REPORTS

The Impact of the Family Planning Supply Environment on Contraceptive Intentions and Use in Morocco

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Although the extent to which organized family planning programs influence reproductive preferences remains a subject of debate, most observers would grant that such programs play a key role in helping individuals to realize their contraceptive and reproductive intentions. However, few prior studies have quantified the magnitude of this facilitating or enabling effect of family planning services, given existing demand for contraception. This study takes advantage of panel survey data and linked information on the supply environment for family planning services in Morocco in order to bridge this research gap. In the analysis, contraceptive use during the 1992–95 period is related to contraceptive intentions in 1992; individual-, household-, and community-level determinants of contraceptive behavior; and family planning supply factors. Estimation procedures are used that control for unobserved joint determinants of contraceptive intentions and use. Evidence of a significant enabling or facilitating role of family planning services is found, and the results also suggest that family planning program factors influence contraceptive intentions in important ways. (STUDIES IN FAMILY PLANNING 1999; 30[2]: 120–132)

Do organized family planning programs hasten the transition from high to low fertility and, if so, what is the magnitude of their contribution to fertility decline vis-à-vis other determinants of societal fertility levels (for example, levels of infant mortality, socioeconomic development, and education)? These questions have long been the subject of debate in the international population community (see Freedman 1997; Bongaarts 1994 and 1995; Knowles et al. 1994; and Pritchett 1994 for recent contributions to this debate).

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At the heart of the debate is the issue of the causal pathways through which family planning programs influence contraceptive use and, ultimately, fertility. Three possible paths of influence may be distinguished. First, programs might influence fertility preferences (that is, demand for children) by influencing social norms regarding family size. Second, programs might contribute to the conversion of latent demand for fewer children into manifest demand for contraception by increasing the social acceptability of contraception. Finally, programs might influence the likelihood of contraceptive use, given demand, by reducing the economic and psychosocial costs of practicing contraception.

The strength of the empirical evidence regarding the respective causal pathways is varied. The weakest evidence is for family planning program effects on fertility preferences. In making the "demand-side" argument, Pritchett (1994) contends that since (1) fertility transitions in developing countries have been driven primarily by changes in demand for children and (2) factors such as mortality decline, economic development, and increases in educational levels appear to account for a large share of societal changes in the level for demand for children, family planning programs have played a

relatively limited role in the transition to lower fertility. In a more recent review, Freedman (1997) concluded that although some evidence has been found that family planning programs have influenced fertility preferences, the evidence is thin. He notes, however, that the lack of supporting evidence is as much the result of the limited number of rigorous studies that have examined this issue as it is an accumulation of negative findings.

The evidence in support of the second hypothesized path of influence is stronger. A number of studies suggest that family planning programs have been a catalyst in crystallizing latent demand for smaller families into intentions to use contraceptives, and, in some cases, into large increases in contraceptive use (Caldwell et al. 1988; Cleland 1994; DeGraff 1991; Koenig et al. 1987; Knodel et al. 1987; Phillips et al. 1996; Robinson and Cleland 1992; Simmons et al. 1988; Simmons 1996).

The third possible causal pathway is the least contentious of the three. Because a primary function of family planning programs is to reduce barriers to the use of contraceptives, logically, one would expect that the probability that women and couples who stated their intention to practice contraception in the future will actually adopt a method would be strongly influenced by the quantity and quality of the family planning services available to them. Most observers would grant that programs play a key role in helping individuals to realize their contraceptive and reproductive intentions.

Although less contentious, few prior studies have measured the magnitude of this specific facilitating or enabling effect of family planning services, however, given existing demand for contraception (Cochrane and Guilkey 1995 is an exception). As a result, the extent to which family planning programs are effective and efficient in carrying out this important role is not well documented.

The paucity of prior micro-level research on this issue may be attributed largely to a lack of suitable data. In order to measure these effects well, longitudinal contraceptive-use data for a panel of women with known intentions regarding future use and linked data measuring the supply environment for family planning services are required. Although linked program and household survey data are available in a number of settings as a result of the efforts of the Demographic and Health Survey (DHS) and the Population Council's situation analysis program, few panel surveys with linked family planning program data have been undertaken.[1]

The present study takes advantage of an opportunity in Morocco to assess the magnitude of supply-side effects on contraceptive use given intentions to use a method. Because the 1995 DHS in Morocco was conducted as a panel survey using a subsample of respondents from the 1992 DHS, contraceptive use during the 1992–95 period can be related to stated intentions to use a method in the 1992 survey. In addition, data were gathered using the DHS service availability module (SAM) protocol in conjunction with the 1992 survey, providing information on the quantity of family planning services available in sample communities (that is, in DHS sample clusters) and limited information on service quality.

Data and Methods

A total of 9,256 women aged 15–49 were interviewed in the 1992 Morocco DHS-II survey (Ministère de la Santé Publique and Macro International 1993). In the 1995 Morocco Panel Survey, 107 of the 212 sample clusters from the 1992 DHS-II were randomly chosen, and field-workers were instructed to revisit the same households that had been chosen for the 1992 survey and to interview all women aged 12–46 in 1992 who had been recorded in the household roster for that survey, along with any new female household members aged 15–40 (Azelmat et al. 1996). When the members of a household who had been interviewed in 1992 had moved out of the sample cluster prior to the 1995 survey, the 1995 interview was conducted with the members of the new household who resided in the same dwelling. No attempt was made to locate either individuals or entire households that had moved outside the sample cluster during the period between the two surveys.

