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Determinants of Contraceptive Switching Behavior in Rural Sri Lanka

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This study examines the influence of a selected set of determinants of contraceptive method switching in rural Sri Lanka. Of interest is the question of how change in contraceptive practice at the individual level can account for patterns observed at the aggregate level. Based on calendar data on contraceptive use over a 3-year period, collected for more than 3,000 married women in a 1986 survey, the multivariate analysis shows that women who attain all or a significant proportion of their desired fertility tend to switch to more effective methods. Women who experience method failure tend to switch methods, usually to a type that is more effective. The woman's background determinants of age and education have small but significant effects on method switching, whereas the effect of household economic well-being is not significant. There is strong indication that rural couples are practicing contraception in a nonrandom fashion, switching methods in accordance with changes in their fertility motivations and contraceptive experience.

Early studies of contraceptive use focused on prevalence and sociodemographic correlates of the methods accepted by individual women (e.g., Carrasco 1981; Concepcion 1981). Now that family planning programs have been in place long enough for repeated studies of the same populations, research emphasis has shifted to trends in prevalence and differentials (London et al. 1985; Mauldin & Segal 1988; United Nations 1989). These trends aggregate the contraceptive histories of individual women, but their underlying factors cannot be understood by examining only prevalence patterns at sequential points in time. In this study we examine the relative influence of determinants of method change among rural Sri Lankan couples over a 2-year interval. A key question for the study is whether method use observed in a cohort of continuously married couples is largely constant across episodes or responds to changes in fertility demand and contraceptive use experience.

In Sri Lanka, family planning has been regularly promoted since the mid-1960s, contraceptive prevalence has increased, and a significant proportion of users have accepted modern methods (see Fig. 1). Government-sponsored programs have provided education and counseling on an array of modern methods [condom, pill, intrauterine device (IUD), injectables, and male and female sterilization]. Since 1980 women and men who choose sterilization have received financial compensation[1] (de Silva et al. 1988). The continued

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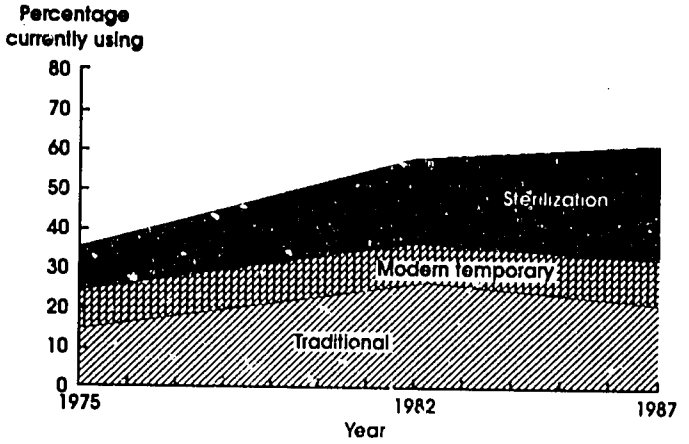

Figure 1. Trends in Current Contraceptive Use by Method Type Among Currently Married Women of Reproductive Age: 1975 Sri Lanka World Fertility Survey, 1982 Sri Lanka Contraceptive Prevalence Survey, and 1987 Sri Lanka Demographic and Health Survey

promotion of contraceptive practice concentrates on both raising overall use and improving effectiveness levels.

A striking aspect of the prevalence patterns that have emerged in Sri Lanka is the predominance of traditional methods and sterilization, with fewer women using modern temporary methods. In addition, the proportion of women who use modern temporary methods has remained relatively constant. This stability of modern temporary methods during periods of increasing contraceptive prevalence has been observed infrequently in other populations. It is not known whether the pattern results from high levels of method continuation and few new acceptors of modern temporary methods or from an equilibration of the flows of users into and out of this use category. These alternative explanations have important and differing implications for both family planning programs and the theory of contraceptive use dynamics (see Mundigo, Phillips, & Chamratrithirong 1989). A goal of our analysis is to discover whether one of the explanations is appropriate in rural Sri Lanka.

Studies of the determinants of contraceptive method choice have focused on the characteristics of women that essentially reflect structural features of society, such as education or household wealth (see Bulatao, Palmore, & Ward 1989). When determinants of switching behavior are of interest, however, it becomes appropriate to ask, as we do in this study, What has changed in the time since a method was chosen that would contribute to a subsequent change in use? Figure 2 presents a conceptual framework of couple-level factors influencing method choice over time (top). Our study estimates an empirical model for switching between two time points derived from this framework, as shown in Figure 2 (bottom).

Conceptual Framework

The contraceptive method chosen by a couple at a particular point in time may be viewed as determined by their evaluation of the following:

1. the number of present and additional children they desire,
2. their knowledge and belief regarding their present and future fecundity, and
3. their knowledge and beliefs about contraceptive methods, their effectiveness, availability, side effects, and so on.

2'

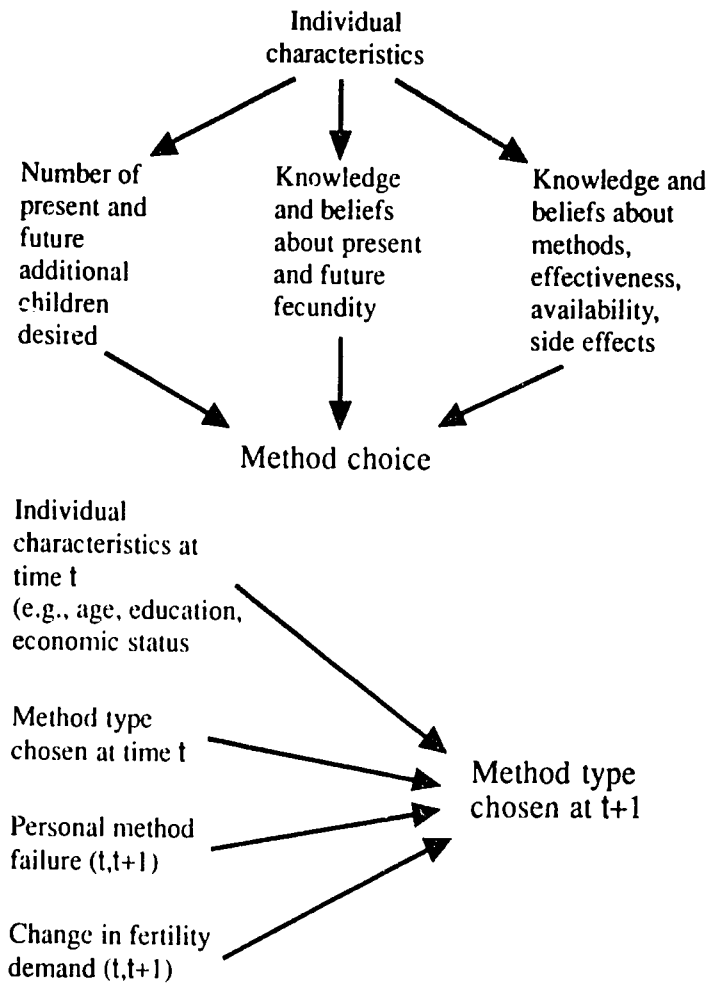

Figure 2. (Top) Conceptual Framework of Couple-Level Factors Influencing Method Choice; (bottom) Empirical Model of Couple-Level Factors Influencing Method Switch

This conceptual framework omits factors that are unnecessary for the analyses we present but lists ones similar to those in the conceptual model proposed by Bulatao (1989), who identified contraceptive goals, competence, access, and evaluation. In particular the third factor of contraceptive knowledge and beliefs incorporates many interesting influences on method choice that have received detailed attention in studies of determinants of method choice (e.g., Zablan et al. 1989) or method switching (e.g., Grady, Hayward, Billy, & Florey 1989).

