural than in urban areas. The same study indicated the existence of a small difference in the prevalence of use between metropolitan Bangkok and provincial urban centres; in 1970, 36 per cent and 29 per cent of the two groups, respectively, were reported as current users.

To summarize the position, other studies offer no new insights into or hypotheses for the socio-economic determinants of contraceptive use. Research in Thailand on this topic has been mostly restricted to descriptive bi-variate tabulations of use,urban-rural residence and educational level. The SOFT Survey, with its relatively large sample size, national coverage and wide range of variables represents a good opportunity to discover whether our understanding of the subject can be advanced beyond the descriptive and rather elementary level so far achieved.

5 Selection of Variables for Analysis and Statement of Objectives

Following the review of preliminary SOFT findings on contraception and the brief reference to other studies, we now consider the variables to be used in the further analysis and then proceed to define its precise objectives.

5.1 DEPENDENT VARIABLES

In view of the considerable overlap between ever-users and current users (nearly 70 per cent of the former group were also current users), it was considered unnecessarily repetitive to carry out investigations of both variables. Of the two, current use was considered preferable because of its greater precision and its more direct implications for an understanding of fertility. The focus of interest was further narrowed to current users of efficient methods on the grounds that this group is of special interest to the Thai family planning administrators. In any case, only 9 per cent of all current users, representing a mere 3 per cent of the whole sample, reported use of one of the inefficient methods. Their exclusion, therefore, can make little difference to the pattern of results.

Socio-economic determinants may well vary between particular methods, though no relevant tabulations were included in the Country Report. However, any method-specific analyses would have to be confined to the three most commonly used methods – the pill, IUD and sterilization (male or female) – because the number of women practicing other methods is too small to warrant serious investigation. In view of this limitation and to confine the analysis within reasonable boundaries, it was decided to retain current use of any efficient method as the dependent variable.

Current use of any efficient method or of a specific method has its limitation as a dependent variable. It does not take into account length of use prior to the interview, probability of continuation, or likely efficacy. By itself, of course, it reveals nothing about motivation – in particular whether use of methods other than sterilization is intended as a means of family limitation or of postponement of the next birth. The use of Number of Living Children as a demographic control implies to some extent a control for attitude towards family size limitation. Nevertheless, data concerning the respondent's desires for any additional children were also elicited in the SOFT Survey, and a strong case can be made for their inclusion in any study of the determinants of use. One approach would be to carry out separate analyses for those wanting another child or undecided and those not wanting another, and to search for differences in socio-economic determinants of the two groups. A second approach might include attitude towards future births as an intermediate variable, focussing on the extent to which socio-economic determinants in use are attributable to similar differentials in attitude towards limitation. Both approaches are subject to difficulties in interpretation, since readiness to limit family size is not necessarily causally prior to adoption of contraception. Rather the two processes may change together, mutually reinforcing each other. Awareness of the potentiality of contraception and satisfactory experience of a particular method may themselves increase the desire to avoid further births.[3] Also, the causal relationship between desire for more children and number of living children has an equally complex form.

In practice it was decided to restrict the present analysis by omitting attitudinal variables on family size. As a result, socio-economic differentials in contraceptive use were examined but no attempt was made to determine to what extent these differentials operated through these intervening and interacting factors.

5.2 THE CHOICE OF SUBPOPULATION

The choice of current use as the dependent variable implies a decision regarding the study population. In the Country Report, tabulations of current use were restricted to the currently married, non-pregnant women, but unlike most subsequent WFS Surveys, women reporting fecundity impairment (other than contraceptive sterilization) were included in the denominator. The gain in analytical precision from a closer matching of the frequency of an event or form of behavior to the population at risk usually outweighs the attendant risks and it was therefore decided to exclude infecund women, thus reducing the study population to the 2,548 respondents who, on the basis of survey evidence, were 'exposed' to the risk of conception[4] at time of interview and for whom contraception was directly relevant.

Another complication concerning the study population arose from the fact that three economic variables were derived from the household schedule preceding the husbands' interviews and were unavailable for 407 'exposed' women whose husbands had not been interviewed. Because of the inconvenience and extra cost of conducting analyses on two sample bases, it was decided to use the smaller base of 2,141 respondents. As a precaution, some preliminary work was carried out to confirm that the omission of the 407 women made no difference to the main pattern of results.

As a further simplification, the sample weights used in the Country Report tabulations were dropped. As the range of weights was narrow this decision was justifiable on the grounds of expediency.

5.3 INDEPENDENT VARIABLES

Listed below are all the variables available on tape at the time of this study and considered broadly socio-economic in nature. From this long and unwieldy list of 22 variables, 13 were eliminated for a variety of reasons. Pattern of work, occupation, and work status before first marriage were clearly less relevant than other available occupational variables concerning more recent experience. Religion, Ethnicity, Literacy, and Childhood Type of Place of

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[3] See for instance, Debavalya & Knodel (1978) and Westoff (1978).

[4] Had the appropriate data been collected, the study population could have been further refined by exclusion of women in a state of *post partum* amenorrhoea, temporarily separated from their husbands or sexually inactive for other reasons.

Residence yielded very poor splits of the sample; in the case of the last two there was also a high degree of overlap with other variables (Educational Level and Current Place of Residence) which further eroded their usefulness. Husband's Current Employment Status and Wife's Current Labour Market Status were similarly redundant because of their close associations with other occupational measures and were omitted for that reason. Two versions of Husband's Occupation were available, one reported by the wife and the other by the husband himself. The degree of inconsistency between the two measures was shown to be minor in the Country Report, and we therefore decided to take the wife's response as this would allow us to use the larger sample base if necessary. In the final analysis, however, the smaller base was used. Finally, the variable Size of Family Enterprise was deleted as the cross-tabulations in the Country Report had shown no consistent relationship with current use.

This process of elimination left a more manageable total of nine variables (plus three standard demographic variables, Age, Age at Marriage and Number of Living Children) for inclusion in at least the exploratory stages of the multivariate analysis. Their marginal distributions for the relevant subpopulation, with the exception of Family Income which is a continuous numerical variable (though grouped into six classes for the purpose of the Country Report), are shown in Table 7. A brief description of each variable follows.

SOCIO-ECONOMIC VARIABLES AVAILABLE FROM SOFT

Source: Fertility Survey
Region of Residence[a b]
Type of Place of Residence[a b]
Educational Level of Respondent[a b]
Educational Level of Husband[b]
Literacy of Respondent
Literacy of Husband
Respondent's Childhood Type of Place of Residence
Husband's Childhood Type of Place of Residence
Respondent's Religion
Respondent's Ethnicity
Respondent's Current/Most Recent Occupation[b]
Husband's Current/Most Recent Occupation[b]
Respondent's Pattern of Work[a]
Respondent's Occupation before First Marriage
Respondent's Employment Status before First Marriage
Respondent's Most Recent Employment Status[a b]
Husband's Current Employment Status

Source: Husband's Survey
Husband's Current/Most Recent Occupation
Current Labour Market Status of Wife[a]

Source: Household Survey
Family Income[a b]
Standard-of-Living[a b]
Size of Family Enterprise[a]

a Included in at least some of Country Report tabulations of contraceptive use.
b Incuded in present analysis.

Table 7 Distribution of Study Population, by Socio-Economic Variable Selected for Analysis

Region	Bangkok	North	North-East	South	Central
	144	553	755	212	477

Type of Place of Residence	Urban	Rural
	271	1870

Educational Level	None	Primary	Secondary	Higher and University
Respondent	351	1650	96	43
Husband	147	1648	249	97

Most Recent Employment Status of Respondent	Unpaid Family Worker	Employee	Self-Employed	Not Worked Since Marriage
	171	389	1374	207

Current (Most Recent) Occupation	Professional Technical Administrative	Clerical	Sales	Service	Self-Employed Agriculture	Agricultural Worker	Skilled Manual	Unskilled Manual	Never Worked
Respondent	46	29	239	49	1429	86	166	30	67
Husband	128	53	106	88	1324	71	308	57	5

Standard-of-Living	0–4	5–9	10–14	15–19	20–24
	480	1136	326	139	60

A. REGION OF RESIDENCE

For administrative purposes, Thailand is divided into four regions. The most economically important of these is the Central Region in which the capital is situated. With its flat alluvial plains and annual floods during the monsoon, this is a particularly fertile rice-growing area and is densely settled. The South Region, comprising peninsula Thailand, is the smallest in terms of both area and population. The principal crops cultivated are rice, rubber, coconuts, and fruit, and there is also extensive tin mining. Four of its fourteen provinces, those bordering Malaysia, are largely inhabited by Malay-speaking Moslems, in contrast to predominant Buddhist Thais in the rest of the country. The north part of the country is divided into two large regions, the North and North-East. The North includes sparsely populated mountainous and forested areas, extending to Burma in the north and west, and densely settled rice growing areas in the valleys. The North-East is relatively dry in climate and has infertile soil, though its population density is second only to the Central Region. The main crops of this region are glutinous rice and, more recently, maize, kenaf, and tapioca.

For the purposes of the Country Report and of this study, the Metropolis of Bangkok was excluded from the Central Region and considered independently. The differing socio-economic composition of the relevant subsample residing in the four regions and Bangkok is illustrated in Table 8, by reference to a few of the other variables. The Bangkok Metropolis is clearly distinguished from the four regions by its highly educated, non-agricultural population. The Central Region, with one-fifth of husbands possessing a secondary level or higher education and one-half in non-agricultural jobs, also possesses a distinct socio-economic profile. The North and South regions are similar to each other, while the North-East has the lowest proportion living in urban areas, possessing secondary or higher education, and working in a non-agricultural job. It is interesting to note, however, that the proportion of men and women with no formal education at all is surprisingly low in the North-East.

B. TYPE OF PLACE OF RESIDENCE

Only 13 per cent of the sample population are classified as residing in urban areas, and of these, Bangkok Metropolis accounts for a little over one-half. Most of the provincial urban population lives in small towns with a population of less than 20,000. The educational and occupational profile of the urban population is similar to that depicted for Bangkok in Table 8.

C. EDUCATIONAL LEVEL

The educational status of both husbands and wives were summarized by a grouping into four categories: no schooling, primary school (representing approximatively one to four years of full-time education), secondary school (representing approximatively five to ten years of full-time education) and a high school-university category denoting eleven or more years of education. Though this classification is highly unsatisfactory in dividing the sample (over three-quarters of both husbands and wives fall in the primary group), it was felt that a finer grading, or alternatively taking years of education as a numerical variable, was unrealistic.

As expected, there is a high degree of association between the educational level of the wife and that of the husband, and with occupation and standard-of-living. (Table 9).

