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Demand or Ideation? Evidence from the Iranian Marital Fertility Decline*

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Is the onset of fertility decline caused by structural socioeconomic changes or by the transmission of new ideas? The decline of marital fertility in Iran provides a quasi-experimental setting for addressing this question. Massive economic growth started in 1955; measurable ideational changes took place in 1967. We argue that the decline is described more precisely by demand theory than by ideation theory. It began around 1959, just after the onset of massive economic growth but well before the ideational changes. It paralleled the rapid growth of participation in primary education, and we found no evidence that the 1967 events had any effect on the decline. More than one-quarter of the decline can be attributed to the reduction in child mortality, a key mechanism of demand theory. Several other findings support this main conclusion.

What causes the onset of fertility decline? Traditional demographic transition theory, or demand theory, says that the cause is economic development and the resulting social modernization (Becker 1960, 1965, 1981; Davis 1945, 1963; Notestein 1945; Schultz 1969, 1976; Thompson 1929). In perhaps its most highly developed form (Easterlin 1975; Easterlin and Crimmins 1985), this theory says that actual fertility is influenced by the demand for children, the supply of children, and the cost of regulation.

The demand for children is a function of the cost of children (which increases with the amount of formal education they receive, the extent to which women work outside the home, and the opportunity cost in terms of other ways of spending money) and the benefits from children (which increase with the extent to which children work). The supply of children is a function of child mortality and is also affected by age at marriage and by breast-feeding. The cost of regulation depends on the availability, cost, convenience, and knowledge of contraception, as well as on the psychic cost of using it. Economic development and social modernization raise the costs and lower the benefits of children, thus leading to reduced demand for children and hence to fertility decline.

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Doubt was cast on demand theory by the European Fertility Project (Coale and Watkins 1986), which showed that the fertility decline in most European countries started at about the same time but under different economic and social conditions, that there were sharp differences across ethnic and linguistic barriers within the same country (e.g., in Belgium), and that most English-speaking countries followed similar patterns of fertility decline. These findings led several authors to postulate that fertility decline is produced by the diffusion of new ideas and knowledge about fertility regulation rather than by changes in socioeconomic factors, a hypothesis that we will call ideation theory (Cleland and Wilson 1987; Freedman 1979; Knodel and van de Walle 1979).

Ideation theory also presents difficulties, however. It is less precisely formulated than demand theory, and thus is harder to test in the usual way, by using it to generate predictions that can be compared with data. Also, there has been little direct observation of the diffusion of ideas and information about fertility control and of how this affects fertility behavior.

Much of the evidence for ideation theory consists of examples from different countries, but counterarguments also exist. For example, the fact that fertility decline followed ethnic lines in some countries could be due to ethnic stratification rather than to the diffusion of ideas: demand theory would predict earlier declines for dominant ethnic groups. This largely explains what happened in Belgium, where the dominant French-speaking Walloons underwent an earlier decline than the subordinate Flemish: about three-quarters of the fertility difference between Walloons and Flemish in 1880–1910 was explained by socioeconomic differences (Lesthaeghe 1977, Table 6.1). Also, the English-speaking peoples displayed similar patterns of fertility decline in every place where they were dominant, but the subordinate Irish had a much later decline (Knodel and van de Walle 1979). The pattern of fertility decline among the French-speaking peoples also seems to have varied with their status. In Quebec, and in Canada generally, the French were subordinate and had a later decline than their English-speaking neighbors (Henripin and Péron 1972; Lachapelle and Henripin 1982), whereas in Belgium, the French were dominant and had a faster decline than the subordinate Flemish.

One influential version of the ideational hypothesis is due to Lesthaeghe (1983), who says that "a cost-benefit paradigm is necessary but not sufficient" and "should be complemented by an attempt to link the outcome of choice to alterations in ideational components as well" (p. 412). A major difficulty with testing hypotheses that one might formulate on the basis of this statement is that changes in the cost-benefit calculus tend to occur at about the same time as ideational changes and to be highly correlated with them in cross-sectional data, as shown by Lesthaeghe's own factor analysis. His cross-sectional analysis of the 1963–1970 decline in West European marital fertility does not show that the cost-benefit paradigm is insufficient on its own (Lesthaeghe 1983:415). Indeed, fertility decline in Belgium, his leading case, was correlated more strongly with economic than with ideational indicators (Lesthaeghe 1983, Table 12).

Lesthaeghe and Wilson (1986) expanded this analysis to other countries, but they controlled only for household mode of production, not for other socioeconomic variables such as those considered in the earlier analysis of Belgium. Even so, averaging over five countries, they found that 63% of the variance in fertility decline was explained by the single economic variable considered, and only about one-fourth as much (16%) by secularization, their cultural variable (Lesthaeghe and Wilson 1986, Table 6.7).

Lesthaeghe (1992) developed his arguments further, but his statistical results in that most recent study were based on zero-order correlations; thus they did not establish that ideational factors had effects, once economic factors were controlled for (Table 1.9). In any event, his analyses suggest that the economic factors were more important. A cross-sectional analysis of nineteenth-century fertility decline in 600 districts of England and Wales concluded that cultural variables had no explanatory power, once the standard macro-economic variables of traditional demographic transition theory had been controlled for (Friedlander 1983; Friedlander, Schellekens, and Ben-Moshe 1991).

Writers who advocate ideation theory have made two fairly clear predictions about its implications for modern fertility declines in Third World countries. First, official family planning programs are likely to accelerate fertility decline, except in societies that are highly resistant to fertility decline (e.g., Cleland and Wilson 1987:29; Freedman 1979:10; Knodel and van de Walle 1979:240). Second, improvements in the status of women also tend to accelerate this decline (e.g., Knodel and van de Walle 1979:238). We will refer to such changes as ideational changes.

Detailed longitudinal studies that use time-ordering and individual data to separate socioeconomic from ideational effects provide a more effective way of comparing the two theories than aggregate cross-sectional studies. The former have been hard to conduct, however, because development and ideational changes tend to accompany one another. The period 1950–1977 in Iran constitutes a rare quasi-experiment that allows this separation. Iran's economy grew very fast from about 1955; in 1967, 12 years later, major measurable ideational changes occurred, namely the establishment of an aggressive official Family Planning Program and the passing of the Family Protection Act, which greatly improved the status of women. The 1977 Iran Fertility Survey, IFS, was conducted at just the right moment to separate the effects of these two sets of changes.

Several other questions are interesting in their own right and are also related to the basic issue that we have just discussed. Is fertility decline a period effect or a cohort effect (or both)? If it is a period effect, then it affects childbearing women of all ages equally. If it is a cohort effect, then it affects only younger women at first, after which overall fertility declines as the affected cohorts make up a greater proportion of all women of childbearing age. Demand theory says that fertility decisions are determined by the costs and benefits faced by couples at the time when the decisions are made, and so implies that fertility decline is a period effect, not a cohort effect. It is less clear what ideation theory implies, but cohorts tend to be marked for life by the ideas prevalent in their youth (Ryder 1965), thus ideation theory would seem likely to imply that fertility decline, at least in part, is a cohort effect, perhaps as well as a period effect.

