REPORTS

Determinants of Contraceptive Method Choice in Rural Tanzania Between 1991 and 1999

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Four pooled Demographic and Health Survey data sets are used to examine the determinants of contraceptive method choice in rural Tanzania for the period from 1991 to 1999. The individual data are linked to facility surveys conducted in the same communities so that the impact of Tanzania's family planning program can be examined. The focus of the study is an examination of the effect on method choice of the three major components of Tanzania's family planning program: logistical support, trained providers, and communications programs. The statistical methods employed correct for the potential endogeneity of family planning message recall. Simulations are used to quantify the impact of the important policy variables. All three components of the program are shown to have had an impact on modern method choice. (STUDIES IN FAMILY PLANNING 34[4]: 263–276)

Tanzania is one of the poorest countries in the world, having a gross national product per capita of about US$240 per year (World Bank 1999). With a very low expenditure per capita on health of about $36 per year, Tanzania is ranked 174 among 191 countries in this area of expenditure (WHO 2000b). Like many countries in sub-Saharan Africa, Tanzania has been struggling to cope with the spread of HIV, which had infected 8 percent of the adult population by the late 1990s. Available data on health statistics (including nutrition, morbidity, and mortality) reflect these trends. They suggest that only slight or no improvement has been made in the general health of the Tanzanian population in the last decade. Family planning, however, appears to run contrary to this trend, showing an increase in contraceptive prevalence of modern methods from 6.6 percent in 1991 to 15.6 percent in 1996[1] and a decrease in the total fertility rate from 6.3 children per woman of reproductive age in 1992 to 5.5 children in 1995. The more than doubled contraceptive prevalence rate masks the fact that most of the gains in the use of modern contraceptive methods occurred between 1992 and 1996: Between 1996 and 1999, contraceptive prevalence grew by only 2.3 percentage points (National Bureau of Statistics and MEASURE Evaluation 2000). One reason for this countervailing trend may be the government's initiation of programs to reduce fertility during the past decade. With funding from a host of donor agencies, the government formulated a new family planning initiative that upgraded the services in existing facilities and carried out an information and education campaign through the media that provided family planning messages directly to the public.

This study examines the features of the national family planning program that seem to have affected contraceptive method choice in Tanzania. The research covers a period of time that encompasses the entire life of one donor agency's initiative—that of the United States Agency for International Development (USAID). USAID has been one of the largest donors contributing to the family planning program in Tanzania during this period, providing a significant portion of its budget.[2] Data for this study cover the period beginning in 1991, a year before the initiation of the government of Tanzania's family planning program, and continue through 1999, permitting us to assess the impact that donor funding and programmatic decisions can have on the success of a family planning program.

The data contain demographic, socioeconomic, and family planning information about the women surveyed and about the facility characteristics of the family planning services that are available to women within their communities. The information is drawn from four pooled

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cross-sections of data gathered in 1991, 1994, 1996, and 1999. Because the data are longitudinal, that is, many of the same facilities were visited during all four surveys, the leveling off of contraceptive use in Tanzania can be investigated. In particular, we can study both supply and demand factors that may explain both the initial surge in contraceptive use and the slower rate of increase seen in the program's later years.

Pooling the four cross-sections of the data set enables us to focus specifically on rural women, although the country as a whole has a low level of contraceptive prevalence. When characteristics such as access to family planning services are considered, urban women typically encounter a supply market with a choice of many facilities located close to work and home. Access is, therefore, a vague concept for an urban woman because she may be unable to identify her contraceptive market easily, and concepts such as distance to a facility may be hard for her to define. We are more likely to be able to disentangle the effects of access as they relate to rural women. The market these women encounter is easier to perceive because their choices are restricted by the relative paucity of facilities and greater geographic distances to them.

The wealth of available data allows us to go a step farther than previous studies have in considering the effect of family planning program components on contraceptive method choice in Tanzania. In past research, all modern methods were aggregated into one outcome, a necessary approach because of the low prevalence of contraceptive use in Tanzania, especially in the early 1990s. In this analysis, the large sample size obtained by pooling four data sets allows us to break down the modern-methods category into specific types of methods. Condoms can be considered separately from other types of modern methods, a useful and timely advantage in light of the evolving AIDS epidemic in East Africa and the dual role that family planning programs now play in encouraging healthy sexual behavior while providing methods of family planning. Moreover, the data permit us to assess the impact of different components of the family planning program on condom use in Tanzania during the 1990s.

In the last decade, the government of Tanzania has undertaken a decentralization campaign to encourage the private provision of family planning services. Within the private sector, pharmacies have been cited as an increasingly important source of contraceptive methods for many users (National Bureau of Statistics and MEASURE Evaluation 2000). Because information about pharmacies is available from the first and last surveys used in this study (1991 and 1999), we are also able to examine the impact that access to pharmacies has on contraceptive method choice.

Components of the National Program

In 1992, the government of Tanzania devised its first National Population Policy. The policy was developed to address the country's high total fertility rate of about 6.3 children per woman (Ngallaba et al. 1993), an under-five mortality rate of 141 deaths per 1,000, and the low gross national product per capita (equivalent to US$110). With substantial funding from donor agencies, the National Population Policy and subsequent population policies have been implemented by the Ministry of Health through its Reproductive and Child Health Unit, which later became the Reproductive and Child Health (RCH) Section.

The major donors for family planning in Tanzania are USAID, the United Nations Population Fund (UNFPA), the British Overseas Development Administration, the German Association for Technical Cooperation, and the International Planned Parenthood Federation (IPPF). Most of the assistance provided by USAID and UNFPA is channeled through the RCH section, whereas assistance from IPPF is centered around its own set of clinics in urban areas that provide family planning.[3] The RCH section oversees a large network of government-managed hospitals, health centers, and dispensaries throughout the country.

UNFPA provided $21 million in support of the family planning program over a five-year period during the mid-1990s. The funding from USAID began in 1990, reaching an initial bilateral funding level of $20 million over a period of seven years. During the subsequent decade, USAID was one of the largest donors to support the population, health, and nutrition initiatives in Tanzania, providing an average allocation of $11 million per year.

In 1998, the two main programs receiving ongoing support from USAID in Tanzania were the Family Planning Services Support (FPSS) project and the Tanzania AIDS Project. At that time, $6.5 million was allocated for the FPSS budget (30 percent for child-survival activities and 70 percent for family planning). The overall goal of the FPSS project was to "improve the health and well-being of women and children by enhancing the opportunity to choose freely the number and spacing of children" (Shutt et. al. 1994:2). The major components of the program were to train health-care providers in the provision of family planning methods and services, to provide logistical support for the provision of contraceptive supplies, and to develop an information, education, and communication (IEC) program to promote family planning. During the decade, the government of Tanzania made a substantial effort to integrate the family planning program into its maternal and child health program. In 1997, it initiated a reproductive and child health program that continued through 1999.