Because we are interested in contraceptive use dynamics, the decision process can be viewed as continuing over time, resulting in a sequence of method choices. This sequence may include long periods during which the method does not change, no method is used, or the method switches from one to another. In this conceptual framework the choice of "no method" is treated the same as the choice of a contraceptive method. For example, in the postpartum period, no contraception may be used because of perceived protection from lactation. This is an example of the importance of a couple's present fecundity as a determinant of method choice.

Changes in these factors are expected to contribute to method switches. If there are no changes in any of these factors, then the method used is not expected to change. For example, as Figure 2 indicates, a change in the number of additional children desired (or fertility demand) should increase the probability of a method switch, but a woman's years of education (which usually does not change) should not have direct effects on method switching. A woman's personal experience with the effectiveness of a prior method could include method failure, which would subsequently affect the probability of changing methods. We expect changes in these factors of fertility demand and contraceptive experience to be important predictors of method switches in the observed interval.

In our analysis of determinants of method switching, we include some relatively static variables that have been shown to be significant correlates of method choice and may suggest changes in other determining factors. One example is the woman's age, used to approximate her fecundity and other life course effects on contraceptive knowledge. The influence of contraceptive knowledge, a factor in the conceptual model, is empirically embodied in the method type used previously at time t.

There is an intrinsic degree of difficulty in switching methods. A woman using no method can switch to any available method with relative ease. A pill user can switch directly to an IUD or sterilization but would need to go through a period of nonuse before she could switch to rhythm. Sterilization, on the other hand, is essentially irreversible. This ease or difficulty in changing is captured by the direct effect of method at time t on method at time $t + 1$, as shown in Figure 2 (bottom), and by estimating origin-method–specific models in multivariate analyses described later.

Data and Statistical Methods

Description of Contraceptive Histories

An individual woman's contraceptive history is a sequential record of her episodes of contraceptive use and nonuse. This record may also include information about pregnancies and periods of amenorrhea. If all details are included, the number of different possibilities will approach or equal the number of women in a study; hence attempts to describe and analyze contraceptive histories must begin with some system of reduction of information.

In practice, data describing contraceptive histories will already omit some details and will limit the possible approaches. For example, World Fertility Survey (WFS) data include first method ever used, penultimate method, and current method used (if any). This information permits a limited analysis of contraceptive histories Kane, Gaminiratne, and Stephens (1988) examined patterns and determinants of method switching using WFS-like data.

The data analyzed here come from a sample of 3,253 currently married women of reproductive age (15–44), interviewed during the Rural Family Planning Survey. The survey was conducted from August 1985 to February 1986 by the Family Planning Association of Sri Lanka (FPASL) with assistance from Family Health International. The sample covered three of the six socioeconomic and ecological zones and 17 of the 24 districts in Sri Lanka, therefore it is not completely representative of rural Sri Lanka. It was necessary to exclude some northeastern districts because of political disturbances at the time of the survey.

The sample design was a two-stage stratified sample. After zones and villages were selected by using probability proportional to size procedures, eligible women were randomly selected from village resident listings maintained and regularly updated by the FPASL. The sample population also was confined to the Sinhalese, who constitute 75% of the total population in Sri Lanka. Because of the controls on ethnic character and rural location, there is considerable homogeneity in sample composition. This has the disadvantage of mitigating socioeconomic differentials in patterns of contraceptive method change but has the advantage of increasing the significance of any variation found.

The survey collected monthly data on contraceptive practices, pregnancy status, and reasons for nonuse over a period of 36 months preceding the time of interview, following a calendar suggested in Laing (1985) and shown in Figure 3. First, pregnancies and their months of gestation were recorded on the pregnancy record form for the 36-month period. For each conception during this period, the respondent was asked whether it had occurred while she was using contraception and, if so, what method she was using. The duration of postpartum amenorrhea for each pregnancy was next recorded.

Then starting with the current month and working retrospectively, the interviewer asked about contraceptive practice in each month and recorded the method(s). For each month of nonuse (other than during gestation), respondents were asked the reasons for not practicing contraception. The first method ever used was ascertained. The amount of detail available in these data permits a choice of systems of information reduction.

Tsui, Thapa, Hamill, and de Silva's (1989) descriptive analysis of these data motivated the multivariate analysis we present here. They described each woman's contraceptive history with a list of episodes of method use during the 3-year period covered by the survey. An episode was treated as continuing until a different method was used. To reduce the number of possibilities further, methods were lumped into four categories: traditional, modern temporary (condom, pill), modern intermediate (IUD, injectables), and modern permanent (sterilization). Periods of nonuse were ignored. For example, a woman's 3-year contraceptive history would be described as "traditional" if she used only rhythm and withdrawal during those 3 years or "traditional–modern intermediate" if the first method she used during those years was rhythm and she then switched to an IUD.

The emphasis of the Tsui et al. (1989) approach was the description of patterns of method switching. DaVanzo, Reboussin, Starbird, Ann, & Abdullah (1989) used a similar system that defined episodes in terms of interbirth intervals. Although both approaches retain detailed information about sequences of events, information about the duration of method use episodes is lost.[2] Because the present study's interest is in rates of method switching (i.e., rates of flow of women into and out of method use categories), we have chosen to describe contraceptive histories in a way that retains information about time. Rates, by definition, are time dependent.

Two general alternatives for including time dependency present themselves. The first uses the length of each episode and suggests a proportional-hazard multivariate life table approach to modeling the determinants of method switching (e.g., Grady et al. 1989). The second fixes points in time and analyzes probabilities of switching from one state (method) to another during the intervals between these time points. This approach suggests a multinomial logistic-regression analysis of transition probabilities.

We have chosen the transition probability approach in this study for three main reasons. First, all our data are left censored; we are unable to tell from the survey how long women have been using their first method in the survey period. This greatly reduces the applicability of hazard models. Second, the lack of information about duration forces the use of some Markovian model, that is, where duration in a state is not required to examine probabilities of switching. The multinomial logistic model estimated here is essentially the same as a discrete hazard model without duration effects and a single time period. In addition, the transition probabilities estimated here could be used to project the proportions of the cohort using each method type for subsequent time increments. Third, because multiple switches are rare in the observed period, little is lost by missing the occasional intervening method. Less than 4% of the women switched more than once during the interval.

To reduce the number of possibilities and increase the number of each type of switch, we have combined contraceptive methods into the following four categories: (1) no method; (2) traditional methods—rhythm, withdrawal, and abstinence; (3) modern temporary methods—condom, pill, IUD, and injectables; (4) modern permanent methods—male and female

MONTHLY FP AND PREGNANCY RECORD (Mark months at right as indicated):

1 **Pregnancy Outcome** (from Pregnancy Record Form)

Birth = Live birth (excluding stillbirth)
Loss = Fetal loss (miscarriage, abortion, stillbirth)

2 **Months of Gestation** (Ask how many for each pregnancy, including current pregnancy, if any)

G = Gestation (Mark G for each month; first G is conception month)

3 **Amenorrhoea** For each Birth or Loss, ask how many months until menstruation resumed. Mark "AM( )" for that number of months minus one. If the respondent menstruated one month after delivery, do not mark any month.

AM( ) = Amenorrhoeic (leave parentheses empty for now)

4 **Amenorrhoea following 1982 Delivery** Check Pregnancy Record Form for delivery in1982. If so, ask whether still amenorrhoeic in 1983, and mark.