It is well established that urban women tend to have fewer children than rural women (Hobcraft 1985). But is the fertility of migrants from rural to urban areas determined by their childhood (rural) residence, their current (urban) residence, or something between the two? Previous studies based on World Fertility Survey data have tended to use place of childhood residence to predict fertility (e.g., Entwisle and Mason 1985). By arguments similar to those in the discussion of period and cohort effects, demand theory implies that fertility behavior is influenced by place of current residence rather than place of childhood residence, whereas ideation theory is likely to imply that place of childhood residence (perhaps as well as place of current residence) is an important predictor.

It has been argued that according to both demand and ideation theories, a higher status of women leads to reduced fertility. Demand theory is formulated in terms of a household that balances costs and benefits, but the husband and the wife may well perceive these costs and benefits differently, so that their relative weight in making decisions is important. The higher the woman's status, the greater her weight in decision making. Because women bear most of the physical burden and risk of childbearing, it has been commonly assumed that women seek to reduce the number of pregnancies. Mason (1984) discussed some of the ways in which women's higher status could depress fertility, including giving women more power to achieve their (allegedly) lower fertility goals. Mason and Taj (1987), however, in an exhaustive review of published studies, found no evidence of systematic differences in average fertility goals between men and women.

Modernization may reduce fertility even if the mechanisms postulated by demand theory do not work. It is well established that more educated women tend to have fewer children (Cleland and Rodríguez 1988), as do more urban women. Modernization tends to increase the proportion of better-educated women and of urban women in the population, and thus to reduce fertility; we call this the compositional effect. Do these effects account for the entire fertility decline? If not, how much of it do they explain?

Finally, did the decline consist mainly of an increase in interbirth spacing or of stopping after a certain number of births?

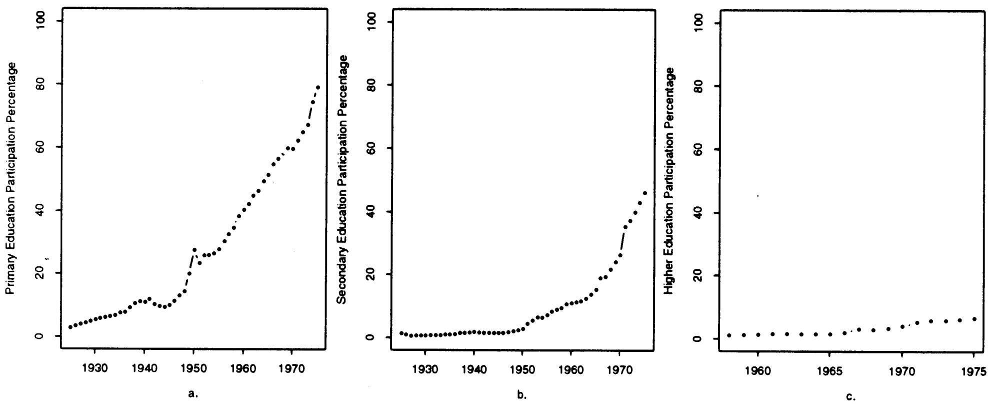
BACKGROUND: IRAN TO 1977

The period up to 1977 in Iran is ideal for determining whether the onset of fertility decline was due to economic development or to large and measurable ideational changes in the form of an aggressive official Family Planning Program and laws that greatly improved women's status. Rapid economic development started around 1955, while the ideational changes occurred in 1967; thus the timing of the onset of fertility decline enables us to compare the two competing theories. The 1977 IFS is of high enough quality and contains enough detail to allow an accurate estimate of the time when fertility began to decline.

The Pahlavi period in Iran started in 1925 with the coronation of Reza Shah Pahlavi as the ruler of a traditional and economically developing nation. The ensuing half-century saw a sustained effort to modernize and westernize Iran by government fiat. Until Reza Shah abdicated in 1941 and was succeeded by his son, this process was relatively gradual; it was largely halted and even reversed in the first years of the son's reign. The process resumed in the early 1950s, was accelerated by the Shah's "White Revolution" in 1963, and ended with the Islamic Revolution in 1978–1979 (Abrahamian 1982).

Most of the postwar period was characterized by rapid economic growth fueled by oil exports, and by rapid modernization imposed from above. Oil production grew steadily during the first half of the century, but the dramatic growth began only in 1955; by 1974, oil production had reached 10 times the highest pre-1955 figure. This was a major factor in the massive growth which increased overall economic activity fourfold in half a generation.

Overall participation in education increased rapidly in Iran during the Pahlavi period. Figure 1 shows the evolution of approximate participation rates according to aggregate official statistics.



Source: Mitchell (1982)

Figure 1. Overall Educational Participation in Iran, 1925–1975: (a) Primary; (b) Secondary; (c) Higher Education

Educational expansion largely paralleled the oil-fired economic growth that started in 1955. In the following 20 years, primary enrollments increased by a factor of 5, second-level enrollments by a factor of 14, and higher education enrollments by a factor of 10. Primary participation rose from about 25% in 1955 to 80% in 1975, so that near-universal primary education was achieved during that period. Second-level participation increased from less than one in 10 to nearly half; participation in higher education was still low in 1975, even though it had increased from 1% to 7% in the 20-year period.

Several political and legal changes aimed at improving women's status were implemented during the period of our study. In 1963 women got the vote, and in 1967 the Family Protection Act was passed. This gave women greater equality in marriage, divorce, and child custody, increased the legal age of marriage for women to 18, and banned polygyny without the wife's permission. In 1967 an official Family Planning Program was established, and the proportion of women using contraceptives rose from almost nothing in 1967 to a substantial proportion in 1977 (see Table 4).

Infant mortality was 300 per 1,000 in 1956; by 1976 it had fallen to 117 per 1,000. Demand theory predicts that this reduction in infant mortality would have led to a reduction in marital fertility. Our analysis below shows that this was the case, and quantifies its extent.

DATA

Our analysis is based on data from the IFS, which was conducted by the Iran Statistical Center in 1977 as part of the World Fertility Survey, WFS. It consists of the full fertility histories of a sample of married women, the oldest of whom were born in 1926; our data thus cover the Pahlavi period almost exactly. They were not fully analyzed when they were collected because of the revolutionary situation in Iran. The data were released to the Shiraz University Population Center in 1984; a descriptive report was prepared by Homa Agha, with consultation by Akbar Aghajanian at Shiraz University Population Center (Agha 1985). A preliminary report on the survey was released by the Iran Statistical Center in 1987 (Iran Statistical Center 1987). At the request of Akbar Aghajanian, further analysis of the IFS data was permitted and encouraged in 1990 by the Director of the Iran Statistical Center.

The IFS was based on a nationally representative sample of ever-married women under age 50. On the basis of a multistage random sampling random sampling procedure, 6,056 households were visited and all ever-married women who were less than 50 years old were interviewed. This procedure resulted in interviews with a total of 4,932 women. There were 42 nonresponses for an effective sample size of 4,890. There were 16,997 births in 77,088 ever-married-woman-years for parities 1 and above. Here we focus on marital fertility, starting with the time of first birth.

In general it seems reasonable to expect high-quality data from the IFS. Even so, in collecting data in a developing country with a low female literacy rate, errors in the dates of events and the number of children ever born are to be expected. Estimates of the levels and trends of fertility depend on the extent to which women forget to mention births, misreport the dates of births, or misreport their own ages.

