Subjective Expectations and Demand for Contraception

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Abstract One-quarter of married, fertile-age women in Sub-Saharan Africa report not wanting a pregnancy and yet do not practice contraception. We collect detailed data on the subjective beliefs of married, adult women not wanting a pregnancy and estimate a structural model of contraceptive choices. Both our structural model and a validation exercise using an exogenous shock to beliefs show that correcting women's beliefs about pregnancy risk absent contraception can increase use considerably. Our structural estimates further indicate that costly interventions like eliminating supply constraints would only modestly increase contraceptive use, while confirming the importance of partners' preferences highlighted in related literature.

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1 Introduction

Total fertility rates in low-income countries remain high, averaging 4.6 children per woman (World Development Indicators, 2019). Importantly, these appear markedly higher than desired by women: in nationally representative surveys, about one quarter of married, fertile-age women in these countries state that they do not wish to become pregnant, but are also not using contraceptives — a phenomenon commonly referred to as "unmet need for family planning." This results in over 52 million unwanted pregnancies and about 70,000 maternal deaths due to unsafe abortions each year (Singh et al., 2014). However, there is surprisingly little systematic evidence about why this so-called unmet need persists.

On the supply-side, fewer than 10% of married women with unmet need across 52 low-income countries cite high cost or inadequate supply as the primary reason for not using contraceptives (Sedgh et al., 2016), and the results of randomized controlled trials providing subsidies for contraceptive use are mixed — e.g., Chin-Quee et al. (2010) and Desai and Tarozzi (2011) find no effect while Anukriti et al. (2021) and Athey et al. (2021) do, suggesting that the importance of supply-side constraints varies across settings. On the demand side, high fertility is strongly correlated with high *desired* fertility (Pritchett, 1994), but very little is known in quantitative terms about the causes of the gap between women's fertility intentions and the practice of contraceptive methods beyond evidence that partner's preferences matter for contraceptive use generally (e.g., Ashraf et al., 2014).[1] Notably, however, nearly half of women not using contraceptives but desiring to avoid pregnancy cite either breastfeeding/amenorrhea or infrequent sex as the primary reason for not using contraception (44% across the 52 countries included in Sedgh et al., 2016) — and may therefore incorrectly believe that they face a low risk of pregnancy.[2] If women systematically underestimate pregnancy risk absent contraception, then simply recalibrating their beliefs may increase contraceptive use.

In this paper, we use detailed data on the subjective beliefs of women in Mozambique to study the role of both supply- and demand-side determinants of contraceptive choice among adult women in union who do not wish to become pregnant. We quantify women's preferences over a broad set of contraceptive choices and attributes using a structural model

[1] See Section 2.1 for Sub-Saharan African specific statistics about the gap between women's fertility intentions and actual fertility and regarding the prevalence of modern vs. traditional contraception.

[2] Close to half (47%) of women reporting infrequent sex as a reason for not using contraception report having sex in the preceding three months. Most women reporting breastfeeding or post-partum amenorrhea as the main reason for not using contraception do not meet the World Health Organization (WHO) criteria for lactational amenorrhea as protection against pregnancy (Sedgh et al., 2016).

and use estimates to predict how contraceptive use would respond to a range of potential technologies and family planning program strategies. Finally, we conduct a validation exercise in which we create an exogenous information shock by informing women about the average risk of pregnancy in the population absent contraception. This allows us to estimate the effect of this information on beliefs about pregnancy risk and intentions to use contraception in the future as well as to evaluate our model predictions regarding *actual use* against this exogenous benchmark.

In doing so, we make four contributions to existing literature. Our first- and key substantive contribution is to provide evidence consistent across our structural modelling and a reduced-form validation exercise exploiting exogenous variation in beliefs that (i) own perceived risk of pregnancy absent contraception is a quantitatively relevant source of discrepancy between pregnancy intentions and contraceptive use, and (ii) it can be effectively altered through a novel, readily scalable, low-cost information intervention providing information to women about the WHO reference risk of pregnancy within 12 months when not using contraception (85%, communicated as "Studies show that, on average, out of 20 sexually active women of reproductive age who do not use any contraception, 17 will get pregnant within the next 12 months"). Low perceived risk of pregnancy is a common self-reported cause of non-use of contraception among postpartum women in SSA (Gahungu et al., 2021) and among women with unintended pregnancies in the US (Nettleman et al., 2007; Mosher et al., 2015). But to the best of our knowledge, our paper is the first to analyze the role of perceived risk of pregnancy absent contraception on non-use beyond self-reported causes.[3]

