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Abstract

Fertility analysis in Tunisia is revisited by focusing on regulation instruments instead of the number of births or the number of children alive. In Muslim societies, in which marriage is the exclusive acknowledged childbearing context, a woman may be seen as starting her fertility regulation period by postponing her age at marriage. Once married, she can adjust the delay before her first birth control. Then, she can decide whether or not to use a contraceptive, and finally she can select a specific contraception method. These four decisions, approximately arranged sequentially, may somewhat interact with the sequential stages of the woman's lifecycle and involve distinct motivations: (1) enrolment in higher education; (2) participation in the labor market; (3) a given fertility objective; and (4) dealing with middle age and old age health problems.

Using data from the 2001 Tunisian PAP-FAM survey data, we estimate econometric models that provide an approximate description of fertility regulation as an outcome of the above sequential decisions. Accordingly, the significant effects of our explanatory variables gradually arise and vanish across the models as the women proceeds in her fertility regulation process. Our findings suggest that family network and sociocultural environment greatly shape the household preference for children. Although strict causality inference is beyond the possibilities of a single cross-section, the elicited correlations point to suggestive explanations that call for additional collection efforts to better capture lifecycle decisions of family members and the interactions of the extended family across this lifecycle.

Keywords: fertility regulation, age at marriage, marriage duration at first birth control, contraceptive use, contraception method, Tunisia.

JEL Codes: J12, J13, C25, C41.

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1. Introduction

Research on fertility is now a well-established field, with some emphasis—as far as individual female decisions are concerned—on investigating the factors explaining the number of desired or realized progeny.[1] On the other hand, less attention has been devoted in this literature to the precise fertility regulation decisions. Moreover, these decisions are generally treated separately—for example, through the analysis of use or not of a given contraceptive method. Our strategy in this paper is to focus on contraception means instead of the number of children. We do this by eliciting suggestive correlations in the logical sequence of contraception decisions over time, with special attention to family interference. In this paper, we show how some insight can be gained by considering the diverse regulation decisions made by a woman, through an approximately sequential framework that interacts with distinct motivations that also often succeed one another sequentially over her reproductive span.

Fertility regulation is often seen (for example, in Easterlin 1975, 1978) as a simple decision where the disadvantages of unwanted children are perceived by a woman as greater than the regulation economic and psychological cost. Moffit (1984) pointed out that couples may delay childbearing either because the opportunity cost of children's early education may exceed the value they ascribe to having children, or because the marginal utility of the mother's leisure is (approximately) greater than the utility achieved by having a child. Some simplifications are involved in this conception, starting with the hypothesis that the regulation decision is only made by the woman herself. Several other major elements are neglected. Parental utility being directly increased by the presence of children constitutes an additional motivation for early births. Moreover, the long spell over which regulation may occur, the multiplicity, and the sequentiality of diverse reproductive decisions should be considered. Analyzing the number of children implies data for which fertility has occurred over several decades. Obviously, regressing

[1] See, for example, Cochrane and Guilkey (1995); Karsten and Kohler (2000); Klasen and Launov (2006); Kohler (1997); Link (2011); Rindfuss et al. (2007).

fertility outcomes on current covariates is a gross approximation. Instead, looking at specific regulation decisions may sometimes allow the researchers to focus on better defined phases of the fertility process.

All regulation decisions may involve complex expectations, and trial and error. Moreover, their analysis may be further complicated by changes in individual preferences over time, and by competition between regulation motivations, each connected to a different period in the woman's lifecycle. Specifically, schooling prospects, work participation, family construction, and old age health concerns may, in an almost successive fashion, occupy the minds of women as they get older. Faced with this complexity, it is clear that estimating a complete fertility model, at least in the Tunisian case, is way beyond the possibilities of the available cross-sectional data. In these conditions, our approach is rather to focus on observable birth control decisions and their suggestive correlations with observed covariates.

What are the main regulation decisions? Firstly, a woman may control exposure to unwanted birth by delaying her marriage, as analyzed early on in Davis (1963) and Bongaarts (1978). In fertility transition theories, general restrictions of nuptiality are often seen to take place following a historical drop in mortality, which reduces the need for a large number of children (Chesnais 1992).

Marriage has also long been considered in the literature a proxy for exposure to the risk of fertility, on the grounds that premarital sexual intercourse is relatively uncommon among women.[2] In principle, a woman could exploit her complete fertility lifecycle, from puberty to menopause. In practice, she often begins her actual fertility cycle only after her marriage. Marriage timing may affect both supply and demand of children.[3] This makes still more sense in conservative Muslim countries, in which marriage is the sole socially tolerated context for sexual intercourse and childbearing (Axinn and Yabiku 2001). In particular, in Tunisia, the primary reason for getting married is to have children. This is supported by very low incidence of out of wedlock pregnancies in the Tunisian data (less than 0.5 %).

[2] Bongaarts (1983); Coale (1992); Hirschman and Rindfuss (1980).
[3] See Bongaarts (2006); Bongaarts and Potter (1983); Rosero-Bixby (1996).

The hypothesis that the main motivation for marriage is having children is consistent with the fact that access to birth control means, such as the pill, and abortion has been found to reduce marriage incidence, which suggests that it was a device for legitimating unwanted births (Choo and Siow 2006). In that case, marriage is seen as a substitute for contraceptive techniques.

However, the motivations for delaying marriage may be multiple. Let us consider a few of them. A woman may have low fertility objectives: she may even refuse to have any child—for example, to preserve a comfortable and autonomous lifestyle. She may want to pursue personal projects incompatible with raising children, such as enrolment in higher education. She may want to establish her professional career without the hindrance of young children at home after a long workday, assuming that she could find and afford to pay for childcare during the day. If borrowing is not possible, childbearing may be postponed until the couple has achieved minimal savings to allow the wife to leave the labor market. Finally, she may suffer from some health problems that would make giving birth hazardous. Interestingly, these diverse motivations may roughly be arranged according to the lifecycle, with schooling motives more relevant for young women and health problems more frequent among middle aged or older women. We shall follow this line of interpretation in this paper.

