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How Access to Contraception Affects Fertility and Contraceptive Use in Tunisia

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What were the important factors in Tunisia's fertility decline? Better education for women and more access to family planning and contraception and to all the things that contribute to mortality decline — including health care facilities (especially clinics) and good water.

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To a great extent, fertility decline in Tunisia can be explained by the rise in the age at which women marry, probably because they are better educated and because social legislation has given them more rights. This legislation has ranged from the abolition of polygamy to increased rights in the work force. Before guidance can be given to other countries, more analysis is needed on how changes in marriage behavior were brought about in Tunisia. The cross sectional analysis used in this paper could not address issues of what determined the age of marriage.

A second major factor in fertility decline in Tunisia was the increased use of contraception. The main focus of this paper is what determines the practice of contraception. The general increase in the use of contraception was the result of a strong family planning program as well as increases in education over time. The family planning program in Tunisia is considered one of the best in the world.

There has been a substantial program to improve the access of the rural, poor, and least educated population groups to family planning. Although in the last 10 years contraceptive use increased the most among the least educated women, these groups are still served less well than the more privileged. We know this because the uneducated women have one child more, on average, than they say they want.

Other countries studying their own demographic transition should study the history of the fertilility decline in Tunisia. Cross-sectional analysis of what determines contraceptive use and fertility as carried out in this paper can be used to guide Tunisia itself on where it might most profitably expand its activities to increase contraceptive use and thus fertility decline.

The results in this paper show the central role of mortality decline and access to contraception in this process. Health facilities, especially clinics, and good water are important in reducing mortality, which in turn increases the motivation to restrict fertility and the likelihood that people will act on that motivation.

The effects lag, however. Access to health facilities at age 20 matters more than current access in affecting motivation. Thus, a long term program to further reduce mortality is important. Hospitals and doctors in rural areas appear to play less clear a role than clinics, but further analysis of what determines mortality — especially in rural areas — would be needed to design a proper health strategy.

The structural model Cochrane and Cuilkey use is designed to distinguish exogenous from endogenous variables — to separate such community variables as access to family planning from the channels through which they operate. One of the most important findings is the importance of access to family planning and health facilities to the motivation to reduce fertility and to act on that motivation by using contraception. Many people in the field have dismissed the measures of motivation used in this study, but the authors found these particularly important.

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I. Introduction

Evidence from the large numbers of research projects designed to study the effects of family planning programs on contraceptive use and fertility has presented mixed results. The conflict between the results is partly due to differences in data but also partly due to differences in modeling strategies and estimation methods. A major fault has been the failure to distinguish exogenous from endogenous variables. Because of this, community variables such as family planning access are often included in the same equation with the channels through which they operate. In this case, the apparent impact of access is diminished. Appropriate specification would allow the total effects to be observed.

The purpose of this paper is to employ a structural model to assess the effects of access on contraceptive use and fertility in Tunisia. The theoretical model is built upon the contributions of Easterlin (1978), Easterlin and Crimmins (1985), Rosenzweig and Schultz (1985) and Schultz (1989). Two versions of the model are developed. The first version examines the effects of the number of currently surviving children on the decision to have additional children and their desired spacing. Fertility intentions are then used as right-hand-side endogenous variables in equations that explain current contraceptive use and choice among methods. In the second version, fertility intentions formed five years ago are assumed to affect duration of method specific contraceptive use in the five year interval. Contraceptive use is then hypothesized to affect number of births in the last five years.

The statistical methods that we employ to estimate the structural model allow community level variables to be important components of the model. The methods correct for unobservable community level influences on the dependent variables. Our methods must also correct for the fact that many of the dependent variables are either dichotomous, ordinal, or categorical. The estimation method that we use is the generalized method of moments estimator. The data used in the study are from the Tunisian Demographic and Health Survey (DHS) conducted in 1988. The data collected at the household level include basic household socioeconomic data, fertility levels, and family planning awareness and use. The community data contain simple information on the availability of government and social facilities such as schools and cinemas and detailed information on the range of health and family planning services available including access to family planning information. These data include distances and travel times to various facilities, services offered, personnel, and hours of service as well as information on when the programs were implemented.

The paper is organized as follows. The next section presents background information on the demographic transition and the role of the family planning program in Tunisia. Section III presents an overview of the structural model that guides the research and discusses the method of estimation. This section can be skipped by those uninterested in the details of methodology. The data set used in the analysis is presented

in Section IV along with a brief discussion of some descriptive statistics. Section V contains the estimation results and we conclude in Section VI.

II. The Background

A. Tunisia's Demographic Transition

Tunisia has progressed quite far in the demographic transition since Independence in 1956. The crude birth rate has fallen from 46 to 30 and the crude death rate from 23 to 7. Although this represents an unchanging rate of natural increase of 16 per 1000, the crude death rate is unlikely to fall much more, while the fertility rate will probably continue to decline. The determinants of contraceptive use and fertility are the major foci of this paper. The role of the family planning program and of access to family planning are of major policy importance for the future decline of fertility in Tunisia and for generalizing from this experience to other countries. It is, therefore, important to put the Tunisia case into context.

Fertility in Tunisia has declined at a pace similar to that of the average lower middle income countries. The Total Fertility Rate (TFR) of 4.1 is almost identical to that of the average of similar countries. Yet one might have expected that fertility would be even lower for several reasons: 1) Tunisia has a strong family planning program and was ranked 14th out of 99 countries on family planning program effort in 1982 (Mauldin and Lapham 1987). 2) It has almost 60 percent of its population in urban areas and has infant mortality below that of the average country at its level of development. 3) It has also had a program of social reform that seems to be exactly what would be recommended by those who stress the importance of creating the demand for family planning through social change. These legislative and programmatic changes, outlined in Table 1, have occurred much earlier than in other countries of the region.

Despite this legislative change, female schooling has expanded slowly until recently. In 1965, Tunisia had a female enrollment rate at the primary level 75 percent that of other lower middle income countries. For secondary schooling, female enrollment rates were less than half of those of comparable countries. By 1988, almost universal primary enrollment had been achieved and female enrollment rates at the secondary level had reached almost 80 percent of those of comparable countries. These changes have begun to have an impact on adult women. Whereas 77 percent of the women in the World Fertility Survey (WFS) of 1978 had had no schooling, by 1988 the DHS sample had only 57 percent without schooling. The proportions with primary and some secondary schooling had doubled over the period from 16 percent to 31 percent and 7 percent to 12 percent, respectively. This is substantial progress, but these are still very low levels of education for a country that has achieved a TFR of 4. This is graphically illustrated in Figure 1, which shows that the TFR is below what would be expected on the basis of the level of female illiteracy. Thus, it appears that Tunisia has in some sense

been able to substitute a strong program and strong supportive social legislation for women's and children's rights. In the analysis below, we will examine the relative importance of these factors in the determination of contraceptive use and fertility.

During the decade between 1978 and 1988, the TFR dropped by one-third. This occurred in part because of the improved education of women, but even within educational categories fertility dropped substantially as well. The TFR among those with no schooling decreased from 7.3 to 5.1 while the TFR of those with more than primary school, from 5.4 to 3.9. These are almost identical percentage decreases.

The fertility decline in Tunisia has resulted from changes in marriage behavior and increases in contraceptive use. Breastfeeding patterns have changed relatively little. Lapham in his 1970 study attributed 42 percent of the decline in the crude birth rate in the 1960s (as opposed to the TFR) to changes in marriage behavior and 40 percent to increased contraceptive use. By 1978 the contribution of marriage to suppressing fertility was very important and the average age of marriage was over 21 years, much more like that of Latin America than of Asia or Africa where women spend a much larger proportion of their lives in marriage. Between 1978 and 1988, marriage behavior continued to change in ways to reduce fertility and by the time of the DHS fertility was only 52 percent of what it would have been if women had been married throughout their entire reproductive life[1] (Rutstein, et al. (in progress)). While in the past marriage has played a major role in reducing fertility, it is unlikely that the age of marriage will increase much further. This and the fact that data were not available to identify the determinants of age of marriage, explain why the analysis of this paper focuses on family planning as a determinant of fertility. Clearly, to help guide other countries in the process of fertility transition, additional work is needed to identify the role that social legislation and economic change played in bringing about this substantial increase in the age of marriage.

Contraceptive use has increased substantially over the period analyzed. The Bongaart's index of contraception has decreased from 75 percent to 65 percent while usage of modern methods has risen from 25 percent to 40 percent and usage of all methods from 31 percent to 50 percent. (UN 1987; Rutstein, et al. (in progress)). The majority of this increase in usage appears to have occurred among the least educated where overall usage rose from 25 percent to 42 percent.[2] This is consistent with the hypothesis stated above that the strong program has to an extent compensated for slower progress in female education.

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[1] The WFS figure was 66 percent, but whether the estimation techniques are exactly comparable is uncertain.

[2] Although the more educated have substantially higher usage than the less educated, (67 percent versus 42 percent) the more educated are much more likely to use traditional methods. The comparable figures for the usage of modern methods is 45 percent and 37 percent.

A major objective of this paper was to determine the relative roles of the demand to limit fertility and the access to means of doing so in expanding contraceptive use. The WFS showed that 49 percent of women wanted no more children and that the actual fertility was 1.5 children higher than the desired level (Lightbourne 1987). It is interesting to note that the current TFR is very close to the desired TFR in 1978. It is also important to note that not all groups have been equally successful in implementing their fertility preferences. While those with more than primary schooling now have fewer children than they said they wanted a decade ago, the uneducated still have in excess of one child more than they said they wanted. In addition, the desired family size has decreased by about half a child for all educational groups. This indicates that there is still potential unmet demand for family planning among the less educated. The family planning program plays a major role in helping women achieve their fertility preferences. It is also a hypothesis of this paper that family planning access also plays a role in shaping those preferences. In the next section, we will briefly outline the characteristics of the program and then turn to the analysis of the data.

B. The Family Planning Program

The policy to support fertility decline evolved in several stages. In the first stage (1956-64) emphasis was placed on making changes in social legislation to encourage reductions in the demand for children and in liberalizing legal access to the means of reducing fertility (see Table 1). The second stage began with an experimental program to deliver family planning in maternal and child health centers.[3] By 1973, this program had only expanded to 38 centers and a more aggressive approach was deemed necessary. Therefore, in that year, the office of Family Planning and Population (ONFP) was founded[4] and charged with the responsibility for research, orientation, coordination and delivery of population and family planning activities. In 1980, despite the progress made by ONFP, more needed to be done. Thus, an effort was made to provide family planning in an integrated approach through the Basic Health Care (BHC) services of the Ministry of Health (MOH).

Currently, two-thirds of Tunisia's family planning services are offered through ONFP. Each governorate has one training and one regional family planning center operated by ONFP. In addition, with the use of 67 mobile teams, ONFP offers services through 800 of 1462 BHC facilities whose own staff can not or do not provide such services. There are also 10 mobile ONFP units which can provide services where there are no facilities available. The MOH staff itself only provides services directly in 16 percent of its clinics. The private sector is also relatively limited in its service provision.

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[3] This program was set up in 1963 in collaboration with the Ford Foundation.

[4] This has gone through several changes in its place within the government, but was initially and is now a quasi-independent institution operating under the Ministry of Health.

A major policy question to be addressed in the following analysis is whether further expansion of family planning services would further increase usage and lower fertility.

The type of delivery system affects the type of methods chosen. Given the heavy reliance on mobile teams and mobile units, the IUD is an easier method to implement than methods that require more constant resupply and has thus played a central role in the program. The oral contraceptives are often initially provided by the government program and resupplied through the private system.[5] Almost 60 percent of the condoms used is also supplied through the private sector. Tubal ligation did not play a major role in the program until 1974, but since that time there have been 8,000 to 10,000 acceptors a year, and there were sharp increases in 1987 to 1988. Male sterilization, though legal, has not been accepted. Currently 34 percent of users rely on IUDs, 17 percent rely on the pill, 23 percent rely on female sterilization, 8 percent rely on condoms, vaginal methods and injection, and 19 percent on traditional methods. Urban and rural areas have almost identical usage rates for sterilization, but rural areas have much lower use of all other methods. The uneducated are much more likely to use sterilization than the other groups and much less likely to use other methods.[6] Rather surprisingly the urban and the more educated are much more likely to use traditional methods than others. Abortion laws are now quite liberal, but the incidence of abortion is relatively low. In 1988, there were about 23,000 abortions, about one per ten live births. This and the pattern of usage reported in the survey, indicate that abortion is used primarily as a back-up for contraceptive failure rather than as a major method of family planning. The effect of access on the choice of method will be explored in detail in the analysis of current use in Section V of the paper.

The Tunisia family planning program has not only a strong service delivery component, but a strong information, education and communication (IEC) component as well. It was ranked ninth among 101 countries on its IEC component as of 1982. (Middleton and Lapham (1987))

III. Structural Model and Statistical Methods[7]

A. Structural Model

The analytical framework to be utilized for this research project is based on work by Easterlin and Schultz. While there has been substantial debate between these two

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[5] Although 75 percent of pill users get their supplies from the private sector, 45 percent were introduced to the pill through the public sector.

[6] This may explain some of the lack of education effects in our structural models.

[7] This section should be skipped by the general reader.

innovators, the access to a rich data set has allowed us to develop an integrated model incorporating their separate contributions. The Easterlin framework which incorporates the demand for children, natural fertility and the cost of fertility regulation is intuitively appealing, and the process of demographic transition which it sketches out provides useful insights.

In the early stages of demographic transition the supply of living children is below the desired level of fertility and thus fertility is constrained by natural fertility. As survival rates improve and the process of development lowers the family size preferences of the couple, actual fertility will exceed desired fertility. Initially, family planning will not be used because of its perceived high or actual costs and because actual fertility continues to be determined by natural fertility. Eventually, fertility regulation is adopted and actual fertility falls below natural fertility, but still exceeds the demand for children. When the costs of regulation become negligible, actual fertility equals the demand for children. From the point at which the unregulated supply of surviving births begins to exceed the demand for children, the cost of fertility regulation can be said to be a constraint on fertility decline.

As appealing as this framework is, there are a number of problems with testing it empirically. The main dimensions of the model are all subject to more or less serious problems of measurement. Easterlin and Crimmins in various papers have measured demand by desired family size, and have estimated natural fertility by estimates of regression equations with various proximate determinants and cost of regulation as various as the woman's knowledge of contraception or community access to family planning. Their results have tended to show the significance of both the difference between natural fertility and desired fertility and the cost of fertility regulation. The relative importance of these factors have varied, however, from place to place.

Schultz has criticized the work by Easterlin in several ways: 1) he rejects the usefulness of the concept of desired family size, and 2) he rejects the technique used by Easterlin to estimate natural fertility. His rejection of desired family size is in part an economist's hesitation to take what people say at face value and in part the belief that desired family size is in fact endogenous with respect to the costs of fertility regulation. His rejection of the Easterlin technique for estimating natural fertility arises from his belief that the recursive method used by Easterlin to estimate natural fertility leads to biases in the estimation of the effect of contraception use on fertility and thus it underestimates the natural supply of children. In Rosenzweig and Schultz (1985), the authors use U.S. data to illustrate how a simultaneous model which allows for couples to adjust their contraceptive behavior on the basis of their perceptions of their own fertility leads to a larger magnitude of effects of usage on fertility since more fecund couples are more likely to adopt contraception earlier and use more reliable methods.