The quality of the IFS was assessed comprehensively by Aghajanian, Gross, and Lewis (1993). They concluded that the survey data are of good quality, at least as good and in many respects better than WFS data from comparable countries. Trussell (1984) argued that the errors present in WFS data of this quality do not change the substantive conclusions from complex regression analyses. The single biggest problem is that although respondents were asked both the month and the year in which each event occurred, the month was missing in many cases; thus we have worked only with the year of occurrence. Otherwise there were few missing data. We excluded those women who had missing data on any of the quantities of interest to us here; as a result, for parities 2 and above, only 8% of the intervals were excluded. The amount of missing data is small, and our analysis shows no systematic differences between women with and without missing data.

METHODS

Discrete Event History Analysis

Our data are in the form of event histories, and so event history analysis (e.g., Tuma and Hannan 1984) is the method of choice. We are working with discretized data that include only the calendar year of each event; thus we used a discrete-time event history analysis method (Allison 1984). In this approach, each woman-year of exposure is treated as a separate case, and the response is the occurrence or not of an event in that year; the baseline hazard rate and the effects of covariates are modeled by logistic regression. Here we describe our models briefly; a fuller description of the methods is given in Raftery et al. (forthcoming).[1]

The resulting data set was modeled by the logistic regression model

$$\text{logit}(\pi_{iky}) = \log\left(\frac{\pi_{iky}}{1 - \pi_{iky}}\right) = \beta_0 + \sum_{j=1}^{p} \beta_j x_{jiky}, \tag{1}$$

where x_{jiky} is the jth covariate for the ith woman at parity k in calendar year y, and β_0, β_1, . . ., β_p are unknown regression coefficients. This model was estimated by maximum-likelihood. The covariates considered for inclusion in Eq. (1) include functions of age, duration t, parity k, birth cohort, calendar year y (i.e., period), and individual characteristics of the woman such as her education and that of her husband, where she grew up, where she lived at the time of the interview, and her age at marriage. Therefore we faced the classic demographic problem of modeling age, period, and cohort, as well as duration and parity. Thus, in a sense, five clocks are running simultaneously. We dealt with this problem by exploiting the longitudinal nature of the data, and also by modeling these effects parametrically whenever such modeling made theoretical sense and was well supported by the data. This approach broke the formal identities that can make estimation impossible.

We find a clear pattern to the relationship between fertility and age: a rapid increase is followed by a more gradual decrease. It makes sense to represent the pattern in a parametric form if this procedure is supported by the data. To do so, for each year of age below 50, we calculated the number of woman-years and the number of births to women of that age in our data set. Dividing the number of births by the number of woman-years gives an estimate of the average age-specific marital fertility. This estimate is fit well by a logit-quadratic polynomial function of age, namely

$$\text{logit(fertility)} = \gamma_0 + \gamma_1 a + \gamma_2 a^2 \; (R^2 = 0.94), \tag{2}$$

where $a = (\text{age} - 31)/10$. The parameters γ_0, γ_1, and γ_2 are estimated by including a and a^2 as independent variables in the model (Eq. (1)). The raw estimated fertility rates are shown together with the fitted curve given by Eq. (2) in figure 2. The good fit of the curve is clear.

We also modeled the effect of duration t parametrically. We calculated the average fertility rate by duration t, using the method just described for age (but using only parities 2

Figure 2. Estimated Fertility Rates with Fitted Logistic-Quadratic Curve

and higher). For durations 3 and higher, the fertility rate declines almost exactly exponentially ($R^2 = 0.99$ in a weighted logarithmic regression). Therefore we coded duration using four covariates: one dummy variable each for durations $t = 0$, 1, and 2, and one further variable equal to

$$\begin{cases} 0 & \text{if } t = 0, 1, 2 \\ \text{logit } (ab^t) & \text{if } t \geq 3, \end{cases} \tag{3}$$

where $a = 0.726$ and $b = 0.795$.

Parity is coded linearly as the number of previous births. We also fitted models that coded parity as a set of dummy variables, but the linear coding accounts for most of the variability and fits much better according to BIC (Eq. (4)). The one difference relates to parity 1; we dealt with this by including a dummy variable for parity 1. Cohort was coded in five-year age groups, 15–19, 20–24, . . ., 45–49. Initially, we coded period as in Table 3, with dummy variables for periods chosen so as to make the standard errors similar. Later, for exploratory purposes, we coded period with a dummy variable for each year. Finally, we fitted models in which the period effect was modeled parametrically. In all our parametrizations of the period effect, there was a dummy variable for 1977, which we included because only part of this year was observed.

Child mortality is measured as 0 if the previous child had died by the time of the survey, and 1 if not. We also fitted models in which child mortality was measured as 0 if the previous child had died before the next child was born, as reported by the mother. These models, however, fitted less well and indicated a smaller (although still large) effect of child mortality. We interpreted this result as indicating substantial errors in the reported *time* of children's death, but showing that *whether* they had died was reported accurately. Thus we used the latter as our measure.

Several of the independent variables considered are categorical but ordered; these include educational attainment and size of place of current residence. One possibility is to code these as sets of dummy variables, but this method is often unparsimonious and computationally expensive. Instead we searched for transformations of the variables that were meaningful and supported by the data, as follows. We carried out ordinary least squares linear regression with each birth as a case. The length of the interval ending in that birth was the dependent variable, and the independent variables were the same as those in Eq. (1), with the exception of duration. Calendar year was coded as the year at the beginning of the interval. The variables were not coded linearly, however. Rather, we used the ACE technique (Breiman and Friedman 1985; see DeVeaux 1989 for an exposition) to find the monotonic (nonparametric) transformation of each variable that made the regression as linear as possible. We used the results to suggest meaningful *parametric* transformations for use in Eq. (1).

Educational attainment is coded in six categories: none (0), incomplete primary (1), complete primary (2), incomplete second level (3), complete second level (4), and higher (5). The ACE transformation of the respondent's education showed that the effect was linear when coded in this way, so no transformation was needed. Husband's education was coded in the same way as wife's education. Size of place of residence was coded in five categories, as follows: rural (0), small towns (1), cities below 100,000 (2), cities above 100,000 (3), and Tehran (4). In this way, rural women constitute a baseline from which differences are measured. Place of childhood residence was coded in two categories: city (1) and village (2).

Descriptive statistics for some of the key variables are shown in Table 1.

We based model comparison on the BIC statistic, in the form

$$\mathrm{BIC} = -\chi^2 + p\log n, \tag{4}$$

where χ^2 is the likelihood ratio test statistic for comparing the null model with no covariates with the model of interest, p is the number of independent variables in the model of interest (not counting the intercept) as defined by Eq. (1), and n is the sample size—that is, the number of cases (woman-years) in the logistic regression (Eq. (1)) (Raftery, forthcoming). The *smaller* BIC is (i.e., the more negative), the better the model. For the model with no covariates, BIC is 0, so a positive BIC indicates a model that is worse than the null model.