Second, this paper is the first to document probabilistic beliefs about contraception and use them to structurally model its demand in a developing country. Importantly, our setting is one in which beliefs, preferences, and both economic and societal constraints are likely to differ substantially from those previously studied (namely Delavande (2008) studying the United States and Nakamura (2016) studying Japan). In Delavande (2008), for example, only three of the 100 women interviewed did not use a modern contraceptive method, while 73% of the sample in Nakamura (2016) used condoms and only 7% used hormonal methods. This stands in stark contrast to the context of Sub-Saharan Africa (SSA), where

[3]Two studies use coarse proxies for low perceived risk of pregnancy and find them to be significantly associated with unmet need. These proxies are, in turn: a binary indicator for whether the woman believes that her fecundity is impaired or that she is altogether infecund (Mosher et al., 2015) and an indicator for whether the postpartum woman believes that it is possible to get pregnant before menses return (Embafrash and Mekonnen, 2019).

only 29% of women between the ages of 15 and 49 use a modern contraceptive method, 1 in 3 of these uses injections and less than 1 in 6 uses condoms (United Nations and Social Affairs, 2019).

No single randomized controlled trial is likely to be able to determine which of many alternative policies would be the most effective or cost-effective (Todd and Wolpin, 2006). This seems especially true when there are many possible alternative policies with no clear *a priori* ranking, which applies to our case given the dearth of quantitative evidence on the causes of unmet need in developing countries. In this context, a key advantage of our structural exercise is that it sheds light on the effect of many potential interventions beyond the one we study further, hence informing a variety of potential future research on unmet need for family planning.

Our third contribution is comparing structural estimates with findings derived from exogenous variation in the context of contraceptive behavior, which bolsters confidence in our model's counterfactuals. In contrast to most of the work combining structural modeling and experimental variation (recently reviewed in Todd and Wolpin, forthcoming), we do not have a randomized controlled trial comparing treated and control individuals (i.e., a "between-subject experiment"), but we instead use variation from a "within-subject experiment" comparing the same individuals before- and after they receive our information treatment (requiring no costly follow-up). While in this validation exercise we can only observe changes in (beliefs and in) intended contraceptive use, we can compare the effect of the exogenous information shock on intended contraceptive use with the effect on actual contraceptive use that our model predicts given the observed exogenous change in beliefs. A key advantage of within-subject experiments relative to between-subject experiments is their higher statistical power, while a potential disadvantage is an increased risk of experimenter demand effects (EDE) (de Quidt et al., 2019). We take advantage of this higher power while contributing a new approach to testing for EDE at minimal cost, as we describe below.

Our fourth contribution is to devise a new test for the presence of experimenter demand effects (EDE). Specifically, we model EDE as a form of measurement error (as in Blattman et al., 2019) and derive testable implications of the presence of EDE in beliefs and in intentions to use contraception which can be tested by comparing different estimates of the effect of beliefs on intentions using data obtained both before and after treatment. Intuitively, EDE introduces bias in post-treatment estimates, so estimates using before- and after-treatment data should differ if EDE is present. A similar test can be applied in other contexts and complements prior approaches which are appealing but more costly as they rely on either additional, qualitative data collection to validate survey data (Blattman et al., 2019) or on additional treatment arms in which experimenter demand is made more or less explicit (De Quidt et al., 2018; Mummolo and Peterson, 2019).

We first find, descriptively, that women generally hold accurate (or plausible) beliefs along many dimensions, but they systematically underestimate both the probability of pregnancy absent contraception and the efficacy of hormonal contraceptives (in the latter case, by as much as 3-5 times the true efficacy for injections and implants, respectively).