A second regulation decision is the timing of the first contraceptive use after marriage. This first use may occur immediately after marriage if children are not immediately desired. Contraceptive use may also take place episodically along the reproductive span—for example, to allow for birth spacing that helps the family to spread the corresponding economic and time burden over years. However, the first use of contraceptives is a major landmark in family strategy, which justifies isolating it. On the one hand, if the main aim of marriage is to give birth, it is usual that, at its inception, no contraception method be used. Sometimes the number of desired children may be reached before the first contraceptive use. Alternatively, a pause may be desired in the arrival of further offspring, which would trigger the first birth control. The time gap between the wedding date and the first birth control may involve both anticipated and unanticipated decisions, which may reflect not only cost-benefit

calculations, but also subjective attitudes toward family planning. However, this gap can be easily observed, as opposed to the detailed birth control process, which justifies examining it.

A third unobserved stage of regulation is the full sequence of contraceptive use over the reproductive span. However, what can be observed is whether the woman is currently using contraception, or if she has used some in the past. Obviously, these 'synthetic' decisions must take place after (or at the time of) the first use of contraceptive techniques. It may be interesting to exploit information about them that differs from that of the first contraception choice, and relate this to the woman's lifecycle.

Fourthly, it seems logical that the decision about the birth control method generally follows the decision of whether or not to use contraception. This point of view suggests disregard of the case advocated by Heckman and Willis (1975) that imperfect fertility control may imply that an optimal contraception strategy is to delay births, as a precaution. Although this simplifying sequential perspective of regulation is not the only possibility, it still seems to be relevant and will help us to organize the data analysis. The choice of method may be influenced by its perceived efficiency, by private and social approval, and by its impact on health. It may also depend on the availability of control services and on cost-benefit calculations. However, given that contraception in Tunisia is free, easily available, and accessible, we do not consider cost or access limitations to means of contraception as explanatory variables.

As mentioned before, regulation decisions can often be arranged sequentially. Marriage occurs first, which triggers the fertility risk; then comes the time of first use of contraception; then diverse decisions take place over time to apply (or not) contraceptive techniques, each of these decisions possibly associated with or followed by choosing a specific method. Obviously, a sequential setting is only approximate. For example, a woman may change the control methods over time, or think about them even before marriage. Another exception to this rigid sequential picture is childbirth out of wedlock, even though this is rare in Tunisia. Nonetheless, a schematic sequential view of the decision process is helpful in organizing analyses, despite being approximate. This is because the somewhat logical succession of decisions should dominate the few exceptions contradicting it.

In this paper, we look into how a woman's contraceptive strategy can be seen as an approximate outcome of the above four successive birth control decisions, providing an original and integrated perspective on regulation decisions. This is notably interesting when some event or constraint restricts some decisions, and then the subsequent decisions are blocked. Moreover, this approach enables us to highlight hints about distinct dominant motivations for each control stage. This may have some consequences for the design of family planning policies that could be more accurate—for example, by using different targeting criteria at each regulation stage.

Our focus is on Muslim countries in which marriage is the exclusive context for sexual intercourse and childbearing and for which few studies are available.[4] Indeed, the determinants of fertility regulation have been rarely analyzed from the perspective of Muslim societies. In this respect, the Tunisian case is interesting in that it is the Muslim country with the most advanced family planning system.

Our empirical application is based on econometric models specific to each successive birth control decision. We find substantial correlations in Tunisia between family network and birth control decisions, in phase with lifecycle issues. With cross-sectional data from a single survey, we cannot pretend to identify accurately causal channels of contraception. However, eliciting correlations suggestive of subjacent causal processes is still interesting and it notably contributes to further extraction of information from an interesting dataset. Not using these data on the ground that accurate treatment effects cannot be estimated would be a mistake if the aim is better understanding birth control in Tunisia. Accordingly, our challenge is exploiting necessarily limited available data while still providing suggestive insight.

The structure of the paper is as follows. In section 2, we present the context and the data. In section 3, we report and discuss our estimation results. Finally, we conclude in section 4.

[4] For example, Ahmed (1985); Hanks (2006); Yursteven (2015).

2. The Context and the Data

2.1. Fertility Regulation in Tunisia

Fertility has plummeted in Tunisia over the last half century. The fertility rate, which was close to eight children per woman in the early 1960s, has almost fallen below the renewal threshold (2.05 children per woman) since 1999. Even though a slight rise has been recorded from 2010, the fertility rate remains low at 2.4 children per woman in 2015. This decline comes from a steady reduction in children demand that is accompanied by deliberate birth control by women. Sandron and Gastineau (2002) and Bousnina (2013) provide detailed descriptions of the fertility transition in Tunisia.

These demographic changes have been fostered by laws and institutions that have enhanced the status of women and developed family planning, starting with the 1956 Code of Personal Status that promoted female emancipation. The Code regulated marriage and divorce, abolished polygamy, set a minimal legal age for marriage, and replaced repudiation with divorce. The minimal legal age for marriage was set to 15 years for women and 18 years for men in 1956, and later further revised in 1964 to 17 and 20 years respectively. As a consequence, women and men in 2014 were getting married on average at 28 and 34 years respectively.[5] These changes have direct consequences on fertility, since births out of wedlock are negligible—about 0.5 % of births over 2000–2012.[6]

The Tunisian government, through public campaigns, encouraged families to limit their number of children. Family allowances were cut for households with more than four children, then with more than three children. Advertising and sales of contraceptive devices were legalized in 1961. A new institution, the ONFP (National Board for Family and Population) was initiated in 1964 to assist the government in restricting and monitoring fertility. Abortion was legalized in 1973. Finally, modern contraceptive instruments, allowing couples to better control their progeny, were provided for free.

[5] All quoted statistics are taken from the Tunisian Annual Statistics of the National Institution of Statistics (INS) from 1957 to 2014.
[6] Source: Tunisian Ministry of Women and Children: annual report on children 2000, 2012.