Table 8 Cross-Classification of Region and Selected Background Variables

Background Variable	Bangkok		North		North-East		South		Central		Total	
	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
Type of Place of Residence												
Urban	144	100.0	43	7.8	26	3.4	26	12.3	32	6.7	271	12.7
Rural	–	–	510	92.2	729	96.6	186	87.7	445	93.3	1870	87.3
Educational Level of Wife												
None	15	10.4	145	26.2	80	10.6	51	24.1	60	12.6	351	16.3
Primary	85	59.0	384	69.4	653	86.5	150	70.3	379	79.5	1650	77.1
Secondary	24	16.7	15	2.7	17	2.3	6	2.8	34	7.1	96	4.5
High or University	20	13.9	9	1.6	5	0.7	5	2.3	4	0.8	43	2.0
Educational Level of Husband												
None	8	5.6	62	11.2	28	3.7	41	19.3	8	1.8	147	6.9
Primary	62	43.1	416	75.2	663	87.8	140	66.0	367	76.9	1648	77.0
Secondary	38	26.4	58	10.5	44	5.8	27	12.7	82	17.2	249	11.6
High or University	36	25.0	17	3.1	20	2.6	4	1.9	20	4.2	97	4.5
Husband's Current Occupation												
Professional, Technical and Administrative	25	17.4	32	5.7	32	4.2	8	3.8	31	6.5	128	6.0
Clerical, Sales, Service	59	41.0	58	10.4	32	4.2	26	12.3	72	15.0	247	11.5
Skilled Manual	45	31.3	90	16.2	28	3.7	22	10.3	123	25.8	308	14.4
Unskilled Manual	4	2.8	17	3.1	9	1.2	2	0.9	25	5.2	57	2.7
Agricultural. No Work	11	7.6	356	64.4	554	86.6	154	72.6	226	47.4	1401	65.4
Total	144	100.0	553	100.0	755	100.0	212	100.0	477	100.0	2141	100.0

D. WORK STATUS AND OCCUPATION

The propensity of Thai women to engage in productive work is well-known, and all but 10 per cent of the subsample had worked since marriage. The construction of the variable Current or Most Recent Work Status is based on the well-known hypothesis that the opportunity cost of childbearing will be greatest for women in salaried or wage employment. As Table 7 shows, less than 20 per cent of wives fall into this category; the large majority were classified as self-employed, reflecting the dominant role of small scale farming in the Thai economy, and a smaller proportion were unpaid family workers.

For husbands as well as for wives, occupational structure is dominated by the self-employed agricultural category. Not unexpectedly there are relatively more men than women in professional and clerical jobs and in non-agricultural manual work.

E. STANDARD-OF-LIVING AND INCOME

The Standard-of-Living variable was based on a set of items ascertained by a mixture of observation and direct questioning during the household interview, which in most cases immediately preceded the more detailed husband's interview. A simple scoring system was used to denote the presence or absence of certain household facilities and consumer durables, and these were summed to give a total score for each household in the range of 0 to 23. This score was then ascribed to each married couple in the household who was eligible for the detailed interview. For the purposes of the Country Report tabulation, three classes, – low, medium, and high – were formed from the distribution and, because of much higher scores in urban than in rural areas, class boundaries were defined differently for the two segments. In this analysis, such grouping was unnecessary. The component items and their score values are noted below:

Bank account
0 had no bank account
1 had bank account

Household water supply
0 from canal and other sources
1 public pipe or well
2 private pipe or well

Building materials used in construction of house
0 local and reused materials
1 wood and other less expensive materials
2 cement or wood and cement

Type of flooring
0 clay
1 wood and other less expensive materials
2 cement, rubber tile, and expensive materials

Table 9 Cross-Classification of Educational Level of Wife and Selected Background Variables

Background Variable	Educational Level of Wife									
	None		Primary		Secondary		High or University		Total	
	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
Educational Level of Husband										
None	92	26.2	54	3.3	1	1.0	0	–	147	6.9
Primary	245	69.8	1382	83.8	21	21.9	0	–	1648	77.0
Secondary	13	3.7	182	11.0	46	47.9	8	18.6	249	11.6
High or University	1	0.3	32	1.9	28	29.2	35	81.4	97	4.5
Current/Most Recent Occupation of Wife										
Professional, Technical, or Administrative	1	0.3	5	0.3	12	12.5	28	65.1	46	2.1
Clerical	0	–	5	0.3	13	13.5	11	25.6	29	1.4
Sales	33	9.4	186	11.3	18	18.8	2	4.7	239	11.2
Service	4	1.1	40	2.4	5	5.2	0	–	49	2.3
Agriculture	284	80.9	1219	73.9	12	12.5	0	–	1515	70.8
Skilled or Unskilled Manual	19	5.4	152	9.2	24	25.0	1	2.3	196	9.1
Not Worked since Marriage	10	2.8	43	2.6	12	12.5	1	2.3	67	3.1
Standard-of-Living Score										
0–4	130	37.0	347	21.0	3	3.0	0	–	480	22.4
5–9	198	56.4	918	55.6	19	19.8	1	2.3	1136	53.1
10–14	14	4.0	263	15.9	29	30.2	19	44.2	326	15.2
15–19	5	1.4	90	5.5	31	32.3	13	30.2	139	6.5
20–24	4	1.1	32	1.9	14	14.6	10	23.6	60	2.8

Type of roofing
0 thatch
1 tin or other less expensive materials
2 cement or cement tile

Electricity in the household
0 no electricity
1 had electricity

Ownership of consumer durable goods
Values of ten items were assigned as follows:
1 each for: electric fan; television; radio; watch (including clock); sewing machine; bicycle; and motorcycle
2 each for: air conditioner; refrigerator; and automobile

The derivation of a scale of this nature depends on the relative importance attached to the various items and is highly subjective. In this case, ownership of a car is equated to a cement or cement-tile roof and a bicycle to the presence of an electrical supply. Perhaps more sophisticated scaling techniques or cluster analysis of items could have reduced the somewhat arbitrary and diffuse nature of the scale, though it is by no means certain that the gain would have justified the effort. As it stands, at least three dimensions are probably present. The first may be termed a community factor; the presence of water and electricity supplies (and hence of electrically powered consumer durables) are clearly more dependent on locality than on individual characteristics of households and, to a lesser extent, ownership of cars, motorcycles and bank accounts are dependent on the proximity of roads and banks. The second factor is one of income and reflects the obvious fact that households with low cash income are less able to purchase many of the items. And thirdly, there is the matter of taste, namely, the way in which the collective household, or individual members thereof, choose to spend their disposable income. It should be stressed at this point that the choice of items to represent Standard-of-Living is based on modern materialistic considerations. To the extent that taste is an important dimension of the scale, households with traditional and less acquisitive patterns of expenditure and preferences will be scored lower than those with 'modern' patterns. To sum up, the Standard-of-Living variable used in the Country Report and for the purposes of this further analysis probably reflects the degree of development of the community, the affluence in cash terms of the household and the degree to which 'modern' preferences prevail.

The other variable derived from the household interview – Family Income – though conceptually less complex, raises greater measurement problems than Standard-of-Living. Survey experience indicates that this is one of the most difficult topics on which to obtain reliable data. In SOFT, a thorough and detailed attempt was made to obtain information on all major possible sources of income, using Ministry of Agriculture figures to convert crop areas into net income; these were then summed for the whole household and ascribed to each married couple included in the survey. Nevertheless there can be no guarantee concerning the quality of data thus obtained.

The sources of income explicitly covered in the household questionnaire were described in the Country Report and are:

(1) wages and salaries; (2) net income from farming; (3) income from animals raised; (4) income from selling fish, shrimp, silk-worms, etc.; (5) net income from businesses; (6) rental from land and dwellings; and (7) other income, such as rental of facilities other than land or dwellings, pensions, etc.

5.4 STATEMENT OF OBJECTIVES

The broad aims of the further analysis of contraceptive use were to examine the relationship of particular socio-economic variables net of the effect of the others, to measure the total predictive power of all variables combined, and to allow the introduction of variables not considered in the Country Report, such as husband's education and occupation. The pattern of preliminary results published in that report also led us to define three more specific objectives on which greater emphasis should be placed:

a) Region of residence, as the source of sharpest differentiation in contraceptive practice, was allocated a pivotal role. Though a simple inspection of Table 8 indicates that all variation between regions is unlikely to be explained in terms of their differing socio-economic composition as measured by the other available variables, nevertheless the interesting question remained, 'To what extent can regional differences be attributed such compositional differences?' The attempt to answer this question constitutes the first specific objective.

b) Provided that reasonably large regional differences still remained after controlling for other variables, the next substantial area of interest would take the form of extending examination of socio-economic determinants of use from the national level to the level of each region considered separately.

c) The third specific objective took into account the special efforts made in SOFT to obtain measures of standard-of-living and income. We thought it would be of special interest to find out whether these variables bear any relationship to current use, after controlling the more standard socio-economic variables, such as education and occupation. This might lead to some tentative conclusion regarding the desirability of including such items in future Thai surveys and in other WFS surveys elsewhere.

6 Methodology of the Study

The problems involved in a multivariate analysis of these data are common to many studies in the social sciences. The explanatory or background variables consist of a mixture of scaled continuous variables (Age, Age at Marriage, Standard-of-Living Index), dichotomous variables (Type of Place of Residence), categorical variables with some ordering between categories (Educational Level) and with no ordering between categories (Region of Residence, Husband's Occupation), and these variables have a complex pattern of intercorrelations. We are interested in the relationship of these variables to a response, which is here itself a dichotomous variable, Current Use of an Efficient Contraceptive Method, taking values one for users and zero for non-users. In addition to the variety of variable types, the data are not spread evenly over the categories of the variables; although there is some degree of orthogonality between the socio-economic and demographic variables, the distribution of the sample among cross-classifications of the socio-economic variables is highly uneven, as has been indicated in Section 5.

One approach, which might be termed traditional, is to form cross-classifications of the data and to analyse them descriptively. This method was adopted for the analysis of the data in the Country Report and a summary of the results has already been given in Section 4. Some degree of cross-tabulation is indispensable for illuminating the principal features of the data. However, the limits of cross-classification are well-known. The continuous variables have to be grouped into levels, and the choice of groupings is somewhat arbitrary; the degree of cross-classification is severely limited by the sample sizes required to interpret within cell means with any confidence.