In this paper, we use a model which, 1) incorporates desired family size, but allows us to test whether it is in fact affected by access to family planning services as well

as health services, 2) incorporates the elements of simultaneity suggested by Rosenzweig and Schultz, and 3) models current use of contraception and method choice as well as use and method choice over a five year period so that the desire to space children can be incorporated.

The basic form of the model is laid out in Figure 2 with variable definitions listed on the following page. The model is of the same general form as the one discussed in Schultz (1989 and 1990) with the major difference being that fertility intentions are treated as unobservable variables in his model while our data has excellent measures for these variables and they are explicitly included as observable variables. The figure as drawn encompasses both versions of the model that we will estimate. In the first version, the ultimate dependent variables that we are interested in are current use of contraception and current method choice. They will be a function of current household characteristics and current community characteristics which include the contemporaneously measured, policy relevant set of access and quality of facility variables. Natural fertility is hypothesized to be an unobserved variable that affects contraceptive method choice to the extent that a couple has knowledge of their fecundity.

Current use and method choice are also functions of fertility intentions which will be measured as an ordinal variable that categorizes the strengths of the respondents spacing desires and is described in more detail in the next section. The respondent's fertility intentions are in turn a function of the number of currently living children measured by the number of births minus the number of deaths. Intentions, births, and deaths are all treated as endogenous variables in the model.

The structural form of the model allows us to follow the pathways through which the policy variables affect the contraceptive choice decision. Reduced form current use and method choice equations are estimated also where the total effects of household and community characteristics can be measured. An additional reason for reduced form estimation is that the fertility intentions were not asked of respondents who were sterilized. Therefore, we also estimate a reduced form method choice equation with sterilization included as one of the categories. Only respondents who were sterilized in the last five years are included in the estimations since it is unclear how relevant currently measured household and community characteristics would be for women sterilized more than five years ago. This model is presented in Figure 3.

The second form of the model has recent fertility measured as the number of births over the last five years as the final outcome variable. This second form of the model is clearly important since it allows us to examine the ultimate effects of policies designed to promote effective contraceptive methods. Current contraceptive method is no longer the appropriate form of the proximate variable in this case and method specific measures of duration of use are used along the lines of Rosenzweig and Schultz (1985). The community, household, and fertility intentions variables are adjusted to reflect the five year time period as described below. This model is presented in Figure 4.

B. Statistical Methods

The statistical methods used must take into account the following:

1. Community level variables are important exogenous variables in the models. In addition, the statistical methods must correct for unobservable community level influences on the dependent variables.

2. Endogenous variables are explanatory variables in some equations and methods must be used to correct for potential bias.

3. Some of the important dependent variables are discrete. For example, contraceptive use may be measured as a categorical variable.

An overview of the statistical methods that we will use is presented below within the context of the current use and current method choice model. The methods that must be used to estimate the five year model are similar. Note that the model hypothesizes that a chain of causality runs through the system starting with exogenous household and community characteristics, moving through the intermediate endogenous variables and ending in current use and method choice.

The first two equations are reduced form equations for births and deaths which are hypothesized to be functions of a set of exogenous household and community characteristics:

$$(1)\quad B_{ij} = a_1 C_j + \beta_1 X_{ij} + \delta_1 C_j X_{ij} + \mu_{1j} + \epsilon_{1ij}$$

$$(2)\quad D_{ij} = a_2 C_j + \beta_2 X_{ij} + \delta_2 C_j X_{ij} + \mu_{2j} + \epsilon_{2ij} \qquad i = 1,2,...,N_j$$

$$j = 1,2,...,M,$$

where B_{ij} and D_{ij} represent lifetime births and deaths of the children born to individual i in community j respectively. C_j represents a set of characteristics of community j that are hypothesized to affect the dependent variables and could include such things as access to family planning and health clinics as well as variables describing the economic conditions in the community that have been appropriately backdated (see next section). X_{ij} represents a set of characteristics of the respondent or household[8]. The model allows the community and individual level variables to affect the demand for children additively through α and β. In addition, the possibility that the level of the community level

[8] Since there is generally only one respondent per household, it is not necessary to distinguish between household level and individual level variables.

variables may alter the affect of some individual level variables is allowed for through the presence of the multiplicative term involving δ. The μ and ϵ represent unobservable community and individual influences respectively.

Equations (1) and (2) allow for a two level error structure. Estimation of the parameters of models with such an error components structure specified above has a long history in the sample survey literature as well as the literature dealing with panel data. A textbook discussion of the issues can be found in Hsiao (1986). The method has rarely been applied to control for unobservable community level effects (see Turchi, Guilkey, and Hess (1990), for an exception). The methods of estimation for continuous dependent variables have followed two main strategies that involve either treating the μ as fixed or random. The fixed effects estimator has several advantages but is of little use in our context because it does not permit estimation of α, the coefficient vector for the community level variables, which is a parameter of primary importance to us.

We assume that both μ and ϵ are independent, identically normally distributed random variables with mean zero and standard deviations σ_μ and σ_ϵ respectively. The practical implication of these assumptions is that ordinary least squares will result in consistent parameter estimates but the standard errors will be incorrect. Our solution is to estimate the equations by generalized least squares since it is a more efficient estimator and the estimated standard errors are asymptotically correct.

The third equation in the model relates fertility intentions to a set of exogenous variables and the number of living children:

$$(3)\quad W^{*}_{ij} = a_3C_j + \beta_3X_{ij} + \delta_3C_jX_{ij} + \phi_3(B_{ij}-D_{ij}) + \mu_{3j} + \epsilon_{3ij}$$

where W^{*}_{ij} is an unobserved continuous variable that represents the strengths of the respondents desire to space children and the other variables are as defined above. The observed dependent variable is W_{ij} which is W^{*} sorted into ordered categories as W^{*} passes through thresholds that must be estimated. To keep the notation simple, we use the same notation for the vectors of household and community variables as used in equations (1) and (2). These vectors will not overlap completely in the actual empirical work. In fact, if the system of equations is identified, they can not overlap completely. Equation (3) introduces two complications: a limited dependent variable and an endogenous right-hand-side variable. The two estimation methods that have typically been used for ordinal variables are ordered probit and poisson regression. We use the ordered probit method since the error term assumptions that need to be made are the same as are made for equations (1) and (2) and these assumptions are less restrictive than those that are typically imposed in the poisson regression model (see Maddala, 1983). As a practical matter, the methods typically give similar results (see Trevedi and ?????).

The presence of births and deaths on the right-hand-side of equation (3) presents more serious estimation problems. Even though the model is recursive in the introduction of endogenous variables, we hypothesize that there are common unobservable household and community characteristics that affect all three endogenous variables. The result is that simple ordered probit estimation of equation (3) will result in inconsistent parameter estimates. Our solution is to use a generalized method of moments (GMM) estimator (see Hansen (1982), and Pagan and Vella (1990)).

GMM is an instrumental variables method that includes two-stage least squares as a special case for linear models. Since this estimator has not been widely used in limited dependent variable models, we present some details on the method. To do so, define P_{ijk} as the probability that the response of individual i in community j falls in category k of the ordinal variable W_{ij}. The probabilities will be functions of the right-hand-side of equation (3) which means that they will be functions of the unobserved coefficients and unobserved thresholds (see Maddala, 1983, p.48). The mean of W is

$$(4)\quad E(W_{ij}) = \sum_{k=1}^{M} kP_{ijk}.$$

A residual can then be formed:

$$(5)\quad e_{ij} = W_{ij} - E(W_{ij}).$$

The GMM estimator exploits the orthogonality between this residual vector and the set of strictly exogenous variables in the model plus additional orthogonality conditions implied by the first order conditions associated with the thresholds. If we let Z_{ij} represent this set of variables (Z_{ij} contains both C_{ij} and X_{ij}), and form both the residuals into a vector and the instruments into a matrix, the the GMM estimator minimizes the following expression in terms of α_3, β_3, δ_3, and ϕ_3:

$$(6)\quad e'Z'A^{-1}Ze$$

where A is an appropriately chosen weighting matrix.

We follow a two-step estimation procedure. We first set $A = Z'Z$ to obtain an initial set of parameter estimates. We then calculate residuals and form a weighting matrix that involves averaging within communities so that the error components structure can be taken into account (see Avery and Hotz (1985), and Gallant and White (1988), Ch. 6).

The next set of dependent variables are current use of a method of contraception and use disaggregated into contraceptive method choice. Clearly the decision to use or

not use a method of contraception will be a function of the fertility intentions, however defined, and the couple's perception of their fecundability or natural fertility of births (see Rosenzweig and Schultz, 1989). Method choice could also be a function of these two variables. We will also assume that the supply of births can be adequately controlled simply by including some appropriate individual level variables such as the age of the mother as explanatory variables in the contraceptive method choice equation.

There are two estimation strategies that have been used to estimate models with unordered categorical dependent variables: multinomial probit or logit. The multinomial probit estimator is easier to justify on theoretical grounds since its underlying error term assumption is one of normality which is a standard assumption. In addition, it does not suffer from the IIA (independence of irrelevant alternatives) problem that plagues multinomial logit. The problem with the probit estimator is that it is computationally infeasible if there are more than three categories for the dependent variable unless some type of approximation is used.[9] Since we have more than three categories, we use the multinomial logit estimator.

Consider the following specification for exhibition purposes:

$$(7)\quad \log \frac{\Pr(Y_{ij}=k)}{\Pr(Y_{ij}=1)} = \alpha_{4k}C_j + \beta_{4k}X_{ij} + \delta_{4k}C_jX_{ij} + \tau_{4k}W_{ij} + \mu_{4jk} \qquad k=2,\ldots K,$$

where the dependent variable is the log odds that individual i in community j will chose method k relative to method 1. Equation (7) specifies a set of K-1 equations with the use of the first method in the denominator as arbitrary. The K-1 equations, plus the fact that the sum of the probabilities must equal one, imply that we can solve for the K probabilities for each individual. These probabilities can be used to form expected values for the dependent variables and residuals that can again be used in GMM estimation. We followed the same general strategy as was laid out for the ordered probit estimator.

The analysis of the model that has recent fertility as its ultimate dependent variable is similar and follows closely the work of Rosenzweig and Schultz (1985). The first dependent variable is the respondent's fertility intentions at the start of the five year period measured as desired family size minus the number of living children that the respondent had at the beginning of the five year period. This equation contains no endogenous right-hand-side variables and is estimated by ordered probit. The standard errors of the coefficients are corrected for the two level error structure. The second set of dependent variables are duration of use in the five year period of various types of

[9] See Akin and Guilkey, 1989, for an example of the use of multinomial probit for a trichotomous dependent variable.

contraception. These equations are estimated by applying the GMM estimation strategy to the tobit method. The final dependent variable is births in the last five years and GMM is used along with the ordered probit model.

IV. The Data Set and Descriptive Statistics

The data used in this analysis is the Demographic and Health Survey conducted in Tunisia in 1988. The sample is a nationally representative sample of ever married women between the ages of 15 and 49 in 156 sample segments. The total number of women in the sample is 4184. The sample used in the analysis dropped women who were not currently married (approximately 150 women), women who were over 45 years of age (approximately 300 women), women who had been sterilized more than five years (approximately 160 women), and women who were from two sample segments where there was no service availability data gathered (approximately 80 women). The end result was a sample size of 3482 women with 1366 women from rural communities and 2116 women from urban communities. The current use analysis dropped women who were pregnant (approximately 400 women) while the five year analysis dropped women who had not been married at least five years (approximately 850 women).

An issue that has important policy implications is the effect of infant mortality on fertility intentions. It has been a fundamental tenet of the theory of demographic transitions that mortality decline stimulates fertility decline through behavioral and biological channels. In particular, it is hypothesized that parents are more likely to use contraception to lower the risk of child death. (See Cochrane and Zachariah, 1983.) Since mortality figures based on our current sample of women would be unreliable because the sample size is too small and since mortality for the current respondents would have to be treated as an endogenous variable, we calculated community mortality measures from census data along the lines suggested by Montgomery (1985). The Tunisian census data from 1987 were used in the calculations of the community mortality measures using indirect estimates based on the number of births and surviving children by age of mother. The probability of dying between birth and age 5 was the measure of mortality selected for this analysis. These estimates were made for urban and rural areas in each governorate.

Appendix Tables 1 and 2 present descriptive statistics on all variables used in the analysis as well as their definitions. Since our preliminary model specifications indicated that there were major urban-rural differences, we initially stratified the entire analysis into separate urban and rural samples. Therefore, the descriptive statistics in the Appendix are also presented separately for the urban and rural samples. In the final analysis, however, given the relatively small size of the rural sample, the analysis was executed for the sample as a whole and interaction terms were used to determine the differential access to services in urban and rural areas.

Access to public services was defined to cover access to educational opportunities, health facilities and family planning. In urban areas access to various health facilities was measured by whether a facility was available within five kilometers. In rural areas, access was measured by whether a facility was available within 10 kilometers. For education, the number of types of schools available within the defined radius was used. For health facilities, it was possible to measure whether a doctor, a pharmacy, a hospital and two different kinds of clinics[10] were available within the radius. Since the date at which the facility was established was also available, it was possible to determine roughly whether a health facility was available at the time that the woman was 20 years of age. This helps us establish the effect that such access would have had on her history of births and infant and child deaths. In both urban and rural areas, it was possible to measure access to family planning by the number of contraceptive methods available in the locality. In rural areas, it was also possible to determine if the family planning field worker provides contraceptives at all and whether that is at least four times a month. Finally, on the individual questionnaire there was a question on whether the respondent had heard a family planning message within the last month.

V. Multivariate Results

A. Determinants of Current Contraceptive Use

Table 2 presents the empirical specification for the structural model for current use of contraception as described in Figure 3. The basic variables of age, education, residence[11], husband's education, and whether the woman resided in a rural area at age 12 are present in all equations. Variables that are unique to particular equations are listed under the appropriate columns. With the empirical specification written out in this format, it is straightforward to see the exclusion restrictions that are used to identify the model.

The first equation is the number of births to women which depends on the basic individual variables and the access to health facilities when she was age 20. It should be noted that age, residence (current and at age 12), and husband's education all have the expected signs which are significant. Wife's own education is not significant. Access to doctors and type 3 clinics have a marginally negative effect on fertility in urban areas and pharmacies have a much stronger negative effect. In rural areas, clinics of both types and pharmacies have highly significant negative effects on the number of births. Rather

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[10] The clinics were quite distinct. The type 2 clinic.....

[11] There are three separate variables: urban/rural, small city/large city, and remote/non-remote.

surprisingly, however, the access to hospitals has a significantly positive effect[12]. This equation is of interest because it shows that general access to health facilities reduces fertility over the life span even if we do not include specifically whether family planning is available at those facilities. This effect, however, is not instantaneous, but depends on access early in the childbearing period. The effect of current access on contraceptive use is explored in the fourth equation of this structural model.