Strikingly, our structural analysis then shows that common supply-side interventions are unlikely to effectively increase use: even the most dramatic (and costly) increase in supply, removing all direct and indirect monetary costs of contraceptives, eliminating waiting times, and removing uncertainty about availability increases contraceptive prevalence by only 1.1 percentage points. Similarly, new technologies with no side effects increase contraceptive prevalence by about 0.3 percentage points. Alternatively, changing men's fertility preferences and their 'approval' of contraceptives is more effective — if feasible. Aligning fertility preferences between women and their partners increases contraceptive prevalence by 2.4 percentage points, and increasing women's expectations that their partners will approve available forms of contraception by 25 percentage points raises contraceptive prevalence by 3.6 percentage points. Finally, correcting beliefs about pregnancy risk absent contraception by 25 percentage points among women who underestimate this risk raises contraceptive use by about 4.9 percentage points among this group and by 1.9 percentage points overall. Importantly, while these increases may seem small when taken in isolation, they represent substantial progress compared to the current slow pace of change. In comparison, the increase in contraceptive prevalence among married women observed in Mozambique between 2003 and 2015 was only 4 percentage points (MISAU, INE and ICF, 2016). If a comprehensive policy could fully address the demand-side barriers related both to partners and to beliefs about the risk of pregnancy absent contraception, its predicted combined effect would be to reduce unmet need in our sample by nearly 39% (from about 30 to 18 ppts).

The findings from our validation exercise further show that, once informed of the population average risk of pregnancy absent contraception, women realign their probabilistic beliefs about their own risk of pregnancy with this population statistic — suggesting that the initial gap is less due to private information about own risk of pregnancy relative to the average woman than to incorrect beliefs about population risk — and increase their stated intention to use contraceptives in the future. Importantly, our structural estimates are consistent with findings based on exogenous variation in beliefs about own risk of pregnancy absent contraception. Among the main target of our experiment — namely women who, at baseline, believe to be at a lower risk of pregnancy absent contraception than the general population (i.e., below 85%) — our experiment increases the expected risk of pregnancy absent contraception by 23.5pp and intention to use contraceptives in the future by 4.4pp. This is very close to our structural prediction of the effect of the observed exogenous change in beliefs on *actual* contraceptive use (4.8pp). Reassuringly, our tests do not suggest the presence of EDE on either beliefs or intentions to use contraception, especially among this key group of women. Women whose baseline beliefs are above 85% revise their beliefs in line with our information message, but they do not decrease their intentions to use contraception, thus assuaging concerns about unintended consequences. In fact, women in this subgroup also increase their intentions to use, albeit by less than women who underestimate the pregnancy risk at baseline. This may be due to a degree of EDE since our EDE test is less conclusive for this subgroup. But it could also be due to the information message leading to more precise beliefs about the high risk of pregnancy absent contraception.

In addition to the prior literature reviewed above and to which our study most directly contributes, we add to the growing number of economic studies incorporating beliefs data, which have the advantage of allowing preferences to be disentangled from beliefs without assumptions about these beliefs — e.g., that the subjective expectation used by the individual when making decisions is equal to the average outcome observed in the population. These include, for instance, Álvarez and Vera-Hernández (2013), Bennear et al. (2013) and Delavande and Kohler (2015) on health; Wiswall and Zafar (2015), Boneva and Rauh (2019) and Delavande and Zafar (2019) on education; Van der Klaauw and Wolpin (2008) on savings and retirement; and Van der Klaauw (2012) on teachers career decisions.

Our work also complements existing research on the correlation between contraceptive use and demographic, socio-economic and community characteristics (e.g., Ainsworth et al., 1996; Stephenson et al., 2007; Wulifan et al., 2015; Gahungu et al., 2021); on the impact of family planning programs (reviewed in Miller and Babiarz, 2016); as well as randomized evaluations of interventions aimed at encouraging family planning in developing countries (such as Phillips et al., 1982; Desai and Tarozzi, 2011; Shattuck et al., 2011; Ashraf et al., 2014, 2018; Glennerster et al., 2019; Cassidy et al., 2020). Among the latter, most studies shedding light on how contraceptive decisions are formed focus on the role of partners by varying experimentally whether vouchers to access injectables are offered to women in the presence of their partners or not (Ashraf et al., 2014), whether information about maternal mortality is communicated to women, their partners, or neither (Ashraf et al., 2018), and whether or not the use of *female* condoms — which are preferred by men — is promoted (Cassidy et al., 2020).

More generally, our work is related to a rich literature which has produced mixed experimental evidence of the effect of providing information on health and education beliefs and behaviors in developing countries (reviewed in Dupas and Miguel, 2017; Muralidharan, 2017). While there is no simple answer to the question of why information provision has an effect on behavior in some cases but not others, three key considerations are whether: (i) baseline beliefs depart from the information provided, (ii) this information is trusted and *relevant* (i.e., whether the targeted beliefs affect decisions), and (iii) other constraints need to be lifted for individuals to act upon their revised beliefs. Our beliefs data show that baseline beliefs do depart from population statistics, while our results indicate that women trust the information provided in our experiment and find it relevant. Finally, we conclude from both our structural estimates — which take a rich set of other constraints into account including women's perceptions of their partners' preferences — and our validation exercise that, in our context, providing pregnancy risk information potentially increases contraceptive use, and does so independently of other interventions targeting additional barriers to use (such as low bargaining power or high monetary costs).