A total of 4,753 women aged 15–49 were interviewed in the 1995 Panel Survey, of whom 3,168 had also been interviewed in the 1992 DHS-II.[2] This sample of women was restricted in several ways for the purposes of this study. Excluded from the sample of women considered were 770 women who reported using a contraceptive method at the time of the 1992 survey; 1,435 women who were not married at the time of one or the other survey interview; and 53 women who were not married to the same partner at the time of both surveys. The latter women were excluded on the grounds that changes in marital status or partners may have altered their contraceptive intentions or in other ways confounded the relationship between contraceptive intentions and subsequent use. After these exclusions, data for 910 women remained for analysis.

With the exception of information on contraceptive use during the 1992–95 period (which was obtained from the 1995 Panel Survey), all data used in the study were derived from the 1992 DHS-II and the accompanying service availability module. The questionnaire used in the 1992 survey was a slightly modified version of the standard DHS-II "Model A" questionnaire. Individual- and household-level characteristics measured in the survey

for each matched study subject were used as control variables in the analyses.

Intentions to use contraceptives were measured by means of standard DHS questions. Respondents not using a method at the time of the 1992 survey were asked "Do you intend to use a method to delay or to avoid pregnancy at any time in the future?" Respondents answering "yes" were then asked "Do you intend to use a method within the next 12 months?" Forty-two percent of respondents reported that they intended to use a method within the next 12 months, 9 percent intended to do so after 12 months, 1 percent intended to use a method but did not know when, 42 percent that they had no intention of using a method, and 3 percent were unsure of their intentions. For the purposes of this study, all women reporting an intent to use at some time in the future were considered to have intended to use a method. Women stating no intention of using a method and those who were unsure of their intentions were classified as not intending to use.

Information on the supply environment for family planning services and on the characteristics of the communities covered in the survey was obtained from the service availability module implemented in conjunction with the DHS-II.[3] For each sample cluster, information was gathered on community infrastructure (for example, schools and markets) and on the number and types of facilities offering health and family planning services that were located within 30 km (about 19 miles) of each cluster. The nearest of each type of facility (hospital, public clinic, private clinic, private doctor, and pharmacy) was visited, and information on these facilities and their service-delivery operations was obtained. From this information, a series of indicators measuring selected aspects of the family planning service environment in the vicinity of sample clusters was constructed. On the basis of preliminary bivariate analyses, a small number of indicators was chosen for inclusion in the analyses. The operational definitions of these variables are provided in Table 1.[4]

Statistical Methods

The key questions to be addressed in the present study are (1) whether women intending to use contraceptives and residing in areas where the supply environment for family planning services was favorable or more developed were more likely to have gone on to use a method during the 1992–95 period than were women with comparable intentions residing in areas where the service environment was less favorable, and (2) whether the magnitude of supply-side effects on contraceptive use was different for women who intended to practice contraception than for those who did not.

To test these hypotheses, the following bivariate probit model was used:

$$C_{ij} = \alpha 1 + \alpha 2 I_{ij} + \alpha 3 X_{ij} + \alpha 4 Z_{ij} + \alpha 5 P_{ij} + \alpha 6 I_{ij} P_j + \in 1_{ij} \quad (1)$$

$$I_{ij} = \beta 1 + \beta 2 X_{ij} + \beta 3 Z_j + \beta 4 P_j + \in 2_{ij}, \quad (2)$$

where the variable C_{ij} represents whether woman i from community j used a contraceptive method during the 1992–95 period, I_{ij} represents contraceptive intentions at the time of the 1992 survey, P_j represents indicators of the family planning supply environment, $I_{ij}P_j$ represents interactions between these two sets of factors to test whether the impact of the supply environment was different for women who reported in 1992 an intention to use contraceptives in the future than it was for women who did not report such an intention, X_{ij} represents individual-level and household-level characteristics, Z_j represents community-level characteristics, and $\in 1_{ij}$ and $\in 2_{ij}$ represent error terms that may be correlated.

As may be observed, the model has two equations that were estimated simultaneously: a contraceptive-use equation and a contraceptive-intentions equation. The two-equation bivariate probit model is used in order to avoid the estimation problems that would result if a single-equation model were to be used and common unobserved determinants of contraceptive intentions and use existed. Further details of and justification for this estimation approach can be found in the appendix.

Nonresponse Bias

An important methodological concern in panel studies is, of course, that of possible selection bias due to loss of respondents between data-collection points (Duncan and Kalton 1987). In the 1992 survey, 1,324 married women aged 15–46 who were not using a contraceptive method were interviewed. Of these women, 1,024 were reinterviewed in 1995, yielding a retention rate of 77 percent. Previous assessments of these data revealed that respondents who were lost to follow-up differed from those who were successfully interviewed in both survey rounds (Curtis and Westoff 1996; Strickler et al. 1997). Reinterviewed women tended to be less educated, older, of higher parity, and more likely to reside in a rural area. Curtis and Westoff (1996) demonstrate, however, that those reinterviewed and those not reinterviewed were virtually identical with respect to intentions to use contraceptives, the key variable for the present study. Nevertheless, women who were reinterviewed and those lost to follow-up may have differed on unobserved determinants of contraceptive intentions and, if so, this variation might introduce bias of unknown direction and magnitude.