The second equation traces the effect of the above variables on the number of child deaths that a woman has had. In addition, the household's current access to good water and sanitation are included to identify the model. Ideally one would have used measures of these variables at an earlier point in the woman's reproductive history, but that was not possible. The number of deaths increases with the age of the woman and decreases with urban residence. Women who have seven or more years of schooling have significantly fewer deaths even though their education had no effect on their number of births. The fact that education has a more consistent effect on child mortality than fertility has been documented by Cochrane, Leslie and O'Hara (1981). Community access to health care when the woman was 20 has no significant effect in urban areas and in rural areas the effect is very mixed. In rural areas, access to the two types of clinics has a significant negative effect while access to doctors and hospitals have a significant positive effect. This is not completely explainable, but may reflect the fact that there are trade-offs in resource allocation and lower level access to health care is more important in reducing infant and child mortality. This has certainly been the contention of those who wish to promote primary health care. Further exploration of these effects will clearly be necessary before firm policy conclusions are drawn. Access to good water also shows a significantly negative effect on child deaths. This is an effect documented elsewhere. (Cebu Group 1991)

The number of births and infant and child deaths a woman has had determines her current number of living children. This number as well as her background characteristics, household economic resources, current access to family planning information and services and educational opportunities are hypothesized to determine whether a woman wants to have no more children (3) wait at least two years for her next birth (2) or have a baby soon (1). These factors are captured in the fertility intentions equation. Women under 30 are more likely to want to have a baby soon or to wait at least two years to have a child. Women 30 to 35 are more likely to want to wait or to have no more children than are younger women and, also rather surprisingly, than are older women[13]. The more educated the husband, the more likely the woman is to want to control fertility. Wife's education has no effect on fertility intentions, nor do any of

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[12] This perverse effect seems to be related to the effect of hospitals in one governorate and this may reflect a peculiarity of that region which we will pursue in discussions with those knowledgeable on Tunisia.

[13] The reason for this perverse result is that the women in the sample have not been sterilized. Older women who want no more children have probably been sterilized and are thus not in this sample.

the residential variables. Residence, both past and present, probably operates through the current number of living children which has a strongly significant effect on the intention to limit fertility. Likewise, as hypothesized in Cochrane and Zachariah and elsewhere in the literature, the higher the level of community mortality the less likely women are to want to limit their fertility. A crucial question for targeting policies is whether or not access to family planning affects fertility preferences or whether it only affects contraceptive use among those already motivated to use fertility. Our results show that the number of contraceptive methods available has a highly significant effect on the desire to limit fertility. Finally, the variables measuring the economic resources of the household, landownership and household assets, have no effect on intentions. Likewise, the price of child quality, to the extent that is captured by educational opportunities in the community, has no effect[14].

How does access to education, health and family planning affect the actual use of contraception? This is estimated in two ways: 1) the effects of access and background variables are shown controlling for the fertility intentions of households, equation (4), and 2) the effects of all current exogenous variables are measured deleting fertility intentions. This is the reduced form equation (5). Before explaining the findings of these two equations, it is necessary to explain how contraceptive use is measured and how such use relates to other practices which affect fertility, breast-feeding and abortion.

Abortion is available on very easy terms in Tunisia. As such, the question arises as to how it affects the choice of whether to use contraception and which method to use. The general consensus in the field is that abortion is not a major method of family planning in Tunisia, but is used to cover contraceptive failure. If this true, then we can conduct our analysis of contraceptive use independently of abortion behavior. It is difficult to prove that abortion decisions are independent of contraceptive behavior. It is true that the incidence of abortion among the married women in our sample is fairly low. Only 11 percent and 3 percent of the urban and rural women, respectively, report ever having had an abortion and only 4 percent and 1 percent, respectively, have reported having one in the last year[15]. Most women who have recently had an abortion are currently using contraception in the urban areas (84 percent) and approximately half are in rural areas. The methods being used by women who have had an abortion are fairly evenly spread across methods. We interpret this to mean that there are no important issues of simultaneity involved. We also tested the model both including and excluding

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[14] The fact that education has no observed effect may be due to the weakness of the variable used. First, it was not possible to lag the education variable. Second, there was no measure of quality of education. Three, the total number of facilities in the area could not be measured. It was only possible to determine if there was at least one of each type of facility within the 5 or 10 kilometer radius.

[15] Even though abortion is legal in Tunisia, these figures probably underestimate the true extent of abortion given cultural sensitivities. As mentioned in Section II, there is about one abortion per live birth recorded in government facilities.

women who had recently had an abortion and found no substantial differences in the results. This reinforces our belief that there was no simultaneity.

With respect to breastfeeding, the picture is less clear. The incidence of current breastfeeding is much higher than the incidence of abortion with 47 percent of the rural women and 22 percent of the urban women are currently breastfeeding. Those women breastfeeding are less likely to be contracepting in both areas, 46 percent versus 67 percent in urban, and 23 percent versus 37 percent in rural areas. In urban areas, the choice of method is not much affected by breastfeeding. In rural areas, there seems to be a distinct avoidance of the pill by those breastfeeding. This may be due to a lack of information about the compatibility of low dosage pills and breastfeeding or the lack of such pills in the rural areas. This implies that ideally we would like to model contraceptive use and breastfeeding simultaneously. Unfortunately, the data are not such that this is possible since there are no exogenous variables for identifying breastfeeding. In the parallel analysis of Zimbabwe, we were able to collect data on the price of infant formula and will use that to identify breastfeeding. In the current case, we tested the model with the breastfeeding women included and excluded and found no substantial difference in effects.

This having been said, we will examine the determinants on current contraceptive use. The structural equation explaining current use includes only nonpregnant, non-sterilized women and the dependent variable is the use of modern reversible and traditional contraceptives. The reduced form equation includes women sterilized in the last five years and includes sterilization as a method. The structural model shows that women under 35 and women married to more educated husbands in non-remote areas who did not live in rural areas at age 12 are significantly more likely to use reversible contraception than other women. In addition, the more household assets, the more likely a woman is to use contraception. As has been shown in Easterlin's work, fertility intentions play an important role in explaining usage. Women whose husbands are absent are much less likely to use contraception. Of the access variables, the number of contraceptive methods available in the community and having heard a family planning message significantly increase usage. Access to health facilities per se controlling for the number of methods available does not, as a rule, increase usage of these reversible methods. The only exception is access to the more sophisticated type 3 clinics in urban areas which has a significantly positive effect. This raises the question of why access to these facilities affects the number of live births in the live birth equation. This is a point that will be explored in our recent fertility analysis.

The reduced form analysis generally confirms the importance of the number of contraceptives available and the exposure to messages in determining current contraceptive use. It also confirms the importance of community mortality, assets and good sanitation. Again, husband's, but not wife's education significantly affects usage.

The implication of these findings will be spelled out more completely at the conclusion of the paper, but it does appear that access to health and family planning and water and sanitation, but not educational opportunities, have important effects on contraceptive use through their effects on the individual and community experience of mortality which affect fertility intentions. The number of available methods also directly affect the motivation to use contraception and the use of contraception controlling for motivation. The husband's education also plays an important role in determining motivation and usage controlling for motivation. The lack of an effect for wife's education, except on child mortality, is somewhat difficult to explain except to say that the program and the supporting social legislation has probably been able to substitute female education. This is a point that needs to be more fully explored. It may also be that fertility decisions in Tunisia are more male dominated than in some countries. This can not be the full explanation, however, because the wife's fertility intentions play an important role in explaining contraceptive use. It is surprising that her education does not affect those intentions.

To more fully explore the role of these variables on current contraceptive use, we will examine the effect that they have on the choice of individual methods in the next section.

B. Choice of Current Contraceptive Method

There are two models of current contraceptive use. The first model is a structural model which includes the fertility intentions of women. Since it is not possible to measure the intentions of sterilized women given the way the questionnaire was designed, this model excludes sterilized women just as did the structural model of current use. The choices analyzed include the choice of pill/condom/vaginals, the IUD or traditional methods. The second model is a reduced form model which excludes fertility intentions and includes the women who have been sterilized in the last five years. It is, therefore, possible to also include sterilization as one of the choices.

Table 3 reports the results of the structural model. The first point to notice is that the factors of significance differ greatly among methods. Only the absence of the husband has the same effect of reducing use for all three methods. The woman's age has no effect on use of traditional methods, but is very significant for IUD with younger women being more likely to use it than women over 35. For the pill/condom/vaginals, it is the women 26 to 35 who are most likely to use it. Wife's education has no effect on the use of any method, but husband's education has a significantly positive effect on the use of IUD and traditional methods. Residence does not affect pill use, but urban and remote residence reduce the use of the IUD. In the bivariate analysis of method choice, rural women are not more like to use IUDs. Thus, since this analysis controls for access, it may indicate that there is a greater preference for the IUD in rural areas than in

urban areas[16]. The only effect of residence at age 12 is to reduce the use of traditional methods. Household assets significantly increase the use of pills/condoms/vaginals and traditional methods, but not IUD use. This reinforces the picture of the IUD as the method most accessible to the poor and more rural population.

In terms of the motivation and access variables, there are several interesting findings. First, the motivation to restrict fertility significantly increases the use of pills/condom/vaginals and the IUD, but has no effect on the use of traditional methods. It is our hypothesis that this reflects the fact that the motivation measured here is that of the wife while the traditional methods are male controlled. Thus, it may be that highly educated males wish to restrict fertility when their wives do not use traditional methods. While male sterilization is legal in Tunisia, unlike many Moslem countries, it is not a popular choice. Second, as one would anticipate, we find that having heard a family planning message significantly increases use of the modern temporary methods, but not traditional methods. Third, whether a particular method is available in a locality has a highly significant effect on the usage of that method. This is reflected in the very high t value for the choice based coefficient. Four, the effects of health facilities as opposed to the availability of specific methods is quite mixed. Access to pharmacies and hospitals increases the use of pills/condoms/vaginals in urban areas. Doctors increase IUD use in urban areas, but type 3 clinics in rural areas reduce use of IUDs. Rather surprisingly, access to hospitals and type 2 clinics in urban areas increases the use of traditional methods. Fifth, the measures of whether field workers supply family planning methods and how frequently they are supplied have significant effects only on the use of IUD and these effects are difficult to interpret[17]. Thus, the determinants of current use of contraception as discussed above involves a choice of methods that is determined by quite diverse factors. This probably reflects the fact that each method has specific advantages and disadvantages and the balance of these factors differs by individual characteristics and perhaps by access factors as well. This explains why the literature tends to indicate that on a cross-national basis each additional method of contraception offered by a program increases overall usage by about 15 percent points. (Thapa and Kumar (1991))

As shown in Table 3, fertility intentions are generally very important in determining contraceptive use in our sample. Unfortunately, it is not possible to analyze the choice among methods including sterilization with intentions. Therefore, Table 4

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[16] This may be a true difference in preferences or a reflection that in rural areas access is measured by whether the method is available within 10 kilometers rather than five in urban areas. Thus, the general lower access in rural areas encourages the use of methods that do not require resupply. This is consistent with the findings that rural residents are also more likely to use sterilization than are those in urban areas. This is found in both the bivariate analysis and the reduced form analysis to be discussed next.

[17] Whether supplies are available reduces use, but when those supplies are available at least 4 times a month use of the IUD is increased.

reports the determinants of choice of methods deleting fertility intentions and including the exogenous factors that go into determining intentions. For the variables that are common to both the reduced form and the structural equations, the patterns of significance are identical with the exception of frequency of supplies of contraceptives. This variable was shown to significantly increase the use of IUDs when fertility intentions are controlled, but to significantly reduce the use of IUD when intentions are not controlled. This patterns is rather hard to explain unless one assumes that frequency of supplies are somehow targeted to less motivated areas. The pattern is congruent with the effect of frequency of supplies in the reduced form of current contraceptive use in Table 2.

The exogenous variables added to the reduced form equations demonstrate effects which are, for the most part, consistent with their effect on fertility intentions by reducing mortality. Higher community mortality reduces the use of IUDs and sterilization. Good sanitation increases the use of pills and IUDs. The child quality variables of access to education generally are insignificant here as elsewhere except for a perverse effect on pill use.

Use of sterilization is primarily determined by individual characteristics with younger women and those in rural areas or small cities being more likely to choose it. The only policy variable affecting use, except for whether the method is locally available as revealed by the choice based coefficient, is whether the woman had heard a family planning message.

Thus, the patterns of method choice illuminate the findings of current use of contraception in the current model (Table 2). The addition of variables on the access to each individual method proves to be important for explaining choice of method, just as the number of methods available was important for explaining overall usage. The access to health facilities more generally seems to have its effects through the motivation to control fertility by lowering mortality. Therefore, even though Tunisia has infant mortality below that of the average lower middle income country, there still appears to be potential for reductions in mortality in some areas to increase the motivation to control fertility.

C. Recent Fertility Results

Increases in contraceptive use are associated with reductions in fertility on a cross-national basis with every 15 percent points increase in usage associated with a TFR of one fewer child. (Thapa and Kumar (1991)). For various reasons this association between higher usage of contraception and lower fertility are not always observed at the individual level. This may arise either because use is ineffective, it simply duplicates natural protection from breastfeeding, or more fertile women choose to contracept masking the effect of usage. (See .....) To test the effect of usage on fertility in Tunisia controlling for unobserved factors such as individual fecundity, we have developed a five

year model which predicts the proportion of time covered by contraceptive use and the effect of that use on fertility. Table 5 presents the empirical specification of the recent fertility model. The basic individual variables are the same as those presented above. Some variables such as the asset variable have been dropped since this variable measures current assets and not assets that the household had five years ago. In the model, we first measure the number of children that a woman wanted five years ago by subtracting the number of living children at that time from the desired number of children. This measure is far from ideal since the stated number of desired fertility reflects that at the current time and not that five years ago. The determinants of this measure of motivation to restrict fertility five years ago are then estimated with an ordered probit with background characteristics, the sum of the health facilities available five years ago, community mortality and educational opportunities. This equation is then used to predict how many children a woman still wanted five years ago which is included as a determinant of the proportion of the last five years that a woman used modern temporary methods or traditional methods[18]. These proportions were estimated with tobit equations. For sterilization this procedure was not used because the tobit equation for the proportion of the five years covered by sterilization was not stable. Therefore, for sterilization a simple probit equation was used. Finally, the births in the last five years were estimated as a function of background variables and the proportion of the period covered by modern, temporary and traditional methods and whether a woman was sterilized during the last five years. Here again an ordered probit was used.