The remaining $4.5 million of funding supported the Tanzania AIDS Project, which worked largely through nongovernmental organizations (NGOs). The project's activities included establishing NGO networks and clusters, supplying information and condoms in social marketing efforts to encourage sexual practices that would prevent the spread of HIV, and improving health-care providers' diagnosis and treatment of HIV/AIDS and other sexually transmitted diseases.

The government of Tanzania has been slow to respond to the HIV/AIDS pandemic. The National AIDS Control Program was set up within the Ministry of Health by the government in 1987. The aim of the program was to address increasing HIV prevalence during the course of three medium-term campaigns: 1987–91, 1992–96, and 1998–2002. A shortage of funds and a lack of political commitment hampered the implementation of the campaign, however, through the 1990s (MEASURE National AIDS Control Program et al. 2001). During the initial stages of the AIDS pandemic, government-sponsored activities focused on mobilizing the health sector by training health workers and ensuring the safety of blood used in transfusions. The program's focus expanded thereafter to fostering the population's knowledge and awareness of healthful sexual behavior.

The Salama brand of condom was introduced by the National AIDS Control Program, and in 1988, social marketing efforts began that were funded by the USAID AIDScom project. Sales were low at 150,000 units during a one-and-a-half-year period, and in 1993, Population Services International (PSI) took over the condom marketing program. PSI launched a new and innovative social marketing program that included package redesign and an increase in the number of local distributors and in the number and type of retail outlets that sold condoms. PSI also used modern marketing techniques and advertising campaigns. These efforts increased the sale of condoms to more than ten million between 1995 and 1997 (Population Services International 2002).

As part of the government's initiative, a national mass-media campaign was launched to promote family planning. Broadcasting of the radio drama *Twende na Wakati* began in July 1993, and airing of *Zinduka!* began in October of 1993. Both dramas are ongoing; *Twende* is supported by UNFPA and *Zinduka!* by USAID. Since 1993, a number of new radio dramas targeting young people have been introduced. Program planners consider radio drama to be among the best means of disseminating family planning messages. Another component of the IEC effort was the Greenstar logo introduced in 1993 to promote family planning services through identification with a logo or brand. Promotional messages were launched in print and electronic media, and the campaign continues today.

Trends in Sources for Family Planning

In the ten years since the inception of the Family Planning Services Support program, the number of rural women visiting government facilities to obtain modern contraceptive methods and services appears to have leveled off or decreased slightly (see Table 1). Between 1991 and 1996, the use of government facilities increased to 84 percent, but by 1999, it had decreased to 76 percent. Policymakers began to recognize this drop in contraceptive availability in the middle of the decade. Investigation of the phenomenon revealed that two things were happening: First, public family planning facilities were experiencing stock-outs; supplies were not moving from the warehouses to the clinics. Second, few trained providers were working in rural family planning facilities. At that time, a lull in activity was evident as the program's focus moved from provision of services to logistical and management issues.

The role of the private sector in providing family planning supplies and services in rural areas increased during the decade of the 1990s as decentralization of the health-care system led to the privatization of health-care services throughout Tanzania. Table 1 shows that during the decade, the number of rural women reporting private medical facilities as the source of their current modern method of family planning increased from 1 percent in 1991 to more than 2 percent in 1999. In recent years, as the government moves to decentralize public services and foster private investment, private, for-profit facilities have become more important in the provision of services than they were in the past. The increasing role of pharmacies as an alternative source of modern methods is also clear. In 1991, only 2 percent of rural women surveyed listed pharmacies as a source for the methods they used, whereas 4 percent listed them as a source in 1999.

Table 1 Percentage of women surveyed, by their sources of supply for modern contraceptive methods, rural Tanzania, 1991–99

	1991–92	1994	1996	1999
Public	74.8	78.7	83.6	76.4
Private medical	1.1	1.6	2.0	2.4
Private pharmacy	1.9	2.1	2.4	4.3
Other	22.2	17.6	11.9	16.9
(N)[a]	(263)	(228)	(538)	(254)

[a] Rural women currently using modern contraceptives.

Sources: Ngallaba et al. (1993); National Bureau of Statistics and Macro International (1997); Weinstein et al. (1995); and National Bureau of Statistics and MEASURE Evaluation (1999).

Conceptual Framework and Statistical Methods

In Tanzania, improvements in family planning provision took place on both the supply and demand sides during the 1990s. As noted above, the government and the private sector worked to increase the availability of contraceptive supplies and services and at the same time initiated information and education campaigns to influence the demand for these services. The analysis presented here is based on structural models of fertility in which contraceptive use is an endogenous determinant of fertility. These models take into account both demand- and supply-side factors that affect contraceptive use and, ultimately, fertility (see, for example, Easterlin and Crimmins 1985; Rosenzweig and Schultz 1985; Schultz 1989; and Buckner et al. 1995). The simple form of these models suggests that exogenous individual background factors affect a woman's fertility preferences. These factors include the woman's age, education, and household assets, as well as family planning program variables. Together with the direct effects of household and program variables, fertility preferences affect contraceptive practice, which, in turn, affects fertility.

The outcome that we model here is an important proximate determinant of fertility: contraceptive method choice. The focus of this study is on total program effects on contraceptive method choice. We are not concerned here about the specific pathways by which a program variable affects contraceptive preference. For example, a communications campaign may affect fertility preferences that, in turn, alter a woman's choice to use a contraceptive. To examine the causal pathways, we would have to estimate a model in which fertility preferences are first affected by the communications campaign and then allowed to affect contraceptive method choice. We model choice of type of contraceptive method using a multinomial logit model, described in detail in Appendix A.