These policy measures contributed to the rise of the contraceptive prevalence rate from 31 % in 1978 up to 60 % in 2007.[7] In the ONFP survey report of 2001, 84 % of respondents stated that they were or had been using contraceptives (and 62 % were currently using), with no major differences across regions (75 % for rural women vs. 83 % for urban) or across education levels (75.9 % for illiterate, 81.6 % for primary, 84.8% for secondary, and 83.4 % for higher level). Meanwhile, the average time period before the first birth control after marriage has been steadily dropping, from 6.56 years for 45–49 year old women to 1.37 years for 20–24 year old women, as shown in Table 1 along with other statistics. As a consequence, the number of surviving children at the first birth control use is falling. Younger women, aged 20–24 years, often start regulating their fertility after obtaining a surviving child, compared to 2.91 surviving children for those women 45–49 years. Overall, regulation is practiced once women have about two (1.93) surviving children (1.61 children in urban areas vs. 2.63 in rural areas). The methods most commonly used are IUD (intra-uterine device, 44.1 %), the pill (17.4 %), tying tubes (16.7 %), and calendar (11.8 %).

2.2. The Data

The data we use are taken from the 2001 PAP-FAM ONFP survey. A major innovation in this survey is its focus on intergenerational relationships, social culture, and fertility behavior. This survey also provides information about common household characteristics. We base our study on a sample of 3,175 married women whose ages vary from 15 to 49 years, a reasonable approximation of their fertile spell. Many variables are collected from a retrospective questionnaire filled out during a single interview. Nonetheless, these variables inform on lifelong events, particularly on the age at marriage of respondents (*woman's age at marriage*) and *marriage duration before first birth control.* Two dummy variables describe the incidence of birth control. Firstly, the respondents may or may not have used contraception in the past (*contraceptive ever used*); secondly, they may or may not be using contraception at the time of interview (*contraceptive currently used*). Finally, we also make use of data

[7] So far, these statistics have not been updated by the ONFP.

on which contraceptive techniques have been used (the pill; IUD; calendar; the grouping of implant, injection, tying tubes, gel, coitus interruptus, condom, and others as one modality; and several methods jointly used among the pill, IUD, and calendar). Other traditional methods, such as lengthening breast-feeding and post-partum delay of intercourse, are not included. Indeed, these methods are neither efficient nor easy to measure, and little used anyway.[8]

Our selection of independent variables is mostly driven by the literature on the determinants of fertility, providing the information is available in our data, which we complete with original information on social family interactions. We also pay attention to avoiding regressors that would be obviously endogenous and keeping a relatively similar set of covariates for the successive decisions in the interest of comparisons.

Concrete socioeconomic decisions, perceptions, and motivations are clearly important in these issues. It would also be useful to be able to distinguish different sociological groups. All these features are unobserved in the survey; however, a few hints about who financed the wedding and about family interference may partly reflect these elements.

Table 2 reports descriptive statistics for the covariates used in the estimated models. One major independent variable is the number of desired children, as is common in the fertility literature.[9] In these data, this is recorded through a retrospective question to the women ('if you think back in time before having your children, how many children would you like to have?'). Obviously, a woman's age is another crucial covariate, in part because it is correlated with fertility capacity, but also because it encompasses many lifecycle factors. In this respect, the husband's age may also matter. We include a dummy variable for urban areas, as fertility behavior may differ between urban and rural areas. Besides, prices are known to vary a lot with the extent of urbanization, which affects the cost of raising children.

[8] As discussed in Bhalotra and Van Soest (2008), Bongaarts (2006), and Bongaarts and Potter (1983).
[9] Michael and Willis (1975), Rosenzweig and Seiver (1982), Rosenzweig and Schultz (1987, 1989).

The others determinants can be categorized into: (1) measures of educational and career attainment; and (2) characteristics of family and social interactions.

The inclusion of education and job variables is related to the roles of human capital and of the opportunity cost of women's time in fertility theory from its inception (Becker 1960, 1965, 1974). However, a few words of caution are in order. We do not introduce education by attainment levels since these variables do not correspond to statistically significant effects, for women or for men. We only account for schooling occurrence through two dummy variables (*woman never educated*) and (*husband educated*).

Also, given the lack of detailed information regarding the woman's professional status, we are constrained to use only a binary variable indicating whether or not the woman had been employed. In addition, we use a dummy variable informing on the woman's employment situation before marriage (*woman employed before marriage*) to overcome a potential endogeneity issue with a fertility decision made. Indeed, female labor participation before marriage may be mostly undertaken before the fertility decision, since having children is tolerated only in married couples. Therefore this variable can be viewed as less correlated with fertility decisions than contemporary or recent labor participation.

We consider the woman's point of view about her ability to succeed in two simultaneous roles as worker and mother by including a dummy variable for women who think that they are able to accomplish both tasks (*job and housekeeping compatibility).* The husband's socio-professional position is indicated by two dummy variables for '*unskilled husband worker'* or '*skilled husband worker'* that were constructed using specific job information.

Household incomes, along with costs and financial benefits of children, are not observed. We attempt to capture some information on household income through two dummy variables indicating the source of funding for the wedding costs. Given that traditionally wedding must be financed by the husband in Tunisia, then when it is financed by the couple as a whole (*couple finances marriage*), this hint at the husband's financial difficulties. Alternatively, the woman herself may finance her marriage (*woman*

finances marriage). This is often perceived as a specific indicator of a wealthy wife as compared to a somehow destitute husband.

Turning now to social and familial characteristics, the few authors who claim to incorporate such factors of regulation in fact confine them to the father's characteristics (education, profession, area), as in Wong (2005), among others. We innovate by including covariates directly related to the family network, such as a dummy variable for the husband and wife having met in the family for the first time (*family meeting place partner)* and a dummy variable for the husband being initially a close relative of the wife (*family intermarriage*). These variables depict couples that have a traditional orientation and belong to strongly knit families. In Tunisia, marriage within the family is widespread (42.3 %), while 63.5 % of respondent women first met their future husband within the extended family's home. Family endogamy (in both the father's and the mother's lineages) is still substantial despite a trend toward exogamy in all regions. Obviously, this kind of strong family tie favors family interference in the couple's regulation decisions and reinforces interactions among family members.