The ordered probit estimation of the number of children that a woman still wanted five years ago is determined by her age, her education, whether she lives in a remote area, community mortality and, in urban areas, how many health facilities were available five years ago[19]. As expected, there is a monotonic relationship between age and the number of children that women still wanted. The older the women, the fewer additional children she wanted. Age is by far the most dominant determinant of the number wanted. Its extreme dominance causes some problems in the identification of subsequent equations in the model. Education, however, behaves in an unexpected fashion. The women with 4 or more years of schooling wanted more children than women with less schooling. This probably reflects the fact that of two women of equal age, the more educated had married later and was thus in an earlier stage in her family building career. We could control for this factor by including martial duration in the model. Unfortunately, this would effectively include age of marriage as a variable. This is probably endogenous and since there was no way to identify it, we did not control for

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[18] The proportion of time covered by contraceptive use was determined from the contraceptive and birth histories. The exposure period was measured as 60 months less 10 months for each pregnancy. Exposure was used in the denominator and the numerator was the number of months covered by the specific method.

[19] Ideally we would have wanted to determine the number of contraceptive methods available five years ago. This was not possible given the data.

duration. Thus, education's effect here should be interpreted with caution. The other background variable of significance is residence in remote areas which increases the number of children a woman wanted. Of the community variables, by far the strongest is the level of mortality in the community. The higher the mortality, the more additional children women wanted. This is consistent with the current model discussed above. Educational opportunities had no effect. Finally, the sum of health facilities available five years ago had a significant effect on lowering additional fertility in urban, but not rural areas.

The predicted value of the number of additional children wanted is then used along with background and specific access variables to explain the proportion of time a woman had been protected by modern reversible or traditional contraception in the last five years. Given the predominant role that age plays in this predicted value, it is not surprising that age per se does not affect contraceptive use in these two equations. Of the background variables, only three show significance in the two equations combined. Urban residence increases the proportion of time protected by modern methods in the last five years. Husband's education increases and rural residence at age 12 decreases the proportion of time protected by traditional contraceptives. The number of additional children wanted does not, however, affect the proportion of time protected by either modern or traditional reversible methods. Given the importance of preferences in current use of contraception, this probably reflects the unreliability of our technique of projecting preferences back five years.

Access variables have mixed effects on usage during the five year period. Access to type 3 clinics five years ago in urban areas and access to type 2 clinics in rural areas significantly increased usage of modern reversible methods, while access to hospitals in rural areas decreased usage. This perverse result mirrors the unexpected effect of rural hospitals on births and deaths in the current analysis. For traditional contraception, access to doctors five years ago in rural areas reduced usage. This may mean that people are more likely to select modern methods where doctors are available, but this was not significant in the method choice equation. Access to type 2 clinics in rural areas significantly increased use of traditional as well as modern methods.

The equation for sterilization which does not include the predicted number of additional number of children wanted shows very significant age effects indicating that the probability of sterilization increases monotonically with age. No other individual background variables is significant. No health access variable is significant either in this equation. The only significant effects are a reduction in sterilization with higher child mortality and an increase with increased access to education in urban areas[20].

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[20] This is the only place where access to education has significant effects in the expected direction. We are, thus, unwilling to put much weight on the observed effects.

The ultimate equation in the structural model for recent fertility is the number of births in the last five years. Here, we find that the predicted use of various kinds of family planning in the last five years is only significant for modern reversible methods and here it is strongly significant. Several of the background variables are significant as well. The number of births in the last five years decreases monotonically with age and with urban residence. It increases with location in remote areas and rather surprisingly with female education of four to six years. Again, this latter result may arise from the fact that age of marriage has not been controlled as discussed above.

In general, this structural model does not prove very satisfying. In part this probably arises from the fact that fertility intentions five years ago are very poorly approximated by our measurement procedure and poorly explained by the current variables at hand. There is no way around such problems except to use panel data sets. These are rarely available in developing countries. In the US the National Fertility Survey has had such data and this has been used effectively for these purposes by Rosenzweig and Schultz (198-).

Given our disappointment with the structural model, we estimated reduced form equations for the proportion of time covered by contraception (modern reversible or traditional) in the last five years and the number of births in the last five years. These are shown in Table 6. Age has significant effects on the expected sign in all three cases, unlike the structural equations for use. Education has a more significant effect as well: 1) wife's education beyond seven years increases the proportion of time protected by modern reversible methods, 2) husband's education increases usage of traditional methods, and 3) wife's education of four to six years increases fertility. The first effect was not observed in the structural equations and is the only expected effect of wife's education on contraceptive use or fertility in either the current or the five year model. Rural residence at age 12 also plays a larger role in this formulation, reducing the use of modern reversible or traditional methods and increasing fertility. The effect of access variables remains the same between the two equations. Higher community mortality significantly reduces the use of modern reversible methods and surprisingly increases the use of traditional methods[21]. It also has a significant effect of increasing fertility in the last five years. Thus, with the exception of its effect on the proportion of time covered by use of traditional methods, community mortality plays perhaps the most consistent role in fertility transition of any community variable between both the current and the five year analysis, but the analysis of current behavior indicates that access to specific methods as opposed to access to health facilities per se is extremely important in determining use of modern contraception.

[21] This is the only unexpected effect of community mortality in the entire analysis and is not easy to explain.

VI. Summary of the Findings and their Policy Implications

To summarize the diverse finding above, it is useful to focus our discussion on several policy questions: 1) what is the relative importance of various social services on contraceptive use and fertility? 2) does access to contraception affect the motivation to use contraception or only affect use controlling for motivation? and 3) has the very good family planning program been able to eliminate disparities in access by socio-economic groups? In the summary of findings we will focus on the results of the current analysis for the most part because of the instability of the five year analysis. The five year analysis does confirm that usage of modern reversible methods unequivocally reduces fertility.

A. Importance of Access to Social Services

The social services explored in this analysis are the access to educational opportunities, the access to health facilities, the access to family planning, and the access to good water and sanitation. Educational opportunities do not appear to play a role in determining contraceptive use and fertility in Tunisia. This may be the result of the limited amount of information on education collected in the survey, but there is little evidence of strong educational factors in general which leads us to question the quantity-quality trade-off discussed in the literature. This is fairly consistent with evidence in the literature that it is generally access beyond primary school that begins to have its effects on motivating people to restrict fertility. (See Cochrane, Kozel and Alderman 1991; Knodel et al. 1990)

Access to health facilities, on the other hand, play an important role in determining motivation to use contraception through its effects on births and deaths and a much more limited effect on contraceptive use per se. This data set allowed us to create and use a new measure of access to health facilities, a woman's access when she was age 20. In urban areas, access to doctors, type 3 clinics and pharmacies at that age reduced the number of living children, but had no effect on child deaths. In rural areas, access to both types of clinics and pharmacies reduced fertility and access to the two types of clinics reduced mortality. Rather perversely access to hospitals in rural areas increased births and deaths and access to doctors increased deaths. This may imply that the trade-offs between providing more expensive physician and hospital based care and providing clinic based care has not been made appropriately in rural Tunisia in the past. Controlling for the availability of contraception, current access to health facilities per se only rarely affects current use of contraception or the choice of a specific method and in a number of cases perverse results are observed. Only type 3 clinics have a positive

effect on current use in urban areas, but in rural areas those clinics decrease use of IUDs[22]. Pharmacies in urban areas increase use of the pill and other supply methods in both structural and reduced form models. Health access also seems to increase the use of traditional methods. In particular, access to hospitals in urban areas seem to increase their use in both structural and reduced form equations. This is difficult to explain. In general the effects of hospitals are not what is expected and further in country analysis of hospitals, particularly in the central part of the country seems necessary.

Access to family planning methods are the most consistent policy variables affecting use in both structural and reduced form equations on contraceptive use. This is revealed by the importance of the number of methods available in a community in the current use of contraception and of access to specific methods in the choice of specific methods as revealed by the choice based coefficients. The only anomaly in the availability of methods is reflected by whether supplies of contraception are said to be available in the community and the frequency with which supplies are brought. Frequency reduces overall use in the reduced form, but not in the structural equations. In the method specific equations, frequency increases use of the IUD in the structural and reduces it in the reduced form while the presence of supplies reduces IUD use in the structural equation. It has been found elsewhere that access to contraceptive supplies can reduce the use of IUDs because it might be chosen instead of supply methods when supplies of other contraceptives are not available. (See Cochrane (1973)) and more recently.....) More information on the process of supplying contraceptives in rural areas is needed to evaluate these ambiguous results. Nevertheless, the persistence of the other measures of access to family planning are indicators of their important role in a policy to increase contraceptive usage. Finally, another measure of accessibility of family planning in its broadest sense is the knowledge that people have about it. Women who have heard a message on the media about family planning in the last month were consistently more likely to use contraception and to use every method of contraception except traditional methods.

Finally access to good water and sanitation have significant effects in several equations, either in reducing deaths or increasing usage in general or in the choice of modern reversible methods. Their effects on usage probably operates through mortality which in turn affects motivation to restrict fertility. The effect of motivation on use of contraception and the determinants of that motivation are important for the appropriate design of policy.

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[22] This may be due to the fact that when clinic access is limited, women tend to select a method that does not require resupply and thus will choose the IUD. When clinics are available they will select other resupply methods.

B. The Role and Determinants of Fertility Intentions

As has been found in the work of Easterlin and various co-authors, the motivation to restrict fertility as measured by fertility intentions is very important in determining contraceptive behavior. Two questions, however, have not been addressed adequately in the earlier literature: 1) how is the motivation to postpone a birth to be incorporated along with the motivation to have no more children? and 2) does the costs of fertility regulation as measured by access to family planning affect fertility intentions? These two questions are central to addressing the issue of identifying where programs are most likely to be effective and to deciding whether services should be targeted to areas where and/or to individuals for whom the motivation to restrict fertility exists or provided more broadly to stimulate the motivation to restrict fertility.

Our analysis incorporates both the desire to postpone a birth and the desire to have no more children and, thus, should affect the motivation to space as well as limit births. The analysis shows this variable to be of significance in the choice to use contraception in general and the decision to use reversible modern contraception. Although the data do not permit us to determine its role in choosing sterilization, it is no doubt central to that decision as well. What then determines the fertility intentions of women and thus their motivation to use contraception?

The current number of living children has the highest level of significance in determining the fertility intentions. Second in importance is the age of the woman. Next in significance are the level of mortality in the community and the number of contraceptives available. These have identical t values. This implies that programs to reduce mortality and make family planning available are both central to stimulating the motivation to use contraception. This further implies that a family planning program that targeted services only to areas where there is expressed demand to restrict fertility may not be optimal. The appropriate emphasis to give to health and family planning in the Tunisia context depends on a comparison of the magnitudes of the effects of various services through different channels. A simulation exercise will be carried out in a later three country comparison to determine the optimal strategy in different environments. At this point, it is sufficient to note that a narrowly targeted program may miss a major avenue whereby contraceptive use would be increased.

Finally, it should be noted that we do not find that education plays the role we would have expected in stimulating the intention to restrict fertility in Tunisia. Wife's education rarely has any effect. This lack of effect at this point in the model could not result from a failure to control for marital duration, because we have controlled for the number of living children. Husband's education does increase the wife's motivation to restrict fertility, but it shows a somewhat lower level of significance than community mortality or the number of contraceptives available. It should also be noted that neither residence nor household economic circumstances as measured by assets or land ownership have any effect on motivation.

C. The Effect of the Family Planning Program in Eliminating Socioeconomic Differentials

There are two questions that need to be addressed with respect to the program and socioeconomic development: 1) is the program substituting for educational expansion? and 2) has the program been able to eliminate inequality of access by poor and more rural women?

In the discussion of the family planning program in the first part of the paper, we observe that Tunisia has fertility much lower than would be expected for its level of female education and has a fertility level somewhat higher than would be expected for its level of program effort. This implies that program effort may be substituting for higher levels of female education. Does the evidence at the individual level tend to support this? As mentioned above, female education has no effects on fertility intentions, contraceptive use or choice of specific methods in the current model. It has perverse effects in the five year model which probably arise from the inability to control for marital duration. Female education beyond seven years does reduce infant and child deaths and through that might indirectly affect contraceptive use. It does not do so, however. We, therefore, conclude that the program and supporting social legislation on the status and rights of women have played an important part in eliminating differences between women in contraceptive use. This is not to imply that there are not large difference in use among the educational groups, but that these are largely explained by other factors. One such factor may be that since female education has been expanding rapidly, it is highly correlated with age. Thus, age may pick up some education effects. If this is the case, it is not noticeable in terms of unusual age effects. We conclude, therefore, that female education plays less of a role in determining contraceptive use in Tunisia at the present time than elsewhere because of the strong program.

Does this mean that the program has equalized both motivation to control fertility and access to family planning among the motivated across all groups? The answer here appears to be negative. Husband's education, remote residence and household assets all play a role in determining contraceptive use and method choice. Husband's education also increases motivation as discussed above. While access to the IUD and, to a lesser degree, sterilization have greatly increased access to contraception in the rural areas, we still find that, even controlling for motivation and access to family planning, husband's education and assets increase use of the IUD in rural areas and remote residence reduces its use. This implies that there is some element in the program that is not equal for all groups, such as the quality of services or that the poor are less able to use the program either because of fees or other less obvious restrictions. The use of the pill, condoms and vaginals are also affected by family assets, but not husband's education. This is clearly an effect of fees, because while people may be started on these methods by the program, they are generally resupplied through pharmacies and access to pharmacies have a significant effect on their use in urban areas and pharmacies are rarely available in rural areas.

D. In Summation

In summarizing the findings of this paper, it is important to separate the lessons learned across time from the Tunisia experience and the lessons that can be learned from the cross-sectional analysis presented in this paper. As revealed in the discussion of the demographic history in Tunisia, there has been a strong program, good supportive social legislation and the expansion of female education. All of these have played an important role in reducing fertility across all educational and presumably social economic groups. A large part of the fertility decline is explainable by increases in the age of marriage which is probably directly attributable to increases in female education and social legislation that has contributed to greater rights of women. This legislation has ranged from the abolition of polygamy to increased rights in the work force. For guiding other countries on the way to stimulate fertility decline, more analysis is needed on the way that changes in marriage behavior has been brought about in Tunisia. While comparative analysis of the 1978 WFS, the 1988 DHS and earlier surveys would be useful here, the cross- sectional analysis of this paper could not address the issues of the determinants of the age of marriage.

A second major factor in fertility decline has been the increased use of contraception. Over time, this has resulted both from an increase in the number of women with education and also increases in the use of contraception among all educational groups. This latter effect has been the result of a strong program and contraceptive use has increased by the greatest percentage among the least educated over the last 10 years. Although there has been a substantial program to improve access of the rural, poor and least educated to family planning, these groups are still less well served than the more privileged. This is revealed by the fact that the uneducated women have on average one child more than they say they want.

The history of the fertility decline in Tunisia should be more thoroughly studied by other countries embarking on a program to stimulate their own demographic transition. Cross-sectional analysis of the determinants of contraceptive use and fertility as carried out in the paper can be used to guide Tunisia itself on where it might most profitably expand its activities to further increase contraceptive use and thus fertility decline. The results here show the very central role of mortality decline and access to contraception in this process. Health facilities, particularly clinics, and good water are important in reducing mortality which in turn increases the motivation to contracept and thus contraceptive use. These effects, however, are lagged. It seems to be access to these facilities at age 20 that matters more than current access. Thus, a long-term program of further reductions of mortality is important. Hospitals and doctors in rural areas appear to play a less clear role than clinics, but further analysis of the determinants of mortality, particularly in rural areas would be needed for designing a health strategy.