In the rest of the paper, we provide details about context, data collection and surveyed women's characteristics (Section 2), describe the beliefs data (Section 3) and present the model and estimation approach (Section 4), before reporting our model estimates and counterfactuals (Section 5) and experimental results (Section 6). Section 7 concludes.

2 Context, Data Collection and Respondents' Characteristics

2.1 Context

Even in Sub-Saharan Africa (SSA), where desired fertility is high, total fertility is 25% higher (4 vs. 5.1 children, on average across the 32 SSA countries studied in Sedgh et al., 2016) and 24% of married women aged 15-49 in SSA have an unmet need for family planning (23.1% in Mozambique) (World Development Indicators, 2019). All the figures reported here focus on unmet need for *modern* contraception but would not be much different if the comparatively rare use of traditional methods was accounted for. Indeed, in Sub-Saharan Africa (low-income countries), 27.7% (29.1%) of married women aged 15-49 use modern contraception whereas 31.5% (32.8%) use either modern or "traditional" contraception such as periodical abstinence and withdrawal. The corresponding figures for Mozambique are 25.3% and 27.1% (World Development Indicators, 2019).

With a GDP per capita of only US $426 per capita in 2017, Mozambique remains one of the poorest countries in the world despite recent rapid economic growth (during 1996-2015). Fertility is just above the average in Sub-Saharan Africa (SSA) (of 4.8 children per woman), and has been decreasing only slowly: the total fertility rate (TFR) was 5.9 in 1996, and 5.2 by 2017 (World Development Indicators, 2019).

In the three provinces in the south of the country in which we collected our data, according to MISAU, INE and ICF (2016) the TFR ranges from 2.5 children per woman in the capital city Maputo to 4.7 in Gaza Province and contraceptive prevalence ranges from 42% to 47% (as in Kenya or Malawi in 2010).

2.2 Data Collection

In keeping with the focus of our research — namely the causes of the gap between women's fertility intentions and contraceptive use — we only collected data from women who state that they do not want to have another child at least in the coming two years (following the Demographic and Health Surveys' cutoff) and who were likely to need contraception to achieve their fertility intention. More specifically, we used a screening questionnaire to identify women who: (1) were between 18 and 49, (2) were currently married or living maritally, (3) whose husband or partner, if working away, normally returned home at least once per month, (4) did not identify as infecund when asked about their pregnancy intentions, (5) were not pregnant, and (6) did not want any more children or wanted more but did not want another child in the coming two years. Out of the 758 women screened, 107 were deemed ineligible due to criteria (1) to (6). We also asked the remaining 651 women how likely they would be to state the same fertility intentions if the enumerator came one month later and asked them the same questions, and they all answered that they would either "certainly" (86%) or "probably" (14%) give the same answers.

The survey collected data across nine districts of three provinces in Southern Mozambique (Maputo city, Maputo Province and Gaza Province) between January and February, 2018. The door-to-door recruitment of respondents was guided by targets for the distribution of women's level of education based on the latest Demographic and Health Survey (DHS) at the time of fieldwork (DHS 2011) — the targeted proportions were achieved within a maximum 3 percentage points (pp) margin of error.

The probabilistic beliefs survey instrument followed best practices in the area, including the inclusion of a training module and the use of visual aids (dried beans on a grid) (Delavande et al., 2011; Delavande and Kohler, 2012).[4] As part of the training module, respondents were asked questions about events they are familiar with such as the probability that they will go to the market in the coming 2 days/2 weeks, creating opportunities for the respondents to receive feedback on the consistency of their responses. After completing the training module, the respondents received no comments on their answers.