AM( ) for all such months except month of resumption.

5 **Contraceptive Practice** Starting with current month or most recent month still blank or marked "AM( )", ask whether using any method to avoid pregnancy, and if so, how long. Probe to make sure use was continuous during period of more than two months. Work backward through time asking about all months still blank or marked "AM( )". If respondent changed methods or stopped using during a month, mark only the status at the end of the month.

PIL = Pills
IUD = IUD
DEP = Injectables
LRT = LRT/female sterilization
CON = Condoms
VAS = Vasectomy
SAF = Safe period
WIT = Withdrawal

ABS = Abstinence (voluntary)
MIS = Miscarriage/abortion
S + W = Safe period and Withdrawal
S + C = Safe period and Condoms
C + W = Condoms and Withdrawal
O + + = Other method or combination
(mark only if used simultaneously)

6 **Family Planning Status at Time of Conception** (Verify month of conception and ask whether using contraception at that time)

G( ) = Conception month (If using FP add code letter from method; if not using FP, mark letter for reason not using)

7 **Reasons for Non-use** Ask for all months still blank. If more than one reason is given for a month, ask for most important one. Put the relevant abbreviation as shown below. For months still marked "AM( )", place a hyphen (–) inside the parentheses.

WC = Wants child/desired pregnancy
U = Unable or unlikely to bear children (including subfertile)
N = No sexual contact (including husband away, sick)
Am (–) = Amenorrhoea and not using contraception
X = Other reason (specify)

8 **Review** Check to be sure all months up to and including month of interview are marked and all later months are blank. Be sure also that all months marked "AM" and all conception months – first months of "C" – are followed by a code letter or hyphen in parentheses.

DEC '85	
NOV '85	
OCT '85	
SEP '85	
AUG '85	
JUL '85	
JUN '85	
MAY '85	
APR '85	
MAR '85	
FEB '85	
JAN '85	
DEC '84	
NOV '84	
OCT '84	
SEP '84	
AUG '84	
JUL '84	
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MAY '84	
APR '84	
MAR '84	
FEB '84	
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DEC '83	
NOV '83	
OCT '83	
SEP '83	
AUG '83	
JUL '83	
JUN '83	
MAY '83	
APR '83	
MAR '83	
FEB '83	
JAN '83	

Figure 3. Monthly Family Planning and Pregnancy Record

sterilization. When multiple methods are used in the same month, the most modern or permanent method determines the category.[3] Including nonuse as a method category is consistent with the contraceptive experience component in our conceptual model and also makes our list of method categories, or states, inclusive—a woman is always in one of these four states.

6

Our interest is primarily in the structure of effects that determine a method type switch. We consider only two points in time, the end of the first year in the 3-year period and the end of the third year. The resulting approximate 2-year interval, rather than a series of shorter periods, allows more time for switching and higher numbers of method switches. At each of these times, we classify each woman according to her method of choice. Here we deviate from our conceptual model in our treatment of women who were not at risk of conception because they were pregnant or amenorrheic. Because our emphasis is on investigation of the changes in contraceptive methods chosen by women, we are less interested in changes to and from no method when those changes are caused by changes in a couple's beliefs about risk of conception. We are more interested in changes in method chosen (including no method) when a woman believes she is at risk. We gain a great deal of information by classifying each woman not according to her current use at each point in time but according to the method she used most recently when she was *at risk of conception*. We refer to this method as her method of choice at our designated points in time. We chose the end of the first year as a starting time to allow for this search for earlier months at risk.

To summarize, we describe each woman's contraceptive history by specifying her method of choice at two points in time. We will refer to these as her "origin" and "destination" methods. The period between these time points, which we will call the "switching period," is approximately 2 years, and there are four alternative methods, as defined above. We estimate the probabilities of each destination method, given each origin method, and the factors that affect these probabilities.

Of the 3,253 women whose contraceptive histories were analyzed by Tsui et al. (1989), we were able to determine the origin method for 2,999. The remainder could not be classified because they were never at risk during the first year of the 3-year period and were omitted from further analysis. Because omitted women are more likely to be users of less effective methods (they were not at risk because they were pregnant or amenorrheic), their omission contributes to potential selection bias. This is not likely to be a serious problem, however, because our analyses of determinants of method switching are conditional on method of origin.

Determinants and Regression Model of Switching

We analyze the determinants of method switching by using multinomial logistic regression (Hoffman & Duncan 1988; Maddala 1983). Separate models are fit for three of the four origin methods. It was not necessary to fit a model of switching for women who originated with modern permanent methods (sterilization). The dependent variable in each model is the destination method. Thus the probabilities of switching from each origin method to each destination method are estimated as a function of selected explanatory variables:

1. proportional change in family size deficit (hereafter CFD),
2. personal method failure (PMF),
3. woman's age in years (Age),
4. woman's years of education (Educw), and
5. household wealth category (Wealth).

The first two, CFD and PMF, are designed to indicate changes in the factors in our conceptual model. The last three—Age, Educw, and Wealth—are static individual characteristics known to influence method choice significantly (Bulatao 1989).

Change in fertility demand is calculated from the woman's number of living children (*LC*) at the end of the 3-year period, desired family size (*DFS*) at that time, and births (*B*) and deaths (*D*) during the switching period. Family size deficit (*FSD*) is our estimate of the number of additional children desired at the beginning of the switching period: $FSD =$

$DFS - (LC - B + D)$. For women who desired no additional children at the start of the switching period, CFD is zero. For those who desired additional children, CFD represents the proportion of those children gained prior to a method change or, if no method change occurs, during the entire switching period. If desired family size is attained, CFD equals 1. Hence

$$\begin{aligned} \text{CFD} &= 0 && \text{if } FSD \leq 0, \text{ or } B - D \leq 0, \\ &= \frac{B - D}{FSD} && \text{if } 0 < B - D < FSD, \\ &= 1 && \text{if } B - D \geq FSD. \end{aligned}$$

We expect switches from less to more reliable methods to be directly related to fulfillment of fertility demand in this period.

Personal method failure reflects the woman's experience with accidental pregnancies while using contraception. For each woman the number of times she conceived while using her origin method during the switching period is divided by the number of months she used that method during that period.[4] This variable represents a woman's personal experience with the efficacy of a method, and it is expected that her beliefs about the effectiveness of that method may change based on that experience. A woman may have a high PMF value because her origin method was poorly suited for her needs, or simply because she was unlucky. In either case, her faith in the effectiveness of that method is likely to be reduced. Thus we expect PMF to be directly correlated with the probabilities of switching to more effective methods.

Woman's age is a significant covariate of method choice and is measured in single years because preliminary analyses reveal that the additional parameters required for age classes are not justified (likelihood ratio test, alpha = .05). Woman's education is also likely to be correlated with the same factors as age, in part because it will be correlated with age whenever education patterns are changing. It may also have direct effects on fertility demand and personal method failure. Smaller families are generally preferred by more educated women, who may also differentially experience and respond to any accidental pregnancies. As with Age, years of education are used (Eduew) because education classes could not be justified in preliminary analyses.

Household wealth may be correlated with method choice not only because it may have direct effects on desired family size and contraceptive use effectiveness but also because of its correlation with education. Our Wealth variable was actually two indicator variables representing presence in one of three wealth classes. These classes were determined by type of housing and household water source.