Data Sources and Descriptive Statistics

The data concerning facilities are drawn from three rounds of the Tanzania Service Availability Survey (TSAS) conducted in 1991, 1994, and 1996 and from a fourth survey, the Tanzania Reproductive and Child Health Facility Survey (TRCHS facility supplement) conducted in 1999. In 1991, 1994, and 1996, the traditional DHS approach for facility selection was used: A facility was chosen if a group of knowledgeable village leaders reported it to be a source of health and family planning services for their community and if it was within 30 km (about five hours' walking distance) of the community center. The relevant facilities for rural areas were hospitals, health centers, and dispensaries. The closest facility of each type was visited as well. In later surveys, Marie Stopes clinics and UMATI (the Tanzanian affiliate of the International Planned Parenthood Federation) clinics were visited as well, but these facilities operate exclusively in urban areas and are not relevant to this analysis. Pharmacies were also visited in 1991 and 1999 (but not in 1994 or 1996), and some pharmacies were sufficiently near (within 5 km) to rural clusters that they are used in the analysis. The surveys collected data on health services and health-care provision and included information such as the availability of medications, the presence of equipment and supplies, the level and training of family planning providers, the availability of family planning methods, and the number of clients visiting each facility.

A new and improved sampling methodology was used for the 1999 facility supplement. Whereas the TSAS surveyed one facility of each type that was no farther than 30 km from the cluster center, the TRCHS facility supplement surveyed all the health facilities within two concentric cluster rings of the cluster center. The latter method provides information on the entire market potentially supplying family planning services for women in the center of the two rings.[4] The TSAS and the TRCHS facility surveys are comparable across time because the TRCHS sampled a subset of clusters (about two-thirds of the rural clusters) sampled by the TSAS in 1996. The facilities in the previous surveys were, therefore, surveyed again in 1999 if they fell within the two concentric rings of the cluster center, together with additional facilities that were within the two concentric cluster rings of the surveyed cluster. The topics covered in the 1999 survey were the same as those addressed in the previous facility surveys, and questions were asked in the same way for the variables used in the analysis.

Table 2 shows the sample sizes of the facilities surveyed for mainland Tanzania. The samples sizes are given for all facilities because a facility could serve both an urban and a rural cluster. Note that the number of

Table 2 Number of facilities surveyed, by survey and year, according to type of facility, Tanzania, 1991–99

Survey and year	Hospital	Health center	Dispensary
TSAS 1991–92	81	89	218
TSAS 1994	89	118	230
TSAS 1996	90	123	253
TRCHS 1999	88	62	255
Matched 1991–92, 1994, and 1996	78	82	194
Matched 1996 and 1999	64	38	90

TSAS = Tanzania Service Availability Survey. TRCHS = Tanzania Reproductive and Child Health Facility Survey.

each type of facility is less than the total number of clusters (N = 327). The main reasons for this inequality are that in some cases, no facilities lay within 30 km of the community surveyed or a facility served more than one community included in the survey. Moreover, in a small number of cases, facilities refused to participate in the survey (typically, these were large urban facilities). In addition to the total number of facilities surveyed in each year, Table 2 also provides information concerning the sample size of matched facilities. We see a high degree of overlap in facilities in 1991–92, 1994, and 1996. Unfortunately, because of the new sampling strategy used in 1999 and because that survey was conducted only in a subset of clusters, no reasonable sample size could be constructed if we attempted to match 1999 facilities with all three previous surveys. Therefore, the 1999 data are matched only with the 1996 survey.

Of the four surveys, only the TSAS 1992 and the TRCHS 1999 collected data about pharmacies. In 1999, pharmacies were surveyed in part because anecdotal evidence suggested the growing importance of the private sector in the provision of family planning services.

Using the matched facility-level data across the decade allows us to examine two key components of Tanzania's family planning program: logistics and training. Table 3 presents information on the proportion of facilities of each type (hospital, health center, and dispensary) where the three major types of modern methods of contraception (pill, injectable, and male condom) were observed to be in stock on the date of the survey. The results show a clear pattern: Initially, between 1991–92 and 1994 (the early years of the Family Planning Services Support program), the pill, injectables, and condoms were observed to be in stock increasingly in all three types of facility. This increase was followed by a leveling off or decrease between 1994 and 1996 and by a further decrease in most facilities in 1999.

Table 4 displays information about trends in staff training from the 1996 and 1999 surveys. Prior to 1996, the facility survey did not include questions about when the facility staff were trained or by whom. In 1996 and 1999, however, specific questions were included about whether or not staff had received the 1992 in-service training update. The table reports the percentage of facilities in the matched sample having at least one provider who had received the 1992 training update. Across this three-year period, a substantial increase is seen in the number of facilities with at least one trained provider, including a near tripling of this proportion for dispensaries.

Table 4 Percentage of facilities having at least one trained family planning provider who had received the 1992 training update (matched mainland facilities), Tanzania, 1996 and 1999

Facility	1996	1999
Hospital	58	75
Health center	34	50
Dispensary	8	21

Although pharmacies typically are found only in urban areas of Tanzania, a substantial proportion of the rural clusters surveyed were situated within 5 km of a pharmacy. In a matched set of clusters in 1991 and 1999, the proportion of rural women who had access to a pharmacy within 5 km increased from 13 percent to 15 percent during the study period. Although pharmacies mainly stocked condoms, by 1999, 18 percent of the pharmacies also had oral contraceptives in stock and 4 percent had injectables in stock (not shown). In the 1991–92 facility survey, however, condoms were listed under medications, and survey interviewers asked staff whether or not they were available at the facility; they did not, however, verify the answer by observation. We know from comparing the results for the availability question with those for contraceptive methods observed to be in stock that the availability questions overstate that the method is in stock in the facility. In 1999, the survey included questions only about condoms observed to be in stock, and so we have no direct comparison of the availability of condoms in the facilities between 1991–92 and 1999. However, 64 percent of the facilities reported that condoms were available in 1991–92, probably an overstatement of availability, and 68 percent of the facilities reported that condoms were observed to be in stock in 1999. Thus, evidence exists that the availability of condoms in pharmacies increased in the time between the two surveys. We control for differences in the wording of the questions in 1991–92 and 1999 in the multivariate analysis reported below.

Table 3 Percentage of family planning facilities where modern contraceptives were observed to be in stock, by method, according to type of facility and survey year, Tanzania, 1991–99

	Hospital				Health center				Dispensary			
Method	1991	1994	1996	1999	1991	1994	1996	1999	1991	1994	1996	1999
Pill	92	98	97	91	83	94	95	86	84	96	88	92
Injectable	84	97	82	84	34	90	80	84	20	84	81	82
Male condom	82	89	83	84	97	82	87	78	97	87	75	80

Individual-level Data

The individual-level data for these analyses are drawn from the Tanzanian Demographic and Health Survey (TDHS). The first DHS survey was conducted in 1991–92 (Ngallaba et al. 1993). This survey was followed by the Tanzania Knowledge, Attitudes and Practices Survey (TKAPS) in 1994 (Weinstein et al. 1995) and by two more surveys, the 1996 DHS (National Bureau of Statistics and Macro International 1997) and the 1999 Tanzania Reproductive and Child Health Survey (National Bureau of Statistics and Macro International 2000). All four surveys include the same questions; the two later surveys, however, included sections with more detailed questions about AIDS, maternal mortality, and female genital cutting. This analysis uses the women's questionnaire, which collects information from eligible women aged 15–49. The topics included in this questionnaire of interest to this research concern basic background characteristics and contraceptive use.