Using the same wording as in the DHS, we identified women's knowledge of contraceptive methods, prompting them with a brief description whenever they did not immediately say they knew of a method. For all the methods (modern or "traditional") that the respondent said they knew of, as well as for the "no method" alternative, we elicited women's probabilistic beliefs about all the main factors which previous literature has suggested may matter in the decision to use a contraceptive method. We asked about the expected direct costs and indirect costs (e.g., transport costs) of using each method they knew of, as well as about their expected chance of: pregnancy within 12 months; contracting a STD within 12 months; experiencing nausea or headaches; experiencing menstrual irregularities or vaginal infections; experiencing "other" negative side effects;[5] alteration of (their or their partner's) libido or sexual pleasure or interference with romance; getting pregnant within 12 months of discontinuation if wanting to get pregnant; obtaining the method when needed; approval by their partner; being able to use the method — or not using any method in the case of the "no method" alternative — without their partner's knowledge, if for any reason the respondent did not want their partner to know.[6] Responses to the latter question is our measure of perceived concealability. After eliciting women's probabilistic beliefs about contraception, we also asked, among others, about their intentions to use contraception in the future (fol-

[4] Based on evidence presented in Delavande et al. (2011), we asked respondents to express their answers out of 20 rather than out of 10 to improve precision.

[5] After being asked about nausea/headaches and menstrual irregularities, respondents were asked about their chances of "experiencing other negative effects on their health or day-to-day activities as a result of using" each method. This question is aimed at capturing health concerns about contraceptive use, whether relating to actual risks (e.g., mood disorders, stroke) or not.

[6] Pregnancy risk and risk of contracting a STD within 12 months combine expected frequency/timing of intercourse and perceived risk per intercourse. If some women under-report perceived risks over 12 months absent contraception to avoid the potential stigma associated with frequent sex, this may bias our estimates. But as discussed in Section 6.2 (p.36), our data suggests that this is unlikely.

lowing the DHS wording of "Do you intend to use a method to postpone or prevent getting pregnant, at some point in the future? Yes/No/Don't know"), about their partner's desired fertility, and about their sexual activity in the previous month and previous three months.

The enumerators carried out full interviews with 651 eligible women. Of these women, 20 are not sexually active (i.e., report not having had sex in the previous three months) and 24 qualify as infecund based on the DHS definition, and so we drop them from the sample.[7] We also drop 23 women who say they use family planning strategies other than the five main options we consider (injections, no family planning, contraceptive pill, implants and male condoms), such as IUDs (10 women) and traditional methods (6 women) as the number of women using each of these methods is too limited to allow estimation. Out of the 584 women in the resulting analytical sample, 14 women use a combination of methods (i.e., some combination of condom and hormonal method, except for one case combining the pill and implants). In the 13 cases combining a hormonal method with male condoms, we assign the woman to the hormonal method under the assumption that, in these cases, condoms are used mainly for protection against STDs rather than family planning. In the remaining case in which the pill and implants are combined, we assign the woman to implants as it is the most effective of the two methods and it seems likely that the pill was prescribed in order to combat the implants' side effects such as to regulate bleeding.

Respondents' characteristics are described in detail and compared to those from a representative survey in Appendix A-1. To summarize, 30% of our respondents are not using any contraceptive method despite all saying that they do not want to have a child (at least in the coming two years). The most popular contraceptive method is injections, followed by the pill, implants and male condoms. This is largely similar to the method mix reported among comparable women in the latest relevant representative survey, the 2015 AIDS Indicator Survey (AIS).

3 Beliefs Data

3.1 Data Validity

To check the extent to which respondents understand the concept of probability — although the word "probability" was not used when eliciting beliefs, we asked respondents

[7] I.e., they started living maritally five or more years before the interview, are not currently using and have never used contraception, but have not had a child in the past five years and are not pregnant.

to show the enumerator the number of dried beans (out of 20) that best reflected their chance of getting pregnant in the coming year, and then in the coming 5 years. Under 8% of women responded a larger probability in the coming year than in the coming 5 years at their first attempt. After the enumerator explained to these women that she expected a response indicating a larger probability in the coming 5 years than in the coming year as she would have 4 more years, 5% of women still give a lower probability of getting pregnant within 5 than within 1 year. In a robustness check, we exclude these women from the sample and find similar results.

We also asked women to tell us, for four different months in the calendar year (April 2018, July 2018, October 2018, and January 2019), the number of beans which best reflected the probability that it would rain in any given day during this month. While in the years prior to the survey there was much year-on-year variability in the number of rainy days in April and July, women should know that January is the peak of the rainy season while October is a reliably mostly dry month.[8] Figure A-1 shows the distribution of the difference between the expected probability of rain in any given day in January and October. The average difference in answers for the two months is 3.6 beans, compared to an actual difference — expressed in 5-percentage point beans — of 6.2 (3.7) between 2015 and 2017 (2009 and 2018). This suggests that women understood the survey instruments well and elicited probabilistic beliefs are reliable.