Translating Event History Parameters into Total Fertility Rates

An approximate way of translating event history parameters into (marital) total fertility rates, TFRs, is as follows. Let $\bar{\pi}$ be the average value of π_{iky} as defined by Eq. (1), $\bar{L} = \mathrm{logit}(\bar{\pi})$, and $\bar{f}$ be the fertility rate corresponding to $\bar{\pi}$. Not that $\bar{f}$ and $\bar{\pi}$ are not the same because years in which there was a birth are counted more than once in the denominator of $\bar{\pi}$, but not of $\bar{f}$. We have $\bar{\pi} = \bar{f}/(1 + \bar{f})$, so that $\bar{f} = e^{\bar{L}}$. Now, approximately,

$$\mathrm{TFR} = 1 + A\bar{f} = 1 + Ae^{\bar{L}}, \tag{5}$$

where $A = (C - B - 1)$, B is the average age at first birth, and the age-specific fertility rate is approximated by

$$\text{fertility rate (age)} \approx \begin{cases} \bar{f}, & \text{if } D \leq \text{age} \leq C \\ 0, & \text{if not,} \end{cases}$$

(provided that $B \geq D$). From our data we have estimated $D = 15$, $C = 42$, and $B = 19$, so that $A = 22$.

Table 1. Means and Standard Deviations for Variables in the Study

Variable	Mean	Standard Deviation
Year of Birth	1945	9.6
Size of Place of Residence	1.2	1.6
Woman's Education	0.5	1.1
Husband's Education	0.9	1.3
Place of Childhood Residence	1.7	0.5

As an example, let us examine the effect of the woman's education on fertility (see Table 3). Our estimation of Model 1 is based on 77,088 cases including 16,997 births, so that $\bar{\pi}$ is 16997/77088 = 0.2205, corresponding to $\bar{L}$ = logit (0.2205) = −1.263, $\bar{f} = e^{-1.263} = 0.283$, or about TFR = 1 + 22$\bar{f}$ = 7.2. The average educational attainment is 0.5 (see Table 1), and the event history parameter for this variable is −0.18. Thus, for education level 0, $\bar{L} = -1.263 + (0 - 0.5) \times (-0.18) = -1.173$, so that TFR $= 1 + 22\,e^{-1.173} = 7.81$. For education level 5, $\bar{L} = -1.263 + (5 - 0.5) \times (-0.18) = -2.073$, so that TFR $= 1 + 22e^{-2.073} = 3.77$. Thus the average difference in TFR between women with some higher education and those with no education is about 7.81 − 3.77 = 4.04, or about four children.

The average effect on TFR of a change in an independent variable x whose event history parameter is β is about $A\beta e^{\bar{L}}$, by differentiating Eq. (5) with respect to x. For our data, this is about $22e^{-1.263}\,\beta = 6.2\beta$, on average. Thus we can "read" the tables of event history parameters in this article in a rough way by multiplying them by about 6 to gauge the effect on TFR of a unit change in the independent variable.

Exploratory Regression Change-Point Modeling

To pinpoint the time at which the fertility decline started, and to identify its best predictors, we carried out an analysis in three stages. First we fitted an event history model in which period was coded as a set of dummy variables, one for each year. Then we conducted an exploratory regression analysis with the estimated period effect as the dependent variable. Finally, guided by these results, we fitted further event history models in which the period effect is modeled parametrically as a function of substantive independent variables; our final conclusions are based on those models. We now describe the exploratory regression change-point modeling methods.

We first fitted a change-point regression model to the estimated set of period effects, $y(t)$, namely

$$y(t) = a_0 + a_1 y_1(t) + a_2 y_2(t), \tag{6}$$

where

$$y_1(t) = \begin{cases} t & \text{if } t \le t_0 \\ t_0 & \text{if } t > t_0, \end{cases} \tag{7}$$

$$y_2(t) = \begin{cases} 0 & \text{if } t \le t_0 \\ (t - t_0) & \text{if } t > t_0. \end{cases} \tag{8}$$

Here t_0 is the change-point representing the time at which fertility started to decline. To estimate t_0, we fitted the model (Eq. (6)) for each possible value of t_0 and chose the value that gave the best fit as measured by the R^2 value, denoted by $R^2(t_0)$; this is the maximum-likelihood estimator.

An approximate interval estimate follows from a Bayesian calculation. Given the data and a prior distribution that assigns equal prior probability to each possible value of t_0, the posterior probability that the change-point occurred at t_0 is approximately proportional to $\{1 - R^2\,(t_0)\}^{-T/2}$, where T is the number of years. A set of values of t_0 that account for 95% of the posterior probability is a Bayesian 95% confidence interval. We based model comparison again on BIC, in the form BIC $= T \log (1 - R^2) + p \log n$. We used a stepwise forward procedure for selecting variables, guided by BIC. For the data analyzed here, a stepwise procedure guided by significance tests at the 5% level yielded the same result.

Modeling Unobserved Heterogeneity

Heckman and Singer (1984) have pointed out that results of event history analysis can be sensitive to unobserved heterogeneity. To see whether this was the case here, we estimated versions of our preferred model that included unobserved heterogeneity, namely

$$\text{logit}(\pi_{iky}) = \beta_0 + \sum_{j=1}^{p} \beta_j x_{jiky} + \epsilon_i, \tag{9}$$

where ϵ_i is an unobserved woman-specific random effect representing unmeasured characteristics that affect fertility, such as fecundability and coital frequency. We assumed that $\epsilon_i \overset{\text{iid}}{\sim} N(0, \sigma^2)$.

Bayesian estimation of $\beta_0, \beta_1, \ldots, \beta_p, \sigma^2$ and all the ϵ_i is carried out at the same time by using a version of the Gibbs sampler (e.g., Smith and Roberts 1993) with 800 iterations. A diffuse prior distribution for $\beta_0, \beta_1, \ldots, \beta_p$ and $\log(\sigma^2)$ is used. This procedure yields an estimate of the full posterior distribution, and hence confidence intervals, as well as standard errors.

RESULTS

Results of Event History Modeling

Table 2 shows the fits of various event history models. In Raftery et al. (forthcoming) we established that age, duration, parity, (woman's) education, and husband's education all have effects; thus we include these throughout. We modeled parity 1 and parities 2+ separately. The main difference between them, however, is that the average birth-interval length differs much more between parities 1 and 2 than between parities k and $(k+1)$ for k

Table 2. Period, Cohort, or Child Mortality? Model Fits

Model	Other Variables	χ^2	p	BIC
1	None	13,359	10	−13,247
2	Y_3	13,505	18	−13,302
3	C	13,394	16	−13,214
4	Y_3 C	13,525	24	−13,255
5	Y_3 S	13,621	19	−13,407
6	Y_3 Ch	13,566	19	−13,352
7	Y_3 S Ch	13,632	20	−13,407
8	*Y_3 S M*	*14,531*	*20*	*−14,306*
9	Y_3 S M C	14,560	26	−14,268
10	Y_3 S M Ch	14,537	21	−14,300
11	Y_1 S M	14,592	37	−14,176

Notes: All models include age, duration, parity, woman's education, and husband's education. The preferred model is shown in italics (no. 8).

The independent variables are as follows:

C = cohort (seven levels); Y_3 = period (coded as in Table 3);

S = size of the place (five categories) in which the woman resides;

Ch = place of childhood residence (city/village);

M = child mortality (1 if the previous child was alive; 0 if not);

Y_1 = period (coded as one dummy variable for 1900–1952, and one for each year 1953–1977).

The quantities χ^2, p, and BIC are defined by Eq. (4).

$\geq$ 2. Thus, here we modeled all parities (1 and above) together and included a dummy variable for parity 1.