An equally important factor in increasing the motivation to use contraception and the use of contraception among the motivated, is the access to family planning methods. The very strong effects of these variables in this analysis may seem self evident, but a great deal of the literature has failed to find consistent effects of access on use. Part of the reason such strong effects have been found here is the result of the structural model developed. Many earlier studies have failed to distinguish the various channels through which access operates and thus washed out effects. (See Billsborrow and Guilkey 1987) In addition, the results do reveal that in Tunisia today greater expansion of access would significantly increase use. Despite the successes of the program, there also appears to be continued limitations on access among certain socioeconomic groups and these limitations need to be eliminated.

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Table 1. Tunisian Legislative Changes

1) **Personal Status Code of August 13, 1956**

This code granted Tunisian women the civil status of majority. The code abrogated polygamy and abandonment, and established divorced laws. The code also forbade the marriage of pre-adolescent girls (minimum legal age of 15) and guaranteed freedom of choice of the spouse.

2) **Law of November 1958**

Adopted a plan for school attendance, however, no mandatory attendance requirements were placed on education.

3) **Law of January 9, 1961**

Re-established the legal importation, sale and distribution of contraceptive products. (Repealed the 1920 French Law which prohibited such products)

4) **Law of December 31, 1962**

A. Limited the payment of welfare benefits for families with dependent children to the first four children only.

B. Limited tax allowances and salary allowances for the head of the household to the first four children only.

5) **Law of February 20, 1964**

Established a new minimum legal age for marriage, 17 for women and 20 for men, thus, changing the Personal Status Code of 1956.

6) **National Family Planning Program, 1966**

Established the following fundamental objectives:

A. Improvement of the quality of life of the citizen.

B. Realization of demographic balance through controlling the process of procreation.

C. Safeguarding the health of mothers and children.

D. Promotion of the flourishing of the basic cell upon which all society is built, the family.

7) **National Institute of Family Planning and Maternal and Infant Health Care**

Assist the Family Planning Administration of the Ministry of Public Health with the National Family Planning Program. The institute was responsible for all activities relevant to family planning (i.e., medical, educational, and training).

Table 1 (con'd)

8) **Law of July 1, 1965**

This law legalized abortion under sanitary conditions by a doctor during the first three months of the pregnancy and only after the birth of the fourth child.

9) **Labor Law of April 30, 1966**

A. Guaranteed women equal right to employment.

B. Forbade the employment of children under 15 years of age in industry.

10) **Law of March 23, 1973**

Shifted the Family Planning Program to the Office of Family Planning and Population under the auspices of the Ministry of Public Health.

11) **Law of January 13, 1987**

Changed the National Office of Family Planning and Population to the National Office of the Family and Population.

12) **Decree of January 31, 1974**

Provided for joint operation of the National Office of the Family and Population and the Superior Council of Population. Established regional population councils.

13) **Law of September 26, 1973**

Further liberalized the practice of abortion. Legalized abortion within the first three months of pregnancy provided that it be carried out in a "suitable facility."

14) **Decree of December 27, 1985**

A. Regarding regulation of marriage certificates.
Established that each prospective spouse would undergo a complete medical examination, including blood count, prior to marriage. The examining physician would then provide suggestions on birth spacing.

15) **Law of May 6, 1988**

Limited benefit payments to families for the first three dependent children.

Table 2. Model of Current Contraceptive Use in Tunisia:
Estimated Coefficients and t values for Structural and Reduced Form Equations
(Urban and Rural Areas Combined)

Variables	Structural Equations				Reduced Form
	Births	Deaths	Fertility Intention+	Contraceptive Use	Contraceptive Use
Age 15-25	-3.03 (18.21)***	-0.49 (7.78)***	-0.41 (3.56)***	0.70 (2.12)**	-0.64 (4.94)***
Age 26-30	-2.07 (15.27)***	-0.40 (7.21)***	-0.52 (5.48)***	0.88 (3.24)***	-0.15 (1.27)
Age 31-35	-1.02 (8.66)***	-0.29 (5.53)***	0.55 (5.10)***	0.67 (2.94)***	0.10 (0.87)
Education spouse	-0.04 (2.73)***	-0.01 (1.38)	0.03 (2.67)***	0.06 (2.99)***	0.05 (2.67)***
Education 4-6	-0.08 (0.63)	-0.77 (1.57)	0.01 (0.14)	-0.04 (0.29)	-0.15 (1.05)
Education $\geq$ 7	-0.08 (0.41)	-0.13 (2.36)***	0.00 (0.01)	0.02 (0.11)	-0.10 (0.47)
Rural age 12	0.23 (2.31)**	0.02 (0.69)	-0.10 (1.36)	-0.24 (1.82)*	-0.22 (1.63)
Small city	0.30 (2.61)***	0.05 (1.41)	-0.06 (0.62)	0.17 (1.05)	0.09 (0.60)
Urban	-0.88 (4.31)***	-0.23 (2.86)***	-0.07 (0.32)	-0.42 (0.76)	-0.60 (1.06)
Remote	0.06 (0.42)	-0.00 (0.01)	0.02 (0.15)	-0.29 (1.66)*	-0.25 (1.55)
Doctor $\leq$ 5, age 20	-0.20 (1.78)*	0.02 (0.63)			
Clinic 2 $\leq$ 5, age 20	-0.07 (0.64)	0.04 (1.27)			
Clinic 3 $\leq$ 5, age 20	-0.20 (1.71)*	0.02 (0.60)			
Hospital $\leq$ 5, age 20	-0.21 (1.60)	-0.02 (0.41)			
Pharmacy $\leq$ 5, age 20	-0.65 (4.18)***	-0.02 (0.56)			
Doctor $\leq$ 10, age 20 #	-0.18 (0.60)	0.45 (1.86)*			
Clinic 2 $\leq$ 10, age 20 #	-0.73 (2.47)***	-0.33 (4.23)***			
Clinic 3 $\leq$ 10, age 20 #	-0.94 (4.96)***	-0.15 (2.31)**			
Hospital $\leq$ 10, age 20 #	0.78 (2.28)**	0.26 (2.87)***			
Pharmacy $\leq$ 10, age 20 #	-1.18 (4.98)***	-0.10 (1.39)			
Good water		-0.83 (1.88)*			-0.00 (0.02)
Good sanitation		-0.42 (0.79)			0.25 (1.66)*
Methods available			0.10 (3.13)***	0.28 (5.02)***	0.24 (5.39)***
Message			0.06 (1.07)	0.32 (3.32)***	0.33 (3.51)***
Own land			-0.13 (1.11)		-0.27 (1.51)
Sum assets			-0.02 (1.16)	0.12 (3.26)***	0.06 (1.90)*
Ed opportunities $\leq$ 5 km			-0.01 (0.14)		-0.18 (1.64)
Ed opportunities $\leq$ 10 km			-0.01 (0.09)		0.09 (0.48)
Community mortality			-4.39 (3.13)**		-5.43 (2.09)**

Table 2 (con'd)

Variables	Structural Equations				Reduced Form
	Births	Deaths	Fertility Intention+	Contraceptive Use	Contraceptive Use
Living children			0.48 (7.73)***		
Doctor ≤ 5 km				0.19 (0.82)	0.22 (0.80)
Clinic 2 ≤ 5 km				0.13 (0.85)	-0.08 (0.43)
Clinic 3 ≤ 5 km				0.32 (2.31)**	0.19 (1.02)
Hospital ≤ 5 km				0.10 (0.53)	0.22 (1.61)
Pharmacie ≤ 5 km				0.55 (1.09)	0.56 (1.09)
Doctor ≤ 10 km #				0.43 (0.93)	0.45 (0.77)
Clinic 2 ≤ 10 km #				-0.38 (0.87)	0.51 (0.98)
Clinic 3 ≤ 10 km #				-0.26 (0.89)	-0.35 (1.29)
Hospital ≤ 10 km #				-0.20 (0.49)	0.05 (0.14)
Pharmacy ≤ 10 km #				0.36 (1.37)	0.33 (1.11)
Fertility Intentions				1.41 (3.29)***	
Husband absent				-0.55 (4.80)***	-0.48 (3.89)***
r supplies				0.34 (1.54)	0.27 (0.89)
r freq sup				-0.38 (1.16)	-0.53 (1.66)*
Constant	6.19 (34.13)	0.93 (10.53)	0.36 (1.16)	-6.02 (4.50)***	-0.40 (0.83)
N	2860	2860	2860	2860	3064
R^2	45	15			
OLS corrected for unobserved	Threshold		1.08 (17.14)***		

* significant at 10%
** significant at 5%
*** significant at 1%

Rural areas

+ 3 if wants no more children
2 if wants to want two years
1 if wants another children

Table 3. Structural Equations for Current Contraceptive Choice for Tunisia

Variables	Pills/Condoms/ Vaginals	IUD	Traditional Methods
Age 15-25	0.58 (1.56)	1.50 (3.15)***	-0.50 (1.06)
Age 26-30	0.84 (2.71)***	1.51 (4.31)***	-0.08 (0.21)
Age 31-35	0.71 (3.15)***	0.92 (3.61)***	0.08 (0.25)
Education spouse	0.01 (0.30)	0.04 (1.97)**	0.14 (4.57)***
Education 4 to 6	-0.16 (0.81)	0.1C (0.55)	0.03 (0.13)
Education 7+	0.41 (1.48)	0.02 (0.08)	-0.21 (0.56)
Rural age 12	-0.11 (0.64)	-0.20 (1.55)	0.39 (1.99)**
Small city	0.14 (0.60)	-0.09 (0.58)	-0.16 (0.66)
Urban	-1.28 (1.32)	-5.26 (6.85)***	0.45 (0.70)
Remote	0.34 (1.26)	-3.78 (1.86)*	-0.13 (0.30)
Message	0.34 (2.49)***	0.61 (6.06)***	0.14 (0.82)
Sum assets	0.15 (2.93)***	0.06 (1.33)	0.13 (2.38)***
Doctor $\leq$ 5 km	0.12 (0.38)	0.93 (2.50)***	0.56 (1.45)
Clinic 2 $\leq$ 5 km	-0.18 (0.74)	-0.21 (1.29)	0.37 (2.07)**
Clinic 3 $\leq$ 5 km	0.17 (0.62)	-0.09 (0.47)	-0.10 (0.52)
Hospital $\leq$ 5 km	0.34 (1.82)*	0.15 (1.16)	0.39 (2.04)**
Pharmacy $\leq$ 5 km	1.14 (1.88)*	0.16 (0.26)	0.07 (0.12)
Clinic 3 < 10 km #	-0.55 (0.75)	-5.28 (11.25)***	-0.11 (0.22)
Supplies #	0.13 (0.27)	-3.37 (6.18)***	-0.13 (0.12)
Frequency supplied #	-0.06 (0.09)	2.53 (3.89)***	0.85 (0.78)
Husband Absent	-0.50 (2.63)***	-0.35 (2.32)**	-0.72 (3.60)***
Fertility Intentions	.02 (2.14)**	2.47 (3.46)***	0.65 (1.18)
Constant	-4.75 (2.99)***	-3.71 (1.69)**	4.40 (3.01)***
Choice Based Coefficient	6.74 (9.26)***	--	--
N Based	2840	--	--

\# Rural areas
* Significant at 10% level
** Significant at 5% level
*** Significant at 1% level

Table 4. Reduced Form Equations for Current Contraceptive Choice for Tunisia

Variables	Pills/Condom/ Vaginal	IUD	Traditional Methods	Sterilization
Age 15-25	-0.24 (1.22)	-0.20 (1.16)	-0.98 (4.64)***	-3.25 (5.59)***
Age 26-30	0.12 (0.68)	0.27 (1.74)*	-0.48 (2.58)***	-1.43 (5.54)***
Age 31-35	0.36 (2.04)**	0.31 (2.03)**	-0.23 (1.44)	-0.15 (0.85)
Education spouse	0.01 (0.51)	0.04 (1.96)**	0.13 (4.13)***	-0.04 (0.94)
Education 4 to 6	-0.15 (0.71)	-0.03 (0.17)	0.04 (0.17)	-0.02 (0.08)
Education 7+	0.23 (0.78)	-0.08 (0.36)	-0.14 (0.35)	-0.13 (0.30)
Rural age 12	-0.16 (0.90)	-0.18 (1.19)	-0.42 (2.06)**	0.04 (0.21)
Small city	-0.02 (0.06)	-0.09 (0.51)	-0.05 (0.18)	0.55 (1.79)*
Urban	0.60 (0.62)	-0.42 (0.56)	0.69 (0.61)	-1.89 (1.94)*
Remote	-0.13 (0.41)	-0.44 (1.85)*	-0.56 (1.47)	-0.12 (0.41)
Message	0.29 (2.05)**	0.46 (3.85)***	0.13 (0.82)	0.35 (2.13)**
Sum assets	0.09 (1.95)*	0.03 (0.65)	0.05 (0.98)	0.06 (0.88)
Doctor $\leq$ 5 km	0.54 (2.49)***	0.61 (1.55)	0.43 (1.08)	0.41 (0.69)
Clinic 2 $\leq$ 5 km	0.04 (0.16)	-0.05 (0.29)	-0.30 (1.22)	0.17 (0.52)
Clinic 3 $\leq$ 5 km	0.26 (0.84)	0.08 (0.41)	0.09 (0.41)	0.42 (1.35)
Hospital $\leq$ 5km	-0.07 (0.26)	0.17 (1.05)	0.42 (1.98)**	-0.46 (1.48)
Pharmacy $\leq$ 5 km	1.21 (1.72)*	-0.13 (0.22)	-0.00 (0.00)	0.49 (0.50)
Clinic 3 < 10 km #	0.58 (1.05)	-0.34 (0.66)	-0.22 (0.34)	-0.33 (0.76)
Supplies #	0.20 (0.61)	0.25 (0.52)	-0.52 (0.39)	-0.02 (0.03)
Frequency supplied #	-0.02 (0.04)	-1.12 (2.09)**	1.07 (0.73)	-0.03 (0.04)
Husband Absent	0.54 (2.49)***	-0.39 (2.42)***	-0.72 (3.22)***	-0.67 (2.48)***
Community mortality	2.94 (0.73)	-9.90 (3.14)***	0.52 (0.10)	-14.77 (2.92)***
Education opp. $\leq$ 5	-0.35 (2.01)**	-0.14 (1.10)	-0.12 (0.83)	0.09 (0.38)
Education opp. $\leq$ 10	0.15 (0.76)	0.08 (0.48)	0.27 (1.25)	0.07 (0.31)
Good water	-0.12 (0.61)	0.21 (0.99)	-0.10 (0.40)	0.08 (0.34)
Good sanitation	0.50 (1.76)*	0.45 (2.35)***	0.52 (1.11)	-0.31 (1.18)
Own land	-0.28 (0.72)	-0.46 (1.60)	-0.22 (0.67)	0.18 (0.71)
Constant	-2.99 (4.33)***	-0.22 (0.35)	-2.54 (2.51)*	0.66 (0.63)
Choice based coefficient	0.58 (2.92)***	--	--	--
N	3064	3064	3064	3064