For a more refined analysis, where the effects of each variable controlling other variables are of interest, the cross-tabulations can be subjected to the method of standardization. Also, the observed means of the tables can be smoothed by fitting models which assume an additive structure, or a structure where certain specified high order interactions between the variables are assumed equal to zero. Examples of such models are the linear models of analysis of variance, which include as a special case multiple classification analysis (MCA), or log-linear and logit-linear models for cross-classified data[5]. For dichotomous response variables, such as contraceptive use, the logit-linear models are in many ways the most natural and appropriate.

These models illuminate the relationships of the background variables with the response and extend the degree of cross-classification which can be feasibly interpreted. However, in many applications the grouping of continuous variables is cumbersome and inconvenient, and a more efficient analysis can be achieved by fitting more general regression models which treat the individual values of these variables. This is the approach adopted here.

We shall present results from multiple linear regressions of the dichotomous response variable CURRENT USE OF AN EFFICIENT METHOD, henceforward denoted as CUSE. Continuous background variables are introduced in the usual way, and the regression coefficients measure the effect on the mean response of increasing these variables by one unit, with other variables in the regression equation controlled. Categorical variables with more than two levels are introduced in the regression by means of a set of dichotomous dummy or indicator variables. For example, an education variable with four levels – no education, primary education, secondary education, high school education – is represented by three indicator variables, PRIMARY, SECONDARY and HIGH, taking values one if a respondent has primary, secondary or high school education and zero otherwise. The category which is not characterized by an indicator variable, here 'no education', is termed the *reference category*; the choice of reference category is arbitrary, although in some cases a particular choice of reference is natural.

The regression coefficients of these indicator variables have the usual interpretation; that is, they represent the increase in the response when the variable is increased by one unit, with other variables in the regression fixed. However, this exactly corresponds to the difference in mean response between the variable category and the reference category, with other variables fixed. To see this, note that the primary educated group corresponds to values of the indicator variables PRIMARY = 1, SECONDARY = 0, HIGH = 0, and the reference group with no education corresponds to PRIMARY = 0, SECONDARY = 0, HIGH = 0. The effect of adding 1 to the variable PRIMARY, with SECONDARY = HIGH = 0, is to switch from the 'no education' to the 'primary' groups, and thus the coefficient of PRIMARY represents the difference in response between these groups. Similarly, the coefficient for the variable SECONDARY, with PRIMARY and HIGH also in the equation represents the difference in response between the group with secondary education and the reference group with no education. We shall make extensive use of this interpretation of indicator variable coefficients.

There are some special problems associated with applying linear regression to a dichotomous response. The 'mean response' of a dependent variable taking values 0 and 1 is equivalent to the proportion of cases with value 1, and hence in this study is interpreted as the proportion currently using contraception. One would hope that such proportions predicted by a model lie between zero and one, but in practice there is no guarantee that values from a linear regression model lie within these bounds. Also the linear scale of comparisons is often not appropriate when the proportions lie near to the extreme values, zero and one. In many ways a 'logit' (or 'log-odds') scale, logit $p = \log (p/(1-p))$ and the associated logit-linear regression models are more appropriate.

However, methods for fitting non-linear regression models are not always available, and they can be expensive for large data sets since they involve iterative computations. For the data considered here we shall apply linear models with some degree of confidence, because the overall mean of the response is close to one-half, and the means across the background variables rarely deviate outside the range 0.2 to 0.8. In this range the logit scale is nearly linear, and in practice the logit regressions will not differ greatly from the linear regressions. In other cases, where there is a significant number of means of less than 0.1 or more than 0.9, the more complex analysis may be necessary.

Another issue concerns the applicability to a binary response of standard statistical tests (F-test and t-tests) associated with linear regressions. These tests assume that a) the underlying linear model is true, b) the variance of the error term is constant, c) the error term is normally distributed, and d) the sample is selected by simple random sampling. Here we can state with some confidence that none of these assumptions is satisfied! The difficult

[5] See Little, R.J.A. (1978)

question concerns to what extent this negates the usefulness of the statistical analysis, that is, the degree of 'robustness' of the tests. Again the range of the means in our case is such that the assumptions of a linear model for the mean and a constant error variance are plausible; the normality assumption (c) is not necessarily critical for the size of sample considered here. The other assumption is equally problematic for any application of regression to survey data. The attitude adopted here is to present F-statistics, which have a useful descriptive value even though the use of strict F-tests is debatable. These values are categorized informally as 'highly significant' ($p \simeq .001$), 'significant' ($p \simeq 0.01$) and 'not significant' ($p > .05$), but exact P-values are not quoted.

One particular aspect of assumption a) requires special emphasis. The linear regression model, in its simplest form, expresses the mean of a response variable Y as a linear sum of regressors $X_1, \ldots X_K$, that is, $E(Y) = \beta_0 + \beta_1 X_1 + \ldots \beta_K X_K$. A crucial underlying assumption here is that the effects of the regressors $X_1, \ldots, X_K$ are *additive*. That is, effect of one regressor on the response, as measured by its regression coefficient or coefficients, is assumed the same for all levels of the other regressors in the equation.

Differences in the effect of one variable across levels of other regressors are called interactions. As emphasized by Kendall (1976), if an additive model is assumed when in fact interactions are present, then the estimated regression coefficients are weighted averages of effects which vary across levels of the other regressors. If the variations are large and particularly if they involve changes of sign, then these weighted averages give an over-simplified picture of the data.

Hence any analysis would be incomplete without an analysis of interactions. Specific interactions can be incorporated in the regression analysis by forming product variables, such as $Z = X_1 X_2$, and including them in the regression. Alternatively, all first order interactions with a categorical variable can be included by disaggregating with respect to that variable and carrying out separate regressions on the data in each category.

The second of these approaches is adopted here. In a multivariable study it is not possible to look at all possible interactions and many are inestimable anyway because of lack of data. Hence we concentrate on a set of interactions of particular substantive interest, namely, first order interactions between region and the other variables, by carrying out a separate regression within each region. This analysis is described in Section 8.

In any form of regression analysis with correlated predictors, the effect of a variable on the response in general depends on which other variables are controlled by inclusion in the regression equation. Thus, the question arises as to which of these other variables should be controlled. One common approach is to include all variables relevant in a single regression and then to represent the effect of individual variables by their coefficients in the regression equation. This can be very misleading when the regressor variables are highly correlated.[6]

The approach adopted here is to calculate for each regressor variable X a set of regressions with other variables added in a hierarchical fashion. The changes in the coefficient of X as other variables are introduced into the equation can be monitored, allowing a comprehensive analysis of the effect of X on the response. This explicitly recognizes that no single effect is necessarily the right one, but rather that the effect at each step has an interpretation specific to the set of variables in the regression equation at that step.

If this approach is adopted for each regressor variable X in turn, a large number of regressions needs to be fitted. The amount of computation is minimized by using a stepwise regression program, where at each step a new variable is entered and the regression equation is recalculated. In contrast to the usual use of forward stepwise regression where the variable with the highest level of statistical significance is chosen to enter at each step, here the variables are forced into the equation in a predetermined hierarchical order. Thus the set of variables in the regression at each step is controlled.

The BMDP[7] statistical package was used to carry out this analysis, using programs BMDP1R and BMDP2R for the regressions. Most of the widely available packages could have been used, but a comparison of the various packages is not attempted here. The computations were carried out on a Hewlett-Packard 3000 Series mini-computer.

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[6] See, for example, R.A. Gordon (1968),

[7] See BMDP Manual (1975), W.J. Dixon (editor), University of California Press.

7 Regression Analysis of Determinants of Current Use of Contraception

This section presents the results from a series of regressions of current use of an efficient method (CUSE) on a set of background variables.

7.1 SAMPLE BASE

The sample base consisted of 2,141 respondents with the following characteristics: a) currently married, b) not currently pregnant, c) no self-reported fecundity impairment, and d) no relevant variables missing. Women sterilized for contraceptive purposes were included in the base and counted as current users of contraception. Since the variables studied include standard of living (STANDLIV) from the husband's sample, condition d) excludes 407 women who satisfied a), b) and c) but whose husbands were not interviewed. Some analysis not involving STANDLIV were also tried with this group included in the base, and the results were not significantly affected. Thus we sacrifice some statistical efficiency for convenience of exposition and present only results for the smaller base.

7.2 MEASUREMENT OF THE INDEPENDENT VARIABLES

On the basis of the first country report tabulations and the process of elimination described in Section 5, nine socio-economic and three demographic variables were selected for the study. Some initial regressions further reduced this list, leaving the following set of independent variables for the main analysis. As noted in the previous section, for the purposes of regression categorical variables are replaced by groups of indicator variables; thus the variables are arranged in seven groups.

Group 1. Number of Living Children (LIVCHILD). Since the proportion using contraception is not linearly related to Number of Living Children, this was not included in the regression as a continuous variable. Instead LIVCHILD was represented by a set of nine indicator variables, NLCO, NLC1 to NLC8, where NLCk = 1 if the respondent has k living children, and NLCk = 0 otherwise. The reference category consists of women with nine or more children.

Alternative methods of control are also possible. For example, in an inter-country comparison of levels of contraceptive use, Hermalin and Mason (1979) exploit the quadratic nature of the relationship between current use of contraception and number of living children by regressing on linear and quadratic terms in the interval scaled variable.

Group 2. Current Age of Respondent (AGE). This group consists of the single continuous variable AGE = current age in years.

The option of introducing quadratic and higher order polynomials in Age was considered. However, cross-tabulations indicated that, after controlling number of living children, the relationship between Age and Contraceptive Use for the chosen sample base was not pronounced, and thus it was decided to represent the effect of Age simply by the single linear term.

Group 3. Region of Residence (REGION). This variable has five categories, and is represented in the regression by four indicator variables, NORTH, NORTHEAST, CENTRAL and SOUTH, which take value 1 if a respondent resides in the North, North-East, Central or South regions and zero otherwise. The remaining region, Bangkok, is chosen as the reference category.

Group 4. Type of Place of Residence (TYPE OF PLACE). This group consists of the single indicator variable URBAN, where URBAN = 1 for urban respondents and URBAN = 0 for rural respondents.

Group 5. Husband's Educational Level (HEDUC). The four categories of educational level of husband are represented by three indicator variables HPRIMARY, HSECONDARY and HHIGH, which take value 1 for Primary, Secondary or High School Level and zero otherwise. The reference category consists of husbands with no education. The choice of this variable rather than Respondent's Educational Level (REDUC) is explained below.