A comparison of Models 1, 2, 3, and 4 shows that period has a strong effect but that cohort does not. A comparison of Models 2, 5, 6, and 7 shows that place of current residence has a large effect and that place of childhood residence does not explain anything more. Model 8 shows that death of the previous child increases fertility, possibly because of conscious demand for a new child to replace the dead one, the effect of ending breast-feeding, or both.

We fitted the preferred model both excluding and including population heterogeneity. Table 3 shows the estimates when population heterogeneity is included. The estimates are not drastically different when heterogeneity is not included in the model. (See Raftery, Lewis, and Aghajanian 1994 for a more comprehensive presentation of results, including parameter estimates for the model without heterogeneity.)

The effects of woman's education, husband's education, place of residence, and death of the previous child were all large and significant. The education coefficient translates into a difference of about four children between the TFR for women with no education and those with some higher education (as we worked out above). Husband's education also has a significant effect, about one-third as large as that of the woman's own education.

Place of residence also has a large effect, with a difference of about 1.5 children between the most urban women (those living in Tehran) and rural women. Child mortality has a large effect; the death of the previous child more than doubles the fertility rate in the following interval. (This is the case because the ratio of the fertility rate when the previous child was dead to that when the previous child was living was $e^{0.77} = 2.16$.) The interval

Table 3. Estimates for the Preferred Model in Table 2

Variable	β[a]
Intercept	−0.67
Age (Linear)	−0.36
Age (Quadratic)	−0.31
Duration 0	−2.38
Duration 1	0.36
Duration 2	1.23
Duration 3+	2.44
Parity 1	0.22
Parity	−0.08
-1953	−0.04
1954–1958	0.11
1959–1963	0.23
1964–1966	0.08
1967–1969	0.17
1970–1972	0.16
1973–1974	0.11
1977	−0.23
Woman's Education	−0.18
Husband's Education	−0.06
Size of Place of Residence	−0.07
Child Mortality	−0.77

Note: The baseline for the period effect is 1975–1976.

[a] All coefficients are significant at .05 except the up-to-1953 period effect.

following the second birth is about one-third longer on average than that following the first birth; with each subsequent birth, the average length of the following interval increases by about 8%.

Analysis of the Period Effect

We first fitted Model 11 of Table 2, which contained a dummy variable for each year from 1953 onwards; the estimates are shown in Table 4. There is strong evidence for a change-point, and the most likely year is 1959 (Figure 3); with posterior probability about 67%, it occurred in the period 1957–1961. Figure 4a shows the estimated period effects, their approximate 95% confidence intervals, and the fitted change-point regression line. The

Table 4. The Estimated Period Effect and Its Predictors

Year	Period Effect	SE	% Primary Participation	% Secondary Participation	GDP[a]	Family Planning Program[b]
1953	0.13	0.10	26	7		0
1954	0.00	0.09	26	7		0
1955	0.14	0.09	28	7		0
1956	−0.20	0.08	30	8		0
1957	0.18	0.08	33	9		0
1958	−0.06	0.08	35	10		0
1959	0.21	0.07	38	11	304	0
1960	0.19	0.07	40	11	321	0
1961	0.14	0.07	42	11	334	0
1962	0.03	0.06	45	12	355	0
1963	0.11	0.06	46	13	381	0
1964	−0.02	0.06	49	14	412	0
1965	0.00	0.06	51	15	463	0
1966	−0.04	0.06	55	19	508	0
1967	−0.00	0.06	56	19	567	1
1968	0.11	0.06	58	22	635	28
1969	0.08	0.06	60	24	712	48
1970	0.16	0.06	60	26	802	67
1971	0.05	0.06	62	35	903	83
1972	−0.03	0.06	65	37	1,056	96
1973	0.04	0.06	67	40	1,178	94
1974	−0.01	0.06	75	43	1,281	93
1975	−0.16	0.06	79	46	1,296	92
1976	0.00		84	50	1,296	104
1977	−0.32	0.06				

[a] Gross domestic product, GDP, is measured in billions of rials at constant 1959 prices.

[b] Family Planning Program is measured by the number of contraception acceptors per 1,000 women (Nortman and Hofstatter 1978). According to Nortman and Hofstatter, the proportion of "acceptors" had reached 11% in 1977, based on official statistics. According to our own data, the number was somewhat higher, with 19% of respondents reporting current use of the pill and 25% reporting current use of any type of modern contraceptive in 1977 (Aghajanian 1994). This discrepancy is not surprising because one would expect any official count to miss users.

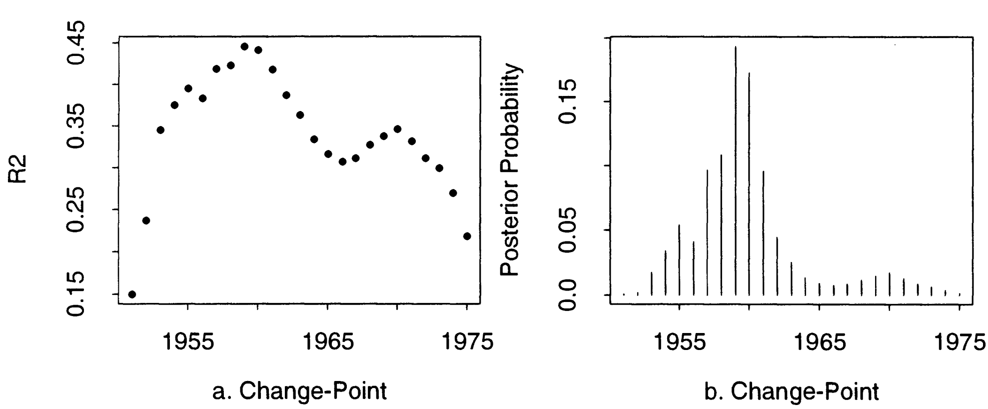


Figure 3. Exploratory Change-Point Regression Results: (a) R^2 for the Linear Change-Point Model for Each Possible Change-Point; (b) Approximate Posterior Probability That the Change Happened at Year t_0, for Each t_0

line fits the period effects well, lying within or very close to all the confidence intervals; we find no outliers and no evidence of nonlinearity or serial correlation.

We then regressed the estimated period effect on variables that represent the competing theories. Demand theory says that modernization increases the direct cost of children by raising the amount of formal education they receive to meet the greater need for skilled labor, and reduces the benefits by making children less available and less useful for work. This happened in a dramatic way in Iran, where participation in primary education rose from 25% to 80% in just 20 years. Demand theory therefore would predict a strong association between fertility decline and primary school participation. The same is true of secondary school enrollments, but to a lesser extent because that change affected fewer people. Demand theory also says that modernization increases the opportunity cost of children by providing other goods on which to spend money. We used gross domestic product, GDP, as a (somewhat imprecise) measure of this effect.