\# Rural areas
* Significant at 10% level
** Significant at 5% level
*** Significant at 1% level

Table 5. Model of Contraceptive Use and Fertility in the Last Five Years in Tunisia

Variables	Structural Equations				
	Addition Children Wanted 5 Years Ago	Proportion of Last 5 Years Protected by Temporary Modern Methods	Proportion of Last 5 Years Protected by Traditional Methods	Probability + Sterilized in Last 5 Years	Births in Last 5 Years
Age 15-25	1.92 (17.64)***	0.83 (0.73)	-0.82 (1.11)	-0.91 (3.29)***	1.48 (7.97)***
Age 26-30	1.42 (22.70)***	0.56 (0.75)	-0.42 (0.75)	-0.66 (5.23)***	1.16 (9.19)***
Age 31-35	0.72 (12.23)***	0.29 (0.94)	-0.29 (1.16)	-0.15 (1.74)*	0.88 (9.65)***
Education spouse	-0.01 (0.74)	-0.01 (1.38)	0.06 (4.80)***	-0.03 (1.33)	-0.00 (0.17)
Education 4-6	0.20 (2.38)***	0.15 (1.03)	0.01 (0.08)	-0.03 (0.03)	0.21 (2.15)**
Education 7+	0.22 (1.70)*	0.20 (1.20)	-0.16 (0.97)	-0.06 (0.26)	0.11 (0.65)
Rural 12	-0.02 (0.36)	-0.06 (1.36)	-0.19 (2.25)**	0.05 (0.56)	0.05 (0.52)
Small city	0.06 (0.74)	-0.03 (0.42)	-0.06 (0.55)	0.19 (1.41)	0.16 (1.60)
Urban	-0.15 (0.72)	0.28 (2.23)**	0.44 (1.47)	-0.60 (1.63)	-0.22 (1.68)*
Remote	0.13 (1.98)**	-0.05 (0.60)	-0.12 (0.84)	-0.14 (0.89)	0.15 (1.95)*
Sum facilities $\leq$ 5, 5 years ago	-0.05 (1.79)*				
Sum facilities $\leq$ 10, 5 years ago	0.03 (0.95)				
Community mortality	3.32 (3.45)***			-4.56 (1.91)*	
Educ opportunities $\leq$ 5	0.02 (0.40)			0.17 (2.04)**	
Educ opportuntiies $\leq$ 10	-0.02 (0.25)			-0.01 (0.07)	
Doctor $\leq$ 5, 5 yrs ago		0.08 (1.37)	0.01 (0.01)	-0.16 (1.62)	
Clinic 2 $\leq$ 5, 5 yrs ago		0.08 (1.00)	-0.13 (1.26)	0.05 (0.27)	
Clinic 3 $\leq$ 5, 5 yrs ago		0.11 (1.97)**	-0.02 (0.17)	-0.08 (0.70)	
Hospital $\leq$ 5, 5 yrs ago		-0.10 (1.27)	0.20 (1.59)	0.00 (0.01)	
Pharmacy $\leq$ 5, 5 yrs ago		-0.03 (0.41)	0.10 (0.90)	-0.17 (1.39)	
Doctor $\leq$ 10, 5 yrs ago #		-0.18 (0.82)	-1.10 (5.35)***	0.11 (0.30)	
Clinic 2 $\leq$ 10, 5 yrs ago #		0.28 (2.09)**	0.51 (1.86)*	0.11 (0.51)	
Clinic 3 $\leq$ 10, 5 yrs ago #		0.16 (1.32)	0.20 (1.22)	-0.15 (0.82)	
Hospital $\leq$ 10, 5 yrs ago #		-0.31 (2.10)**	-0.14 (0.44)	-0.32 (0.74)	
Pharmacy $\leq$ 10, 5 yrs ago #		0.19 (1.63)	0.23 (0.95)	0.41 (1.50)	
Still want, 5 yrs ago		-0.35 (0.63)	0.16 (0.43)		
Proportion 5 yrs modern temp.					-2.67 (6.71)***
Proportion 5 yrs, traditional					-1.18 (0.68)

Table 5 (con'd)

Variables	Structural Equations				
	Addition Children Wanted 5 Years Ago	Proportion of Last 5 Years Protected by Temporary Modern Methods	Proportion of Last 5 Years Protected by Traditional Methods	Probability + Sterilized in Last 5 Years	Births in Last 5 Years
Probability sterilized					-0.23 (0.22)
Constant	-0.76 (5.21)***	0.19 (0.26)	-1.64 (2.12)**	0.54 (1.40)	0.95 (0.66)
Thresholds 1	0.64 (25.09)***				0.99 (2.65)***
2	1.33 (32.54)***				2.28 (3.31)**
3	2.07 (35.08)***				
N	2438	2438	2438	2627	2627

\+ Reduced Form
\# Rural
* Significant at 10% level
** Significant at 5% level
*** Significant at 1% level

Table 6. Reduced Form Equations for Contraceptive Use and Fertility in the Last Five Years in Tunisia

Variables	Proportion of Last Five Years with Modern Temporary	Proportion of Last Five Years with Traditional	Births Last Five Years
Age 15-25	0.11 (1.64)	-0.42 (2.50)***	1.26 (12.58)***
Age 26-30	0.09 (2.37)***	-0.17 (2.54)***	1.00 (17.75)***
Age 31-35	0.11 (3.28)***	-0.17 (2.64)***	0.70 (14.62)***
Education spouse	-0.01 (1.28)	0.06 (4.73)***	-0.01 (0.87)
Education 4-6	0.07 (1.48)	-0.02 (0.19)	0.14 (1.78)*
Education 7+	0.12 (1.96)**	-0.17 (1.05)	0.02 (0.21)
Rural 12	-0.08 (1.91)*	-0.21 (2.55)***	0.18 (2.82)***
Small city	0.01 (0.25)	-0.08 (0.81)	0.14 (1.57)
Urban	-0.02 (0.13)	0.44 (1.55)	-0.10 (0.46)
Remote	-0.06 (0.78)	-0.10 (0.71)	0.13 (1.82)*
Doctor $\leq$ 5, 5 years ago	0.05 (0.97)	-0.01 (0.11)	-0.13 (1.48)
Clinic 2 $\leq$ 5, 5 years ago	0.07 (1.15)	-0.14 (1.24)	-0.03 (0.31)
Clinic 3 $\leq$ 5, 5 years ago	0.17 (3.12)***	-0.03 (0.39)	-0.12 (1.26)
Hospital $\leq$ 5, 5 years ago	-0.03 (0.39)	0.21 (1.64)	0.01 (0.06)
Pharmacy $\leq$ 5, 5 years ago	-0.00 (0.06)	0.07 (0.76)	-0.13 (1.21)
Doctor $\leq$ 10, 5 years ago #	-0.26 (1.63)	-10.42 (40.37)***	0.10 (0.58)
Clinic 2 $\leq$ 10, 5 years ago #	0.33 (4.79)***	0.41 (2.73)***	-0.27 (1.92)*
Clinic 3 $\leq$ 10, 5 years ago #	0.05 (0.47)	0.16 (0.85)	-0.04 (0.43)
Hospital $\leq$ 10, 5 years ago #	-0.29 (2.00)**	-0.12 (0.32)	0.18 (0.96)
Pharmacy $\leq$ 10, 5 years ago #	0.15 (1.15)	0.17 (0.49)	-0.05 (0.37)
Community mortality	-2.44 (4.55)***	1.63 (2.41)***	2.65 (2.30)**
Education opportunities $\leq$ 5	0.03 (0.58)	-0.01 (0.19)	-0.03 (0.58)
Education opportunities $\leq$ 10 #	-0.02 (0.29)	-0.02 (0.12)	0.02 (0.26)
Constant	0.05 (0.37)	-1.44 (6.03)***	0.00 (0.02)

\# Rural areas
* Significant at 10% level
** Significant at 5% level
*** Significant at 1% level

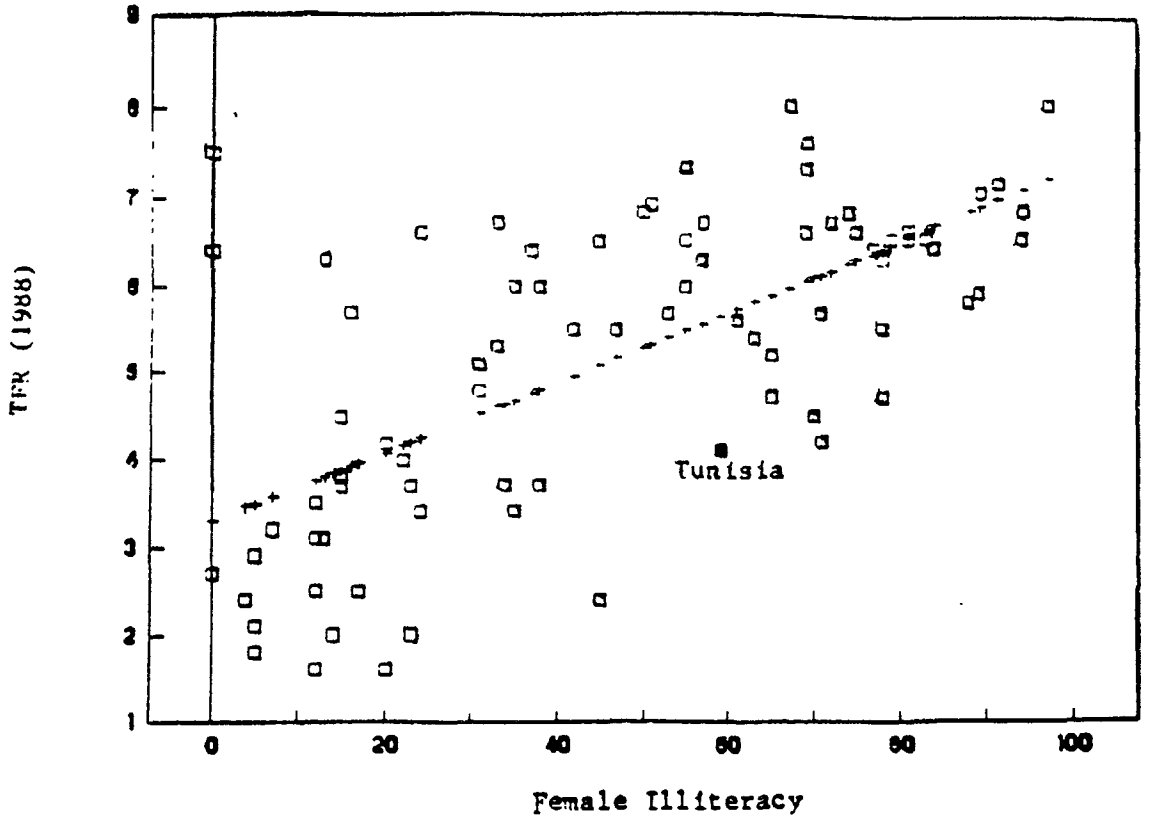

TFR (1988)
8
7
6
5
4
3
2
1
0
20
40
60
80
100
Tunisia
Female Illiteracy

FIGURE 1

MODEL OF RELATIONSHIPS TO BE STUDIED

(The Relationships which have solid lines will be studied in the research project. Variable definitions are attached as a supplement)