The sample for analysis was created by merging all four panels of the TDHS data with the various facility surveys for the same time periods. The sample is restricted to rural women aged 15 to 34 living within mainland Tanzania and in clusters that can be matched with the facility data.[5] Women whose information on key variables was missing were dropped from the sample.[6]

The final sample comprises 12,816 women living in rural areas. The sample size by survey is shown at the top of Table 5, which presents descriptive statistics on all variables used in the analysis. The sample size was small in 1999 because, as noted above, facility surveys were conducted only for a subset of the survey clusters and some responses could not be linked to facility information.

We see that the proportion of women who recalled having heard a family planning message from any source remained relatively stable across the four surveys, averaging about 40 percent of respondents. The radio dramas had not yet begun in 1991, but an upward trend in the number of women who recalled having heard a radio drama with family planning content is evident across the three later surveys.

With regard to contraceptive method choice,[7] nonuse decreased from 94 percent in 1991 to 83 percent in 1999. More than half of that decrease occurred between 1991 and 1994, however, and the rate of decrease slowed considerably after 1994. By far the largest increase by method is the eight-fold growth in the use of other modern methods, specifically injectables. Both the use of injectables and of the condom started with a low base, as reported in the 1991 survey. Pill use doubled over the study period, whereas the use of traditional methods grew at a slightly more moderate pace. Again, we find large percentage increases for the pill, the condom, and other modern methods between 1991 and 1994 and, typically, more gradual increases in later years. Pill use actually decreased between 1996 and 1999.

Table 5 Variables used in the analysis of contraceptive method choice, according to survey year, rural Tanzania, 1991–99

Variable	1991–92	1994	1996	1999
Sample size (N)	(5,115)	(2,216)	(4,053)	(1,432)
Endogenous variables (means)				
Heard a family planning message	0.36	0.44	0.43	0.38
Heard a radio drama with family planning content	—	0.16	0.21	0.33
Contraceptive method choice (means)				
None	0.935	0.870	0.874	0.832
Pill	0.018	0.033	0.047	0.036
Condom	0.005	0.021	0.009	0.022
Other modern method	0.005	0.016	0.029	0.043
Traditional method	0.037	0.060	0.041	0.064
Policy variables (means)				
Number of times method observed to be in stock at facility within 5 km	0.64	1.11	1.97	1.39
Number of facilities within 5 km having at least two trained providers	na	na	0.11	0.12
Number of times method observed to be in stock at pharmacy within 5 km	0.20	na	na	0.18
Individual-level control variables (means)				
Age				
15–19	0.33	0.27	0.29	0.33
20–24	0.27	0.28	0.27	0.25
25–29	0.23	0.26	0.24	0.25
30–34	0.17	0.19	0.20	0.17
Education (years)				
1–6	0.20	0.20	0.20	0.26
7	0.50	0.51	0.55	0.52
8+	0.02	0.02	0.03	0.00
In union				
No	0.62	0.67	0.63	0.65
Partner's education (years)				
1–6	0.21	0.21	0.15	0.17
7	0.49	0.54	0.60	0.44
8+	0.06	0.04	0.06	0.00
No religion	0.17	0.14	0.11	0.15
Household owns radio	0.30	0.39	0.41	0.40
Number of households that own television	(3)	(1)	(21)	(4)

— = Not applicable. na = Not available.

The policy variables presented in Table 5 are related to logistics and training. Percentages are averaged over respondent and not over facility, although these are facility-level variables, so that rural respondents' access to contraceptives can be gauged. Although an individual could be linked to a facility as far as 30 km distant from her community, preliminary analysis indicated that access only had an impact on method choice if the facility were within 5 km of the community. Therefore, each woman was linked to the closest facility of each type

(hospital, health center, and dispensary) within 5 km. As noted above, the 1999 facility survey conducted a census of nearby facilities. In order to make the information from the 1999 survey consistent with data from earlier years, we included only the closest facility within 5 km of each type in this analysis.

Questions concerning contraceptives in stock were asked about five modern methods—the pill, the IUD, the condom, injectables, and vaginal foam—and this information was aggregated in a manner similar to that used in Stephenson and Tsui (2002), by adding up the number of times a method was observed to be stocked by facilities within 5 km of the community. Thus, the maximum possible value for the number of times a method was observed to be in stock is 15 if all three types of facilities serviced the community and all facilities had all five methods in stock. In fact, the maximum number found in the data is ten times, and this number is found rarely. The modal value is zero for all four surveys, and the next-most-frequent value is 1, 2, 3, and 2, respectively, for each of the four surveys. The averages in this table may not appear to be consistent with those in Table 3, where we see an increasing problem with stock-outs starting in 1996. The mean is greater in 1996 and in 1999 than in 1994 because an increase occurred in the number of facilities offering family planning methods during the 1990s. Most rural women were found to have limited options in choice of contraceptive, however, and that situation improved only marginally between 1991 and 1999.

As stated earlier, the detailed training questions were asked only in the 1996 and 1999 surveys, and pharmacies were visited only in 1991–92 and 1999. Despite the increase in the number of facilities having trained providers (shown in Table 4), only a small proportion of rural women have access within 5 km to providers who received the post-1992 training. The pharmacy results must be viewed with caution because of the wording changes between 1991–92 and 1999 that are discussed above.

The rest of the variables in Table 5 are control variables. We see from the means that the distributions of all variables is virtually the same across all four surveys. An increase in radio ownership occurred between 1991–92 and 1994, but ownership has remained fairly stable since then. For television ownership, we report the actual number of households having a television set because the numbers are so small. Television ownership is used as a predictor of having heard a family planning message and as an identifying variable in the estimation of the system of equations. We include this variable because evidence from earlier research suggests that even weak instrumental variables improve the estimation of structural equation models (see Angeles et al. 2003).