We observed evidence of two major ideational changes. The official Family Planning Program started in 1967; we measured its effect by the number of users as a proportion of the relevant population, which grew rapidly over the following 10 years. The Family

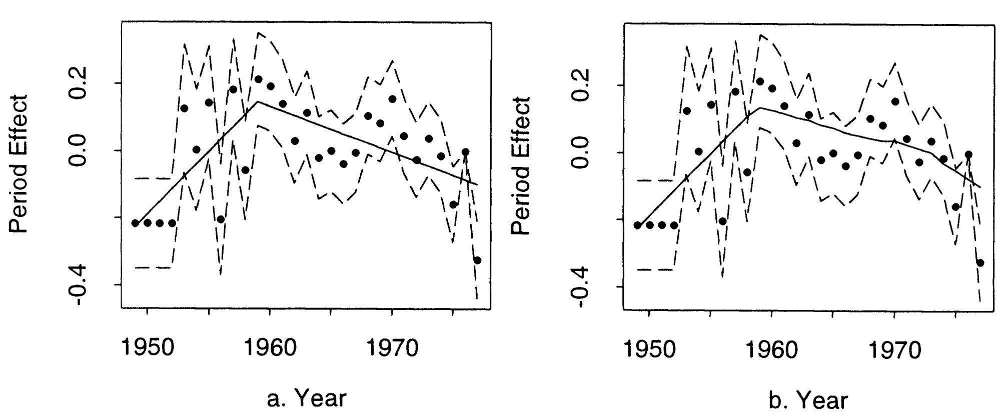


Figure 4. Period Effect Regression Results: (a) Period Effects (dots), their 95% Confidence Intervals (dashed lines), and the Linear Change-Point Model Fit (solid line); (b) Pre-1959: Linear Fit; Post-1959: Primary Education Participation Regression

Protection Act became law in 1967 as well; we represented it by a variable that was equal to 1 in years when it was in effect, and 0 when it was not.

Table 5 shows that participation in primary education is the best single predictor of the period effect, followed by secondary participation and GDP, but that the Family Planning Program and the Family Protection Act have little explanatory power. Model 10 of Table 5, which includes both primary participation and the Family Planning Program, seems to fit better, but this effect is not real because the sign of the Family Planning Program is in the wrong direction. This anomaly disappears in the confirmatory event history modeling (see Table 6). A similar comment holds true for the Family Protection Act variable: when added to primary participation, no other variable explains much, and the model with primary participation as the only predictor fits well (Figure 4b).

Table 6 shows the fits of various event history models in which the period effect is modeled as a function of substantive variables. A comparison of Models 1, 2, 3, and 4 confirms that the period effect is well represented by a piecewise linear function with a change-point in 1959. Models 5 and 6 support the exploratory regression results about the predictive power of primary participation; Model 7 confirms that the Family Planning Program had no additional effect. Models 8 and 9 confirm that a change-point in 1959 fits better than one in either 1957 or 1961. Table 7 shows the estimates for the preferred model in Table 6.

Compositional and Child Mortality Effects

Even when fertility is not declining, more educated couples tend to have fewer children, and urban women tend to have fewer children than rural women. Modernization increases the average educational level of the adult population and also leads to a flight from the land; we would expect this phenomenon alone to lead to a reduction in fertility. We refer to this as the *compositional* effect. We know that this effect does not completely explain the fertility decline, because when education and place of residence are controlled for, the period effect remains. But *how much* of the fertility decline is due to the compositional effect?

We have also seen that death of a child leads to a large increase in fertility in the following interval, and that infant mortality declined considerably over the period of our study. This alone would reduce fertility to some extent, but once again we have seen that it does not completely explain the observed fertility decline. How much of the fertility decline is due to the decrease in child mortality?

Table 5. Exploratory Regression Models for the Period Effect, 1959–1976

Model	Period Effect	p	R^2	BIC
1.	Linear Trend (YEAR)	1	0.40	−6.2
2.	Gross Domestic Product (GDP)	1	0.33	−4.4
3.	Primary Participation (PRIM)	1	0.44	−7.6
4.	Secondary Participation (SEC)	1	0.34	−4.5
5.	Family Planning Program (FPP)	1	0.17	−0.5
6.	Family Protection Act (FPA)	1	0.11	0.8
7.	PRIM + YEAR	2	0.46	−5.2
8.	PRIM + GDP	2	0.49	−6.4
9.	PRIM + SEC	2	0.50	−6.8
10.	PRIM + FPP	2	0.59	−10.1
11.	PRIM + FPA	2	0.56	−9.0

Table 6. Event History Models for the Period Effect

Model	Period Effect: Pre-1959	Period Effect: Post-1959	χ^2	p	BIC
1.	Dummies	Dummies	14,592	37	−14,176
2.	Linear	Linear	14,523	15	−14,354
3.	Dummies	Linear	14,545	21	−14,309
4.	Linear	Dummies	14,570	32	−14,210
5.	*Linear*	*PRIM*	*14,527*	*15*	*−14,358*
6.	Linear	FPP	14,514	15	−14,346
7.	Linear	PRIM + FPP	14,529	16	−14,349
8.	Linear to 1957	PRIM from 1957	14,526	15	−14,357
9.	Linear to 1961	PRIM from 1961	14,520	15	−14,351

Note: All models include age, duration, parity 1, parity, woman's education, husband's education, size of place of residence, and child mortality. The period effect is replaced by the variables shown. The preferred model is shown in italics.

Table 8 shows how much the post-1959 primary enrollment coefficient (i.e., the period effect) declines when these other variables are introduced. When the model includes only age, duration, parity, and period, the post-1959 primary enrollment coefficient is 0.82. (We have dropped the minus sign here because the discussion in this section is solely in terms of the absolute value of the coefficient.) When woman's education, husband's education, place of residence, and child mortality are introduced, the coefficient falls to 0.42. Therefore these variables together account for about 50% of the decline.

It is interesting to see the breakdown of that 50% between the four variables. The most common way to do this is to introduce the four variables one by one in a predetermined order and then observe how much the post-1959 primary enrollment coefficient declines for each. This method is unsatisfactory, however, because it depends on the order in which the

Table 7. Estimates for the Preferred Model in Table 6

Variable	β[a]
Intercept	−2.36
Age (Linear)	−0.35
Age (Quadratic)	−0.31
Duration 0	−2.42
Duration 1	0.32
Duration 2	1.20
Duration 3+	2.39
Parity 1	0.22
Parity	−0.09
Pre-1959 Linear Trend	0.03
Post-1959 Primary Participation	−0.43
1977	−0.24
Woman's Education	−0.19
Husband's Education	−0.06
Size of Place of Residence	−0.07
Child Mortality	−0.75

[a] All coefficients are significant at the .001 level.

variables are introduced, which here would be somewhat arbitrary. Therefore, we show instead in Table 8 how much each variable reduces the post-1959 primary enrollment coefficient if it is introduced first and how much if it is introduced last, and we use the difference between the two to define a range.

Table 8 shows that the decrease in child mortality accounted for a little more than one-quarter of the fertility decline, while the increase in level of (parents') education accounted for a little less. We found no evidence of a compositional contribution to the fertility decline through urbanization because the proportion urban, in fact, did not increase substantially from one cohort to the next in our sample.

Interaction Effects

To examine possible interactions, we fitted a model with all two-way interactions between the variables duration, parity, size, education, and the period effect, and then used a backwards elimination procedure to choose the best subset. The resulting model had L^2 = 14,854, p = 25, and BIC = −14,573; the estimates are shown in Table 9.

The fertility decline was large in Tehran, corresponding to a reduction of about four children in the marital TFR, but in rural areas and small towns the decline was very small (Figure 5). In smaller cities the decline was substantial but less than in Tehran.