In summary, CFD and PMF are measures of changes in two factors in the conceptual framework—fertility demand and contraceptive knowledge and beliefs. Age, Eduew, and Wealth are background variables that may be correlated with these factors. Age, in particular, will be highly correlated with perceptions of fecundity. The three factors, however, do not directly measure changes within the switching period.

As we will discuss in more detail under Results, we tested squared terms for Age and Eduew as well as all second-degree interactions between the selected variables that passed our initial significance tests. The final model presented includes only terms that are significant (likelihood ratio tests, alpha = .05). The test for each term is a test of the hypothesis that its inclusion contributed significantly to the prediction of method switching behavior. Thus the test was a joint test of its significance in all switching models relating to the three origin methods. Besides the simplicity that results from this approach to determining statistical significance, the number of tests needed are relatively few and consideration of Type I errors does not complicate the interpretation of our results.

Results

Description of Switching Patterns

Our preliminary goal in this analysis is the description of the patterns of method switching in our sample of rural married women in Sri Lanka. Figure 4 presents these results in the form of the unconditional and conditional distributions of origin and destination methods. Next to the pie slices that represent the unconditional frequencies of the origin methods (Fig. 4, top) are the conditional distributions of *destination* methods given each origin method. In the bottom part of the figure, the distributions next to the pie slices are the conditional distributions of *origin* methods given each destination method.

A comparison of the unconditional frequencies in Figure 4 reveals short-term trends in the prevalence of method of choice among this cohort of continuously married women.[5] Recall that only 2 years separate these two distributions. In spite of the brevity of this period, shifts in prevalence are noticeable and consistent with those observed elsewhere (e.g., Kane

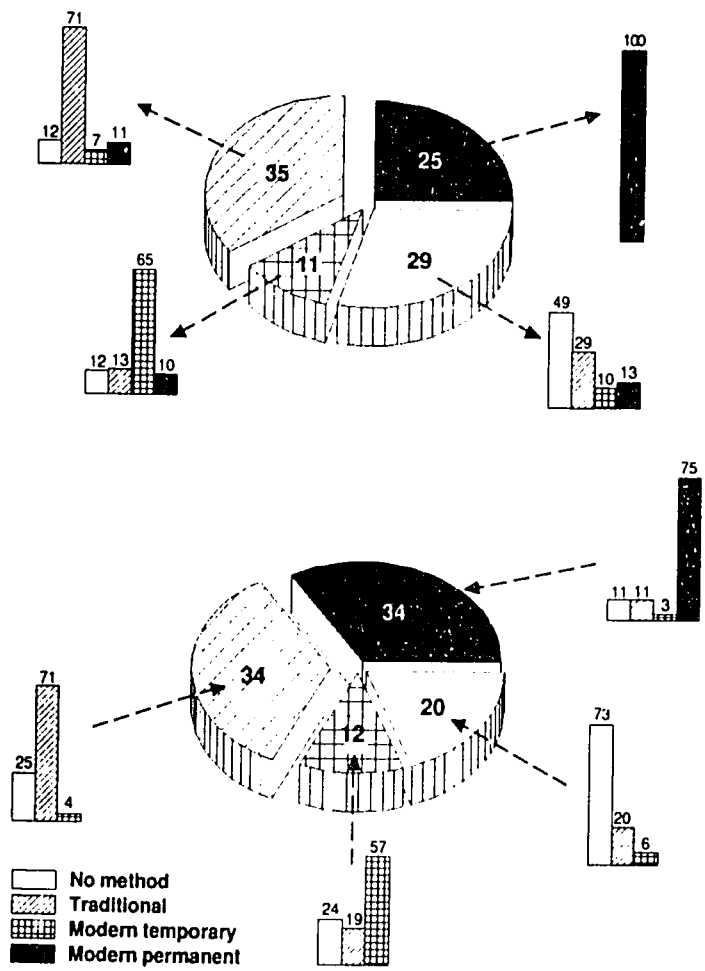

Figure 4. (Top) Unconditional Distribution of Origin Method and Conditional Distributions of Destination Method (at ends of arrows); (Bottom) Unconditional Distribution of Destination Method and Conditional Distributions of Origin Method (at ends of arrows)

et al. 1988). Overall prevalence increased (i.e., no-method use decreased), the prevalence of traditional and temporary methods remained relatively constant, and the prevalence of permanent methods increased.

As suggested earlier, such trends could result from low levels of switching by users of traditional and temporary methods combined with a tendency for nonusers to switch to sterilization. An examination of the conditional distributions reveals that this was not the case for the women in our sample. Nearly 40% of the users of temporary methods switched (Fig. 4, top), and these were replaced by women who switched from no method and traditional methods (Fig. 4, bottom). A smaller but significant proportion of traditional method users switched (Fig. 4, top), and these were replaced primarily by women who had been nonusers (Fig. 4, bottom). Switches from no method to permanent methods did not explain shifts in prevalence; most women who switched from no method chose either a traditional or permanent method (Fig. 4, top), and less than half of the women who switched to sterilization switched from traditional methods (Fig. 4, bottom).

Thus the relative constancy of temporary methods in conjunction with an increase in overall prevalence is best explained by balancing flows of women in and out of all method use categories. These transitions are better viewed in the full matrix shown in Table 1.

Regression Analyses

The first step in building our multinomial logistic regression models was to test the statistical significance of each of the five explanatory variables. We tested the additional contribution of each variable to models containing all four of the other variables. Only Wealth failed to pass this test and was dropped from all subsequent analyses. Next, squared terms for both Age and Eduew were added to the models and found to be significant. All second-degree interactions were then added to the models and tested by using backward elimination. The interaction of CFD with both PMF and Age survived this test. Finally, the significance of each term remaining in the models was rechecked, and all three were significant. Thus the terms in all three of our multinomial logistic regression models were CFD, PMF, Age, $(\text{Age})^2$, Eduew, $(\text{Eduew})^2$, CFD × PMF, and CFD × Age.[6] We conclude that method switching is significantly correlated with CFD, PMF, Age, and Eduew. The second-degree terms in the models refine the shape of the functions describing this relationship.

We are interested not only in which variables significantly affect method switching but in the nature of those effects and the relative importance of the explanatory variables. The variable means are shown in Table 2 and the regression coefficients in each model are given in Table 3, but these are cumbersome for interpreting effects. Instead, we display the results from the regression analyses in a set of graphs (Figs. 5–7), each showing the effects of a

Table 1. Percent Distribution of Destination-Method Type by Origin-Method Type Over 2-Year Switching Period: Rural Sri Lankan Women, 1983–1985

Origin-method type	Total	Destination-method type: No method	Traditional	Modern temporary	Modern permanent
Total (N = 2999)	100	20	34	12	34
No method	29	49	29	9	13
Traditional	35	11	71	7	11
Modern temporary	11	12	13	65	10
Modern permanent	25	0	0	0	100

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single explanatory variable on probabilities of method switching for the average user of a particular origin method.

For example, Figure 5a shows the effects of a change in fertility demand (CFD) on switching probabilities for women who began the switching period as nonusers. The horizontal axis represents 80% of the range of CFD (10th–90th percentiles).[7] In this case these values also contain the entire range of the explanatory variable. The vertical reference line is at the mean of CFD for these women (.38). The vertical axis represents probability of method switching. These probabilities were calculated from the model for women who began with no method, using the values of CFD on the horizontal axis and holding all other explanatory variables at their means.[8] the differences between the lines on the graph represent, from bottom to top, the probability of continuing with no method, the probability of switching to traditional methods, the probability of switching to temporary methods, and the probability of switching to permanent methods. Since the categories are inclusive and nonoverlapping, these probabilities always sum to 1.