Multivariate Analyses

Because the training and pharmacy information was gathered only in 1994 and 1999 and in 1991–92 and 1999, respectively, we estimated three models. The first model uses all time periods and estimates the full model laid out in equations *(1)* and *(2)* (see Appendix A). The results for the estimation of the contraceptive-method-choice equation are presented in Table 6, and the results for the two method-recall estimations are presented in Table 7. We then estimated two versions of reduced-form equations for contraceptive method choice. The first estimation used data from the 1996 and 1999 surveys and included the training variable; the second estimation used data from the 1991–92 and 1999 surveys and included the pharmacy variable. We estimated the reduced-form models using only radio and television ownership to replace the message-recall variables because of the limited sample size resulting from the necessity of using only two of the four surveys. The large number of estimated regression coefficients are not presented for these two reduced-form estimations, but we use instead the estimated coefficients in policy simulations to determine the impact of trained providers and methods available at pharmacies on contraceptive method choice. All simulations are presented in Table 8.

Specification Issues

A brief discussion of preliminary specification issues is in order. Table 6 presents the results for choice of contraceptive method. The decision not to use a method is employed as the base category, and therefore, the coefficients represent the effect of the variables on the log odds of choosing a particular method rather than no method. For the multinomial logit model, the choice of the base method is arbitrary, and all other comparisons can be generated by simple subtraction. Table 7 presents logit results for the two message-recall variables. The dependent variable in each case is the log odds that the respondent will recall having heard a family planning message relative to her not having heard one.

The estimated model has four community- and four individual-level mass points. Because the first mass point is set to zero, a total of 18 community- and 18 individual-level mass points are estimated. The estimated probability weights for the community-level points are 0.18, 0.10, 0.36, and 0.36, whereas the estimated probability weights for the individual-level mass points are 0.54, 0.23, 0.14, and 0.09. A joint test of significance of the heterogeneity parameters yields a p-value of almost zero, indicating strong evidence of the endogeneity of the two message-recall variables. Nearly all of the community-level

heterogeneity parameters are highly statistically significant across the three equations, whereas the individual-level heterogeneity parameters are highly significant for the message-recall equations. Thus, a strong correlation seems to exist in the unobservable community-level variables that affect the three outcomes, but most of the correlation in individual-level unobservable variables is concentrated in the two recall equations. We quantify the effect of the endogeneity correction on the impact of the message-recall variables in the simulations presented in Table 8.

The estimation method that we use is highly nonlinear, and the structural equations estimator is identified without exclusion restrictions. More stable parameter estimates are obtained, however, if valid exclusion restrictions can be employed than if they cannot (see Bollen et al. 1995). We exclude the radio and television ownership variables from the contraceptive-method-choice equation. These two variables have a significant impact on the two message-recall variables and no direct effect on contraceptive use. A joint test of significance of the four estimated coefficients for radio and television ownership in the two message-recall variables yields a p-value near zero, and therefore, the evidence is clear that these variables are important predictors of message recall. Because the estimation method is identified without exclusion restrictions, we can include radio and television ownership in the contraceptive-method-choice equation and test to see if these variables have direct effects on method choice. The p-value for a test that the eight estimated coefficients are jointly significant is 0.08, so the evidence that the exclusion restrictions are valid is marginal. The other estimated coefficients are stable, however, whether or not these variables are included. Therefore, we feel confident that our results are valid and conclude that the model is identified.

As noted above, the estimation sample contains data from four surveys; therefore, we include three dummy variables (with 1999 as the reference year) to control for differences across years that cannot be captured by the observed variables. The estimated coefficients for the survey-year dummies are always negative, and 1991–92 is always the most negative, followed by 1994 and 1996. Thus we find, other things being equal, higher levels of use of any type of contraceptive relative to nonuse in later years. We also attempted to interact survey-year dummies with the message-recall variables and the logistical variables. Although the message–year interactions were frequently statistically significant in models that were estimated without controls for endogeneity, the interactions were not significant when endogeneity was controlled. This result may not be surprising because the message-recall variables as well as the logistical variables all vary over time.

Results

With these preliminary specification issues out of the way, we now discuss the important substantive results. The top section of Table 6 presents results for choice of contraceptive method for the three policy variables. The number of methods observed to be in stock is found to have a positive coefficient for all comparisons, indicating an increased probability of using a method versus using none. In terms of magnitude, the largest effect is for the choice of "other modern method" versus no method, followed by choice of the condom versus none, the pill versus none, and a traditional method versus none. The p-values for the reported t statistics are 0.11 for the pill, 0.16 for the condom, 0 for other modern methods, and 0.45 for traditional methods, however, indicating strong statistical significance only for other modern methods and marginal significance for the pill (not shown). That "other modern methods" (a category that, as noted above, consists predominantly of injectables together with some cases of IUD use) is most sensitive to the availability of methods at fixed facilities is not surprising because these methods are rarely available from other sources, especially in rural areas.

The results for respondents' recall of a family planning message are similar in the sense that the strongest effect is for the comparison of other modern methods versus no method, followed by the pill versus no method. The point estimate for use of the condom versus no method is of a reasonable magnitude, but this estimated coefficient is imprecisely measured as shown by its small t statistic. If one fails to correct for the endogeneity of message recall, the estimated coefficients are highly significant for all comparisons and the point estimates of the coefficients are also larger, except in the case of the comparison of other modern methods with no method. The radio-drama-recall variable is not significant for any of the comparisons. Although the point estimates for the pill and for other modern methods are fairly large, they are imprecisely measured. In contrast, the estimated coefficients for this variable are highly significant in three of four comparisons when endogeneity is not controlled. Thus, the estimated impact of the message-recall variables appears to be misleading if endogeneity is not controlled. We quantify the magnitude of the bias in the simulations discussed below.

The results for the control variables are largely as expected. The omitted category for age is the 30-to-34 age group, and we see that the dummies for the other

Table 6 Multinomial logit results for contraceptive method choice, by selected variables, rural Tanzania, 1991–99