The fertility decline was the same for women at all educational levels, but its extent depended on husband's education (Figure 6). For women at the same educational level, the decline for husbands with some higher education was about 0.8 greater (on the logit scale) than for husbands with no education; this translates into a difference in TFR of about four children. In the pretransition period, husband's education had no effect on fertility, but as the transition proceeded, its effect grew and became almost as large as that of the woman's own education. This finding may explain the conflicting results in the literature about whether husband's education has an effect on fertility (Sorenson 1989).

The interactions help to clarify whether the fertility decline was due to stopping or to spacing of births. There is no evidence that the extent of the decline differed by parity, and the average birth interval increased as fertility declined. Thus the decline seems to have consisted of increased spacing at all parities, rather than of parity-specific stopping. Of course, women may have had the *intention* of stopping, and our results merely reflect that that did not actually happen in most cases. This is consistent with the more general WFS results of Hobcraft (1985), who argues that the stopping-versus-spacing debate is vacuous.

Table 8. Contributions to the Fertility Decline of Population Composition in Terms of Education and Place of Residence, and of Child Mortality

	Post-1959 Estimate in Model ADPY +		% of Period Effect Due to V	
V	V	WHSM–V	Lower	Upper
None	0.82	0.42		
Woman's Education (W)	0.62	0.48	7	25
Husband's Education (H)	0.66	0.43	2	20
W + H	0.59	0.58	20	28
Size of Place of Residence (S)	0.83	0.37	0	0
Child Mortality (M)	0.56	0.64	27	32

Note: All models include age (A), duration (D), parity (P), and period effect (Y).

Table 9. Estimates for the Preferred Model with Interactions

Variable	β[a]
Intercept	−2.73
Age (Linear)	−0.38
Age (Quadratic)	−0.30
Duration 0	−2.97
Duration 1	0.37
Duration 2	1.24
Duration 3+	2.23
Parity 1	0.12
Parity	−0.10
Pre-1959 Linear Trend	0.04
Post-1959 Primary Participation	0.02
1977	−0.27
Woman's Education	0.06
Husband's Education	0.06
Size of Place of Residence	0.03
Child Mortality	−0.76
Duration 0 × Woman's Education	−0.38
Duration 1 × Woman's Education	−0.35
Duration 2 × Woman's Education	−0.30
Duration 3+ × Woman's Education	−0.67
Duration 0 × Parity	0.16
Parity 1 × Woman's Education	0.24
Post-1959 × Duration 3+	1.39
Post-1959 × Size of Place of Residence	−0.43
Post-1959 × Husband's Education	−0.40
Size of Place of Residence × Husband's Education	−0.02

[a] All coefficients are significant at .01 except the post-1959 primary participation and the woman's education coefficients. These main effects are retained because the interactions involving them shown above are highly significant.

DISCUSSION

Demand or Ideation?

Marital fertility in Iran increased during the 1950s and started to decline around 1959, a few years after the beginning of massive economic growth around 1955. The decline continued until 1977, the year in which the IFS was conducted. This decline was largely urban, amounting to about four children per married woman in Tehran, somewhat less in smaller cities, and very little in rural areas. It closely paralleled the large increase in primary school participation. More than one-quarter of the decline can be attributed to the reduction in child mortality, a key mechanism of demand theory. There is no evidence that the Family Planning Program or the Family Protection Act, both instituted in 1967, accelerated the decline; certainly neither caused its onset.

What do these findings tell us about the debate between demand and ideational theories? The Iranian fertility decline closely follows the predictions of the demand theory of Easterlin and Crimmins (1985). It is less clear what ideation theory predicts, but it does suggest that the establishment of the Family Planning Program and the passing of the Family

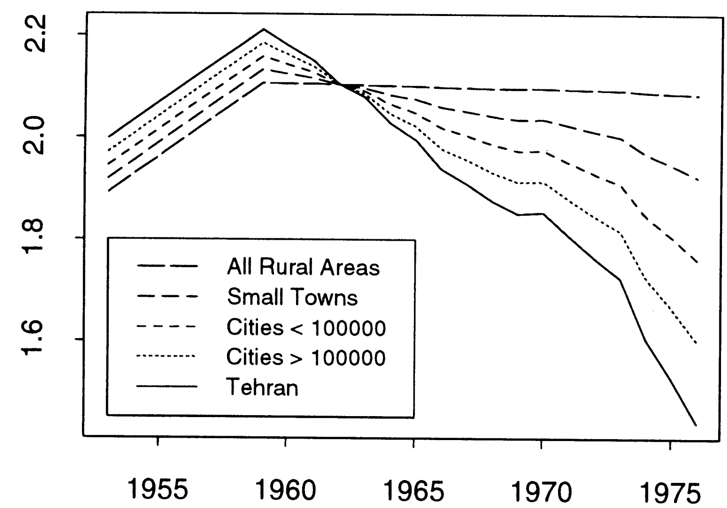


Figure 5. Interaction between Period and Size of Place of Residence: The Period Effect Estimated from Table 9 for Each of the Five Levels of Size of Place of Residence

Protection Act would probably accelerate, and could even precipitate, the fertility decline. Yet not only did the 1967 events not trigger the fertility decline (the timing precludes this), but there is no evidence that they even accelerated it. Thus the Iranian fertility decline seems to be described more accurately by demand than by ideation theories.

Several of our other results supported this general conclusion. The fertility decline was preceded by a fertility increase, precisely as predicted by demand theory, but not by ideation theory. Ideational changes tend to affect the young more than their elders (Ryder 1965), so one would expect an ideational effect to manifest itself partly as a cohort effect. The Iranian fertility decline, however, was a period effect and not a cohort effect, equally affecting childbearing women of all ages. This finding is in line with demand theory, whereby

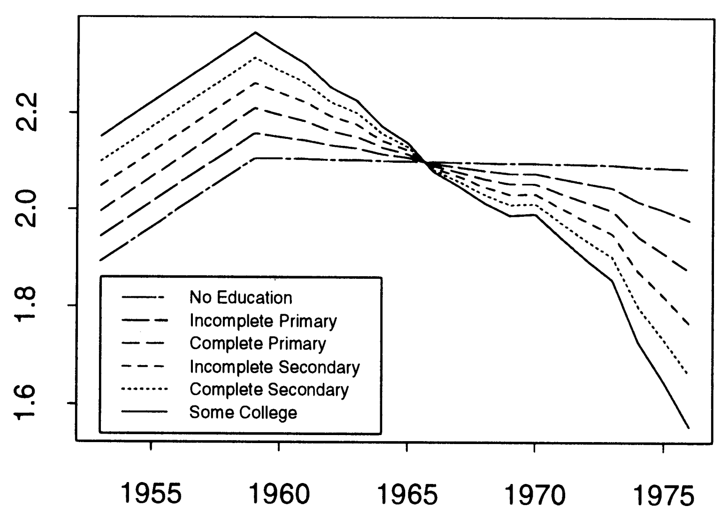


Figure 6. Interaction between Period and Husband's Education from Table 9: Period Effect for Each Level of Husband's Education

fertility behavior is determined largely by *current* costs and benefits rather than by attitudes that change slowly over the life course. Similar results have been obtained for most other WFS countries (Hobcraft 1985), for the United States (Isaac et al. 1979 and Pullum 1980, both as reported by Hobcraft, Menken, and Preston 1982), and for Sweden, Australia, and England and Wales (Page 1977). The fact that place of current residence counts, rather than childhood residence, also points in the same direction.