Likewise, we investigate the relationship between family childcare availability and fertility regulation decisions. However, including the parents' childcare variable poses a simultaneity issue, as childcare may be spurred by a new birth subsequent to a former relaxing of birth control. Then, in an equation in which the dependent variable is a birth control decision, the childcare variable may be correlated with unobservables that may partly cause the former as well as the current birth control status. For that matter, we use instead a proxy binary variable that reports whether either her family or her family-in-law intervenes in the nuclear family decisions (*family interference)*. That is, we assume that when family interferes in the couple's life, this may involve childcare support, although such interference was probably already present before any new birth. Mahfoudh-Draoui (2000, p. 139) report substantial roles of families in childcare: only 8 % of households in rural areas and 4.5 % in urban areas have child carers from outside their family for children under 6 years old. Similarly, we consider parents' financial support by using a binary variable (*descending financial transfers*) that indicates whether the couple benefits from parents and parents-in-law's financial help. 30 % (respectively, 18 %) of the married

couples permanently receive assistance from the husband's relatives (respectively, from the wife's relatives). Furthermore, 71 % of husbands (respectively, 48 % permanently and 23 % occasionally) continue to support elderly members after their own family establishment (5 % for wives).

In addition, we construct a variable (*discussion*) indicating whether the woman commonly talks with her husband about his job, financial difficulties, housekeeping problems, or social issues. This variable somehow informs about the degree of understanding and agreement of spouses. We also attempt to capture female autonomy by including a dummy variable reporting whether the woman must have a relative accompanying her when she visits a health center (*companion to health center*).[10] We interpret this variable as a proxy for the woman's submission to her husband.

Traditional values are also potential determinants of attitudes towards fertility in Tunisia. Accordingly, we define a dummy variable that isolates those women who state that children come from God (*God adds baby*), thereby deterring contraception. Finally, we include a dummy variable for lost pregnancies five years before the survey (*lost pregnancies*) as a proxy for the frailty of the reproductive health status, potentially a medical reason not to use, or to reduce, birth control. We are now ready to turn to the estimation results.

3. The Results

We now discuss the estimation results by following the sequence of decisions as previously detailed. The regressions for marriage age and for marriage duration before the first birth control are specified as Weibull duration models incorporating the abovementioned covariates when possible. In the case of marriage age, a few variables that pertain to post-marriage information are omitted. There is no censorship in this case because the sample is exclusively made of married women. In contrast, 18 percent of women are not observed to have made any birth control attempt yet, which implies that the second duration model is censored for these observations. This justifies the difference found between

[10] To examine empirically the gradual changes in norms of social behaviour that may influence marriage, other possible measures were also tried for the estimations, such as legal age at marriage, or the year of the law of the minimal age at marriage, but no significant result emerged.

the number of observations in the descriptive results and in some estimation results. The estimates of the two duration models are shown in Table 3. The respective regressions for currently using or ever using contraception are then specified as probit models, and the estimates are shown in Table 4. Finally, the choice of birth control method among the women who have chosen to use contraception is specified as a multinomial logit model and the estimates are reported in Table 5. In all the cases, we tried to omit as much as possible any obviously endogenous independent variables. However, since the estimates are based on a unique cross-section and it would be impossible to find instruments for all possible regressors suspected of endogeneity, it is safe to interpret the results as eliciting suggestive correlations rather than robust indubitable causal effects.

3.1. Marriage Age

The estimates for the duration model for marriage age are in the first column of Table 3. Our conjecture that marriage age is used as a birth control device is supported by the estimates that show it is massively influenced by typical determinants of fertility demand. Looking at distinct age classes may have been interesting, although our sample is too small for this. An issue is that ideas about marriage may have changed over time, which may imply that the link between marriage age and contraception is less simple than often claimed. Moreover, not everyone marries. However, using a duration model helps us to make use of a simple interpretation grid in which control variables, such as age and education, contribute to attenuate these concerns. Note also that in this sample there are only a few young persons, which limits the impact of recent changes in preferences about marriage.

A woman's age is a major biological factor affecting the odds of having a child. We also find that it strongly affects age at marriage in the estimates. We therefore face a complex interaction of biological and decision dynamics evolving with age. The estimates show that the hazard rate of the marriage event[11] decreases regularly with the respondent age for all our models in this paper. As the odds of

[11] In this case, the hazard rate is the instantaneous rate of leaving celibacy.

having children deteriorate for women over time, the probability of marriage declines.[12] Moreover, the desire of fertility falls with age; as argued in Cochrane and Guilkey (1995), which invites postponement of marriage since it is viewed as a birth control means. Interestingly, the number of children desired has a significant impact on the timing of marriage. As suggested, childbearing is a central component of the marriage decision. The desire to have children is here the actual trigger of marriage.

We find that women who think that they are able to fulfil both job and housekeeping tasks marry later, significantly at the 10 % level. Diverse interpretations are possible. Overworked women may also be less inclined to marry early and cumulate burdens with the prospect of new childbirth. The results also show that, as in Wong (2005), (ex-ante marriage) employed women postpone marriage more than the unemployed ones. This is consistent with raising kids being a hindrance for career development and even for securing jobs. Besides, subject to rising female labor force participation, the perceived number of marriageable men may fall. This phenomenon has been found to be greater in the case of rising male wage inequality, which may reduce the propensity to marry, as claimed in Loughran (2002).[13]

Higher woman's income, as proxied by 'woman finances marriage', seems to be associated with an increase of the hazard of getting married. Contrary to findings by Palamuleni (2011), wealthier women who finance their own wedding marry earlier, perhaps because they are more attractive financially to male suitors. As usually found —for example, in Zahangir et al. (2008) in Bangladesh—in these data urban woman marry later, while only with marginal significance. This is consistent with, in urban areas, women being more educated and having more jobs opportunities, and being less traditional. However, in contrast with its effect for the other decisions, the woman's education has no significant effect on marriage age. Though, it is found that the few higher education women in the sample tend to have married later, while this variable is not shown in the table for consistency with the sets of covariates in the other equations, and to avoid drawing conclusions based on too small subsamples.