Table 1 Operational definitions of family planning supply environment indicators used in the analysis

Variable	Operational definition
Number of trained nurses at public clinic	The number of nurses at the nearest public clinic who had received training in family planning
Number of sources of family planning at nearest set of facilities	The number of facilities at the nearest hospital, public clinic, private physician, private clinic, and pharmacy that provided family planning services or supplies
Number of sources for contraceptive pills at nearest set of facilities	The number of facilities at the nearest hospital, public clinic, private physician, private clinic, and pharmacy that provided oral contraceptives
Method availability index—public clinic	For each contraceptive method mandated to be offered at public clinics, a score of 2 was assigned if the method was available on the date of data collection for the service availability module and no stockouts had occurred during the previous six months, 1 if the method was either not available on the date of data collection or if a stockout had occurred in the previous six months, and 0 if the method was both unavailable on the date of data collection and prior stockouts had occurred. The method scores were then summed to yield a facility-level score.
Method availability index—nearest set of facilities	Same scoring as for clinic index, except summed across nearest set of facilities to the sample cluster
Training index—nearest set of facilities	Total number of physicians and nurses trained in family planning summed across nearest set of facilities to the sample cluster
Infrastructure index—private physicians and clinics	For the nearest private physician and clinic, each facility was assigned 1 point if it had the following: running water, electricity, and a gynecological examination table. The facility scores were then summed to yield a cluster-level score.

Validity of Responses

A key assumption in the present study is that responses to survey questions concerning contraceptive intentions provide valid measures of respondents' demand for contraception. If this were not the case, the estimated effects of family planning programs, given existing demand for contraception, would also lack validity. However, evidence from prior research indicates strong relationships between reported contraceptive intentions and levels/probabilities of subsequent use on a consistent basis (see Tan and Trey 1994 and Curtis and Westoff 1996, for reviews of the empirical evidence on this issue). Of particular relevance is the recent study of Curtis and Westoff (1996), who examined this issue using the same data analyzed in the present study. The authors concluded that in Morocco, as in a number of other settings where studies have been undertaken, responses to survey questions concerning intentions to use contraceptives are strong predictors of subsequent contraceptive behavior.

Results

Table 2 provides a summary of family planning supply characteristics in the communities considered in the study. As may be observed, facilities offering family planning services or supplies are readily accessible (at least physically) to residents of urban clusters. All urban clusters have at least one, and in most instances, several of each of the five primary types of fixed facilities offering family planning services in Morocco (hospitals, public clinics, private clinics, private physicians, and pharmacies) located within 30 km, with the median distance to the nearest facility offering family planning services being less than 1 km.

Family planning services are also accessible to residents of rural clusters, although less so than they are in urban areas. All rural clusters have at least one facility

Table 2 Family planning supply environment indicators for sample clusters (N=107), Morocco, 1992

Indicator	Urban	Rural	Total
Clusters with specified health facility located within 30 km (percent)			
Hospital	79.7	25.0	60.0
Public clinic	96.9	100.0	98.0
Private clinic	53.1	13.9	39.0
Private doctor	81.3	41.7	67.0
Pharmacy	100.0	72.2	90.0
Median distance (km) to nearest facility			
Hospital	3	49	13
Public clinic	<1	7	<1
Private clinic	6	72	56
Private doctor	<1	43	2
Pharmacy	<1	15	<1
Median distance (km) to nearest facility offering family planning services	<1	7	<1
Clusters with family planning services offered through home visits (CBD)	45.3	69.4	54.0
Mean number of facilities offering family planning within 10 km[a]	3.2	1.0	2.4
Mean index score for contraceptive method availability[a,b]	14.3	7.4	9.5
Mean number of methods available at public clinics[a]	5.1	4.3	4.8
Mean number of sources of oral contraceptives[a]	2.4	1.7	2.1
Mean number of trained nurses	2.4	2.3	2.4
Mean staff training index score[a,b]	3.0	1.0	1.6
Mean facility and equipment index score[a,b]	5.4	2.5	3.4

CBD = Community-based distribution.
[a]Indicators pertain to the nearest of each of the major types of facilities (as given above) located within 30 km. [b]Index ranges vary. See Table 1 for computational details and ranges.

offering family planning services within 30 km, with a median distance to the nearest facility offering family planning services (usually a public clinic) being approximately 7 km (4.4 miles). Hospitals, private clinics, and private physicians are significantly less accessible to rural residents, however, with the median distance to the nearest of these types of facilities being 49 km (30 miles), 72 km (47 miles), and 43 km (27 miles), respectively. The relative deficit of fixed facilities providing family planning services in rural clusters is at least partially offset by the provision of services through community-based distribution (CBD), which covered an estimated 69 percent of rural clusters in 1992.

Summary information on selected aspects of service preparedness (in terms of contraceptive supplies, staff training, and facility infrastructure) is also displayed in Table 2. Perhaps the most striking feature of these data is the magnitude of urban–rural differentials for most indicators. These results suggest that urban–rural differentials in physical access to facilities offering family planning services are compounded to some extent by differentials in facility staffing, infrastructure, and contraceptive method availability. The SAM data provide little information, however, on the more qualitative aspects of service delivery (for example, interpersonal relations and information exchange), and thus may overstate the magnitude of urban–rural differences in what is conventionally thought of as service quality (Bruce 1990).

Contraceptive Intentions and Other Factors Influencing Use

Of the 910 matched women who were not using a contraceptive method at the time of the 1992 DHS-II, 468 (51.4 percent) reported having used a contraceptive method at some point during the period between the 1992 and 1995 surveys (see Table 3). As may be observed, the likelihood of having gone on to use a method during the three-year study period was substantially higher among women stating an intention to adopt contraception in 1992 (73 percent) than among women reporting no such intention (30 percent). Among those reporting in the 1992 survey that they intended to use a method, women who intended to use a contraceptive within 12 months were the most likely to have used one during the 1992–95 period (76 percent), followed by women who intended to use one later (67 percent), and women who were uncertain as to when they might use a method (48 percent) (not shown).

What might explain the behavior of women who stated in the 1992 survey that they had no intention of using a method in the future but who, in fact, went on to adopt a method during the 1992–95 period? In just over one-third of such cases, the explanation appears to be related to childbearing, that is, these women reported in 1992 that they wanted another child, had a child during the study's observation period, and apparently changed their minds about contraception. Among the remaining women who did not intend to use but who went on to do so during the 1992–95 period, their reasons for having adopted a method cannot be readily ascertained from the data available.