Group 6. Husband's Most Recent Occupation (HOCCUP). The original ten categories of this variable included five very small groups, viz 'Not Worked' (.2 per cent of sample), 'Private Household Workers' (.1 per cent), 'Clerical Workers' (2.5 per cent), 'Agricultural Employees' (3.3 per cent) and 'Unskilled Production Workers' (2.7 per cent). Some combination of categories was advisable. Eventually five categories were retained, and represented in the regression by four indicator variables:

PTAD =	1, professional, technical or administrative workers; 0, Otherwise
CLSS =	1, clerical, sales and service workers; 0, Otherwise
SKIL =	1, skilled production workers; 0, Otherwise
UNSKIL =	1, unskilled production workers; 0, Otherwise.

The reference category consisted of the large group of farmers and agricultural employees, plus the negligible group of women whose husbands had never worked.

Occupation of wife and her most recent work status were excluded after some initial regressions which indicated their low predictive power.

Group 7. Standard-of-Living Index. This consists of a single variable, STANDLIV, from the household data, as described in 5.3. The other economic variable, the logarithm of family income, was found to have no relationship with current use after the background variables in groups 1 to 6 were included in regressions.

One other variable, respondent's age at first marriage, was included in initial regressions as a continuous variable. No relationship with current use was found and accordingly this was dropped from further analysis.

7.3 ANALYSIS OF VARIANCE OF NET EFFECT FROM STEPWISE REGRESSION

The set of regressor variables are already correlated. For example, the set of variables for Husband's Occupation include a strong urban-rural dimension which is highly associated with TYPE OF PLACE. Thus, as noted above, the contribution of each variable as a predictor of CUSE depends on which other predictor variables are controlled by inclusion in the regression equation. In this section we present the results from one choice of ordering of the

regressor variables. In later sections, when the individual effects of each group of predictors are analysed, different orderings will be used.
A stepwise regression was calculated in which each of the groups of variables defined above were forced into the equation in the following sequence: LIVCHILD, AGE, REGION, TYPE OF PLACE, HEDUC, and STANDLIV (7.3.1). This gives the following set of regressions:

Step 1: CUSE on LIVCHILD
Step 2: CUSE on LIVCHILD, AGE
Step 3: CUSE on LIVCHILD, AGE, REGION
Step 4: CUSE on LIVCHILD, AGE, REGION, TYPE OF PLACE
Step 5: CUSE on LIVCHILD, AGE, REGION, TYPE OF PLACE, HEDUC
Step 6: CUSE on LIVCHILD, AGE, REGION, TYPE OF PLACE, HEDUC, HOCCUP
Step 7: CUSE on LIVCHILD, AGE, REGION, TYPE OF PLACE, HEDUC, HOCCUP, STANDLIV

In these regressions, categorical variables are represented by their complete set of dummy variables, introduced into the regression as a block.
The choice of order in which variables are entered is a major decision which has an important bearing on the interpretation of the results. In most studies, including the present one, this choice is not clear cut and involves a certain degree of arbitrariness. The actual choice (7.3.1) was based on the following considerations:

1) In general, variables are introduced according to an approximate temporal or causal order. For example, one plausible sequence would be
AGE, REGION, HEDUC, HOCCUP, LIVCHILD,
since respondent's Age is a truly exogeneous variable, region is basically determined prior to the socio-economic variables, and the number of living children is causally posterior to the husband's education and occupation, to the extent that these are determined at the respondent's marriage. The positions of Type of Place of Residence and Standard-of-Living in this sequence are less clear. One possibility is to include them as follows:
AGE, REGION, TYPE OF PLACE, HEDUC, HOCCUP, STANDLIV, LIVCHILD (7.3.2)
However, it should be noted that the position of Type of Place of Residence is unsatisfactory in cases where migration to the city has occurred after the respondent's education. Also, the late position of Standard-of-Living in the sequence is compromised to the extent that this variable is determined early in the respondent's life through inherited wealth. Thus, there seems little hope of obtaining an exact causal sequence.

2) The position of variables is partly modified by the specific objectives of the analysis. Thus, the position of Standard-of-Living posterior to the other socio-economic variables is retained in the final sequence despite the objection just raised, since it is of interest to know how much this variable adds to the explanation of Contraceptive Use after the other more widely used socio-economic variables have been controlled. Also in the final ordering (7.3.1), the demographic control Number of Living Children is moved to the beginning despite its lateness in the temporal sequence. This reflects an analytical desire to assess the effect of socio-economic variables on contraceptive use net of family size. Thus, differentials in contraceptive use which are caused by differing family size distributions between categories of the socio-economic variables are considered to have no analytical interest, for the purposes of this study.

For each of the steps of the regression, most statistical packages print an analysis of variance table giving the regression and residual sum of squares, together with associated degrees of freedom, mean squares and F-statistics. These are given in Table 10. The last column gives the multiple R^2, which is the ratio of the regression sum of squares to the total (= regression + residual) sum of squares and represents the proportion of the variance of current use explained by the independent variables. Note that these R^2 values are low, reaching only 15 per cent when all twenty-three independent variables are included. However, the F values indicate that the overall statistical significance of the independent variables is beyond question. In other words, differentials in current use are apparent from the data.
In our opinion the apparently low proportion of variance in current use explained by the regressions should not cause excessive concern, for the following reasons:

i) For a dichotomous response, an R^2 of unity would obtain in a cross-classification where the proportion currently using for all subgroups was either zero or one. This ideal is clearly not achievable in practice since there will always remain a component of unexplained variation in the dependent variable.

ii) The regression models are subject to large **specification error**, in that many factors which are strongly related to contraceptive use are absent from the study. These include program-specific variables, such as access to family planning services and regional differentials in the promotion of these services, and intermediate variables which measure a couple's desired family size and attitudes towards family planning in general and contraceptives in particular. One would expect these variables to have a larger impact on the level of contraceptive use than would the broad socio-economic characteristics included as predictors here, although as noted above, assessing the causal effect of such variables even when measured is not an easy task.

iii) In addition to the fact that our predictor variables are rather indirectly related to the response variable, they are limited by the fact that they produce highly uneven splits of the sample. For example, we shall see that a variable such as education has considerable **analytical** importance, in that the level of use varies widely according to educational level. Nevertheless, this variable remains a poor predictor of current use for the population because nearly all the respondents fall in the low education categories, and hence the higher level of use among more educated women is restricted to a relatively small component of the population.

iv) In general values of R^2 of more than 20 per cent are not common in sociological research.

From Table 10 we can separate out the effect of each group of independent variables, net of variables introduced at previous steps, by subtracting the regression degrees of freedom and sums of squares of adjacent steps. This leads to the single analysis of variance table in Table 11. For example, the sum of squares for HEDUC in Step 5 of the table 6.33, is obtained by subtracting the sum of squares in Table 10 for Step 4, 62.59, from the sum of squares for Step 5, 68.92, and it represents the effect of HEDUC, net of REGION, AGE, LIVCHILD, and TYPE OF PLACE.
The statistical significance of these net effects can be assessed approximately by F tests on the F-values given in

Table 10 Analysis of Variance from Stepwise Regressions

Step	Variables in Regression	Source	Analysis of Variance: Degrees of Freedom	Sum of Squares	Mean Square	F	R^2
1.	LIVCHILD	Regression	9	24.34	1.705	11.57	.046
		Residual	2136	499.18	.2337		
2.	LIVCHILD, AGE	Regression	10	24.35	2.245	10.39	.047
		Residual	2130	499.16	.2343		
3.	LIVCHILD, AGE, REGION	Regression	14	60.42	4.316	19.81	.115
		Residual	2126	463.1	.2178		
4.	LIVCHILD, AGE, REGION, TYPE OF PLACE	Regression	15	62.59	4.173	19.24	.120
		Residual	2125	460.9	.2169		
5.	LIVCHILD, AGE, REGION, TYPE OF PLACE, HEDUC	Regression	18	68.92	3.829	17.87	.132
		Residual	2122	454.6	.2142		
6.	LIVCHILD, AGE, REGION, TYPE OF PLACE, HEDUC, HOCCUP	Regression	22	71.96	3.271	15.34	.138
		Residual	2116	451.6	.2132		
7.	LIVCHILD, AGE, REGION, TYPE OF PLACE, HEDUC, HOCCUP, STANDLIV	Regression	23	77.19	3.356	15.92	.148
		Residual	2117	446.3	.2108		

Table 11 Hierarchical Analysis of Variance from Regressions of Current Use of Contraception

Step	Variable Entered at Step	Sum of Squares Added at Step	Degrees of Freedom Added at Step	Mean Square	F[a]	Partial R^2
1.	LIVCHILD	24.34	9	2.71	12.8	.046
2.	AGE	.01	1	.01	.1	.001
3.	REGION	36.07	4	9.01	42.8	.068
4.	TYPE OF PLACE	2.17	1	2.17	10.3	.004
5.	HEDUC	6.33	3	2.11	10.0	.012
6.	HOCCUP	3.04	4	.76	3.6	.006
7.	STANDLIV	5.23	1	5.23	24.8	.010
	RESIDUAL	446.3	2117	.211	–	

[a] *The denominators for all the F-statistics are calculated as the residual mean square from Step 7.*

the penultimate column,[8] and the increase in the proportion of the total variance explained at each step is given by the partial R^2 in the last column. The large regional differentials in current use are reflected in the large F statistic for REGION ($F = 42.8, P < .001$). The partial R-squareds for TYPE OF PLACE, HEDUC, HOCCUP and STANDLIV are small: taken together they explain only 3 per cent of the variance after controlling REGION, LIVCHILD and AGE. However, all these effects are statistically significant at the 1 per cent or below. Note in particular that the net effect of STANDLIV has an F value of 24.8 on 1 and 2117 degrees of freedom, which corresponds to a normal deviate of 5; thus there remains a strong association between this standard-of-living index and current use after controlling for the other variables.

To examine the direction and substantive significance of this and other effects it is necessary to examine the regression coefficients from the stepwise regressions. We shall adopt a method of presentation of these coefficients which is a natural extension of the methods of cross-tabulation and direct standardization. We begin by examining the coefficients of the demographic variables.

7.4 DIFFERENCES IN CURRENT USE BY NUMBER OF LIVING CHILDREN

The differences in Current Use by Number of Living Chil-

[8] The definition of partial R^2 is non-standard, in that the denominator is not adjusted for variables entered in previous steps. *Added* R^2 may be a better term.
The strict validity of the F-tests is debatable: see the previous chapter. Also, the F-statistics for categorical variables are highly sensitive to the choice of categories. For example, if the original ten categories of HOCCUP had been retained, the sum of squares for that variable would be only slightly larger than its value 3.04 in the table. However, the degrees of freedom would be increased from 4 to 9, leading to a halving of the F-statistic.

dren have been considered in the Country Report and are of secondary interest in this study. We include them here partly for completeness and partly to explain how the effects of categorical variables are presented in this report.