Reassuringly, women answer 95.4% of beliefs questions on average, 72% of women have at most 5% of missing answers and only 2% of women have 25% or more missing answers. Table A-4 also reports details of missing values by method and by belief, and Section 5.3 shows that our main findings are robust to excluding women with any missing answers. Another possible concern in these types of data is "bunching" at focal values like 0%, 50%, or 100% (see Dominitz and Manski (1997)). Only five respondents concentrate all their answers in the values 0, 5, 10, 15 or 20 out of 20 beans and our conclusions are unaffected by their exclusion from the sample (see Section 5.3).

3.2 Descriptive Statistics

Table 1 reports selected probabilistic beliefs statistics where answers out of 20 dried beans are converted in probabilities (out of 1) for convenience. For conciseness, in this

[8] The number of rainy days by month between 2015 and 2017 is: 9 to 16 in April, 2 to 13 in July, 16 to 19 in January and 7 to 8 in October (https://www.worldweatheronline.com/maputo-weather-averages/maputo/mz.aspx).

subsection we only highlight some key features of our sample's beliefs. Descriptive statistics for the other method-specific beliefs can be found in Table A-5, and a longer discussion of the beliefs held by the women in our sample is provided in Appendix A-2.

The women in our sample appear to have a very good knowledge of the risk of pregnancy when using condoms. They report this risk to be 17% on average, which is within the 13%-18% pregnancy risk under typical use reported by the WHO.[9] Their average expected probability of pregnancy when using no method is high (78%), but it is lower than the risk in the general population of sexually active women according to the WHO (85%) (WHO/RHR, 2016; WHO/RHR and CCP, Knowledge for Health Project, 2018). While it is not possible to say exactly what the true risk of pregnancy is for the women in our sample under each method, the risk incurred when using methods such as implants, for which there is no variability coming from user's adherence to instructions, should be close to the WHO effectiveness statistics unless the quality of contraceptive products or insertion is questionable. Estimates under common use and therefore taking into account unreliable/low quality supply issues and delays in renewal range across developed and developing countries from a failure rate of 0.05% for implants to 6% for injections over the course of one year (WHO/RHR, 2016; WHO/RHR and CCP, Knowledge for Health Project, 2018; Polis et al., 2016), and failure rates in Mozambique are *below* the median based on data from 43 DHS surveys (Polis et al., 2016). Given this, women appear to vastly overestimate the risk of contraceptive failure associated with these methods, which are at least three times more effective than indicated by the average sample beliefs.[10] Interestingly, Table 3 shows that users of hormonal methods are not better informed about these methods' risk of failure suggesting little learning from own use, as further discussed in Section 5.4 — and consistent with the idea that women rely on information about their wider peer group or other common sources of information rather than extrapolating from their own, single experience.

[9] See WHO/RHR (2016) and WHO/RHR and CCP, Knowledge for Health Project (2018). These are based on the "best available source as determined by authors" (p. 383 of WHO/RHR and CCP, Knowledge for Health Project, 2018). Data from self-reports in developing countries uncorrected for underreporting of abortion indicate a lower rate of unintended pregnancies with male condoms (median of 5.4% Polis et al., 2016).

[10] One threat to adherence to the prescribed use of hormonal methods may be issues with method renewal. But the expected chance of obtaining hormonal methods when needed in our sample is very high (82-86%, see Table A-5).