By examining Figure 5a we can see that about two-thirds of nonusers continued to use no method if they experienced no change in their fertility goals, but that the proportion continuing with no method declined to approximately 15% for women who attained their desired family size during the switching period. Although there was a slight increase in the probabilities of switching to traditional and temporary methods with increasing values of CFD, these results suggest that most women who switched from no method, because of the partial or complete attainment of desired family size, switched to permanent methods.

The relationship between method switching and the variables Age and Educw (see Fig. 5 b and c) was weaker for these women than the relationship with CFD. Older women were less likely to start using some method during the switching period; but if they did start a method, it was less likely to be a traditional or temporary method and more likely to be sterilization. Similar patterns were associated with less education.

CFD had weaker effects on users of traditional methods (Fig. 6) than on women who began as nonusers, but the qualitative relationships with this variable were similar in these two groups. Users of traditional methods who attained higher proportions of their deficit in desired family size were less likely to continue traditional methods, less likely to switch to no method, and more likely to adopt sterilization. Here, however, increases in CFD were associated with only slight increases in the likelihood of switching to temporary methods.

Users of traditional methods who experienced high method failure rates (high PMF) were less likely to continue to use those methods (Fig. 6b). Probabilities of switching to all

Table 2. Means of Selected Determinants of Contraceptive Switching by Origin-Method Type Among Rural Married Sri Lankan Women, 1986

	Origin-method type			
Variable	No method	Traditional	Modern temporary	Modern permanent
N	884	1,027	315	767
CFD	.38	.22	.10	NA
PMF	NA	.10	.04	NA
Age	27.87	30.43	30.21	33.20
Educw	6.42	6.77	6.85	5.82

Notes: CFD = Change in fertility demand; PMF = personal method failure; Age = woman's age in single years; Educw = Woman's years of education; NA = not applicable.

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Table 3. Estimated Coefficients (and Standard Errors) From Multinomial Logistic Regressions of Probability of Paired Contraceptive Choices by Origin-Method Type Among Rural Married Sri Lankan Women

Predictor variable	Traditional vs. no method	Temporary vs. no method	Permanent vs. no method	Traditional vs. permanent	Temporary vs. permanent	Traditional vs. temporary
			Origin: No Method (Model χ^2 = 853.2; N = 884)			
CFD	.035 (1.066)	1.047 (1.593)	**7.367** (1.900)	**−7.332** (1.865)	−6.320 (2.204)	−1.012 (1.563)
Age	−.040 (.113)	.221 (.191)	**1.044** (.241)	**−1.084** (.242)	**−.822** (.284)	−.261 (.195)
(Age)^2	−.000 (.002)	−.005 (.003)	**−.016** (.004)	**.016** (.004)	**.010** (.005)	.005 (.003)
Educw	.048 (.091)	.006 (.135)	.134 (.128)	−.057 (.132)	−.129 (.162)	.042 (.140)
(Educw)^2	.001 (.007)	.003 (.011)	−.018 (.011)	.019 (.011)	.021 (.013)	−.002 (.011)
CFD × Age	.063 (.037)	.041 (.058)	**−.134** (.062)	**.197** (.061)	**.176** (.075)	.022 (.057)
Constant	−.186 (1.601)	−4.432 (2.625)	−19.383 (3.810)	19.200 (3.804)	14.951 (4.310)	4.246 (2.668)
			Origin: Traditional (Model χ^2 = 290.9; N = 1,027)			
CFD	**8.355** (1.890)	**8.301** (2.531)	**10.196** (2.325)	−1.841 (1.654)	−1.895 (2.328)	.054 (1.920)
PMF	**−1.968** (.756)	1.041 (.765)	**2.733** (.653)	**−4.701** (.639)	**−1.693** (.652)	**−3.008** (.765)
Age	**.376** (.155)	**.695** (.286)	**.707** (.256)	−.331 (.233)	−.011 (.319)	−.320 (.261)
(Age)^2	−.005 (.003)	**−.012** (.005)	**−.010** (.004)	.005 (.004)	−.002 (.005)	.007 (.004)
Educw	.032 (.098)	.246 (.187)	.198 (.159)	−.167 (.135)	.048 (.203)	−.215 (.169)
(Educw)^2	−.006 (.007)	−.016 (.014)	**−.026** (.013)	.020 (.011)	.010 (.016)	.010 (.012)
CFD × Age	−.238 (.059)	**−.216** (.087)	**−.237** (.073)	−.001 (.053)	.020 (.080)	−.021 (.069)
PMF × Age	−.545 (1.379)	−.914 (1.398)	**−2.601** (1.258)	**2.056** (.977)	1.687 (.986)	.370 (1.143)
Constant	−4.977 (2.268)	−11.731 (4.142)	−13.505 (3.933)	8.529 (3.500)	1.773 (4.789)	6.755 (3.782)
			Origin: Temporary (Model χ^2 = 84.1; N = 315)			
CFD	−.676 (5.580)	6.089 (4.593)	4.396 (5.280)	−5.072 (4.715)	1.792 (4.238)	−6.765 (4.633)
PMF	−2.546 (1.920)	**−5.161** (2.666)	−.063 (1.431)	−1.921 (2.045)	−4.536 (2.773)	−2.615 (2.975)
Age	−.195 (.415)	.108 (.356)	.680 (.547)	−.874 (.517)	−.572 (.475)	−.303 (.299)
(Age)^2	.005 (.007)	.001 (.006)	−.009 (.009)	.014 (.009)	.010 (.008)	.004 (.005)
Educw	**.708** (.248)	**.510** (.155)	**−.842** (.307)	−.134 (.334)	−.331 (.281)	.197 (.221)
(Educw)^2	**−.053** (.019)	**−.039** (.012)	**−.073** (.025)	.020 (.027)	.034 (.023)	−.014 (.017)
CFD × Age	−.004 (.196)	−.241 (.169)	−.095 (.188)	.091 (.160)	−.146 (.150)	.238 (.162)
PMF × Age	10.226 (7.800)	8.041 (8.438)	7.949 (7.565)	2.277 (2.500)	.091 (4.462)	2.185 (4.727)
Constant	−.029 (6.017)	−3.000 (5.126)	−13.569 (8.132)	13.540 (7.767)	10.570 (7.171)	2.970 (4.513)

Notes: No method = nonuse; Traditional = use of rhythm, abstinence, and withdrawal methods; Temporary = use of pill, condom, injectable, internal uterine device; Permanent = use of male or female sterilization; CFD = change in fertility demand; PMF = personal method failure; Age = woman's age in single years; Educw = woman's years of experience. Coefficients at least twice their standard error are in bold face type.