As noted in 7.2, LIVCHILD is represented in regressions by nine indicator variables NLC0 to NLC8. Let us consider the first regression of the previous section, CUSE on LIVCHILD. The estimated regression equation was

CUSE = .262 − .180 NLC0 + .080 NLC1 + .176 NLC2 + .240 NLC3 + .274 NLC4 + .227 NLC5 + .157 NLC6 + .205 NLC7 + .085 NLC8. (7.4.1)

As noted above, the regression coefficients represent differences in the estimated mean level of use between the corresponding category and the reference category, here women with nine or more children. For example, the coefficient for NLC4, .274, indicates that the level of use of women with four children is 27.4 per cent higher than that for women with nine or more children. Also, the intercept .262 represents the mean level of use when NLC0 = NLC1 = . . .= NLC8 = 0, that is, for the reference category. To obtain a more symmetric presentation of these results, the mean level of use for the other categories is calculated by adding the corresponding regression coefficient to the intercept. We obtain the following:

NUMBER OF LIVING CHILDREN	0	1	2	3	4	5	6	7	8	9+
Mean Current Use	.082	.342	.438	.502	.536	.489	.419	.467	.347 (7.4.2)	.262

Thus the last value, .262, is the intercept from the equation and the first value, .082 = .262- .180, is the sum of the intercept and the coefficient of NLC0. These values can be converted to percentage use by multiplying by 100.
The row (7.4.2) is *identical* to the cross-tabulation of Current Use by Number of Living Children, for the given sample base. It exhibits the 'inverted U' shape noted for this relationship in the first country report. A comparison with Table 5 indicates a rather higher level of use for the high parities, reflecting the fact that infecund women are excluded from the base in (7.4.2).

The second regression of 7.3 adds the variable AGE. The resulting regression equation is

CUSE = .280 − .0004 AGE − .188 NLC0 + .072 NLC1 + .170 NLC2 + .236 NLC3 + .270 NLC4 + .224 NLC5 + .156 NLC6 + .204 NLC7 + .084 NLC8 (7.4.3)

Note that the coefficient of AGE is very small, suggesting a negligibly small effect of this variable. A comparison of (7.4.3) with (7.4.1) indicates slight changes in the other coefficients.
The mean age of the respondents is 31.54. Substituting AGE = 31.54 in (7.4.3), we obtain

CUSE = .267 − .188 NLC0 + .072 NLC1 + .170 NLC2 + .236 NLC3 + .270 NLC4 + .224 NLC5 + .156 NLC6 + .204 NLC7 + .084 NLC8. (7.4.4)

Repeating the procedure applied to (7.4.1) using (7.4.4) we obtain the Mean Level of Use by Number of Living Children, controlling AGE:

NUMBER OF LIVING CHILDREN Controlling AGE	0	1	2	3	4	5	6	7	8	9+
Mean Current Use	.079	.339	.437	.503	.537	.491	.423	.471	.351	.267 (7.4.5)

The means in (7.4.5) are interpreted in the same way as category means from Test Factor Standardization. For example, the mean for women with one child, .339, represents the estimated proportion currently using contraception in that group if the mean age of that group was equal to the mean age of the entire sample. Also, the differences in the means in (7.4.5) from the overall mean level of use (.426) are equivalent to the net effects of Multiple Classification Analysis.
This procedure can be applied to control more than one variable. For example, to control AGE and REGION, the estimated equation for the regression of CUSE on AGE, REGION and LIVCHILD is obtained and then mean values of AGE and the indicator variables for REGION (NORTH, NORTHEAST, CENTRAL and SOUTH) are substituted, to obtain another equation of the form (7.4.1). Then the category means for Number of Living Children can be calculated as before. A full analysis of all the controls is omitted in this section, since Number of Living Children is primarily a control variable in this study. A detailed analysis of REGION and other regressors is given in Sections 7.6 - 7.11.

7.5 DIFFERENCES IN CURRENT USE BY AGE

The variables Age and Number of Living Children are highly associated, and the pattern of Contraceptive Use by Age is similar to that found by Number of Living Children, as noted in the Country Report. Also, a negative association between Age and Current Use was found for most family-size categories, as shown in Table 5.

As noted, Table 5 includes all currently married non-pregnant women, and hence does not exclude, as in this study, women who consider themselves infecund. The effect of removing these women on the linear component of the effect of Age is evident in the regression coefficient for AGE in (7.4.3), which is very small (-.0004) and not significant. It appears that within each category of family size, the relationship between Age and Current Use becomes negligible when infecund women are excluded from the sample base.

However, when Number of Living Children and Region are controlled, the coefficient of AGE increases to −.0041, indicating an estimated decrease in current use of the order of 4 per cent for every ten years difference in Age. This figure is subject to a high sampling error. Further controls of Type of Place, Husband's Education, Husband's Occupation, and Standard-of-Living do not affect this coefficient noticeably (details not shown).

The conclusion is that there is some evidence of a negative association between Age and Current Use within family size, after excluding infecund women. However, this effect is rather small and ill-determined.

7.6 REGIONAL DIFFERENCES IN CURRENT USE

So far all the results have been based on the set of regressions given in Section 7.3. For a full description of regional differences it is convenient to modify the order in which variables are introduced so that REGION is introduced first. Thus the first step consists of a regression of CUSE on REGION (represented by the indicator variables NORTH, NORTHEAST, CENTRAL and SOUTH). In the following six steps LIVCHILD, AGE, TYPE OF PLACE, HEDUC, HOCCUP and STANDLIV are added in turn.

At each step the intercept and regression coefficients for NORTH, NORTHEAST, CENTRAL, and SOUTH are converted into regional means using the method of Section 7.4. These means are displayed as percentages in the first five columns of Table 12. Thus the first row, corresponding to Step 1, is simply the cross-classification of the Mean Level of Current Use by Region, and the row for each succeeding step gives the Regional means after controlling for all the variables introduced up to that step. The penultimate column of the table gives the overall mean level of use (42.6 per cent).

The last column of Table 12 gives a summary measure of the magnitude of the differences in the level of use between regions. One plausible measure would be the partial R^2 from analysis of variance, which equals the difference in the regression sum of squares from regressions including and excluding region, expressed as a precentage of the total sum of squares. However, this measures the proportion of the variance in current use attributable to the net effect of

Table 12 Percentage of Currently Married, Non-Pregnant, 'Fecund' Women Currently Using an Efficient Method, by Region, Adjusted for Indicated Variables by Linear Regression

Step	Controls	Region of Residence						
		Bangkok	North	North-East	South	Central	Mean	Partial R
1.	–	54.9	52.8	32.5	18.9	53.7	42.6	.253
2.	LIVCHILD	55.6	53.4	31.8	19.1	53.6	42.6	.259
3.	LIVCHILD, AGE	56.2	53.8	31.2	19.1	53.9	42.6	.263
4.	LIVCHILD, AGE, TYPE OF PLACE	44.4	54.6	32.4	19.2	54.8	42.6	.253
5.	LIVCHILD, AGE, TYPE OF PLACE, HEDUC	43.5	55.3	32.2	21.1	53.5	42.6	.245
6.	LIVCHILD, AGE, TYPE OF PLACE, HEDUC, HOCCUP	43.2	54.9	33.5	21.5	51.8	42.6	.221
7.	LIVCHILD, AGE, TYPE OF PLACE, HEDUC, HOCCUP, STANDLIV	40.1	55.0	34.9	22.1	50.1	42.6	.208
Sample Size = 2141								
Per Cent Distribution =		6.7	25.8	35.3	9.9	22.3		

region, and as such summarizes the *squared* differences in the regional means. Table 12 presents the square root of this measure, viz *partial R*, which summarizes the *absolute values* of the differences.[9] Partial *R* is similar to the BETA measure of Multiple Classification Analysis. The differences in Partial *R* between rows summarize the effect of the controls on the size of the regional differences in current use.[10] The following substantive points emerge from Table 12:

1) Forty-three per cent of currently married, 'fecund', non-pregnant women report current use of an efficient contraceptive method. This level of use ranges from one in two in the Bangkok, North and Central regions to one in three in the North-East region and to one in five in the South region (Step 1).

2) The regional differentials in current use are not attributable to differences in the age and family size distributions between regions (Steps 2 and 3).

3) The only important effect of controlling Type of Place of Residence (Step 4) is to reduce the adjusted mean for Bangkok from 56 per cent to 44 per cent. This apparently dramatic change requires careful interpretation, since the Bangkok region is entirely urban. After step 3, the deviations of Bangkok from the overall mean should be interpreted as *specific to the urban sector*. These deviations are small; for example at step 4 it is 44.4 - 42.6 = 1.8 per cent. The conclusion is that the level of use in Bangkok is not significantly higher than in other *urban* areas. Note that the level of the adjusted mean for Bangkok has little substantive interest except in relation to the adjusted means of the other regions.

4) The partial *R* for region drops from .253 to .206 when HEDUC, HOCCUP and STANDLIV are controlled. Thus, according to this measure about one-fifth of the regional differences can be attributed to regional differences in husband's educational level, husband's occupation and the standard of living index. There remain considerable regional differentials in current use which are due to other factors, such as program-specific differences or cultural differences, not measured by these socio-economic variables.

7.7 URBAN-RURAL DIFFERENTIALS IN CURRENT USE

The urban-rural differencial in current use can be studied by introducing variables into the regression in the following order: 1) TYPE OF PLACE, 2) REGION, 3) LIVCHILD, 4) AGE, 5) HEDUC, 6) HOCCUP, 7) STANDLIV. From the regression coefficient of TYPE OF PLACE in these regressions, Table 13 is constructed in the same way as Table 12.[11]
From Table 13, current use is 13 per cent higher in urban areas than in rural areas. This differential is not affected by controls of REGION, LIVCHILD and AGE, but drops to 9 per cent when HEDUC is controlled, to 4 per cent when HEDUC and HOCCUP are controlled, and to a negligible 1 per cent when HEDUC, HOCCUP, and STANDLIV are controlled. The large reduction when HOCCUP is introduced reflects the high association between TYPE OF PLACE and the farming vs. non-farming categories of Husband's Occupation.

[9] The point of this apparently trivial change of scale is clearer for a dichotomous regressor. If the difference in the adjusted mean responses for the two categories is reduced from, say, 30 per cent to 15 per cent between steps, then the partial *R* is reduced by a factor of two, the partial R^2 by a factor of four.

[10] The partial R^2 for step 1 is obtained from Table 11. For calculating R^2 for other steps it is necessary to rerun the stepwise regression with REGION removed. Note also that here we compare partial *R*'s for the **same** variables for **different** steps, and **not** partial *R*'s for **different** variables within the **same** step. The latter procedure is controversial and should be avoided.