Table 3 Percentage of women not using a contraceptive method in 1992 who ever used a method during the 1992–95 period, by selected characteristics, Morocco, 1995

Characteristic	Used method, 1992–95
Intentions status (1992)	
Did not intend to use	30.3
Intended to use	73.2
Age	
≤24	67.8
25–34	56.6
35+	37.8
Literacy	
Illiterate	49.1
Partially literate	66.7
Literate	71.7
Residence	
Urban	65.7
Rural	46.3
Sewage system in community	
Yes	65.8
No	47.2
Cement floor	
Yes	62.9
No	38.7
Number of sources for oral contraceptives	
0–1	38.4
2	56.7
3–4	65.5
Number of family planning sources within 10 km	
0–1	41.4
2	58.3
3–4	70.4
Method availability index score: Public clinic	
0–2	20.1
3–4	62.6
5–6	56.9
Method availability index score: Nearest set of facilities	
0–8	46.3
9–16	58.3
17–24	61.0
Training index score: Nearest set of facilities	
0 trained providers	46.1
1+ trained providers	61.6
Number of nurses	
0	11.4
1–2	53.2
3+	61.1
Infrastructure index score: Private services	
No	29.9
Yes	58.3
Total	51.4

Among women reporting in the 1992 survey that they had no intention of using a method in the future, 42 percent had previously practiced contraception. Among these women, 43 percent went on to adopt a method during the 1992–95 period, compared with only 16 percent of women who had not previously used a method (not shown). This finding would suggest that for these women at least, stated contraceptive intentions were transitory.

Information on differentials in the likelihood of having adopted a contraceptive method during the 1992–95 period by respondents' selected background characteristics and family planning supply environment factors is also provided in Table 3. Higher likelihoods of having adopted a method are observed for fully literate women, for those residing in urban areas or in communities with a sewage system (a proxy indicator for community wealth), and for those whose homes have a cement floor (a proxy indicator for household wealth in the Moroccan context). The likelihood of having adopted a method varies inversely with age, however. The higher likelihood of younger as compared with older women having adopted a method is consistent with the trend toward contraceptive use at increasingly younger ages in Morocco that is noted in other recent studies (Azelmat et al. 1996). Given the relatively high contraceptive prevalence rate in Morocco (estimated at 50 percent of currently married women in 1995 [Azelmat et al. 1996]), some of the older respondents who were not using a contraceptive method in 1992 might have been traditional women who opposed family planning or who aspired to large families.[5]

A number of factors related to the family planning supply environment were also strongly associated with the likelihood of having used a contraceptive method during the 1992–95 period. Several factors pertain to method availability and, more specifically, to the availability of oral contraceptives. That the likelihood of having adopted a method is associated with the local availability of oral contraceptives is intuitively sensible, given the heavy reliance of Moroccan women on this method; an estimated 64 percent of current contraceptive users were using pills in 1995 (Azelmat et al. 1996). Several factors pertaining to characteristics of the nearest public clinic also emerged as statistically significant. The significance of public clinics is also sensible in Morocco because, other than in large cities, public clinics are the most accessible type of fixed facility offering contraceptive services and supplies. In the 1995 Panel Survey, 58 percent of oral contraceptive users and 63 percent of users of any modern method identified a public clinic (that is, a health center or dispensary) as their usual source of supply (Azelmat et al. 1996).

Further analyses of these factors indicated a moderate-to-high degree of correlation among supply-side factors within sample clusters. Accordingly, a smaller set of such factors was retained for the multivariate analysis. These consisted of: (1) method availability at the nearest public clinic; (2) the number of nurses at the nearest public clinic; (3) the level of staff training in family planning at the nearest set of facilities; and (4) the level of infrastructure at the nearest private physician or clinic.

Multivariate Results

As described here in the Data and Methods section, the net effects of contraceptive intentions and family planning supply-side factors on contraceptive use were estimated using a two-equation statistical model. The multivariate results are displayed in Table 4. Results from two models are shown: Model 1 is an additive or main-effects model, whereas Model 2 allows for interactions between contraceptive intentions and family planning supply factors. Each model contains a contraceptive-intentions equation and a contraceptive-use equation.

Looking first at the main-effects model (Model 1), several factors emerge as having had significant positive effects on contraceptive intentions in 1992.[6] Among these are respondent's age, literacy (full, but not partial), and presence of a cement floor in the home. Unexpectedly, the presence of a community sewage system had a significant negative effect when other factors were controlled statistically. This finding may reflect the tendency for the older sections of large cities (that is, the medina) and newly developed urban fringe areas to lack public sewage systems. The strong negative effect of older age (that is, being in the 35–49 age group) is, as discussed earlier, likely attributable to the combination of cohort and selection effects.

Of particular interest for the present study is that three of the four supply-side factors considered also emerge as important net predictors of contraceptive intentions: method availability at the nearest public clinic ($p<0.10$), number of nurses at the nearest public clinic, and the level of staff training in family planning at the nearest set of facilities. Although these results might indicate a causal relationship between supply-side factors and contraceptive intentions, an alternative explanation should be borne in mind—the possibility that family planning program resources in Morocco have been allocated in a targeted fashion in response to demand for family planning. If so, the actual direction of causation might be from contraceptive demand/intentions to program factors.