Variable	Pill versus none		Condom versus none		Other modern method versus none		Traditional method versus none	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
Policy variable								
Number of times method observed to be in stock at facility within 5 km	0.059	1.60	0.062	1.39	0.090	2.88	0.030	0.76
Heard a family planning message	0.581	1.68	0.301	0.62	0.791	3.09	0.138	0.47
Heard a radio drama with family planning content	0.252	0.86	–0.021	–0.06	0.336	1.20	–0.090	–0.38
Individual-level control variable								
Age (years)								
15–19	–2.184	–8.86	0.339	0.9	–2.300	–6.88	–1.066	–5.95
20–24	–0.344	–2.35	0.836	2.72	–1.057	–5.60	–0.350	–2.89
25–29	–0.161	–1.18	0.671	1.95	–0.622	–3.90	–0.125	–1.08
Education (years)								
1–6	0.390	1.96	0.174	0.49	0.418	1.51	0.342	2.05
7	0.399	2.18	0.681	2.24	0.718	2.85	0.671	4.55
8+	0.712	1.85	1.283	2.48	1.289	3.08	1.588	4.26
In union	–0.784	–2.98	–0.424	–1.01	0.515	1.93	0.263	1.47
Partner's education (years)								
1–6	0.756	3.06	–0.094	–0.18	–0.174	–0.61	0.189	1.07
7	1.314	5.42	0.527	1.34	0.220	1.04	0.466	2.98
8+	1.650	4.77	1.322	2.60	0.661	2.07	0.158	0.56
No religion (year)	–2.141	–3.64	–1.054	–1.94	–0.785	–1.73	–0.435	–2.03
1991–2	–0.970	–3.30	–1.850	–5.69	–2.271	–6.84	–0.744	–3.89
1994	–0.427	–1.90	–0.329	–1.43	–1.217	–4.75	–0.240	–1.41
1996	–0.272	–1.30	–1.396	–5.6	–0.802	–4.35	–0.71	–4.32
Constant	–4.189	–9.90	–5.163	–7.81	–4.989	–9.64	–2.867	–8.35
Community heterogeneity								
Mass point 1	1.829	4.97	1.255	2.5	2.165	4.68	–0.008	–0.02
Mass point 2	0.430	0.83	–0.494	–0.61	0.884	1.75	–0.938	–3.33
Mass point 3	1.316	3.71	0.983	2.25	2.230	5.25	–0.135	–0.39
Individual heterogeneity								
Mass point 1	–0.629	–0.69	–0.753	–0.64	–0.479	–0.59	–0.007	–0.02
Mass point 2	–0.409	–0.41	–0.444	–0.31	–0.469	–0.52	–0.039	–0.03
Mass point 3	1.119	1.27	1.630	1.48	–1.024	–0.93	1.395	1.56

age groups have negative coefficients for all comparisons except those for condoms. Thus, older women are more likely than younger women to be users of the pill, of other modern methods, and of traditional methods. This result is reversed for the condom; women in the 20-to-24 age group are more likely than older women to use condoms, followed by women in the 25-to-29 age group. The omitted category for respondent's educational attainment is zero years of schooling. We find consistent positive and highly significant estimated coefficients for all of the education categories across all comparisons. The largest point estimates are for women with eight or more years of education. Table 5 shows, however, that few women achieve this level of education, and no upward trend in education is discernible for the women in the sample for the period of study. Whether or not a woman is in union and her partner's level of education are included as controls for socioeconomic status. Positive and typically significant effects for partner's education are found for all comparisons. Partners fare no better than respondents in terms of improved education during the survey decade. We attempted to include other measures of assets in the model, but, after controlling for partner's education, these additional variables were found not to be statistically significant.

The results for the message-recall variables reported in Table 7 are much as expected. Women in the 15-to-19 age range are less likely to recall having heard a message than are older women, and the more education a respondent or her partner has, the more likely she is to recall having heard a message. The radio-ownership variable is highly significant for both message-recall variables, but it has a much larger point estimate for recall of a radio drama. This result is reasonable, as is the result that the point estimate for television ownership is much larger for recall of a family planning message relative to recall of a radio drama. The estimated coefficient for television ownership is imprecisely measured for

Table 7 Multinomial logit results for having heard a family planning message as a determinant of contraceptive method choice, by selected variables, rural Tanzania, 1991–99

Dependent variable	Heard a family planning message[a]		Heard a radio drama	
	Coefficient	t-statistic	Coefficient	t-statistic
Age				
15–19	–1.237	–7.56	–0.459	–2.72
20–24	–0.155	–1.47	0.039	0.26
25–29	–0.075	–0.71	–0.167	–0.96
Education (years)				
1–6	0.580	4.67	0.850	4.45
7	1.264	9.60	1.507	7.00
8+	2.134	8.96	2.336	5.92
In union	0.154	1.18	–0.051	–0.29
Partner's education (years)				
1–6	0.403	2.90	0.391	1.82
7	0.617	4.92	0.461	2.56
8+	0.945	4.35	1.203	3.74
No religion	–1.385	–6.80	–1.696	–5.11
Household owns radio	1.631	9.87	2.153	9.51
Household owns television	0.883	1.40	0.573	0.79
Year				
1991–92	–0.120	–0.82	—	—
1994	0.288	1.74	–2.174	–8.81
1996	0.124	0.87	–1.774	–8.07
Constant	–4.786	–10.77	–5.907	–6.86
Community heterogeneity				
Mass point 1	2.417	7.87	4.112	7.40
Mass point 2	1.218	6.21	1.910	5.82
Mass point 3	1.626	7.41	1.650	4.51
Individual heterogeneity				
Mass point 1	2.962	3.85	2.684	6.21
Mass point 2	3.541	4.18	2.801	4.91
Mass point 3	5.588	5.37	5.619	6.40

[a] Heard a message from any source, including from a radio drama.
— = Not applicable.

both equations, however. The survey-year dummies are not highly significant for recall of a family planning message, which is not surprising in light of the results shown in Table 5, where the proportion of respondents who recalled hearing a family planning message remained fairly stable during the study period. As noted above, the radio dramas were not broadcast until 1991, so that an estimation of the recall of a radio drama can be calculated only for the three later survey years. Strong negative coefficients are found for the 1994 and 1996 dummies, also not surprising in light of the higher proportion of respondents who recalled having heard a radio drama in 1999.

The results for the two message-recall equations, although interesting, are estimated in order to control for the endogeneity of message recall in the contraceptive-method-choice equation.

Simulations

Simulations were performed using the actual values for all variables for each of the 12,816 respondents and the estimated coefficients of selected variables to predict contraceptive method choice for each respondent. The predicted probabilities were averaged using all individual responses. The first row of Table 8 presents the results of the simulation. As expected, these percentages duplicate almost exactly the frequency distribution for method choice in the actual data. All variables were kept at their actual values except for one variable, and predicted method choice with that one variable was set to zero and at a positive value (typically one, but additional values were used for the number of methods observed to be in stock at a facility). This procedure allows us to quantify the impact of each important variable on contraceptive method choice.