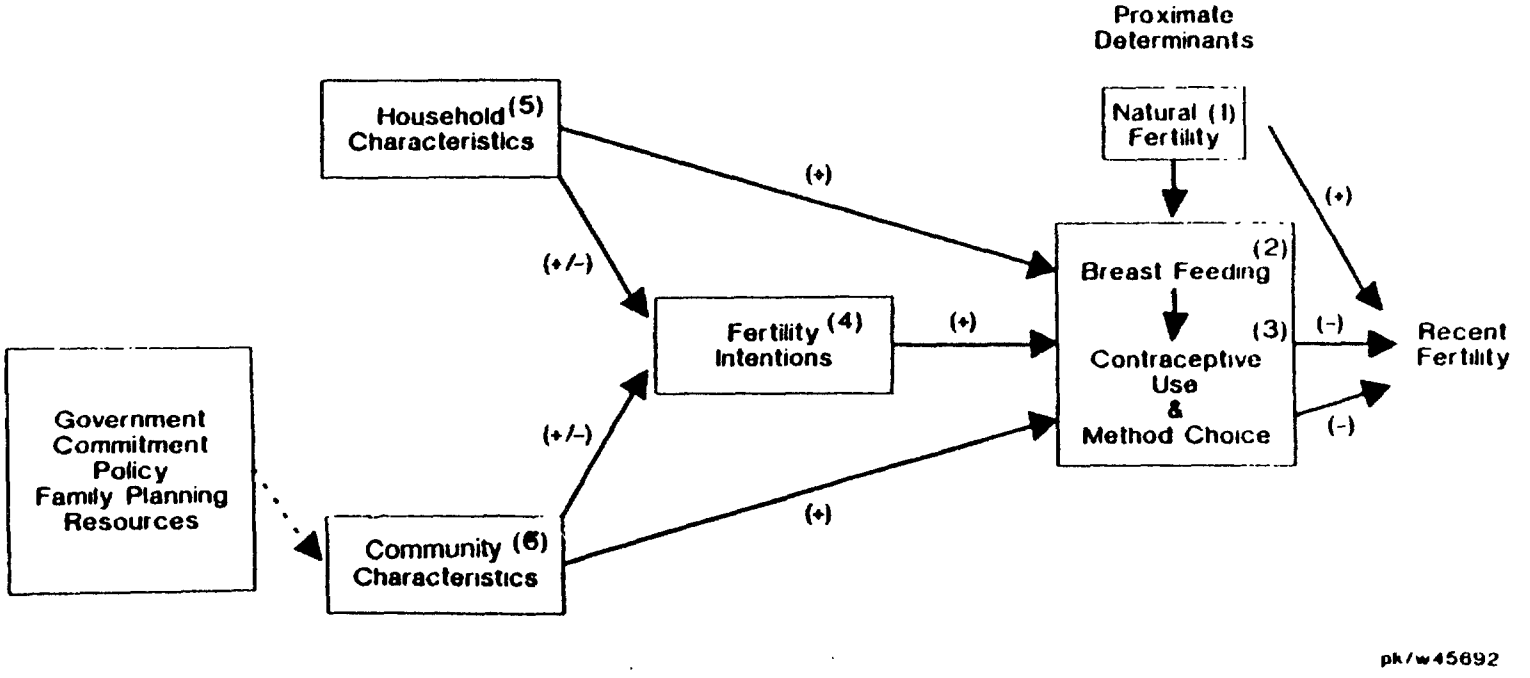


FIGURE 2

Figure 3
Structural Model of the Determinants
of Contraceptive Use in Tunisia

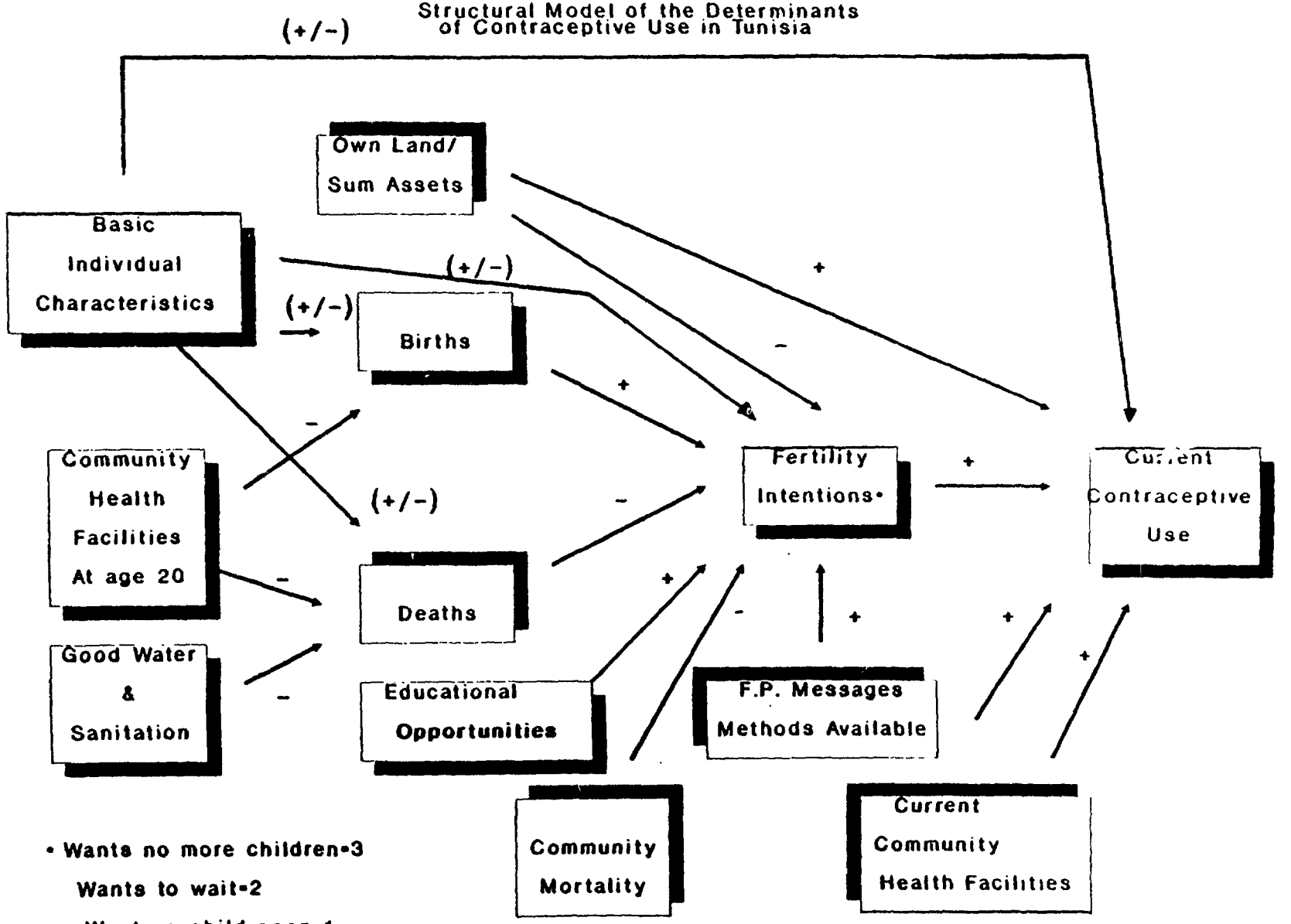
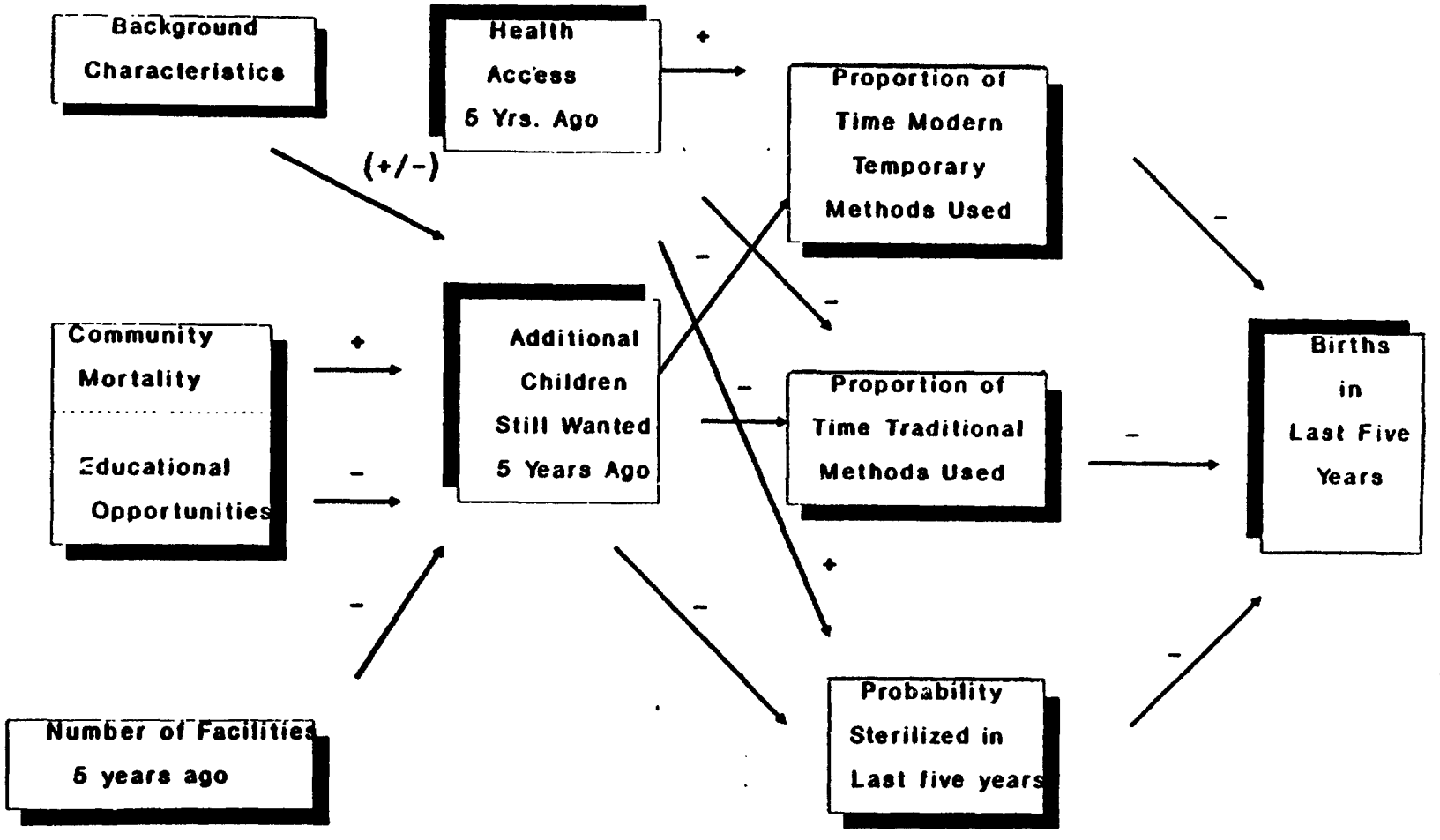


Figure 4
Model of Contraceptive Use and Fertility
in the Last Five Years in Tunisia



Appendix 1

Tunisia Individual Data

Variable	Definition	URBAN Mean (Std. Deviation)	RURAL Mean (Std.Deviation)
Exogenous Variables			
Age	Indicates age in years	33.168 (7.760)	31.168 (6.793)
Age 15 to 25	Dichotomous variable indicating if age of woman is within 15 to 25 years	.186 (.389)	236 (.425)
Age 26 to 30	Dichotomous variable indicating if age of woman is within 26 to 30 years	.215 (.411)	.234 (.423)
Age 31 to 35	Dichotomous variable indicating if age of woman is within 31 to 35 years	.231 (.422)	.264 (.441)
Bicycle	Dichotomous variable indicating family own a bicycle	.099 (.298)	.058 (.234)
Clinic2≤5 Age 20	Dichotomous variable indicating if a type two clinic was available within five kms when the woman was twenty years of age	.319 (.466)	.036 (.186)
Clinic2≤10 Age 20	Dichotomous variable indicating if a type two clinic was available within ten kms when the woman was twenty years of age	.446 (.497)	.218 (.413)
Clinic3≤5 Age 20	Dichotomous variable indicating if a type three clinic was available within five kms when the woman was twenty years of age	.471 (.499)	.418 (.493)

Variable	Definition	URBAN Mean (Std. Deviation)	RURAL Mean (Std.Deviation)
Clinic3≤10 Age 20	Dichotomous variable indicating if a type three clinic was available within ten kms when the woman was twenty years of age	.500 (.500)	.493 (.500)
Doctors≤5 Age 20	Dichotomous variable indicating if a doctor was available within five kms when the woman was twenty years of age	.139 (.346)	.024 (.154)
Doctors≤20 Age 20	Dichotomous variable indicating if a doctor was available within ten kms when the woman was twenty years of age	.169 (.375)	.087 (.282)
Education	Indicates years of education completed	2.805 (3.912)	.986 (2.140)
Education 4 to 6	Dichotomous variable indicating if the woman completed four to six years of school	.288 (.453)	.313 (.464)
Education≥7	Dichotomous variable indicating if the woman completed seven or more years of school	.297 (.457)	.148 (.356)
Education spouse	Indicates years of education completed by spouse	4.766 (4.789)	2.923 (3.529)
Electric	Dichotomous variable indicating person has electric lighting	.729 (.444)	391 (.488)
Farmer	Dichotomous variable indicating husband's occupation is farmer	.157 (.364)	.265 (.441)
Good-Sanitation	Dichotomous variable indicating sanitation facilities of good quality	.756 (.430)	.426 (.495)

Variable	Definition	URBAN Mean (Std. Deviation)	RURAL Mean (Std.Deviation)
Good-Water	Dichotomous variable indicating drinking water of good quality	.822 (.383)	.655 (.475)
Hospitals≤5 Age 20	Dichotomous variable indicating if a hospital was available within five kms when the woman was twenty years of age	.359 (.480)	.033 (.179)
Hospitals≤10 Age 20	Dichotomous variable indicating if a hospital was available within ten kms when the woman was twenty years of age	.501 (.500)	.244 (.430)
Household Size	Indicates total number of people in household	6.494 (2.769)	6.788 (2.862)
Husband Absent	Dichotomous variable indicating if the husband was away from the home for more than a month	.144 (.351)	.228 (.419)
Husband work away	Dichotomous variable indicating if the husband worked in another region (community)	.232 (.422)	.261 (.440)
Message	Dichotomous variable indicating if person heard one or two family planning messages	.641 (.480)	.522 (.500)
Motorcycle	Dichotomous variable indicating family owns a motor-cycle	.153 (.360)	.095 (.294)
Number of Rooms	Variable indicating the number of rooms in the household	2.342 (1.211)	1.838 (1.031)
Own Car	Dichotomous variable indicating family owns a car	.102 (.303)	.034 (.180)
Own House	Dichotomous variable indicating family owns house/ apartment	.751 (.432)	.850 (.357)

Variable	Definition	URBAN Mean (Std.Deviation)	RURAL Mean (Std.Deviation)
OwnLand	Dichotomous variable indicating the husband owns the land	.072 (.258)	.129 (.335)
Own Radio	Dichtomous variable indicating person owns a radio	.753 (.431)	.613 (.487)
Own TV	Dichotomous variable indicating person owns a tv	.728 (.445)	.461 (.499)
Pharmacy≤5 Age 20	Dichotomous variable indicating if a pharmacy was available within five kms when the woman was twenty years of age	.193 (.394)	.043 (.203)
Pharmacy≤10 Age 20	Dichotomous variable indicating if a pharmacy was available within ten kms when the woman was twenty years of age	.222 (.416)	.244 (.430)
Phone	Dichotomous variable indicating individual owns a phone	.075 (.263)	.005 (.071)
Professional	Dichotomous variable indicating husband's occupation is professional	.082 (.274)	.018 (.134)
Radio Message	Dichotomous variable indicating if person heard fp message over radio in last month	.641 (.480)	.522 (.500)
Read news	Dichotomous variable indicating person reads news at least once/week	.196 (.397)	.045 (.207)
Regrigerator	Dichotomous variable indicating person owns a refrigerator	.438 (.496)	.100 (.301)
Rural Age 12	Dichotomous variable indicating individual lived in rural area before age 12	.533 (.499)	.903 (.296)

Variable	Definition	URBAN Mean (Std. Deviation)	RURAL Mean (Std.Deviation)
Skilled	Dichotomous variable indicating husband's occupation is a skilled labor job	.139 (.346)	.085 (.279)
Sum of Assets	Variable indicating the total number of assets the individual owns	3.828 (1.510)	2.608 (1.475)
Tractor	Dichotomous variable indicating family owns tractor	.011 (.104)	.018 (.134)
Wait≤2	Dichotomous variable indicating if person desires to wait less than two years before having another child	.118 (.322)	.152 (.359)
Wait≥2	Dichotomous variable indicating if person desires to wait more than two years	.214 (.410)	.264 (.441)
Watch TV	Dichotomous variable indicating person watches tv daily	.831 (.374)	.637 (.481)
White Collar	Dichotomous variable indicating husband's occupation is a white collar job	.167 (.373)	.086 (.281)
Work Now	Dichotomous variable indicating if the wife is currently working	.105 (.306)	.052 (.222)
Work Past	Dichotomous variable indicating if the wife has worked in the past	.187 (.390)	.102 (.302)

Variable	Definition	URBAN Mean (Std Deviation)	RURAL Mean (Std Deviation)
Endogenous Variables			
Abortion	Dichotomous variable indicating if the woman has ever had an abortion	.083 (.276)	.026 (.160)
Births in Last 5 years	Variable indicating total number of births in last five years	1.108 (.993)	1.498 (.989)
Currently-Breast-feeding	Dichotomous variable indicating if child born in last five years is currently being breastfed	.285 (.451)	.476 (.500)
Current Method	Categorical variable defining the current method of contraceptive use: 1= pill	1.612 (1.880) 12.1	941 (1.615) 6.3
	2= coital methods	3.2	1.2
	3= iud, injection	24.9	11.6
	4= not modern	14.0	4.7
	5= sterilized	5.8	6.5
	0= no method	39.9	69.7
Current Use	Dichotomous variable indicating some method of comtraceptive used	497 (.500)	.301 (.459)
Died	Variable indicating the number children who have died	.429 (.924)	.471 (.915)
Died in Last 5 years	Variable indicating the number child deaths in the last five years	.057 (.263)	.088 (.313)
Duration Coital	Variable indicating number of months coital methods were used in the last five years	.779 (5.042)	387 (3.064)
Duration-IUD/Injection	Variable indicating number of months iud/inj were used in the last five years	6.122 (13.719)	3.391 (10.141)
Duration Pill	Variable indicating number of months the pill was used in the last five years	3.029 (9.619)	2.179 (8.059)