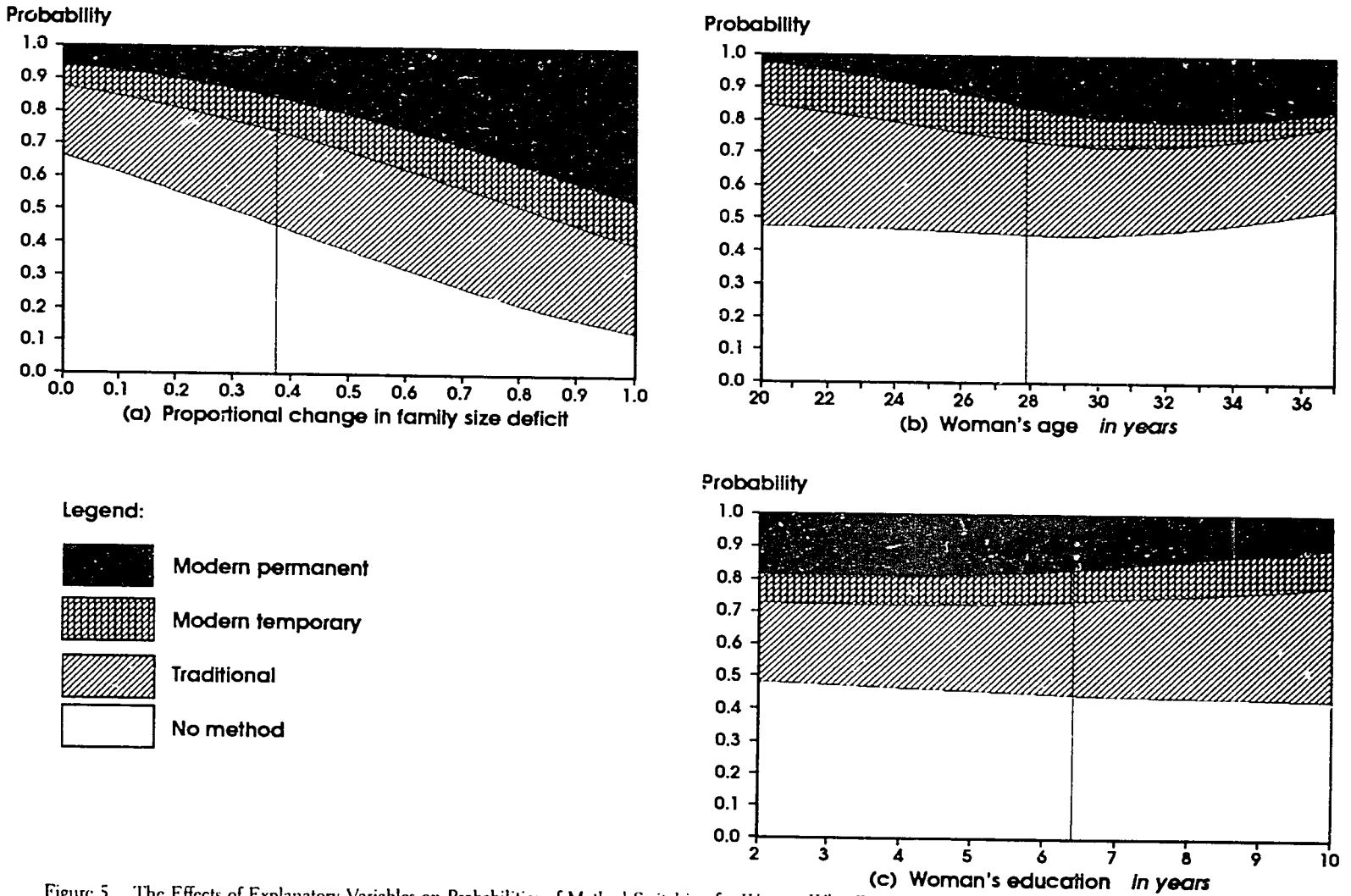

Figure 5. The Effects of Explanatory Variables on Probabilities of Method Switching for Women Who Originate as Nonusers. (The distances between the curves correspond to the predicted probabilities of each destination method. Vertical lines correspond to mean value for explanatory vari ables.)

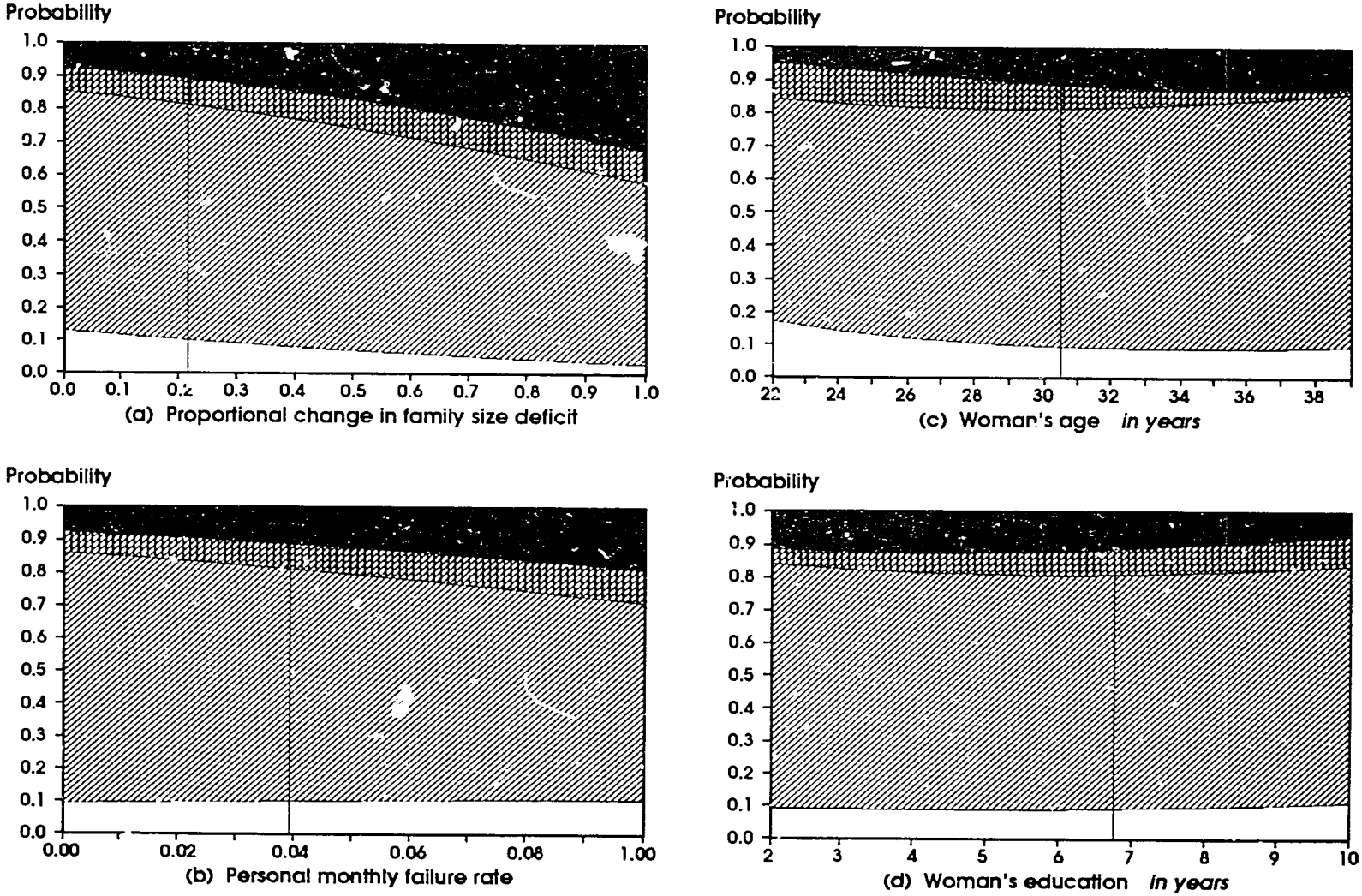

Figure 6. The Effects of Explanatory Variables on Probabilities of Method Switching for Women Who Originate With Traditional Methods. (See legend and caption of Figure 5.)

other method categories, including no method, increased with increasing PMF. Older women were slightly more likely to continue traditional methods and less likely to switch to either temporary methods or no method (Fig. 6c). Older women were more likely, however, to adopt sterilization. There did not appear to be any relationship between Educw and the probability of continuing with traditional methods; but women with more education who did switch were more likely to switch to no method or temporary methods and less likely to switch to sterilization (Fig. 6d).