[12] As argued for example in Bongaarts (1978, 2006), Bongaarts and Potter (1983) and Rosero-Bixby (1996).
[13] Brown and Norville (2001); Hirschman and Rindfuss (1980); Macunovich (1996).

Finally, we find that the presence of social and family networks, proxied by the variable 'family meeting place of partner', increases the hazard of the marriage event. Women belonging to a traditional family which arranges the marriage may spend less time on a partner search. This is not surprising, since traditional Muslims often marry with first cousins or other kin, which is confirmed by the effect of the variable 'family intermarriage' that accelerates the marriage occurrence. Traditional families also typically push for early marriage for fear of the effect of late marriage on the girl's reputation and marriage prospects. We now turn to the second stage decision, the timing of the first birth control after marriage.

3.2. Marriage Duration before the First Birth Control

Once married, a woman can more easily plan the size of her progeny. Sometimes, she prolongs the spell before her first birth control if her goal (or her family goal when the family decides) is ultimately to achieve a moderate family size. This delay may also be motivated by timing the births in relation to other objectives such as schooling, career development, financial constraints following the wedding, or dealing with temporary health issues.

The variable 'desired number of children' does not intervene in regulating fertility. It makes also sense that a woman decides to start using regulation means according to her motivation to have at least one birth, rather than necessarily as a function of a given number of children. Moreover, she may plan to have a certain number of children only after experiencing her first child. Finally, such a measure of ideal family size does not provide exact information on the woman's past motivation for having children, as it imperfectly reflects a retrospective opinion liable to have been easily modified. For example, a woman may adjust her desire early (such as at the marriage period), owing to changes in socioeconomic conditions which alter the perceived cost and benefit of children. An ex-post revision of her family size preference may also occur in the case of undesired births through ex-post rationalization—that is, the desired children number declared may inaccurately reflect what the woman desired when she took the decisions to marry and to delay the first birth control.

The older the woman, the higher the likelihood of having used early after marriage some contraceptive means. This is consistent with older women facing earlier health risks when giving birth. Conversely, the husband's age is slightly negatively correlated, at the 10% level, with the timing of the first birth control after marriage. His age delays the first birth control event.

The difficulty of reconciling a woman's tasks as a housewife and a worker also shapes fertility regulation after marriage: consistently with the results previously found: a woman who is able to fulfil both a job and housekeeping tasks is significantly less inclined to control birth early. However, her possible career plans, as measured by whether she was employed before marriage, do not affect the hazard rate of her initial use of birth control, perhaps because it is a pre-marriage variable. Indeed, while 37.7 % of respondent who worked before marriage, only 14.4 % were still working at the time of the survey. Her husband's professional skill level does not affect the first birth control timing. These results may reflect the smaller role of the husband in the decision of fertility timing, given that fathers typically spend less time with children than mothers.[14]

Women's education seems to matter a great deal. Educated women move more quickly to the first contraceptive utilization after marriage, as opposed to findings by Bloom and Trussel (1984) in the US. Again, the husband's education does not seem to matter.

The variable indicating frequent discussions between spouses significantly increases the risk of the control event—that is, diminishes the span without control. In that case, the woman may not feel the obligation to have children immediately after the marriage to ensure that she can more safely keep her husband.

When women are urban, the hazard function is greater—that is, contraception occurs earlier. Sometimes considered an alternative measure of child cost, with higher shadow price of children and greater

[14] Consistent with Becker and Lewis (1973) and Schultz (1986).

availability of services, an urban residence induces women to lower their demand for children, and hence to intensify contraception practice.

Belonging to a traditional family in which the marriage is arranged by the parents, and the presence of family interference, are found to delay the use of contraceptives, perhaps because conservative values favor large family size. This is consistent with findings in the literature that family-arranged marriages are associated with higher fertility.[15] Moreover, the availability of financial parental assistance is found to affect negatively and significantly the timing of the first birth control. Parental financial help induces a positive income effect on fertility which may motivate couples to adjust upward their offspring size to delay birth control.

3.3. Contraceptive Use

The third considered regulation decision is captured by two dummy variables indicating respectively whether contraceptive is currently used and has been ever used.[16] It is typically hard to elicit significant correlates of contraceptive use in the literature. For example, using data from Ghana, Johnson et al. (2012) only find effects (significantly positive) for two district-level variables: a general socioeconomic development index and population density. In our case, the estimated marginal effects of the respective probit models for the two contraception use variables are shown in Table 4. We comment on them together since the significant effects are often similar in the two models.

The estimates exhibit familial networks as significant factors in the fertility strategy. When family members are tightly knit through family intermarriage, encroachment on marital life, or financial intergenerational transfers, contraceptive devices are less often used at the time of the survey or before. As in Ghimire and Axinn's (2013) findings in Nepal, the widespread erosion of family-arranged marriages should relax resistance to contraception use in Tunisia too.

[15] Caldwell (1982); Ghimire and Axinn (2013); Hong (2006); Frini (2014).
[16] Respectively, 'Do you have any experience of contraceptive practice?' and 'Are you using any contraceptive method at the moment?'

Family interference, which is generally accompanied by opportunities for childcare by grandparents, reduces the woman's time devoted to children and thereby her child opportunity cost. Therefore, it encourages her to have more children and, as a consequence, diminishes contraceptive use. In line with the literature,[17] benefiting from family childcare facilitates the coordination of the woman's roles as worker and housewife, and allows higher fertility. As in Del Boca (2002), Ermisch (1989), and Frini (2014), additional family childcare availability encourages fertility. As previously found for the delay in the first birth control, the availability of financial parental support fosters fertility.