The contraceptive-use equation also yields several interesting results. One important finding is that when the other factors considered in the analysis and unob-

Table 4 Effects of contraceptive intentions, selected background characteristics, and family planning supply factors on subsequent contraceptive use during 1992–95, Morocco

	Model 1				Model 2			
	Contraceptive intentions		Contraceptive use		Contraceptive intentions		Contraceptive use	
Explanatory variable	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z
Household/individual characteristic								
Contraceptive intentions	—	—	0.52	0.42	—	—	1.28	1.12
Age								
15–24 (r)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
25–34	–0.14	–1.29	–0.26	–2.34**	–0.14	–1.31	–0.27	–2.39**
35–49	–0.65	–4.89***	–0.72	–2.93***	–0.65	–4.89***	–0.72	–2.87***
Literacy								
Iliterate (r)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Partially literate	–0.02	–0.09	0.05	0.20	–0.02	–0.10	0.06	0.23
Fully literate	0.34	2.46***	0.21	0.98	0.34	2.47**	0.20	0.97
Cement floor in home	0.25	2.23**	0.37	2.45**	0.25	2.26**	0.35	2.26**
Community characteristic								
Urban residence	0.15	0.96	0.05	0.26	0.15	0.92	0.06	0.32
Sewage system in community	–0.50	–3.43***	—	—	–0.49	–3.42***	—	—
Family planning supply factors								
Method availability								
Public clinic	0.07	1.69*	0.14	2.68***	0.07	1.70*	—	—
Intend to use	—	—	—	—	—	—	0.07	1.30
Do not intend to use	—	—	—	—	—	—	1.20	3.34***
Number of nurses at public clinic	0.10	2.63***	–0.01	–0.15	0.10	2.64***	–0.01	–0.24
Training index: nearest set of facilities	0.18	2.08**	–0.06	–0.38	0.18	2.09**	–0.07	–0.47
Infrastructure index: private clinics	0.12	0.92	0.26	1.43	0.12	0.92	0.26	1.45
Constant	–0.44	–1.94*	–0.84	–1.61	–0.44	–1.96**	–1.14	–2.30**
Rho	0.28	0.41	—	—	0.17	0.28	—	—
Chi-square test of joint significance of supply factors	31.84	—	18.75	—	28.29	—	21.01	—
Prob > Chi square	0.00	—	0.01	—	0.00	—	0.00	—
Pseudo R-square	0.09		0.09					
Log-likelihood value		–1,049.31				–1,046.85		

*Significant at $p \leq 0.05$; **$p \leq 0.01$; ***$p \leq 0.001$. — = Not applicable. (r) = Reference category.

served joint determinants of contraceptive intention and use are controlled statistically in the two-equation model, contraceptive intention fails to emerge as a statistically significant predictor of subsequent contraceptive use. This result is at odds with the observation of significant net effects of contraceptive intentions on subsequent contraceptive behavior in several prior studies (see Curtis and Westoff 1996 for a review of relevant literature), as well as with the results of preliminary analyses undertaken for the present study using a single-equation statistical model.[7]

The most plausible explanation of this result is that the earlier studies and preliminary analyses undertaken for the present study failed to control adequately for the effects of unmeasured factors that are important determinants of both contraceptive intentions and use. That such factors have been accounted for by the two-equation model used in the present study is confirmed by the nonsignificance of the Rho statistics shown near the bottom of the table. The Rho statistic measures the degree of correlation between the error terms in the regression equations (that is, the unobserved factors) and the independent variables included in the models (the observed factors). This finding is discussed below.

Among respondents' background factors, only respondent's age and presence of a cement floor emerge as significant predictors of subsequent contraceptive use.[8] Only one supply-side factor exhibits a significant net effect on the likelihood of contraceptive use—method availability at the nearest public clinic. When considered in light of the empirical results for the contraceptive-intentions equation, this result would seem to suggest that a broader range of supply-environment factors plays a role in influencing intentions than does actual contraceptive use, given an intent to practice contraception.

Model 2 addresses the question of whether family planning supply factors influence the likelihood of contraceptive adoption differentially depending upon contraceptive intentions. To investigate this question, interactions between supply-side factors and contraceptive intentions in the contraceptive-use equation are included in the model (the model is identical to Model 1 in all other respects). As the table shows, the results are largely unaffected by the introduction of interactions. Only one

of the interactions is statistically significant (and accordingly is the only one shown in the table)—the interaction between contraceptive intentions and method availability at the nearest public clinic. Although the enabling/facilitating role of family planning supply factors was anticipated to be reflected in larger effects for those who intend to use contraceptives, the multivariate results indicate that women who reported in the 1992 survey that they had no such intention were influenced to a greater extent by supply-side factors than were women who stated an intention to use.

What might explain this result? Although the validity of responses to the survey questions on contraceptive intentions might be doubted, the consistency between stated intentions and subsequent contraceptive behavior observed in this and other studies indicates that the primary explanation must be sought elsewhere. One possible explanation is that women who intend to practice contraception tend to be sufficiently motivated to avoid further pregnancies that they are able to find alternative sources of supply even when the nearest source proves inadequate to their needs. This explanation is especially plausible in the Moroccan context, given the heavy reliance of Moroccan women on oral contraceptives and the pill's wide availability from sources other than public clinics (for example, from pharmacies and home visits/CBD). Therefore, limited method availability at public clinics may not pose as significant a burden on potential contraceptive users in Morocco as it might in other settings.

As to why women stating in 1992 that they had no intention to use contraceptives were significantly more likely to have used a method by the time of the 1995 survey when method availability at the nearest public clinic was high rather than low, the most plausible explanation would seem to be a supply-side effect on both contraceptive intentions and subsequent use. Because the causal ordering is clear, the empirical results of the contraceptive-use equation provide stronger evidence of such an effect than do the results of the contraceptive-intentions equation.