The apparent effect of CFD on switching by users of temporary methods (Fig. 7a) was similar in magnitude to its effects on nonusers. Women who began with temporary methods and attained higher proportions of their family size deficit were much less likely to continue temporary methods; and when they switched, they usually switched to sterilization. There was a slight decrease in the probabilities of switching to either a traditional method or no method with increased CFD.

As was the case with users of traditional methods, users of temporary methods who experienced method failure were less likely to continue their origin method (Fig. 7b). Probabilities of switching to all other methods increased with PMF.

Older women were more likely to continue temporary methods (Fig. 7c). The probability of switching to traditional methods for these users was unrelated to age, but older women were less likely to stop practicing contraception. The relationship between age and the probability of switching from temporary to permanent methods was not monotonic. This probability was highest at intermediate ages, around 30 years old. The oldest women were the least likely to make this switch.

Education had little effect on the probability of continuing with temporary methods (Fig. 7d) but was related to the destination method for those who did switch. Women with approximately 5 years of education were the most likely to switch to sterilization, and the most educated women were the least likely to make this switch. The probability of switching to nonuse was the lowest for women with 6 or 7 years of education and highest for the least educated women. In addition, there was a slight monotonic upward trend in the probability of switching to traditional methods with more years of education.

The preceding discussion of the regression analysis results is framed in terms of the relationships between switching probabilities and the four final explanatory variables, rather than discussing each term in our models. In other words, we discuss the effect of age that occurs in three terms [Age, $(Age)^2$, CFD × Age], rather than each of those terms individually. The interaction terms require mention, however, because in some cases the significance of interactions may mean that the effect of an explanatory variable is qualitatively different for different groups of women.

We examined the role of the interactions of CFD with PMF and Age by constructing graphs similar to those in Figures 5–7 (see Fig. 8). CFD is on the horizontal axis and probabilities of method switching are calculated for a particular origin method as before, except that here the interacting variable (PMF or Age) is set at its 10th percentile in one graph and its 90th percentile in another graph that is otherwise the same. Comparing these graphs shows, for example, the difference in the effects of CFD when women have low versus high values of the interacting variable.

The interaction of CFD with PMF functions as a minor adjustment to the relationship between these two variables and method switching (graphs not shown); there were some qualitative differences, however, in the apparent effects of CFD for younger versus older women.[9] As expected, young women using no method, who experienced little or no reduction in their family size deficit, were very unlikely to switch to sterilization (Fig. 8a), but older women with a CFD near zero may make this switch (Fig. 8b). This may reflect the possibility that some older women may have already reached desired family size but were not using any contraceptive method because they believed their chances of conception

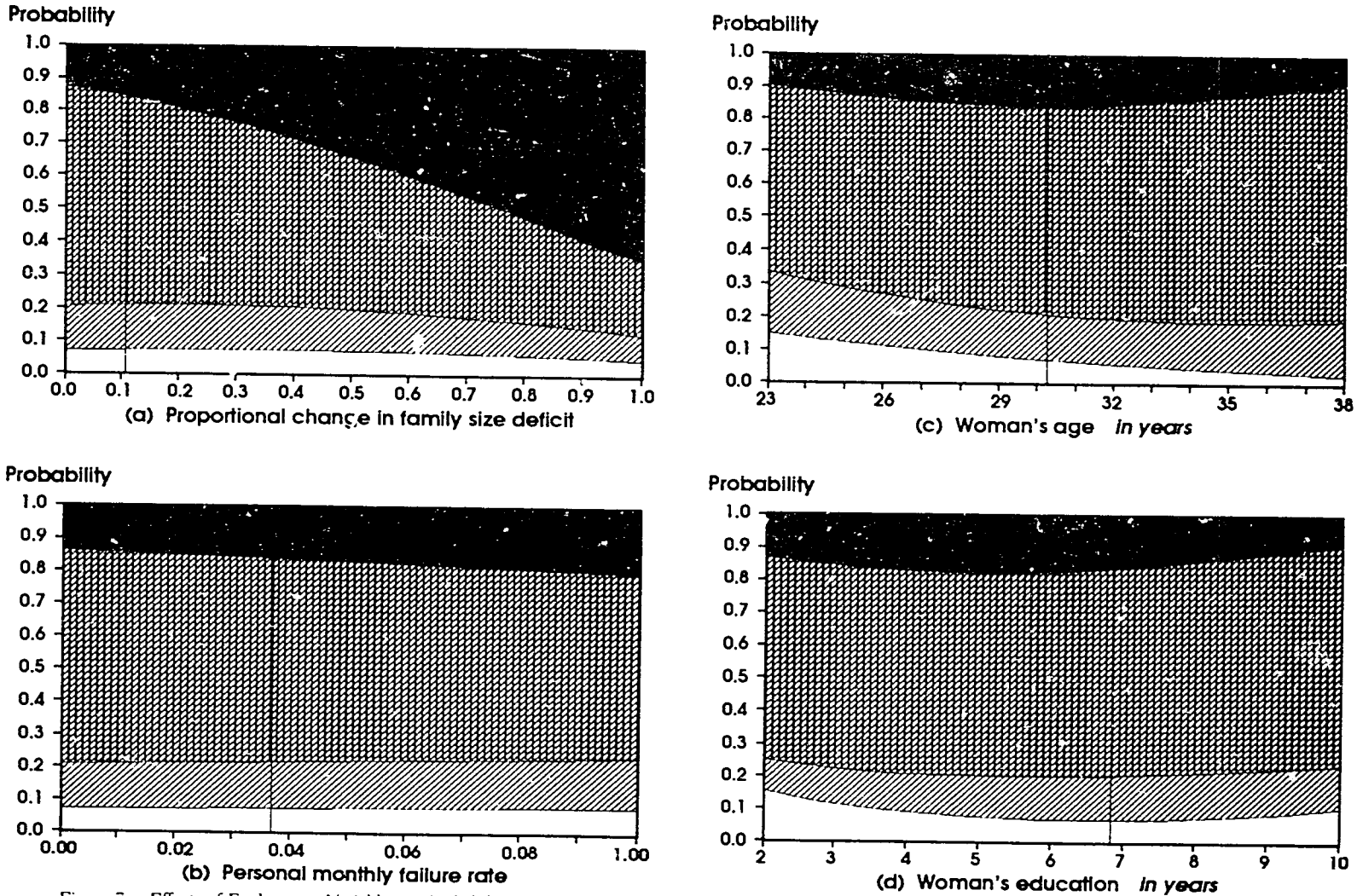

Figure 7. Effects of Explanatory Variables on Probabilities of Method Switching for Women Who Originate With Modern Temporary methods. (See legend and caption of Figure 5.)