A traditional sociocultural context still appears to be unfavorable to birth control. Indeed, women who think that an additional child is a decision by God have lower contraceptive practice. These women may often just be passive observers of their own procreation process. Moreover, traditional contexts in which the woman's marriage is arranged by the families are also associated with lower use of contraception currently.

As in the equation for the delay in the first birth control, easy communication among spouses has affected birth control in the past, but not currently. Similar to findings in Link (2011) and Sharan and Valente (2002), better communication between husband and wife increases contraception use, at least in the past. This is consistent with contraception often being a joint decision by spouses.

A woman's age positively affects her contraceptive use, at the survey time or in the past. Even though many respondents are observed around the end of their reproductive path (49 percent are 37–49 years old), there is enough spread in the age variable to reveal a decline in the need and capacity for progeny with age. However, the husband's age does not influence birth control.

A woman's education is associated with greater use of contraception, whether in the past or at the survey time. The literature has long shown that women's schooling favors better knowledge and more effective and intensive use of contraceptive methods.[18] The effect of education may also be related to

[17] Recently, Aassve et al. (2012); Compton and Pollak (2011); Rindfuss et al. (2007).
[18] Chen et al. (1990); Rosenzweig and Schultz (1989); Schuler et al. (1997).

participation in the labor market. For example, Adebowale et al. (2014) find that more educated Malawian women are more likely to be engaged in professional activities and, as a consequence, more likely to want to limit their progeny. As before, male education does not influence the contraception decision, unlike Cochrane and Guilkey's (1995) findings in the 1988 Tunisian case.

The effect of the compatibility between the two woman's roles as housewife and worker negatively impacts former contraceptive use, although it is insignificant for current use. Perhaps this compatibility matters mostly in the early lifecycle, when the woman is trying to establish her career. If that is the case, this would correspond generally to some 'past use' of contraceptives and justify the results. However, this is not supported by the other variable on careers (woman employed before marriage), which has no significant impact on contraception use, either now or previously. Moreover, the husband's skill levels and residency in urban areas are not associated with fertility control in that case.

The number of desired children affects current contraceptive use, as in Bollen et al. (1995) in 1988 Tunisia, but does not significantly affect past use. This may be because former contraceptive use is not directly related to the current number of desired children, since this goal may have changed over time. Besides, current use of contraceptives may often correspond to the youngest women in the observed sample, with a short fertility history. In that case, the stated number of desired children should express relatively accurately their motivation for fertility regulation. In contrast, large spells of past regulation often correspond to older women who have a long fertility history and have adjusted their desire for children over time.

Finally, the decision to use contraceptives is also related to health. Lost pregnancies, which may be a sign of health problems, may induce women to delay contraception and would explain the positive effect of this variable.

3.4. Birth Control Methods

Once the decision of contraceptive use is taken, a woman has to select a birth control method. This first matters because different methods may have different rates of failure. Hotz and Miller (1993) found that

US couples use more efficient contraceptives when they have more children, which may be the result of having experienced several methods over time. The methods also affect sexual pleasure and comfort differently. For example, Rosenzweig and Schultz (1989) found in the US that the more educated the couples, the more sexually satisfying the methods they chose, while they also achieved better protection due to greater knowledge. Methods may also differ in their availability and in their cost when they are not free.

We estimate a multinomial logit model, in which IUD is the base category as this is the most frequent alternative (58 %). The other categories are chosen as calendar; grouping of pill, IUD, and calendar; and the other methods. This nomenclature preserves both sufficient frequencies in all alternatives and meaningful analyses. The estimates are reported in Table 5.

Only a few effects appear to be significant. Conditional on the list of introduced independent variables in the multinomial model, which appear insignificant when comparing these choices, IUP and the pill are found to be substitutable. Indeed, none of the introduced effects significantly distinguishes use of IUD from use of the pill. This is notably interesting because these two methods give a woman more decision power over birth control.

A woman's age increases all the probabilities of using methods other than the pill and IUD. This is the case for using calendar or for using diverse combinations of methods including (or not) calendar. This may involve cohort issues, since some older women did not have as much choice of methods in their early fertility span as today. Once again, the husband's age does not influence birth control, even the method choice.

Living in an urban area and greater women's education are positively associated with the use of calendar relative to IUD (and the pill), and this whether calendar is isolated or grouped with IUD and the pill. Precisely, 79 % of the urban women and 86 % of the educated women use calendar, for only 21 % of the rural women, and 14 % of the non-educated women. An opposite result was found in the very different context of Ethiopia, where educated women and urban women tend to use modern

contraception (Lakew et al. 2013; Mekonnen and Worku 2011). This may be related to the fact that the calendar method, based on monitoring the fertility period each month, requires the husband's cooperation. In urban areas, men are often more open minded and cooperative, which may allow easier use of the calendar method instead of IUD. For example, a husband's positive attitude toward contraception was found to facilitate the increase in use of contraceptives in Cameroon (Pillai and Teboh 2011). Also, urban women have a greater tendency to use a diverse mix of methods. If a woman's education seems to favor the calendar method (whether on its own, or grouped in a mixture with the pill and IUD), it may be that the calendar method requires some minimal knowledge of calculus for efficient application.

Again, male education and skill levels do not intervene in the fertility regulation, beyond a slight negative effect (at 10 % level) of being an unskilled worker on preferring the calendar method. In these data, as opposed to Cochrane and Guilkey (1995), women's education affects the method choice, while husband's education does not matter much.

More active women, as measured by having been employed before marriage, more often choose a diverse mix of other contraception methods, perhaps because this mix fits better the more diverse circumstances encountered in an active life.

Finally, the number of desired children is not correlated with the choice of method. This suggests that all methods are perceived as sufficient efficient birth control means by the surveyed women.

Most included relationship variables, whether with the husband or the family, do not affect the woman's choice of method. For instance, this is the case for communication among spouses, family intermarriage, and encroachment on marital life, which were correlated with the previously considered decisions.