Simulation Results

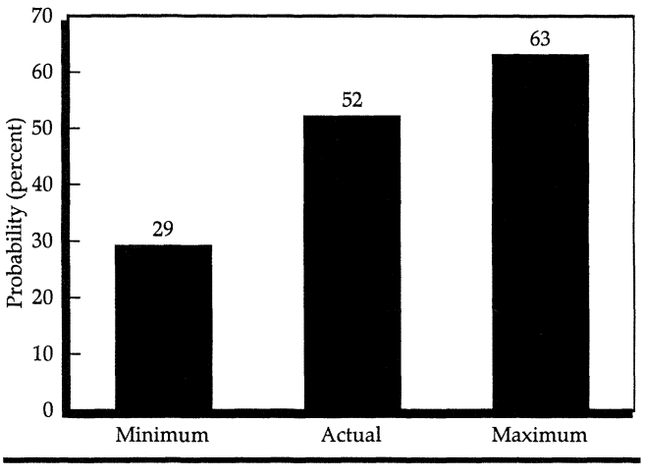
Because the bivariate probit-estimation procedure used in the study is nonlinear, the magnitude of effects cannot be readily ascertained from the regression coefficients. To provide readers with a better appreciation of the magnitude of effects observed in the study, a series of simulations were run. In the simulations, the predicted proportions of women (1) intending to use a contraceptive method in 1992 and (2) proceeding to use a contraceptive method during the 1992–95 period were compared under alternative scenarios concerning the supply environment for family planning services when the observed effects of the other factors considered in the analyses were held constant at their observed levels.

For the purposes of the simulation exercise, the family planning supply environment was defined in terms of the four supply factors considered in the multivariate analyses (see Table 4). Three levels of the supply environment were considered in the simulations. In the baseline simulation, each of the four supply factors was set at their observed levels in each sample cluster (that is, the levels indicated by the 1992 service availability module data). In a second simulation, each supply-side factor was set equal to zero, simulating the scenario of a minimal supply environment with respect to these factors. In the final simulation, each of the four factors was set equal to either its theoretical maximum value or (for continuous variables) to the maximum observed in the sample communities to assess the hypothetical effects of an optimal family planning supply environment. Simulations were also run to assess the magnitude of effects of interactions between contraceptive intentions and supply-side factors.[9] The results of the simulation exercise are presented graphically in Figures 1 and 2.

Figure 1 illustrates the net effects of variations in the family planning supply environment on contraceptive intentions at the time of the 1992 survey. When the four supply-side factors are set at their observed values in each sample cluster, the predicted proportion of women intending to use a contraceptive method at some point in the future in 1992 is 52 percent, which is equal to the observed proportion of study subjects reporting an intention to use a method. In the hypothetical scenario where all four supply factors were at their minimum levels in each sample community (that is, no contraceptive methods, nurses, or trained service providers at public clinics and no relevant infrastructure at private clinics), the simulation results suggest that the proportion of women intending to use a contraceptive method in the future in 1992 would, instead, have been 29 percent. By comparison, in the event of an optimal supply environment in each sample community, the predicted proportion of women intending to use a method in the future rises to 63 percent. As may be readily ascertained from Figure 1, sizable supply-side effects on contraceptive intentions are suggested.

Figure 2 displays the results of simulations of the conditional or enabling effect of the family planning supply environment on contraceptive use, given intentions to use in the future. The set of bars to the left pertains to all women irrespective of their stated contraceptive intentions in 1992. As compared with the baseline level whereby 52 percent of women not using a contracep-

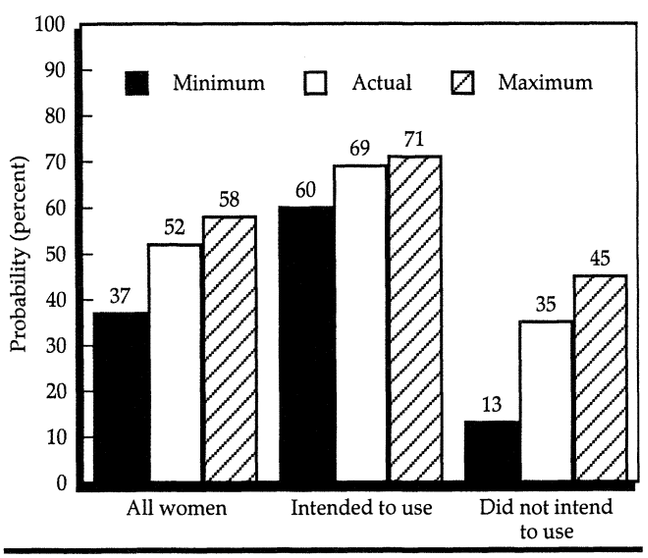
Figure 1 Simulated effects of increases in the family planning supply environment on intentions to practice contraception, Morocco, 1992



tive method in 1992 proceeded to use a method during the 1992–95 period, the simulation results indicate that this proportion would have been only 37 percent if each sample community had had only a minimal supply environment. If each sample community had had an optimal supply environment with respect to the four factors considered, 58 percent of women would have proceeded to use a method during this period, according to the simulation.

The other two sets of bars in Figure 2 indicate the predicted magnitude of effects of variations in the family planning supply environment on contraceptive use during the 1992–95 period for those who in 1992 stated that they intended to use a method and those who stated that they did not, respectively. As may be observed, the pattern and direction of effects is similar for both groups of women, but substantially larger in magnitude for women reporting that they had no intention to practice contraception in the future at the time of the 1992 survey.