[11] In fact, for a **dichotomous** variable, these additional regressions are not needed using BMDP, since this package presents regression coefficients for variables **not yet entered** at each step. Details are omitted (Cf. previous footnote).

Table 13 Percentage of Currently Married, Non-Pregnant, 'Fecund' Women Currently Using an Efficient Method, by Type of Place of Residence, Adjusting for Indicated Variables by Linear Regression

Step	Controls	Type of Place Residence: Urban	Rural	Mean	Partial **R**
1.	–	54.2	40.9	42.6	.090
2.	REGION	53.6	41.0	42.6	.060
3.	REGION, LIVCHILD	53.9	41.0	42.6	.060
4.	REGION, LIVCHILD, AGE	54.6	40.9	42.6	.064
5.	REGION, LIVCHILD, AGE, HEDUC	50.0	41.5	42.6	.039
6.	REGION, LIVCHILD, AGE, HEDUC, HOCCUP	46.1	42.1	42.6	.020
7.	REGION, LIVCHILD, AGE, HEDUC, HOCCUP, STANDLIV	43.6	42.4	42.6	.005
Sample Size = 2141					
Per Cent Distribution =		12.7	87.3		

A substantive explanation of the effects is not straightforward, but it appears that part of the urban-rural differential can be attributed to the better educational background of the urban population, reflecting either the enhanced educational opportunities of towns and cities or the tendency of the better educated to migrate to the urban sector. The modest difference of only 9 per cent, when education is controlled, is somewhat surprising, as many aspects of urban life, such as greater exposure to mass media and access to family planning services, might have been expected to have exerted a stronger influence on the adoption of family limitation practices. Less importance can be attached to the further narrowing of the gap to a mere 4 per cent and 1 per cent when occupation and standard-of-living, respectively, are introduced. Occupational structure so closely overlaps the urban-rural categories (about 75 per cent rural husbands were engaged in agriculture compared to about 7 per cent of urban husbands), that the rural-urban differential net of occupational differences, is an extremely artificial construct. However, the data do imply the absence among non-agriculturalists of any marked behavioural difference between the urban and rural sectors.

The final erosion of the differential when standard-of-living is controlled is of even less interest because the scale itself has an inbuilt rural-urban component.

7.8 DIFFERENTIALS BY EDUCATIONAL LEVEL

Two highly associated variables, Respondent's Educational Level (REDUC) and Husband's Educational Level (HEDUC) were available as measures of the educational dimension. The reasons for choosing the latter variable for the intensive analysis of the data will be discussed first.

Four effects of education are given in Table 14, the separate effects of HEDUC and REDUC, the net effect of HEDUC controlling REDUC and the net effect of REDUC controlling HEDUC. The last two effects indicate the **additional** explanatory power of each variable after the other variable is controlled. All the effects are presented as percentages in each category in a manner analogous to Table 12, and all are adjusted for REGION, LIVCHILD, and TYPE OF PLACE.

It is evident from Table 14 that Husband's Educational Level is a better predictor for Current Use than Respondent's Level of Education. The partial R for the marginal effects of REDUC and HEDUC, given in the last column of the table, are .085 and .110, respectively, and the partial R for the net effects are even more divergent, .057 and .091, respectively.

The superiority of HEDUC reflects both the larger differences in the adjusted levels of current use between categories and the slightly better split of the sample, illustrated by the percentage distributions at the foot of the table.

The substantive importance of this finding is that husbands' characteristics are at least as important as wives' characteristics in influencing contraceptive behaviour. Its methodological implication is that, especially in countries where a WFS sample is very unevenly divided according to wife's educational level, husband's education should be included as one of the explanatory variables from the first preliminary report onwards.

The effects of controls on differentials by HEDUC are summarized in Table 15, which has the same layout as Table 12 for Region. Note that these results require a different stepwise regression with HEDUC introduced first.

The percentage currently using has a strong positive relationship with HEDUC, ranging from 29 per cent for husbands with no education to 62 per cent for husbands with high school education. However, the variable explains less than 2 per cent of the variance in use, since it does not produce an even split of the sample: over three-quarters of the sample fall into the primary educated class. On the assumption that these strong differentials persist in the future, a major increase in contraceptive use can be expected as educational standards improve.

The positive relationship is reduced by region of residence, increased when number of living children and age is controlled and is little affected by type of place of residence. The net effect of controlling for all four above-mentioned variables is minor (see line 5 of Table 15). However, the effect of introducing occupation and standard-of-living is substantial and reduces the differences in use between secondary or higher education and the primary or lower education group, rather than the differences between secondary and high school/university or between primary and no education. The partial R declines from .11 to .068 when these two variables are added as controls. As both occupation and standard-of-living may be viewed as consequences of educational attainment, one interpretation of these results is that some 40 per cent of the relationship between education and use operates through occupation and standard-of-living, leaving 60 per cent to some other aspect of the educational experience.

Table 14 Percentage of Currently Married, Non-Pregnant 'Fecund' Women Using an Efficient Contraceptive Method, by Respondent's Educational Level and by Husband's Educational Level, with Indicated Variables Controlled by Linear Regression

	Controls	Educational Level					
Variable	REGION, LIVCHILD, TYPE OF PLACE And	None	Primary	Secondary	High	Mean	Partial **R**
REDUC	–	33.2	44.1	44.6	57.1	42.6	.085
HEDUC	–	29.5	41.6	49.3	62.0	42.6	.110
REDUC	HEDUC	36.1	44.4	37.0	40.7	42.6	.057
HEDUC	REDUC	32.7	41.2	49.4	63.6	42.6	.091
Sample Size = 2141							
Per Cent Distributions							
	REDUC	16.4	77.1	4.5	2.0		
	HEDUC	6.9	77.0	11.6	4.5		

7.9 DIFFERENTIALS IN CURRENT USE BY HUSBAND'S MOST RECENT OCCUPATION

Differentials in current use by Husband's Occupation are summarized in Table 16. The proportion currently using an efficient method ranges from 36 per cent for Agricultural Employees and Farmers to about 55 per cent for Skilled Production Workers, Clerical, Sales and Services Workers, and Professional, Technical and Administrative Workers, with the small group of Unskilled Production Workers having an intermediate level of use. About a third of these differences are removed when REGION is controlled,

Table 15 Percentage of Currently Married, Non-pregnant 'Fecund' Women Currently Using an Efficient Method, by Husband's Level of Education, Adjusted for Indicated Variables by Linear Regression

		Husband's Level of Education					
Step	Controls	None	Primary	Secondary	High	Mean	Partial R
1.	–	29.3	41.4	51.5	61.9	42.6	.127
2.	REGION	31.7	41.8	48.4	57.9	42.6	.093
3.	REGION, LIVCHILD	29.0	41.5	50.3	63.1	42.6	.120
4.	REGION, LIVCHILD, AGE	29.1	41.4	50.4	63.6	42.6	.121
5.	REGION, LIVCHILD, AGE, TYPE OF PLACE	29.5	41.6	49.3	62.0	42.6	.110
6.	REGION, LIVCHILD, AGE, TYPE OF PLACE, HOCCUP	30.0	42.2	46.7	58.1	42.6	.086
7.	REGION, LIVCHILD, AGE, TYPE OF PLACE, HOCCUP, STANDLIV	31.8	42.6	44.8	53.4	42.6	.068
Sample Size = 2141							
Per Cent Distribution =		6.9	77.0	11.6	4.5		

Table 16 Percentage of Currently Married, Non-Pregnant, 'Fecund' Women Currently Using an Efficient Method, by Most Recent Occupation of Husband, Adjusted for Indicated Variables by Linear Regression

		Occupation						
Step	Controls	Professional Technical & Administrative	Clerical Sales & Service	Skilled Production	Unskilled Production	Agri-cultural	Mean	Partial R
1.	–	58.6	53.1	56.2	43.9	36.3	42.6	.182
2.	REGION	56.4	50.4	51.3	38.6	38.3	42.6	.119
3.	REGION, LIVCHILD	56.5	51.2	50.8	38.8	38.3	42.6	.118
4.	REGION, LIVCHILD, AGE	57.6	51.3	50.3	38.7	38.3	42.6	.120
5.	REGION, LIVCHILD, AGE, TYPE OF PLACE	56.7	50.6	49.7	38.6	38.7	42.6	.105
6.	REGION, LIVCHILD, AGE, TYPE OF PLACE, HEDUC	49.3	48.9	50.2	39.6	39.5	42.6	.076
7.	REGION, LIVCHILD, AGE, TYPE OF PLACE, HEDUC, STANDLIV	45.4	44.8	48.2	41.1	40.9	42.6	.045
Sample Size = 2141								
Per Cent Distribution =		6.0	11.5	14.4	2.7	65.4		

reflecting no doubt the relatively high incidence of the high-use occupations in Bangkok. In particular the difference between unskilled production workers and those engaged in agriculture disappears. Once again demographic controls do not account for the observed differentials, but the controls of TYPE OF PLACE and HEDUC (Step 6) remove much of the remaining differences between occupational categories, leaving only a 10 per cent difference in use between unskilled production and agriculturalists on the one hand and the remaining 3 categories on the other. The effect of occupation, independent of region, type of place and education, is thus about half its gross effect when these factors are uncontrolled. The small net effect of occupation is further reduced in Step 7 when standard-of-living is controlled, but little interpretative emphasis can be placed on this because standard-of-living is itself largely determined by occupation.

7.10 DIFFERENTIALS IN CURRENT USE BY STANDARD OF LIVING INDEX

The proportion currently using contraception is positively associated with the standard-of-living index: on the average this proportion increases by 2 per cent for every unit increase in the index. The standard-of-living index is naturally associated with the educational level and occupation of the husband, and one might expect the magnitude of the relationship with current use to decline when these related variables are controlled; however, the relationship persists, the effect being a reduction of the average differential of use per unit from 2 per cent to 1.6 per cent, which is still highly statistically significant. Thus, it appears that this variable, unlike the other economic variables, size of family enterprise, and family income, captures dimensions of modernity and community development (see Section 5.3) which are related to use and not measured by the other background variables in this study.

7.11 SUMMARY OF CONCLUSIONS

1. Only a small percentage (15 per cent) of the variance in current use can be explained by the joint effect of all socio-economic variables. However, there is evidence of statistically significant differentials between several of these variables and contraceptive use.

2. There are large regional variations in the level of current use, which ranges from 19 per cent in the South to over 50 per cent in Bangkok and in the North and Central Regions. About one-fifth of this variation can be attributed to differing socio-economic composition and degrees of urbanization. After allowing for these, region remains the main major source of differences in contraceptive practice.