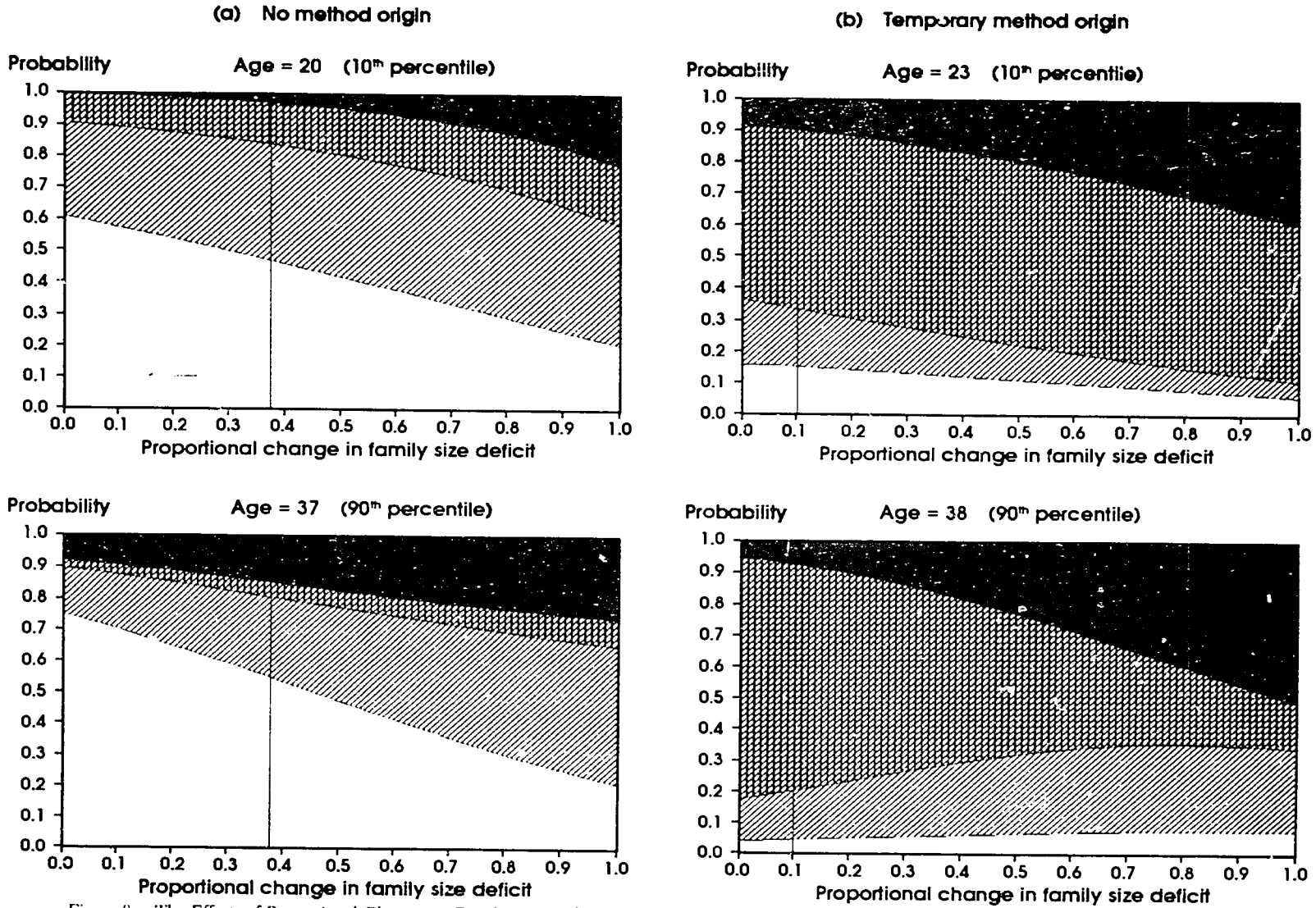

Figure 8. The Effects of Proportional Changes in Family Size Deficit (CFD) on Probabilities of Method Switching for Women Whose Origin Method Was (a) Nonuse and (b) Modern Temporary, at 10th and 90th Percentile Values of Age. (See legend and caption of Figure 5.)

were low. (During the switching period, some of these women may have elected to accept sterilization in response to the compensatory payments offered by the government.)

The interaction of CFD and Age also had important effects for women who originally used temporary methods. For older women, the effects of CFD were similar to those for women of average age (compare Figs. 7a and 8b, bottom half). For younger women, however, the attainment of a portion or all of their desired family size during the switching period did not appear to affect their probability of continuing with traditional methods (Fig. 8b, top half). Given that they switched methods, both young and average-aged women who attained desired family size during the switching period tended to switch to sterilization. Younger women who attained desired family size and switched were only slightly more likely to select sterilization than traditional methods or no method.

Summary and Implications

This study was motivated by the need for a dynamic approach to the analysis of contraceptive histories now that aggregate trends demonstrate a secular change in overall prevalence. We demonstrated this approach by analyzing determinants of method switching in rural Sri Lanka, where the predominant use of traditional methods, relatively constant and moderate use of temporary modern methods, and increasing of sterilization warrant such an examination. Our results suggest how change at the individual level, in terms of retaining or shifting among method types, can inform patterns observed at the aggregate level. They also confirm the analytic utility of the proposed conceptual framework. Variables related to changes in the components of fertility demand and contraceptive knowledge and beliefs influence strongly the type of method switching.

Most striking, perhaps, the switching behavior in this population of rural married women in Sri Lanka appears to be a direct response to both family size shifts and poor contraceptive experience in this period. Women who attained all or a significant proportion of their desired family size tended to switch to more effective methods. Women who experienced failure of a method tended to switch methods, usually to one that was more effective. This pattern of responding to family size motivation and contraceptive failure experience is independent of influences from individual background determinants. The latter tend to be of minimal importance, perhaps because of the relative homogeneity of the sample and because they do not directly measure *changes* in factors affecting method choice. It is significant to be able to state that switching by individual contraceptors is systematic and predictable behavior. In addition, although national trends generally show increased use of all method types, they belie a significant amount of underlying individual change.

Programmatically these results suggest three things. First, for Sri Lanka, efforts to reduce method failure among rural women will also reduce contraceptive switching. Second, from the perspective that organized family planning activity is designed to facilitate optimal method choice, these findings suggest that rural Sri Lankan couples are able to achieve their fertility objectives with the range of contraceptive methods available. Third, this analysis has not been concerned with the related question of whether a reduction in fertility, often a rationale of family planning programs, is being achieved. If fertility reduction is a goal of organized family planning activity, however, the analysis indicates that it would be attainable through the alteration of family size motivations. Rural couples are practicing contraception and adopting methods in accordance with their fertility motivations.

Notes

[1] Compensation was offered earlier in some locales.

[2] DaVanzo et al. (1989) retained some duration information by counting interbirth intervals.

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[3] A nontrivial proportion of women use multiple methods in Sri Lanka. For simplicity, the switching definition is based on the more effective of the two methods. The bias is minimal, as the combined effectiveness of multiple method use approximates that of the more effective one (see Thapa & Hamill in press).

[4] Most women with method failures in this 2-year period experienced one accidental pregnancy; 14 women were recorded as having two accidental conceptions.

[5] This trend is restricted to the cohort under study and is different from the trends seen in Figure 1 to the extent that entry into marriage or universal marriage experience has changed the underlying female populations.

[6] PMF does not appear in the model for women who originally used no method because they could not experience method failures.

[7] The convention of displaying the 10th–90th percentiles of the explanatory variable on the horizontal axis was followed throughout Figures 5–7, with one exception. The 5th and 95th percentiles of PMF were used for women who originally used temporary methods because the 90th percentile was less than the mean. This highly skewed distribution of PMF was a consequence of the relatively low rate of failure for these effective methods.

[8] The means are those for the women who began with the appropriate origin method, in this case no method. The means of second-degree terms in our models were calculated from the means of the first-degree explanatory variables. For example, the mean of $(Age)^2$ was calculated by squaring the mean of Age, rather than by squaring the age of each woman and calculating the mean of these squared values.

[9] The interaction of CFD and Age had only minor effects on switching probabilities for women who originally used traditional methods.

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