For the message-recall variables, simulations are reported based on estimations with and without corrections for endogeneity for purposes of comparison. In general, whether or not correction is made for endogeneity of message recall, the direction of the impact on contraceptive method choice is the same: decreased nonuse and

Table 8 Simulated percentages indicating the effect of selected variables on contraceptive method choice, using correction for endogeneity bias compared with no correction, rural Tanzania, 1991–99

Variable	No method	Pill	Condom	Other modern method	Traditional method
All variables at actual values	89.5	3.0	1.0	1.9	4.6
Heard a family planning message					
No	91.1	2.3	1.0	1.2	4.4
Yes	88.0	3.7	1.2	2.4	4.7
No (no endogeneity correction)	91.8	2.2	0.8	1.3	3.9
Yes (no endogeneity correction)	87.0	4.0	1.3	2.4	5.3
Heard a radio drama with family planning content					
No	89.7	2.9	1.1	1.7	4.6
Yes	88.9	3.6	1.0	2.3	4.2
No (no endogeneity correction)	90.1	2.7	0.9	1.8	4.4
Yes (no endogeneity correction)	86.5	4.8	1.5	2.0	5.2
Number of methods observed to be in stock at facility within 5 km					
0	90.1	2.8	1.0	1.6	4.5
2	89.3	3.1	1.1	1.9	4.6
5	87.9	3.5	1.3	2.4	4.9
Facility with at least one provider having the post-1992 training update					
No	87.7	4.4	1.2	3.0	4.7
Yes	84.9	4.4	0.8	5.1	4.8
Number of methods available at pharmacy within 5 km					
1991–92: No methods	94.7	1.6	0.5	0.5	3.7
1991–92: One method	92.5	2.3	0.5	0.5	4.1
1999: No methods	84.8	3.4	1.8	3.7	6.2
1999: One method	78.2	4.0	3.7	6.7	7.3
Respondent's education (years)					
0	92.8	2.3	0.7	1.2	3.0
1–6	90.3	3.3	0.8	1.6	4.0
7	88.3	3.1	1.2	2.1	5.3
8+	80.3	3.5	1.9	3.1	11.2

at least a small increase in use for all methods. The magnitude of the impact is larger, however, when no correction is made for the endogeneity of message recall. In other words, the impact of message recall appears to be overstated if no correction is used. For example, with the endogeneity correction, moving from a "no" to a "yes" response on recall of a message causes a reduction of 3 percent in nonuse. When no correction for endogeneity is made, however, the reduction is 5 percent, a major difference. The principal contributor to overstatement is use of traditional methods; the degree of overstatement for modern methods is substantially less. The results for recall of a radio drama must be viewed with caution because, as noted above, the point estimates of the coefficients were imprecisely measured, especially when corrections for endogeneity were employed. They tell a similar story, however. We see that moving from no recall of a radio drama to recall reduces nonuse by almost 4 percent when no correction is used and by only 0.8 percent when a correction is used.

We now turn to simulations for the number of methods observed to be in stock at a facility within a distance of 5 km. In the data, this variable fluctuated between zero and ten, but values above five were found infrequently. Therefore simulations are performed here for zero, two, and five methods. As we move from availability of no methods to availability of five methods, we see a substantial reduction in the simulated percentage of nonuse and a corresponding increase across the board in simulated use for all methods. The largest increases are for other modern methods and for the pill. Encouraging results are found for the provider-training variable as well. As noted above, the effect of this variable can be calculated only for 1996 and 1999. We estimate a reduced-form model for method choice to measure the impact of provider training and use it to perform simulations. As we move from considering a facility having no provider who received the post-1992 training update to one having at least one trained provider, we find a substantial reduction in nonuse. Almost all of this reduction is associated with an increase in the use of other modern methods, which is not surprising because injectable contraceptives were a focus of the Family Planning Services Support program.

The pharmacy simulations are also based on reduced-form estimations, except that the 1991–92 and 1999 surveys are used. As noted above, a wording change occurred in the survey concerning the availability of contraceptives at pharmacies between 1991–92 and 1999 that probably caused an overstatement of availability in 1991–92. Therefore, finding an interaction term between number of methods at pharmacies and survey year that is highly significant is not surprising. Simulated effects are presented for the availability of no method and of one method at pharmacies and are shown separately for 1991–92 and 1999. In 1991–92, little impact of contraceptive availability at pharmacies on use is evident. In 1999, however, a substantial impact is seen: In particular, the simulated probability of condom use is more than doubled. A substantial increase is shown for probability of use of other modern methods and of the pill, methods that were found to be available in some pharmacies by 1999.

The final simulations presented in Table 8 show the impact of respondent's education on contraceptive use. These results are presented in order to gauge the size of the impact of the policy variables relative to the impact of female education, a variable almost universally considered to be of major importance. As more years of respondent's education are simulated, the expected result is confirmed that nonuse decreases and use of all methods increases. Interestingly, the largest increase found is for traditional methods. Except for the eight-year-and-higher category, rarely attained by Tanzanian women, we see impacts that are similar in magnitude to the policy variables.

Conclusions

In the early years of the 1990s, the government of Tanzania and several donors made a concerted effort to reduce fertility in Tanzania by means of a substantial upgrade of the family planning delivery system. The program had three main components: (1) better logistical support for fixed facilities so that they would have a variety of contraceptive methods available; (2) improved training for family planning providers; and (3) a public information campaign that included family planning radio dramas as an important component. The result of this effort was a major increase in modern contraceptive use between 1991–92 and 1994 and smaller rates of increase for the rest of the decade.

All three components of the family planning program played a role in bringing about this increase. The number of methods that facilities within 5 km of the survey community had in stock had a positive effect on method use, especially for injectables. Stock-outs of modern methods became increasingly problematic, however, in the second half of the decade; the number of methods available to the communities remained at a low level as late as 1999. A positive and promising result is that the availability of methods at pharmacies, which had little impact in 1991–92, had a strong impact in 1999, especially on condom use. Few rural respondents had access to this private supply source even in 1999, however.

Another promising result is that simulations for 1996 and 1999 based on a reduced-form estimation of the contraceptive-method-choice equation that were calculated for those with access to family planning providers who had received the post-1992 training update showed a positive effect of this training on use of other modern methods. In the facility results reported in Table 4, a substantial increase is evident in the number of facilities having providers with this training. Rural women in the sample have limited access to these providers, however, because the training program was first targeted at providers in urban facilities with a high volume of clients.

Finally, even after correcting for bias resulting from a reliance on respondents' recollection that they had heard a family planning message, we see that respondents who remembered having heard such a message were more likely to use a modern method of family planning, especially the pill or injectables. The proportion of such women was relatively stagnant during the study decade, however, and this variable shows a smaller impact on method use after correcting for endogeneity bias.