However, a deficit in female autonomy measured by the obligation of having a relative accompany the woman when she visits a health center is positively and significantly correlated with the use of methods not hindered by this restriction, as opposed to the IUD that requires a doctor visit for prescription. In general, greater female autonomy has been found to contribute to raising contraceptive use (Sallee

2000). We find that it may also affect which kind of contraceptive is used. Finally, descending transfers are positively and significantly associated with lower occurrence of the mix of calendar, the pill, and IUD.

It is worth thinking about these results in terms of beneficial or undesirable consequences for (1) efficiency, (2) pleasure and comfort, and (3) health. For this, the main opposition we can consider is between IUD/the pill on the one hand and calendar on the other. IUD and the pill are more efficient than calendar. However, they may be less comfortable and bring health problems. Using condoms provides the best protection against venereal diseases, while the calendar method or IUD does not protect well against sexually transmitted diseases. In contrast, IUD is very efficient in terms of birth control; then comes the pill, with good efficiency unless the patient forgets to take them, while the other methods may involve rare accidents that allow for unwanted births. In terms of comfort outcomes, condoms are the less comfortable method, while calendar is the most comfortable, and IUD and the pill occupy an intermediate position. Focusing mostly on the comparison of IUD/the pill with calendar, we may attempt to deduce the consequences for some significant correlates in the estimation. In this respect, the woman's age is the variable that has the best consequences, in that it simultaneously improves efficiency, comfort, and health. In contrast, the education of the woman and a rural location have positive impacts on efficiency, but negative ones on comfort and health.

4. Conclusion

We propose to consider fertility decisions as approximately controlled by women or families throughout several sequential decisions: marriage age, duration marriage at the first contraceptive use, contraceptive decision, and methods choice.

What does having a sequential perspective change in terms of analysis of the issues at hand? With this approach, distinct stages in the lifecycle can be better captured, with, for example, concerns about completing schooling or professional establishment early in life, then fertility plans, and finally health

concerns later on. This reveals successive dominant motivations of women, couples, and families that must be taken into account to better understand the whole birth control trajectory.

Although strict causality inference is beyond the possibilities of a single cross-section, the elicited correlations point to suggestive explanations that call for additional collection efforts to better capture lifecycle decisions of family members and the precise interaction of the extended family across this lifecycle.

Among our main findings is the influence of the family on the woman's birth control strategies. In particular, the availability of family childcare and parental financial assistance make the couple less inclined to limit fertility. Thus, neglecting to deal with the husband and other extended family members may make family planning policies less efficient in Tunisia.

Only the woman's age is significantly present in the whole set of estimated successive birth control models. Other independent variables appear to bear differently on diverse stages of this global decision process. Some of these factors are notably missing, such as the number of desired children, which has no significant effect for the contraceptive choice and the first birth control timing, although its effect is significant for the age at marriage, and the education of the woman, which has no effect on marriage but does on delay of the first birth control.

There are a number of policy implications. Even though we cannot assess in these data the direct effects of social policies or of the changes in service offered on contraception practices, it is still interesting to draw tentative policy lessons. The successive motivations of women also have consequences for the design of family planning policies that should be more a case of 'fine tuning' than when focusing only on a general target of offspring size viewed as the exclusive fertility objective of women and families. In particular, the triggering of fertility—that is, having a child or not—and the number of desired children, or spacing of births, have sufficiently distinct correlates to distinguish policy design addressing these two dimensions.

Additionally, policy-makers should account more for the extended family on the design of family planning programs. For example, fertility surveys could be conducted not only directed toward women but also to the husbands and their families. Moreover, media and advertising campaigns for fertility monitoring should also be directed toward men and families, and not just toward women. Finally, future research should also incorporate more sequential perspectives on women in relation to family interactions about fertility processes and associated socioeconomic decisions.

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Appendix

Table 1. First birth control

	Marriage spell before the first birth control					**Number of surviving children before the first birth control**				
Age	Marriage spell at first birth control by region		Marriage spell at first birth control by education level		Average	Surviving children number at first birth control by region		Surviving children number at first birth control by education level		Average
	Urban	Rural	Illiterate	Educated		Urban	Rural	Illiterate	Educated	
20–24	1.22	1.59	1.59	1.28	1.37	0.94	1.12	1.14	0.96	1.01
25–29	1.85	2.54	3.07	1.77	2.10	1.15	1.51	1.62	1.17	1.28
30–34	2.05	3.94	3.89	1.94	2.64	1.18	1.99	1.95	1.15	1.44
35–39	2.82	5.76	5.19	2.70	3.62	1.45	2.70	2.41	1.42	1.79
40–44	4.17	6.93	6.80	3.80	5.03	2.02	3.13	3.06	1.87	2.37
45–49	5.10	10.11	8.76	4.09	6.56	2.35	4.25	3.76	1.96	2.91
Total	3.16	5.60	5.84	2.71	3.92	1.61	2.63	2.68	1.46	1.93

Table 2. Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Dependent variables					
Woman's age at marriage	3,175	21.61	4.20	10	45
Marriage duration before the first birth control	2,595	4.28	4.77	0	28
Contraceptive currently used	3,175	0.62	0.48	0	1
Contraceptive ever used	3,175	0.82	0.38	0	1
Pill	3,170	0.43	0.49	0	1
IUD	3,172	0.58	0.49	0	1
Calendar	3,122	0.19	0.39	0	1
Modality grouping implant, injection, tying tubes, gel, coïtus, condom…	3,175	0.37	0.48	0	1
Modality grouping pill, IUD and calendar	3,175	0.38	0.48	0	1
Independent variables					
Woman's age	3,175	35.85	7.45	16	49
Husband's age	3,175	42.95	9.44	22	99
Woman never educated	3,173	0.37	0.48	0	1
Husband educated	3,165	0.82	0.38	0	1
Job and housekeeping compatibility	3,137	0.59	0.49	0	1
Woman employed before marriage	3,175	0.32	0.46	0	1
Skilled husband worker	3,094	0.14	0.35	0	1
Unskilled husband worker	3,094	0.62	0.48	0	1
Urban	3,175	0.60	0.48	0	1
Woman finances marriage	3,175	0.00	0.01	0	1
Couple finances marriage	3,175	0.00	0.04	0	1
Family interference	3,029	0.52	0.49	0	1
Descending financial transfers	3,175	0.06	0.24	0	1
Family intermarriage	3,172	0.45	0.49	0	1
Family meeting place partner	3,175	0.69	0.46	0	1
Discussion between wife and husband	3,175	0.97	0.15	0	1
Companion to health center	3,174	0.24	0.43	0	1
God adds baby	3,175	0.01	0.13	0	1
Lost pregnancies	3,175	0.09	0.28	0	1
Number of desired children	3,175	3.23	1.46	0	16