Figure 2 Simulated conditional effects of increases in the family planning supply environment on contraceptive use, by intention status in 1992, Morocco



Discussion

Although the question of whether organized family planning programs influence reproductive preferences remains a subject of debate, most observers would grant that such programs play a key role in enabling individuals and couples to realize their childbearing goals by providing accessible, acceptable, and high-quality services. Accordingly, the degree to which programs are successful in satisfying existing demand for contraception is more or less universally viewed as an important measure of program performance. The present report seeks to add to the limited number of studies that have explicitly measured this enabling or facilitating effect of family planning programs, given existing demand for contraception, by taking advantage of the availability of individual-level panel data linked with community-level information on the family planning supply environment in Morocco. In the study, the likelihood that women who were not using a contraceptive method at the time of the 1992 DHS-II would use a method at some time prior to the 1995 Panel Survey was modeled as a function of contraceptive intentions, background factors, and family planning supply factors.

The empirical results reconfirm the importance of both demand- and supply-side factors as determinants of contraceptive behavior. Women who stated an intention to practice contraception in the future in the 1992 survey interview were more than two times more likely than women stating no such intention to have proceeded to adopt a contraceptive method during the 1992–95 period. The family planning supply environment was also observed to exert a significant influence on the likelihood that women would adopt a method during the three-year study period. Women who resided in areas with a favorable family planning supply environment were substantially more likely to have gone on to use a contraceptive method during the three-year study period between the two surveys than were women less favorably situated with regard to family planning services, regardless of their contraceptive intentions at the time of the 1992 survey.

The study produced several unanticipated findings, however. Two of these appear to be the result of appro-

priate modeling of the relationships between contraceptive intentions, family planning supply factors, and contraceptive use. The first is the (net) nonsignificance of contraceptive intentions as a predictor of subsequent contraceptive use in the two-equation model. A comparison of the findings with earlier studies using single-equation statistical models suggests that common unobserved determinants of both contraceptive intentions and use were responsible for the strong effect of intention on subsequent use observed in the single-equation model. When these unobserved factors were controlled through appropriate multivariate modeling in the present study, the magnitude of this effect was greatly reduced.

What might these unobserved factors be? Several possibilities suggest themselves. At the level of individual women and couples, both contraceptive intentions and use might be manifestations of an (unobserved) broader motivation or of a demand for smaller family size. As such, they may merely be steps in a behavioral process that begins with latent demand for reduced family size and ends with action being taken to avoid further pregnancies. Such a proposition is consistent with widely accepted theories of fertility behavior (Caldwell et al. 1988). Equally plausible is that the unobserved factors operate at the community level through community norms and acceptance of modern contraception as a legitimate means of controlling fertility. Such an explanation is consistent with the findings of several studies. A recent study in Thailand, for example, demonstrates that patterns of contraceptive choice vary widely by community in a manner that does not reflect community-level variations in the supply environment for family planning services (Entwisle et al. 1997). The authors attribute this finding to the existence of local networks of women who share information and experiences with other women in the community concerning contraception in general and on specific methods. The importance of local informal networks in influencing contraceptive behavior is also demonstrated in a recent study in Kenya (Rutenberg and Watkins 1997). In all likelihood, unobserved factors operating at both the level of individuals and households and of communities are relevant joint determinants of contraceptive intentions and use.

A second unanticipated result was that a wider variety of supply-side factors emerged as strong net predictors of contraceptive intentions than of contraceptive use, given intention to use. Although the study sought to measure the enabling effects of family planning services on contraceptive use, given demand for contraception, contraceptive intentions appeared to be more responsive to variations in the supply environment for family planning than was the actual practice of contraception. This finding might indicate that supply-side factors influence contraceptive decisions further up the chain of decisionmaking that leads to contraceptive use than the decision to adopt a contraceptive method. Several researchers have, for example, argued that an important way in which family planning programs influence contraceptive behavior is by helping to convert latent demand for fertility regulation into manifest demand (Caldwell et al. 1988; Cleland 1994), and based upon this study's findings, possibly into intentions to use a method.

The caution noted earlier about inferring a causal effect of supply-side factors on contraceptive intentions in the present study bears reiteration, however. The effects observed here could have resulted from family planning program resources having been targeted disproportionately at communities having a high demand for services during a time prior to the study's reference period. In the 1990s, the Moroccan national family planning program targeted rural areas for improvements in family planning services. The authors are unaware, however, that targeting has been undertaken at the local or community level based upon demand for contraception. Nevertheless, the possibility that targeted allocation of program resources may have contributed to the large effects of supply-side factors on contraceptive intentions observed in the study cannot be discounted completely.

The final unanticipated result concerns the differential effect of supply-side factors on contraceptive use for those who intend to use and those who do not. Although the effects of variations in the family planning supply environment were expected to be more pronounced among women who intended to use a method, this expectation was not borne out by the empirical findings. Instead, the empirical results suggest that supply-side factors influenced both groups of women, but that the effects appear to have been larger among those who did not intend to use a method.

One interpretation of this finding is that in a setting like Morocco, where family planning is socially accepted and services are relatively widely available, women who aspire to control their future fertility tend to be successful in finding alternative sources of services and supplies, even when aspects of the local supply environment do not fully satisfy their needs. On the other side of the coin, the empirical results for both the contraceptive-intentions and -use equations suggest that supply-side factors may play an important role in generating demand for contraception (along with an increased likelihood of proceeding to use a method). Although the evidence from the present study is derived from a relatively small group of women observed over a short period of time, no other explanation is plausible to suggest why

women stating no intention to practice contraception in the future would have been substantially more likely to have used a method thereafter when the family planning supply environment was favorable than when it was less favorable. Further research is needed, however, to assess the extent to which and the conditions under which family planning programs can influence reproductive intentions.