The decline equally affected women at all educational levels, but it was greater among women whose *husbands* were more educated (after controlling for their own educational level). This may be because husband's education is a reliable proxy for husband's occupational status and hence for the socioeconomic standing of the household. Households with higher socioeconomic standing tend to participate more fully in modernization and hence to have a greater fertility decline, as predicted by demand theory. If the decline were driven primarily by the transmission of ideas, one would expect more educated women to be affected more strongly than less educated women, but this was not the case.

One of our main findings is that fertility decline in Iran closely paralleled the expansion of mass primary education. This is essentially Caldwell's (1980, 1982) theory, which our results both support and allow us to refine. It is important to distinguish between the effects of mass education on current fertility and on the subsequent fertility of students currently in the school system. The former are mainly demand-related; the latter are essentially ideational. The former are measured in our study by current enrollments; the latter are measured by the parents' education. The former lead to an immediate fertility decline; the latter have a delayed effect.

Caldwell postulated five mechanisms through which mass education causes fertility decline; three of these are demand-related and two are ideational. How, then, can we assert that the Iranian fertility decline was consistent with demand rather than ideation theories? The three demand-related mechanisms are the reduction of the child's potential as a worker, increased schooling costs, and the fact that schooling makes the child more dependent. All of these relate to mass schooling of the *children* and imply an immediate effect on fertility, which is precisely what we observed.

The ideational mechanisms are cultural change and the introduction of Western values. Both of these are postulated to affect the fertility of students once they grow up, and hence to have a delayed effect on fertility. Our results show that only about one-quarter of the fertility decline was due to the increase in *parents'* level of education (Table 8). The study of Egypt by Faust et al. (1991) suggests that even this small and delayed ideational effect of mass education may be moot. They found that the Egyptian school system, far from introducing Western values, actually reinforces Islamic family values, although it is essentially a Western-style system. They also found that schools and teachers have little influence on students in terms of role modeling. By contrast, they found that the demand-related mechanisms operated as Caldwell had postulated.

The Lack of Effect of the Family Planning Program

Our finding that the Family Planning Program did not initiate, or even accelerate, the fertility decline appears at first sight to contradict many cross-national cross-sectional studies that have found an association between fertility decline and family planning effort (Cutright and Kelly 1981; Freedman and Berelson 1976; Mauldin and Berelson 1978; Menard 1983, 1985, 1986, 1987, 1990; Tolnay and Christenson 1984; Tolnay and Rodeheaver 1988; Tsui and Bogue 1978). These authors, however, assumed that family planning effort preceded fertility decline both temporally and causally, an assumption that is open to question. Demeny (1979a, 1979b) pointed out that fertility decline *preceded* family planning effort in several countries such as Taiwan, and we have shown this to be the case in Iran as well. Davis (1967) and Hernandez (1981, 1984) contended that family planning programs are effective only where substantial socioeconomic transformations have already increased the motivation for family limitation. Kelly and Cutright (1983) argued that fertility decline causally precedes family planning effort, on the grounds that fertility decline indicates the demand for contraception, which family planning programs then are established to meet. Our results for Iran are consistent with this argument, although they do not prove its validity. Of course, the Iranian fertility decline was still at an early stage in 1977, and it is possible that the Family Planning Program could have had a substantial effect later on.

Our result is not inconsistent with those of the authors who found cross-national associations between fertility decline and family planning effort, because the two events occurred in Iran within a fairly short time. Our longitudinal study, however, reveals the temporal order of the two events in a way that the cross-sectional studies cannot, and so sheds some light on the direction of causality between the two (if any).

In practical terms, how can we explain the finding that the Family Planning Program did not accelerate the fertility decline? The Family Planning Program emphasized use of the pill, and our data show that it was successful in one sense: 85% of the women interviewed reported having heard of the pill, 37% reported ever having used it, and 19% of the currently married women who were not pregnant reported using the pill at the time of the survey (Aghajanian 1994). Our data, however, provide no evidence of any association between pill use and lower fertility for individual women. This statement is based on analyses not reported here, which consisted of estimating event history models in which ever use of the pill was included as an independent variable. It was true both on average overall, and for each parity individually. Anecdotally, interviewers reported seeing piles of unused boxes of pills in the homes of women who reported having used this method.

Perhaps the following is a clue. Two-thirds of current contraceptive users in rural areas were using the pill, while in urban areas the rate was only 40%. Withdrawal was the best-known and most widely used method apart from the pill; this was used by one-third of urban contraceptive users but by only 16% of rural users. Thus, where fertility was truly declining (in urban areas), withdrawal was being used widely, while in rural areas, where the fertility decline was very small, the pill was the main method and withdrawal was little used. It follows that the fertility decline we observed may have been due, at least in part, to the use of withdrawal rather than modern methods. Withdrawal is a long-standing traditional method in Iran.

This hypothesis is somewhat plausible because the decline consisted of spacing rather than stopping of births, and because fertility was still quite high at the end of our period, even in Tehran. A full answer to this question would require birth-interval-specific data on contraceptive use, including correctness of pill use, which we do not have. Even this information might not be enough, however, as shown by the fuller Korean WFS data (Bumpass, Rindfuss, and Palmore 1986).

A reviewer has pointed out that if the fertility decline was achieved mainly by withdrawal rather than by modern contraceptive use, we may ask whether the demand for fertility limitation was satisfied by withdrawal alone, or whether there were social, cultural, or other barriers to the use of the pill. As far as we know, no data are available to answer this question, but we note that Islam does not prohibit the use of artificial contraception. Also, fertility was still fairly high even in Tehran at the end of our period, so it is plausible that the observed reduction could have been caused mainly by withdrawal.

The Effect of Birth Order

In one important respect, our results for Iran are not the same as those reported for other WFS countries. Hobcraft (1985) reported a lack of association between fertility behavior and parity beyond the second birth, once other factors are controlled for. By contrast, the strong significance of the parity coefficient in Tables 3, 7, and 9 indicates a clear association between fertility behavior and parity in Iran, consisting of a gradual decline of fertility with increasing parity of about 8% per birth. This effect is relatively subtle in that the differences between neighboring parities are small, but it is clear and important. Our finding may be due to the power of our methodology, in which case it also may be present, albeit so far undetected, in other WFS data sets. On the other hand, this result may be unique to Iran.

Trends since the Islamic Revolution

In 1979, shortly after the IFS, the Islamic Revolution took place. The 1986 census counted a population of 49.4 million, implying the high population growth rate of 3.4% per annum for 1976–1986. Detailed analysis of 1986 data suggests that the high rate of growth was due to a decline in infant and child mortality (Aghajanian 1993) and to an increase in the total fertility rate of urban women (Aghajanian 1991). The increase in total fertility was largely the result of higher fertility among older women.

During the early 1980s, and especially during the eight years of the Iran-Iraq war, the Islamic Republic discontinued the previous regime's population policy and encouraged marriage and procreation. Also, the rationing system, which was based on the number of people in the household, may have encouraged couples to have more children. Another factor might be the lesser availability of contraceptives through government clinics. Some of these possible reasons are economic and others are ideational; further work is needed to explain this reversal of fertility decline.

NOTE

[1] A Fortran program implementing the methods described in the methods section is available free of charge by sending the e-mail message "send eha from general" to statlib@stat.cmu.edu.

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