Table 3. Estimates of Weibull duration models (estimated coefficients)

Woman's age at marriage		**Marriage duration before the first birth control**	
Woman's age	-0.022***	Woman's age	0.0134***
	(0.0038)		(0.003)
Woman never educated	-0.0632	Husband's age	-0.00539*
	(0.078)		(0.002)
Job and housekeeping compatibility	-0.149***	Woman never educated	-0.231***
	(0.058)		(0.058)
Woman employed before marriage	-0.359***	Husband educated	0.0475
	(0.066)		(0.072)
Urban	-0.139*	Job and housekeeping compatibility	-0.14***
	(0.071)		(0.054)
Woman finances marriage	0.213***	Woman employed before marriage	0.0736
	(0.066)		(0.060)
Family intermarriage	0.161**	Skilled husband worker	0.085
	(0.063)		(0.093)
Family meeting place partner	0.290***	Unskilled husband worker	-0.046
	(0.067)		(0.063)
Number of desired children	0.0903***	Urban	0.109**
	(0.016)		(0.054)
		Descending financial transfers	-0.309***
			(0.106)
		Family interference	-0.112**
Constant	-15.84***		(0.052)
	(0.434)	Family intermarriage	-0.0925*
			(0.052)
		Discussion between wife and husband	0.422***
			(0.148)
		Number of desired children	-0.0098
			(0.016)
		Constant	-2.187***
			(0.266)
Observations	3,132	Observations	2,901

Note: Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table 4. Probit model estimates of contraceptive currently used and ever used (marginal effects)

	Contraceptive currently used	**Contraceptive ever used**
Woman's age	0.0103***	0.0277***
	(0.003)	(0.004)
Husband's age	0.0011	-0.0039
	(0.002)	(0.003)
Woman never educated	-0.150***	-0.222***
	(0.05)	(0.06)
Husband educated	0.014	0.059
	(0.06)	(0.07)
Job and housekeeping compatibility	-0.080	-0.147**
	(0.04)	(0.05)
Woman employed before marriage	0.0072	0.009
	(0.05)	(0.06)
Skilled husband worker	-0.019	0.146
	(0.08)	(0.10)
Unskilled husband worker	-0.029	-0.007
	(0.05)	(0.06)
Urban	-0.0006	0.069
	(0.05)	(0.06)
Descending financial transfers	-0.352***	-0.290**
	(0.09)	(0.11)
Family interference	-0.146***	-0.158***
	(0.04)	(0.05)
Family intermarriage	-0.106**	-0.080
	(0.05)	(0.05)
Discussion between wife and husband	0.155	0.391**
	(0.15)	(0.16)
God adds baby	-0.583***	-0.475**
	(0.18)	(0.18)
Lost pregnancies	-0.289***	-0.330***
	(0.08)	(0.08)
Number of desired children	-0.0385**	-0.025
	(0.01)	(0.01)
Constant	0.187	0.102
	(0.25)	(0.29)
Observations	2,901	2,901

Note: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 5. Multinomial logit: method choice (base category IUD)

	Pill	**Calendar**	**Implant, injection, tying tubes, gel, coïtus, condom…**	**Grouping of pill, IUD and calendar**
Woman's age	-0.008	0.0666***	0.0699***	0.0600***
	(0.01)	(0.02)	(0.01)	(0.009)
Man's age	0.013	-0.012	-0.003	0.0004
	(0.01)	(0.01)	(0.008)	(0.006)
Woman never educated	-0.211	-1.180***	0.234	-0.375**
	(0.21)	(0.42)	(0.17)	(0.15)
Husband educated	-0.225	-0.167	0.064	0.129
	(0.27)	(0.41)	(0.19)	(0.16)
Woman employed before marriage	0.028	0.224	0.337**	0.179
	(0.24)	(0.31)	(0.16)	(0.14)
Skilled husband worker	-0.142	-0.662	-0.261	0.147
	(0.40)	(0.48)	(0.27)	(0.21)
Unskilled husband worker	0.267	-0.615*	0.021	-0.106
	(0.27)	(0.32)	(0.18)	(0.16)
Urban	-0.282	1.108***	-0.353**	0.322**
	(0.22)	(0.41)	(0.15)	(0.14)
Descending financial transfers	0.390	-0.227	-0.519*	-0.667**
	(0.39)	(0.54)	(0.29)	(0.26)
Family intermarriage	0.386*	-0.373	0.122	0.036
	(0.22)	(0.34)	(0.15)	(0.13)
Family interference	-0.20	0.23	-0.14	-0.088
	(0.21)	(0.30)	(0.14)	(0.12)
Discussion between wife and husband	0.669	1.052	-0.192	0.774*
	(0.75)	(1.09)	(0.39)	(0.41)
Companion to health center	0.316	0.511	0.393**	0.069
	(0.25)	(0.35)	(0.17)	(0.15)
Number of desired children	-0.129	-0.023	0.035	-0.016
	(0.08)	(0.09)	(0.05)	(0.05)
Constant	-1.591	-4.869***	-2.389***	-2.16***
	(1.10)	(1.76)	(0.75)	(0.68)
Observations	2,426	2,426	2,426	2,426

Note: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1