3. The rural-urban difference in use of 13 per cent persists across regions but can be partially explained by concomitant differences in educational level. The almost complete disappearance of the differential when occupation is controlled implies similarity of behaviour between urban dwellers and non-agricultural rural couples. Thus, there is little evidence that urbanity *per se* influences the readiness of couples to use contraception.

4. Husband's educational level is marginally more closely related to current use than wife's educational level. Furthermore, as the distribution of the sample is less skewed for husbands than wives, husband's education explains more of the variance in use. Differences in current use are of the same order of magnitude as those for region. After adjustment for demographic and geographic controls, the level of current use is twice as high among couples where the husband has eleven or more years of schooling than for couples where the husband has no formal education. However, the statistical significance of these differences is slight because the population is concentrated in low education categories.

5. Even when all other background variables are controlled, the standard-of-living index remains significantly associated with use.

6. Husband's Occupation exerts only a very modest influence on contraceptive use, when other background variables are controlled while income, wife's work status and occupation were found to be even less important and were discarded after some exploratory regressions.

8 Within Region Analysis of Contraception Use

8.1 METHODOLOGY

The regression analysis of the previous section is based on a model which assumes that the effects of all the background variables REGION, LIVCHILD, AGE, TYPE OF PLACE, HEDUC, and HOCCUP on current use are **additive**. In other words, differences in current use according to one variable are assumed to be the same for all levels of the other variables. In situations where this is not true, the additive regression effectively forms a weighted average of the observed differences over the levels of the other variables, and thus ignores any variation of the differentials between these levels. These variations in differences are sometimes called interactions.

There are two ways of incorporating a study of interactions in the regression framework. The first is to introduce multiplicative variables, such as AGE x NORTH or NLC[1] x TYPE OF PLACE x SKIL into the regression equations described above. Typically there are many interaction terms of this type, and many choices have to be made about which to include. The second approach is to split the sample according to the levels of one or more background variables, and then to carry out additive linear regressions separately for each subsample. The latter is equivalent to a special case of the first approach where all the first order interactions between the splitting variables and the other predictor variables are included in the equation.

Here the study of interactions is limited by sample size considerations; typically the percentage of variance in current use which is explained by the background variables is small (about 15 per cent), and thus large samples are required to obtain statistically significant effects. If subgroups are formed, then the sample sizes may diminish to a point where within group differentials are not distinguishable from random fluctuation.

Since there are relatively large regional differentials in current use, and cross-regional comparisons are of particular substantive interest, we shall restrict ourselves to an analysis of interactions with region. Accordingly we adopt the second of the approaches mentioned above, using REGION as the splitting variable and carrying out a separate regression on current use within each region.

The limitations of the sample regarding this analysis are illustrated in Table 8, which tabulates sample sizes by background variable and region. Seventeen of the seventy-four cells have sample sizes of less than twenty, and estimated levels of current use for these cells are of little value, although they are presented in parenthesis in succeeding tables for completeness.

Unlike the previous section we shall here restrict the analysis to a single stepwise regression within each region, with variables introduced in the following order:

LIVCHILD, AGE, TYPE OF PLACE, HEDUC, STANDLIV.

Thus, the estimated effects for each variable in this list are net of all variables appearing before it.

8.2 DEMOGRAPHIC AND SOCIO-ECONOMIC DIFFERENTIALS IN CURRENT USE WITHIN REGION

The overall effects of variables are summarized in Table 17.

Table 17 Effects of Background Variables on Current Use, by Region

a. Chi-Squared Statistics (Sum of Squares for Effect Divided by Residual Mean Sum of Squares)

Variable Entered	*df(u)*	$X^2_{u,.95}$	Region				
			Bangkok	North	North-East	South	Central
1. LIVCHILD	9	16.9	20.9	56.5	62.9	16.8	32.7
2. AGE	1	3.8	.4	5.5	1.0	.1	2.3
3. TYPE OF PLACE	1	3.8	–	.1	13.9	22.5	.0
4. HEDUC	3	7.8	1.7	2.4	12.1	11.3	9.4
5. HOCCUP	4	9.2	7.6	1.7	7.3	5.3	8.9
6. STANDLIV	1	3.8	.6	4.2	9.5	3.8	9.7
Sum 3-6	9	16.9	9.9	8.4	42.8	42.9	28.0
Sum 1-6	19	30.1	31.3	70.4	106.6	59.8	63.1
Residual ms			.228	.228	.197	.129	.228

b. Partial *R*-Squareds (100 x Sum of Squares for Effect Divided by Total Sum of Squares)

1. LIVCHILD	9	13.4	9.4	7.5	6.7	6.3
2. AGE	1	.3	.9	.1	.0	.4
3. TYPE OF PLACE	1	–	.0	1.7	8.9	.0
4. HEDUC	3	1.1	.4	1.4	4.5	1.8
5. HOCCUP	4	4.9	.3	.9	2.1	1.7
6. STANDLIV	1	.4	.7	1.1	1.5	1.9
Sum 3-6	9	6.4	1.4	5.1	17.1	5.4
Sum 1-6	19	20.0	11.7	12.7	23.8	12.1

Statistical significance is assessed in Table 17, part a, by the ratio of the sum of squares of the effect to the sum of squares of the residual from the final regression equation. For large residual degrees of freedom, such as here, these are approximately chi-squared with u degrees of freedom, where u is the usual degrees of freedom associated with each effect and given in the second column of the Table 17, part a. The third column gives the 95 per cent point of the standard distribution for reference.

The values of Table 17, part a, are positively related to sample size when effects differ from zero. Thus Table 17 presents values of another measure of association which is not sensitive to sample sizes within each region, namely the partial R-squared, equal to the effect of the sum of squares expressed as a percentage of the total sum of squares. Note that these values are sensitive to the distribution of the background variables within each region.

Finally, the predicted means for each background variable within Region are given in Table 18, which is the two-way analog of the rows of Tables 13, 15, and 16. Note that the row means in the last column of the table are obtained from the additive regressions for the whole sample **including** REGION, and hence are net of that variable. Estimates in parentheses are based on sample sizes of less than twenty, and hence cannot be interpreted with any conviction.
The following points emerge from these tables:

a) Between 7 per cent and 14 per cent of the variance in current use is explained by the demographic variables LIVCHILD and AGE. This percentage is noticeably high for Bangkok (13.7 per cent), but this may be attributable to sampling fluctuation, since the Bangkok sample is small.

The following points concern the overall effect of the socio-economic variables TYPE OF PLACE, HEDUC, HOCCUP, and STANDLIV on the level of use within each region. They are derived from the penultimate rows of Table 17, parts a) and b), which are calculated by summing over the net effects of each variable.

b) In Bangkok differentials by HEDUC, HOCCUP, and STANDLIV are not statistically significant ($x^2_9 = 9.9$), although they explain 6 per cent of the variance of current use. The lack of statistical significance reflects the small size (144) rather than a lack of true differences, which may of may not be uncovered by a larger sample. Thus, no firm conclusions can be drawn from the data.

c) In the North differentials are again not statistically significant ($x^2_9 = 8.4$), and they explain only one per cent of the variance in current use. In this case the sample size is larger (553), and there is clear evidence of homogeneity in the level of contraceptive use between socio-economic groups in this region (Table 18).

d) In the Central region, where the level of use (54 per cent) is similar to levels in Bangkok and the North, a different pattern emerges. Statistically significant differentials exist ($x^2_9 = 28.0$), and explain 5 per cent of the variance in current use. Inspection of the individual variables in Tables 17 and 18 indicate that there is no urban-rural differential, but a higher than average level of use among women whose husbands have secondary or higher education, who have skilled, non-agricultural jobs, and who enjoy a high standard-of-living.

e) The North-East region is characterized by an intermediate level of use (33 per cent), and significant diff-

Table 18 Percentage of Currently Married, Non-Pregnant 'Fecund' Women Currently Using an Efficient Method, by Region and by Background Variable, Adjusted for Indicated Controls by Regression within Region

Variable	Controls	Categories	Region					Mean
			Bangkok	North	North-East	South	Central	
TYPE OF PLACE	REGION, AGE, LIVCHILD	Urban	54.9	51.1	64.7	51.0	55.3	54.5
		Rural	–	52.9	31.4	14.4	53.6	40.9
HEDUC	REGION, AGE, LIVCHILD, TYPE OF PLACE	None	(46.7)	45.0	12.9	4.8	(41.5)	29.5
		Primary	52.4	53.0	31.9	19.6	50.9	41.6
		Secondary	51.2	57.9	43.4	34.6	60.4	49.3
		University	64.9	(58.5)	57.5	(41.5)	81.2	62.0
HOCCUP	REGION, AGE, LIVCHILD, TYPE OF PLACE, HEDUC	Professional, Technical Administrative	70.1	52.6	39.9	(7.0)	60.2	58.6
		Clerical, Sales and Service	41.6	49.1	48.0	33.8	64.5	53.1
		Skilled Production	59.1	58.3	46.3	15,7	62.7	56.2
		Unskilled Production	(44.2)	47.2	49.5	(6.2)	42.4	43.9
		Agricultural Employee or Farmer	(32.9)	52.3	30.6	17.7	49.9	36.3
STAND-LIV	REGION, AGE, LIVCHILD, TYPE OF PLACE, HEDUC, HOCCUP	Regression Coefficient	.008	.014	.025	.019	.019	.016
		Mean	54.9	52.8	32.5	18.9	53.7	42.6

Note: Parentheses denote cells where the denominator is less than 20 respondents.

erentials by Type of Place of Residence, Husband's Educational Level, and Standard-of-Living in the expected direction. Current use is twice as high in urban areas (65 per cent) as in rural areas (31 per cent), and a considerable positive association between use and both husband's education and standard-of-living remains after this effect is controlled by inclusion in the regression equation.

f) In the South the proportion currently using is only 19 per cent, and as expected, there are large and highly significant ($x_9^2 = 42.9$) differentials by socio-economic variables. The most striking of these is the urban-rural differential, which alone explains 9 per cent of the variance in current use. The percentage using among the twenty-six urban women is 51 per cent after AGE and CHILDREN are controlled, compared with 14 per cent among the remaining 186 rural women. There is also a statistically significant positive association between use and husband's education, despite the small sample size for this group.

We have shown that in addition to the large differences in levels of current use of contraception between regions, there are considerable differences in the socio-economic differentials in current use within regions. Broadly speaking, a high level of use is associated with low socio-economic differentials; however the Central Region is somewhat exceptional in this regard, since there remain differentials by Educational Level and Standard-of-Living despite the high level of use.