Appendix

Justification of the Bivariate Probit Estimation Procedure

The most straightforward method for estimating the impact of contraceptive intentions on use would be to use a single-equation univariate probit or logit model similar to equation *(1)* in the text. Contraceptive intentions and subsequent use could have been jointly determined, however, by common factors that were not measured as part of the study, and are, therefore, unobserved in the analysis. Relevant examples of such unobserved factors include charismatic local family planning program leadership, community-specific cultural norms that are supportive of family planning, and so forth. If such factors have an impact on intentions and use, the $\in 1_{ij}$ term in equation *(1)* would be correlated with I_{ij} (the effect of contraceptive intentions on subsequent use), and the estimated coefficient for I_{ij} would be biased.

Therefore, selecting an estimation strategy that controls for unobserved factors that influence both C_{ij} and I_{ij} is important. The idea is to purge the contraceptive-intentions variable of the distorting effects of common unobserved determinants of intentions and use, thus yielding consistent estimates of the effects of contraceptive intentions and other factors on contraceptive use.

A frequently used strategy for controlling for the influence of unobserved variables is to use a two-step procedure. Applying such a procedure in this study would involve first estimating equation *(2)*, using the coefficient estimates to predict the probability that a woman intended to use a contraceptive method at the time of the 1992 survey, and then estimating equation *(1)* using predicted intentions as an independent variable. This strategy, however, is incorrect. The problem with applying a two-step procedure in this study concerns the discrete nature of the two dependent variables of concern, I_{ij} and C_{ij}. When both equations are estimated using a logit (or a probit) model, the procedure yields inconsistent coefficient estimates (see Davidson and MacKinnon 1993 and Amemiya 1985). Because of this problem, the authors use a bivariate probit model to estimate equations *(1)* and *(2)*. The bivariate model assumes that the error terms $\in 1_{ij}$ and $\in 2_{ij}$ follow a bivariate normal distribution, and it yields consistent parameter estimates (Amemiya 1985).

Although the model's nonlinear functional form identifies the coefficients, nevertheless an instrumental variable is included in the model—an argument in the intentions equation but not in the contraceptive-use equation. The instrument used is an indicator of whether a modern sewage system was present in the respondent's community. This factor is hypothesized to affect contraceptive use only indirectly through its effect on contraceptive intentions. To determine the appropriateness of this variable as an instrument, the authors carried out two specification tests. First, a model was estimated using the indicators of both a modern sewage system in the community and the intentions of the women in the contraceptive-use equation. The coefficient estimate of the sewage indicator was not statistically significant ($Z = -1.21$). Secondly, Hausman's specification test was conducted (Amemiya 1985) using the log-likelihood value of the bivariate probit model described above and the log-likelihood of Model 2 in Table 4. The test yielded similar results.

Notes

1 Of the countries in which DHS and situation analysis studies have been conducted, the authors are aware of only two instances in which panel surveys of individual women with linked family planning program data are available—Morocco (the subject of the present study) and Peru (see Mensch et al. 1997).

2 The remaining, unmatched women consisted of (1) women from households that had replaced households interviewed in the 1992 survey (who had moved away or for some other reason could not be located), (2) new members of households interviewed in both 1992 and 1995, and (3) women who were considered to have been matched when the data file was developed, but upon further scrutiny were judged by the researchers for this study to have been questionable matches. In the latter category, the authors excluded 81 women whose reported ages in the two survey interviews differed by more than five years and whose reported number of children ever born differed by more than one child.

3 Data pertaining to the family planning supply environment in 1992 were used in lieu of data pertaining to the 1992–95 period (which could be derived by also considering the 1995 SAM data) for two reasons. First, changes in the supply environment for family planning services in Morocco during the reference period for the study were relatively modest in nature and largely concerned qualitative aspects of service delivery (for example, improved counseling and quality of services) that were not well measured by the SAM protocols. Second, many of the changes that did take place occurred late in the period of time considered in the study (that is, in 1994 and 1995), and thus are unlikely to have had major effects because the 1995 survey was conducted in May. Nevertheless, these changes may have influenced contraceptive behavior in ways that were not measured, although the authors feel that such influence is unlikely.

4 The use of indicators pertaining to the nearest facilities as representing the supply environment available to residents of sample DHS clusters might be questioned. In preliminary analyses, however, a variety of more "global" indicators was tested (for example, total number of facilities or facilities offering family planning services located within 30 km), but these were found to have

much weaker statistical relationships with contraceptive behavior than did the variables pertaining to the nearest facilities. One possible explanation for this result is that facilities within a given locale tend to be relatively homogeneous with regard to services offered and service quality, and thus the characteristics of the nearest facilities serve as reasonable proxy indicators for the overall local supply environment.

5 When models were estimated that included other community-level variables, the coefficient estimates of these variables were not statistically significant. (Moreover, the coefficient estimates of the supply environment and contraceptive intentions were similar to the model reported in Table 4.)

6 The variables included in the models estimated in this study differ from those considered in the Curtis and Westoff (1996) study using the same data; variables were eliminated that reflected individual choice that might be determined jointly along with contraceptive intentions by unobserved factors.

7 In preliminary analyses of determinants of contraceptive use during the 1992–95 period using a single-equation main-effects model that included the same independent variables considered in the two-equation model shown in Table 4, the effect of reported contraceptive intentions in 1992 was large and highly significant statistically (coefficient = 0.985, $Z = 8.960$)

8 The community sewage system variable does not appear in the contraceptive-use equation because it is being used as an instrumental variable, and thus appears only in the contraceptive-intentions equation.

9 The contraceptive-intentions variable used in the contraceptive-use equation in the simulations was the predicted probability of having intended to use a method at the time of the 1992 survey. Use of this variable was necessary in order to obtain simulation results that were consistent with the bivariate probit results shown in Table 4.

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