Variable	Definition	URBAN Mean (Std Deviation)	RURAL Mean (Std Deviation)
Duration Sterilization	Variable indicating number of months sterilization was used in the last five years	5.006 (15.596)	1.474 (7.123)
Duration-Traditional	Variable indicating number of months nonmodern methods were used in the last five years	3.092 (10.730)	1.141 (5.694)
Exposed	Variable indicating the number of months exposed to the risk of pregnancy in the last five years	48.567 (9.753)	44.461 (19.540)
Fertility-Intentions	Ordinal variable indicating the strength of the woman's desire to space children	1.55 (.695)	1.433 (.741)
	1 if woman wants a child 2 years ago	11.7	15.1
	2 if woman wants to wait 2 years or more	22.9	26.3
	3 if woman wants no more children	65.4	58.5
Ideal Number Children	Variable indicating ideal number of children desired	3.415 (1.193)	3.853 (1.220)
Living Children	Variable indicating the number of current living children	3.557 (2.264)	3.740 (2.389)
Pregnant	Dichotomous variable indicating if person currently pregnant	.107 (.309)	.141 (.348)
Recent Abortion	Dichotomous variable indicating if the woman has had an abortion in the past year	.023 (.151)	.007 (.085)
Still Want	Variable indicating the number of children the family still wants to have	1.332 (1.480)	1.685 (1.660)
Still Want 5 years ago	Variable indicating the number of children the family still wanted to have as of five years ago	1.517 (1.482)	1.994 (1.618)
Total Births	Variable indicating total number of births in family	3.985 (2.698)	4.212 (2.807)

Appendix 2

Tunisian Community Data

Variables	Definition	URBAN Mean (Std Deviation)	RURAL Mean (StdDeviation)
General Variables			
Big City	Dichotomous variable indicating if type of locality is a large city or suburb	.497 (.500)	000 (000)
Clinic2≤5	Dichotomous variable indicating if distance to nearest type 2 clinic within five kms	.709 (.454)	.043 (.203)
Clinic2≤10	Dichotomous variable indicating if distance to nearest type 2 clinic within ten kms	.834 (.372)	.328 (.470)
Clinic3≤5	Dichotomous variable indicating if distance to nearest type 3 clinic within five kms	.950 (.218)	.749 (.433)
Clinic3≤10	Dichotomous variable indicating if distance to nearest type 3 clinic within ten kms	.958 (.200)	.907 (.290)
Clinic2FP≤5	Dichotomous variable indicating if distance to nearest type 2 family planning clinic within five kms	.666 (.472)	.043 (.203)
Clinic2FP≤10	Dichotomous variable indicating if distance to nearest type 2 family planning clinic within ten kms	.796 (.403)	.295 (.456)
Clinic3FP≤5	Dichotomous variable indicating if distance to nearest type 3 family planning clinic within five kms	.746 (.436)	.717 (.450)

Variables	Definition	URBAN Mean (Std Deviation)	RURAL Mean (Std Deviation)
Clinic3FP≤10	Dichotomous variable indicating if distance to nearest type 3 family planning clinic within ten kms	.844 (.363)	.831 (.375)
Community Mortality	Variable indicating the mortality rate for the community	.080 (.023)	.124 (.032)
Condoms	Dichotomous variable indicating if condoms were available to community	.903 (.297)	.701 (.456)
Doctors≤5	Dichotomous variable indicating if distance to nearest doctor within five kms	.911 (.285)	.119 (.323)
Doctors≤10	Dichotomous variable indicating if distance to nearest doctor within ten kms	.938 (.241)	.333 (.471)
DoctorFP≤5	Dichotomous variable indicating if distance to nearest family planning doctor within five kms	.899 (.301)	.119 (.323)
DoctorFP≤10	Dichotomous variable indicating if distance to nearest family planning doctor within ten kms	.930 (.256)	.309 (.462)
DrHospital-≤5	Variable indicating number of doctors in family planning hospital that is within five kms of community	.769 (1.431)	000 (000)
DrHospital-≤10	Variable indicating number of doctors in family planning hospital that is within ten kms of community	1.051 (1.600)	.036 (.186)
DrClinic2≤5	Variable indicating number of doctors in type 2 family planning clinic that is within five kms of community	.221 (.564)	.043 (.203)

Variables	Definition	URBAN Mean (Std Deviation)	RURAL Mean (Std Deviation)
DrClinic2≤10	Variable indicating number of doctors in type 2 family planning clinic that is within ten kms of community	.394 (1.209)	.070 (.256)
DrClinic3≤5	Variable indicating number of doctors in type 3 family planning clinic that is within five kms of community	.112 (.315)	.013 (.114)
DrClinic3≤10	Variable indicating number of doctors in type 3 family planning clinic that is within ten kms of community	.129 (.360)	.013 (.114)
Educations≤5	Variable indicating sum of education opportunities available within five kms	3.112 (.907)	1.274 (.628)
Educations≤10	Variable indicating sum of education opportunities available within ten kms	3.355 (.822)	1.618 (.849)
Family Planning	Dichotomous variable indicating family planning services exist in community	.902 (.297)	.701 (.458)
Female Sterilization	Dichotomous variable indicating female sterilization available	.416 (.494)	.051 (.219)
Frequency Mobile	Dichotomous variable indicating fp mobile unit covers locality at least four times a month	.234 (.425)	.371 (.483)
Frequency Supplies	Dichotomous variable indicating fp worker offers supplies at least four times a month	.169 (.376)	.196 (.397)
Gouvernat	Ordinal variable indicating the gouvernat of the locality	14.839 (9.205)	14.873 (7.469)
Hospitals≤5	Dichotomous variable indicating if distance to nearest hospital within five kms	.731 (.443)	.061 (.240)

Variables	Definition	URBAN Mean (Std Deviation)	RURAL Mean (Std Deviation)
Hospital≤10	Dichotomous variable indicating if distance to nearest hospital within ten kms	.850 (.357)	.296 (.457)
Hospital-FP≤5	Dichotomous variable indicating if distance to nearest family planning hospital within five kms	.431 (.495)	.018 (.134)
Hospital-FP≤10	Dichotomous variable indicating if distance to nearest family planning hospital within ten kms	.527 (.499)	.122 (.327)
Hrsclinic2≤5	Variable indicating the number of hours per week a type 2 clinic; within five kms of community; is open for family planning purposes	20.985 (17.562)	.747 (4.372)
Hrs Clinic2≤5	Variable indicating the number of hours per week a type 2 clinic; within ten kms of community; is open for family planning purposes	25.034 (16.410)	.295 (.456)
Hrs Clinic3≤5	Variable indicating the number of hours per week a type 3 clinic; within five kms of community; is open for family planning purposes	16.984 (17.453)	3.89 (8.299)
Hrs Clinic3≤10	Variable indicating the number of hours per week a type 3 clinic; within ten kms of community; is open for family planning purposes	18.373 (17.231)	6.019 (11.176)
Hrs HospitalFP≤5	Variable indicating the number of hours per week a hospital; within five kms of community; is open for family planning purposes	13.939 (17.797)	.293 (2.145)

Variables	Definition	URBAN Mean (Std Deviation)	RURAL Mean (Std Deviation)
Hrs Hospital FP≤10	Variable indicating the number of hours per week a hospital; within ten kms of community; is open for family planning purposes	17.049 (18.505)	3.464 (10.280)
Injection	Dichotomous variable indicating injection available in community	.026 (.159)	000 (000)
IUD	Dichotomous variable indicating iud available in community	.883 (.322)	.679 (.447)
Mainroad	Dichotomous variable indicating if access road is main road	.688 (.465)	.425 (.494)
Market	Dichotomous variable indicating the availability of a weekly market in the locality	.662 (.474)	.261 (.439)
Midwife	Dichotomous variable indicating there exists a midwife in locality	.247 (.433)	.126 (.332)
Nurses Clinic2≤5	Variable indicating number of nurses in type 2 family planning clinic that is within five kms of community	.877 (.880)	.043 (.203)
Nurses Clinic2≤10	Variable indicating number of nurses in type 2 family planning clinic that is within ten kms of community	1.114 (1.060)	.295 (.456)
Nurses Clinic3≤5	Variable indicating number of nurses in type 3 family planning clinic that is within five kms of community	.732 (.443)	.665 (.472)
Nurses Clinic3≤10	Variable indicating number of nurses in type 3 family planning clinic that is within ten kms of community	.786 (.443)	.753 (.432)

Variables	Definition	URBAN Mean (Std Deviation)	RURAL Mean (Std Deviation)
Nurses Hospital≤5	Variable indicating number of nurses in family planning hospital that is within five kms of community	1.695 (3.598)	.055 (.402)
Nurses Hospital≤10	Variable indicating number of nurses in family planning hospital that is within ten kms of community	2.107 (4.100)	.344 (1.058)
Pharmacy≤5	Dichotomous variable indicating if distance to nearest pharmacy within five kms	.947 (.224)	.179 (.383)
Pharmacy≤10	Dichotomous variable indicating if distance to nearest pharmacy within ten kms	.972 (.166)	.435 (.496)
PharmacyFP≤5	Dichotomous variable indicating if distance to nearest family planning pharmacy within five kms	.947 (.224)	.179 (.383)
Pharmacy-FP≤10	Dichotomous variable indicating if distance to nearest family planning pharmacy within ten kms	.972 (.166)	.435 (.496)
Pill	Dichotomous variable indicating availability of the pill	.903 (.297)	.701 (.458)
Primary School≤5	Dichotomous variable indicating the availability of a primary school within 5 kms of locality	.980 (.141)	.978 (.147)
Primary School≤10	Dichotomous variable indicating the availability of a primary school within 10 kms of locality	.988 (.108)	.978 (.147)
Region	Ordinal variable indicating the region the community is located in	3.717 (1.889)	3.819 (1.368)
Remote	Dichtomous variable indicating if community is 30 to 100 km from nearest large town	.155 (.364)	.352 (.478)

Variables	Definition	URBAN Mean (Std Deviation)	RURAL Mean (Std Deviation)
Secondary School≤5	Dichotomous variable indicating the availability of a secondary school within 5 kms of locality	.945 (.229)	.145 (.352)
Secondary School≤10	Dichotomous variable indicating the availability of a secondary school within 10 kms of locality	.963 (.188)	.361 (.480)
SmallCity	Dichotomous variable indicating if locality type is small town	.311 (.465)	000 (000)
Supplies	Dichotomous variable indicating if fp worker offers any fp supplies	.260 (.440)	.283 (.451)
University≤5	Dichtomous variable indicating the availability of a university within 5 kms of locality	.338 (.474)	000 (000)
University≤10	Dichtomous variable indicating the availability of a university within 10 kms of locality	.338 (.474)	000 (0)
Urban	Dichotomous variable indicating household in urban area	.695 (.462)	000 (0)
Vaginal	Dichotomous variable indicating if vaginals are available in the community	.889 (.314)	.701 (.458)
Vocational≤5	Dichotomous variable indicating the availability of a vocational school within 5 kms of locality	.781 (.414)	.151 (.358)
Vocational≤10	Dichotomous variable indicating the availability of a vocational school within 10 kms of locality	.886 (.318)	.279 (.449)

Variables	Definition	URBAN Mean (Std Deviation)	RURAL Mean (Std Deviation)
Years Clinic2≤5	Variable indicating number of years type 2 clinic within five kms has been available in the community	21.065 (13.290)	.630 (3.180)
Years Clinic2≤10	Variable indicating number of years type 2 clinic within ten kms has been available in the community	21.065 (13.290)	5.105 (8.238)
Years Clinic3≤5	Variable indicating number of years type 3 clinic within five kms has been available in the community	21.065 (13.290)	10.609 (10.865)
Years Clinic3≤10	Variable indicating number of years type 3 clinic within ten kms has been available in the community	21.065 (13.290)	12.488 (10.931)
Years Doctors≤5	Variable indicating number of years doctor within five kms has been available in the community	4.846 (5.057)	.394 (1.354)
Years Doctors≤10	Variable indicating number of years doctor within ten kms has been available in the community	5.188 (5.163)	1.886 (3.486)
Years Hospitals≤5	Indicates years hospital within five kms in service	16.714 (21.946)	.606 (3.079)
Years Hospitals≤10	Indicates years hospital within ten kms in service	16.714 (21.946)	8.031 (14.647)
Years Pharmacys≤5	Indicates years pharmacy within five kms in service	16.714 (21.946)	.807 (3.118)
Years Pharmacys≤10	Indicates years pharmacy within ten kms in service	16.714 (21.946)	2.608 (4.553)

Variables	Definition	URBAN Mean (Std Deviation)	RURAL Mean (Std Deviation)
Variables for 5 year analysis			
Clinic2-5yearsagos≤5	Dichotomous variable indicating if a type 2 clinic was available to the community within five kms five years ago	.695 (.461)	.0432 (.203)
Clinic2-5yearsagos≤10	Dichotomous variable indicating if a type 2 clinic was available to the community within ten kms five years ago	.819 (.385)	.313 (.464)
Clinic3-5yearsagos≤5	Dichotomous variable indicating if a type 3 clinic was available to the community within five kms five years ago	.672 (.470)	.588 (.492)
Clinic3-5yearsagos≤10	Dichotomous variable indicating if a type 3 clinic was available to the community within ten kms five years ago	.681 (.466)	.676 (.468)
Doctor-5yearsagos≤5	Dichotomous variable indicating if a doctor was available in the community within five kms five years ago	.409 (.492)	.022 (.147)
Doctor-5yearsagos≤10	Dichotomous variable indicating if a doctor was available to the community within kms ten five years ago	.437 (.496)	.143 (.350)
Hospital-5yearsago5	Dichotomous variable indicating if a hospital was available in the community within five kms five years ago	.699 (.459)	.043 (.203)
Hospital-5yearsagos≤10	Dichotomous variable indicating if a hospital was available to the community within kms ten five years ago	.818 (.386)	.263 (.440)

Variables for 5 year analysis

Variables	Definition	URBAN Mean (Std Deviation)	RURAL Mean (Std Deviation)
Pharmacy-5yearsagos≤5	Dichotomous variable indicating if a pharmacy was available in the community within five kms five years ago	.676 (.469)	.040 (.197)
Pharmacy-5yearsagos≤10	Dichotomous variable indicating if a pharmacy was available to the community within kms ten five years ago	.692 (.462)	.214 (.411)
SumMethods-5yearsagos≤5	Variable indicating the sum of health facilities available within five kms five years ago	3.151 (1.392)	.736 (.789)
SumMethods-5yearsagos≤10	Variable indicating the sum of health facilities available within ten kms five years ago	3.447 (1.263)	1.610 (1.480)

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