We have discovered significant interactions between Regions and Background Variables, and thus the additive linear regression model of the previous chapter is clearly an oversimplification. The extent to which this invalidates the previous analysis is arguable; we feel that the simplified picture based on the additive model remains useful and illuminating despite its limitations in reality.

9 Discussion of Findings

This study had two broad aims, the first of which was to illustrate the application of certain statistical techniques to data generated by the World Fertility Survey. We consider that the utility and flexibility of a form of step-wise regression, in which variables are entered in predetermined orders, has been demonstrated and that results have been presented in a manner which should be easily comprehensible and attractive to the demographer. Of course the approach has its attendant problems and defects, not least the need for assumption of linearity and additivity, and interpretation of findings is difficult where the regressor variables are themselves highly intercorrelated and where causal or temporal ordering of these variables is uncertain. Nevertheless, we think that the analytical strategy adopted here is potentially useful for many WFS data sets which possess the same structure and similar content as the data set from Thailand analysed here.

The second, and perhaps more important, aim was to advance our understanding of the relationship between contraceptive use and socio-economic factors, beyond that achieved by the Country Report. In this, at least partial success can be claimed, though, as with most non-experimental social research, conclusive results are elusive. We have noted the slight superiority of husband's as opposed to wife's educational level as a predictor of use, net of region and place of residence; the relative unimportance of family income or occupation, after controlling for the above mentioned variables; the attribution of the rural-urban differential to educational and occupational differences and the persistent effect of the standard-of-living index. These are all new findings, which could not have been reached by an extension of the cross-tabulation approach of the Country Report because of the small sample size. Perhaps of most practical importance has been the finding that only about one-fifth of the marked regional differences in contraceptive behaviour can be attributed to regional variations in urban-rural composition, educational or occupational structure of the population or standard-of-living. Though a critic justifiably might point out that such a conclusion could be inferred from the cross-tabulations presented in Tables 6 and 8, there is considerable merit in demonstrating it statistically and expressing it quantitatively, as was done in Table 11.

Like many research studies, this one poses as many new questions as it provides answers. In this instance, the failure of selected socio-economic factors to account for more than a modest part of the large regional differences in use provides the most interesting topic for further speculation and research and it is worth considering what further lines of enquiry could be pursued usefully.

The first possibility is that economic factors, not included in the SOFT Survey or inadequately measured therein, may play an important role in explaining regional variations.

Regions vary in terms of transport and communication networks. The fertile valleys of the North have highly developed systems which facilitate access to urban facilities and integration of the rural and urban economies. Similarly, the inhabitants of the Central plains come under the strong influence of the Bangkok Metropolis. In the North-East and the South, road systems are less developed, the pattern of settlement in some areas is more scattered, with the consequence that the rural population is more cut-off from urban-inspired innovations and activities.

Furthermore, there is evidence that rural incomes in the early 1970's showed markedly different trends between regions. Rural poverty apparently increased in the North and Central, decreased in the South and remained static (though at a high level) in the North-East. Similarly, there are large regional differences in land tenure with tenant or part-tenant farmers being most common in the Central Region but almost non-existent in the North-East.

Table 19 The Prevalence of Low Income Households and Tenant Farmers, by Region

Region	Percentage of Rural Households with Income under 6000 Baht[a]		Percentage of Farmers Who Are Owner-Operators, Tenants, or Part-Owners and Part-Tenants[b]	
	1969	1971-73	Owner-Operators	Tenants and Owner-Tenants
Bangkok-Thonburi	10	5	–	–
Central	25	35	59	41
South	54	45	84	16
North	52	64	82	18
North-East	73	75	97	3

Source:
a National Statistical Office Survey cited by Turton (1978)
b National Statistical Office Survey cited by Niphon Phauphongsakor (1975)

These additional sources of economic data have been introduced to safeguard against the dismissal of the possibility that socio-economic structure and change may exert a greater influence on regional differences in contraceptive use than implied by the regression analysis. However, any links between income movements or land-tenure patterns and fertility behaviour is purely conjectural and, on balance, the conclusion remains that factors other than those commonly subsumed under the label 'modernization' must have played an important part in the emergence of regional variations.

Another possibility is that long-standing cultural differences between regions account for different levels of contraceptive use through divergent response to the family planning programme. There is some evidence to support such a cultural explanation. The inhabitants of the North traditionally have been more integrated into the main stream of Thai culture than the Thai-Laos of the North-East or the inhabitants of the South with their Malay-speaking, Moslem minority. Though for reasons outlined in Section 5.1, great importance should not be attached to family size attitudes as causal determinants of use, nevertheless Table 20, based on SOFT data, indicates a desire for larger families in the two low-use regions.

Interpretation of these data is not straightforward. As Debavalya and Knodel (1978) have pointed out, in their comparison of Rounds 1 and 2 of the Longitudinal Study and the SOFT Survey, trends in preferred family sizes trend to accompany rather than precede trends in contraceptive prevalence. In rural areas, where contraception was still relatively uncommon in the early 1970's, desired family

Table 20 Mean Desired Family Size for Currently Married Women and Percentage of Currently Married, Fecund Women Wanting No More Children, Standardized for Number of Living Children

Region	Mean Desired Family Size	Percentage Wanting No More Children
Bangkok	3.9	49.0
Central	3.5	60.2
North	3.3	64.7
North-East	4.0	56.1
South	4.1	41.4

Source: SOFT Report, Vol. 2.

size showed no decline between 1968 and 1971. Between 1971 and 1975, however, by which time a quarter to a third of married women were using a method, a decline in desired size occurred. In urban areas, by contrast, where contraception was already firmly established by the late 1960's, a consistent downward trend in desired size is apparent between 1969 and 1975. The tentative conclusion drawn by the authors is that 'fertility desires may respond to the spread of family planning practices rather than vice versa'.

To establish whether this same apparent time-sequence applies to regions would require a regional breakdown of Longitudinal Study data on preferences. These data are not available and, in view of the small size of the rural sample (based on about 1500 households), it is extremely doubtful whether regional measures could be obtained with sufficient sampling precision to be useful. Whether or not this analysis proves feasible, its potential contribution is clear. Evidence that fertility preferences in the North-East and South remained static between 1972 and 1975 while declining in the Central and the North Regions would weaken the case for a cultural explanation. If, however, the regional diversity in preferences is not merely a phenomenon that emerged after 1972, then the likelihood of deep-seated differences in values and the plausibility of a cultural explanation would be strengthened. Some further illumination of the relationship between region and fertility preferences possibly could be gained by a regional analysis of attitude data on perceived costs and benefits of children from the SOFT husband's survey. But the insights into cultural values afforded by large scale sample surveys are often severely limited by measurement problems and superficiality of question and answer and perhaps the more intensive, small scale approach of many sociological and anthropological studies is needed.

So far discussion has been confined to possible socio-economic and cultural determinants of contraceptive practice, the so-called demand factors; supply factors which concern the nature and implementation of the Thai family planning programme have been neglected. We should now examine the possibility that regional variations in use merely reflect geographical variations in accessibility to contraceptive supplies or in the quality and reputation of family planning services and staff. Recent international comparisons[12] and indeed the striking successes of the Thai and Indonesian family planning programmes have re-affirmed the belief that interventionist policies focussed on reproductive attitude and behaviour may make an equally or even more important contribution to fertility declines than broader socio-economic modernization. Another recent study by Rodriguez (1978), based on WFS data, concluded that probability of use was influenced by perceived travelling time to the nearest source of supply. The major difficulties of these lines of enquiry which attempt to establish the relative importance of demand and supply factors in determining contraceptive use (or fertility change) are the near-impossibility of deriving measures of the quality (as opposed to the 'quantity') of a programme and the possible inter-dependence of demand and supply variables. More remote and underdeveloped areas, where initial demand for services is likely to be low, also tend to suffer from understaffing, inadequate supplies and other logistical problems that erode the effectiveness of a programme. Similarly morale and enthusiasm of staff, and thus the quality of a programme, tend to suffer if the reaction of the public is hostile or apathetic. The converse is equally true: nothing succeeds like success! These types of feedback greatly complicate any attempt to assess the independent effect of either supply or demand factors.

These problems have been mentioned as caveats not as deterrents to such research. Indeed investigation along these lines should be a high priority in Thailand as there are several strands of evidence to suggest that programme-specific factors may account for much of the regional variations in behavior. The large regional variations in method choice (see Table 21 below) imply differing regional emphases of the programme; the prevalence of depo-provera in the North is clearly a legacy of the success-

[12] See, for instance, Freedman, R. & Berelson, B. (1976) and Mauldin, W.P. (1978). For a detailed case study, see Blaikie, P.M. (1975)

Table 21 Per Cent Distribution of Current Users, by Specific Contraceptive Method and by Region

	Specific Contraceptive Method							
Region	Pill	IUD	Female Sterilization	Male Sterilization	Injection	Condom and Other Female Scientific	Traditional	Total
Bangkok	46	11	23	9	1	4	6	100
Central	44	9	25	11	5	1	6	100
North	50	14	13	6	12	1	5	100
North-East	28	39	14	1	4	1	13	100
South	30	11	20	3	2	2	33	100
All	41	19	18	6	6	2	9	100

Source: SOFT Survey

ful Chiang-Mei project. In the same region the striking absence of rural-urban or socio-economic differentials indicates a highly diffused programme effort. The contrary may be true in the South where differentials are most marked and reliance on traditional methods most common. Finally, it may be no coincidence that the two low-use regions, the North-East and the South, have been the most politically sensitive parts of the country and the least well-served by transport and communication networks, where perhaps government programmes have been most difficult to implement.

Though indices of health, manpower, and facilities are available by district (Mahidol University, 1975), we are unaware of any equivalent data specifically designed to gauge family planning inputs. Their apparent absence is understandable in view of the pluralist nature of Thai family planning services. Both the commercial sector and voluntary organizations have made important contributions, and, in addition, there has been a variety of special projects in different parts of the country, in which different approaches to the delivery of services have been tried. One example is the abovementioned Chieng-mai injectable project and another is the United Nations funded maternity-based scheme in the North-East. To compile realistic district or regional measures of family planning effort from such a diversity of institutions and projects would be a difficult task. However, the community level data from the SOFT Survey, as yet unanalysed, represent another data source on supply factors, and their addition to the set of independent variables used in this study could enhance our ability to explain regional differentials in use.

To conclude, we have attempted in this final section to sketch potentially useful avenues for further investigation of the patterns of contraceptive practice that existed in Thailand in 1975. To pursue them all with equal thoroughness would be a major undertaking, but it is to be hoped that some progress can be made before the data become of historical interest only.

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