Thus, in spite of the strong impact on contraceptive use of policy variables and other factors including female education, it is easy to understand why contraceptive prevalence did not increase at a faster pace in Tanzania in the latter half of the 1990s: Results presented in Table 5 show clearly that no meaningful improvements occurred in the areas of logistics, training, or communications for the country's rural women. Moreover, levels of female education and women's socioeconomic status as measured by partner's years of education were stagnant. Although increasing women's educational attainment is obviously an important strategy for the long run, the simulations show that increased efforts to improve the three components of the program could yield substantial dividends as well.

Appendix A

The statistical specification for the multinomial logit model of choice of contraceptive method used in this study is as follows:

$$\ln\left[\frac{P(C_{tij}=k)}{P(C_{tij}=1)}\right] = X_{tij}\beta_k + t\delta_k + P_{tij}\alpha_k + M_{tij}\gamma_k + \mu_{tj}^C + \varepsilon_{tij}^C, \quad (1)$$

where the dependent variable is the log odds that woman i ($i = 1,2,\ldots,N_{tj}$) from panel t and community j used contraceptive method k relative to contraceptive method l. The Xs represent characteristics of the respondents such as age, education, and religion. The ts represent a set of three dummy variables for the 1991, 1994, and 1996 panels; the 1999 panel is arbitrarily chosen to be the reference category. The Ps represent program variables that measure various aspects of family planning services such as availability of contraceptive methods, trained providers, and pharmacies located near the community in which the respondent lives. The M represents whether or not the respondent recalled having heard a family planning message or if she recalled having listened to one of the radio dramas with family planning content. The final terms in equation *(1)* are a community-specific error term (μ^C) that is allowed to vary through time and an individual-level error term (ε^C). The community-specific error term allows individuals within the same community to have correlation in their choice of contraceptive method as a result of unobserved factors (attitudes of community leaders toward contraception, for example). The statistical implications of this specification are that standard methods will yield correct point estimates of the coefficients but that standard errors will be biased downward, which means that t statistics will overstate significance (see Angeles et al. 2002). The random-effects method discussed below corrects this problem and also corrects for the potential endogeneity of the message-recall variables.

Ideally, we would simply estimate equation *(1)* and then use simulation methods to gauge the impact of the policy variables. Unfortunately, as is well known, message recall is a potentially endogenous determinant of contraceptive method choice (see Figueroa et al. 2002). For example, women who recall having heard a family planning message may also be more likely to be motivated to use a contraceptive method. Because motivation is unobserved and cannot be controlled in the statistical model, simple methods that ignore the endogeneity of message recall may result in upwardly biased measures of the impact of the message variables. The standard solution to this problem is to use a simultaneous equations-estimation procedure to correct for the bias (see Bollen et al. 1995). The simplest simultaneous-equations method uses instrumental variables or two-stage least squares. Unfortunately, these methods are not appropriate if both dependent variables are binary or categorical. Therefore, the method used here is the full-information maximum-likelihood method by which we estimate the contraceptive-method-choice equation jointly with an equation that explains message recall. We refer to this joint-estimation procedure as a structural estimation procedure. Its purpose, however, is simply to correct for bias resulting from message recall, and we examine total program effects on contraceptive method choice because the message variables together with the logistic and training variables are placed directly in the method-choice equation.

The statistical specification of the message-recall equation is similar to equation *(1)*:

$$\ln\left[\frac{P(M_{tij}=1)}{P(M_{tij}=0)}\right] = X_{tij}\beta^M + t\delta^M + Z_{tij}\alpha^M + \mu_{tj}^M + \varepsilon_{tij}^M, \quad (2)$$

where the dependent variable is the log odds that individual i from community j and panel t recalls having heard a family planning message (in the empirical work, we estimate separate recall equations for the respondent's having heard a fam-

ily planning message and for her specific recollection of having heard a radio drama). The Xs and *t*s are as discussed in equation *(1)*, and the Zs represent variables that we assume affect message recall uniquely but do not have a direct effect on contraceptive method choice. These variables are necessary for statistical identification of the model and responses concerning household ownership of a television or radio.

We assume that the error terms in equations *(1)* and *(2)* are correlated and that this correlation is what causes simple methods to yield biased estimates of message recall on contraceptive method choice. As noted above, our solution is joint estimation of equations *(1)* and *(2)* by full-information maximum-likelihood methods. Specifically, we use an extension of Heckman and Singer's (1984) semiparametric method that imposes no specific distributional assumptions on the unobserved heterogeneity, but instead assumes that it can be approximated by a discrete probability distribution where both the mass points and the probabilities are estimated. This approach has been used successfully by Mroz and Weir (1990) to estimate discrete time-hazard models for child spacing and by Guilkey and Riphahn (1998) to estimate the mortality hazard for young children in Cebu, the Philippines. A comparison of the assumption of normal errors with that of nonparametric error-term distributions in structural equations models was made by Mroz and Guilkey (1995) who found that when the true distribution of the errors was approximately normal, the parametric and nonparametric estimators gave similar results. When the true distribution was far from normal, the nonparametric estimator generated much more accurate parameter estimates. The specific estimation procedure that we use here does not restrict the mass points for the discrete distributions to be the same across equations. Instead, using a generalization drawn from Mroz (1999), each mass point is estimated separately for each equation. This more general specification allows greater flexibility in the pattern of correlations across the error terms. For more details, see Mroz (1999), where the more general specification is referred to as nonlinear heterogeneity.

Notes

1 Fertility rates are taken from the *World Health Statistics Annual* (WHO 2000b), and prevalence of modern methods is taken from United Nations (2000).

2 An internal memo at the MEASURE Evaluation project estimates that USAID contributed about $4.5 million in 1998 to family planning programs.

3 In addition to the IPPF or UMATI (Uzazi na Malezi Bora Tanzania) clinics, some urban areas are also served by Marie Stopes clinics. Neither of these organizations has clinics in rural areas of Tanzania, however.

4 See the Tanzania Reproductive and Child Health Facility Survey, 1999, Appendix A (National Bureau of Statistics and MEASURE Evaluation 2000), for a more detailed explanation of the sampling methodology.

5 All clusters in Zanzibar were dropped from the sample.

6 Few observations were lost from the first three surveys. Approximately 400 observations were lost in 1999, mainly because facility information was gathered only for a subset of clusters.

7 Type of contraceptive use is drawn from the contraceptive-use section of the questionnaires in which the question about current method of contraception is asked. Because we examine the effect of methods available at pharmacies, we place the pill in a separate category; condoms and pills are the predominant methods available at pharmacies. To keep the number of categories manageable, we grouped injectables, the IUD, and foam into the "other modern" category. The predominant method in this category is injectables.

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