Table 1: Summary Statistics for Selected Method-Specific Variables

	If using:	Condoms	Implants	Injections	No Method	Pill
WHO P(Pregnancy w/i 12 months)		*0.18*	*0.01*	*0.06*	*0.85*	*0.09*
P(Pregnancy within	Mean	0.17	0.25	0.19	0.78	0.35
12 months)	SD	0.27	0.25	0.23	0.26	0.3
	Obs.	553	469	537	579	540
P(STD within	Mean	0.14	0.79	0.78	0.75	0.78
12 months)	SD	0.27	0.24	0.24	0.27	0.24
	Obs.	557	494	550	566	549
E(Method Cost)	Mean	22.47	25.64	27.03	0	14.07
	SD	130.85	190.58	196.86	0	99.16
	Obs.	554	498	549	584	545
E(Other Costs)	Mean	22.58	27.37	36.55	0	24.07
	SD	171.70	194.50	249.78	0	208.58
	Obs.	554	498	550	584	547
P(Menstrual Irreg.	Mean	0.06	0.52	0.58	0	0.46
or Vaginal Infections)	SD	0.18	0.26	0.30	0	0.31
	Obs.	540	430	529	584	517
P(Altered Libido,	Mean	0.26	0.15	0.19	0	0.14
Pleasure or Romance)	SD	0.32	0.22	0.27	0	0.24
	Obs.	533	418	513	584	497
P(Other Negative	Mean	0.06	0.33	0.31	0	0.31
Effects)	SD	0.164	0.266	0.296	0	0.272
	Obs.	539	440	523	584	516
P(Pregnancy after	Mean	0.81	0.69	0.69	0.73	0.75
Discontinuation)	SD	0.293	0.24	0.25	0.29	0.23
	Obs.	552	462	534	575	539
P(Partner Approval)	Mean	0.55	0.54	0.58	0.4	0.6
	SD	0.32	0.30	0.32	0.34	0.31
	Obs.	554	491	550	574	549
P(Hide from Partner)	Mean	0.05	0.32	0.42	0.32	0.38
	SD	0.18	0.30	0.34	0.33	0.32
	Obs.	558	487	550	573	551

Source: WHO figures in italics: WHO/RHR (2016) and WHO/RHR and CCP, Knowledge for Health Project (2018). For all other figures: survey described in Section 2.2. P(·) stands for "probability of event happening" and E(·) is the expectation operator. "'STD" refers to the perceived probability of contracting a STD. Costs are expected monthly costs. When the number of observations is less than 584, this is due to either some women not knowing of the relevant method (see the last column of Panel B of Table A-1 for the number of women who know of each method), or to women not answering a question about a method. Waiting time corresponds to the middle of the interval chosen by respondents and is expressed in minutes. Top 1% in terms of costs and waiting times removed.

As in many other developing countries today, family planning methods are available free of charge in government facilities in Mozambique, and are also available at a cost from private providers. Consistent with the fact that, except for male condoms, at least 85% of users in the last DHS (2011) obtained their contraceptives from public providers, expected direct monetary costs are low (from 14 to 27 Meticais per month or an annual cost of no more than about 1% of GDP per capita).

We also elicited women's expected probability of approval of each alternative contraceptive method by their coreligionists (i.e., individuals who share the same religion, whose opinions may or not align with the position of religious *authorities*), as well as their parents, friends and partner. Expected approval by coreligionists, friends and parents are thought of as capturing both opposition from people whose opinions women may value and opposition by the woman herself due to religious or cultural reasons. The women's expected probability of approval by others is generally low (60% or less), especially in the case of coreligionists. As expected, women who say that their partners want more children or want them earlier than them have a lower expected probability that their partners would approve of them using a method relative to not using a method.[11] Partners' fertility preferences — which do not vary within woman — are however not the only driver of differences in expected approval across alternatives, which vary within woman: the pairwise coefficient of correlation (ρ) in partner approval across the three hormonal methods is between .68 and .69, and that between condoms and hormonal methods between .37 and .47. Similarly, approval of the "no method" alternative is overall largely uncorrelated with that of specific contraceptive methods (ρ between -.12 and -.01) even though, unsurprisingly, over a quarter of women expecting a high chance (15/20 and above) of partner approval of injections expect a zero chance of approval of the no method alternative, for instance. Taken together, these data suggest that (i) many women believe that their partners are willing to use contraception to achieve the women's family plan even though they personally do not wish to avoid a pregnancy and (ii) method-specific attributes influence partners' willingness to use them.

In summary, women in our sample are, on average, well informed about the failure rate of the male condom method, but underestimate the probability of pregnancy when not using any contraception and vastly overestimate (by a factor of 3 or more) the probability of

[11] For instance, the expected probability of approval if using injections minus the expected probability of approval if not using any method is 25 (2) pp on average among women whose partners have similar (higher) fertility preferences.

pregnancy when using hormonal methods, resulting in a large underestimation of the ability of hormonal methods to protect women against pregnancy relative to using no method. Reassuringly, however, women do not generally appear to be under the misconception that hormonal methods have adverse effects on their ability to get pregnant after discontinuation. Women also understand perfectly well that only condoms protect against STDs, and have a high expected risk of contracting STDs when using no protection. Expected monetary costs, waiting times and other issues with supply are low. The expected probability of side effects is high and within a reasonable range. Finally, expected rates of "approval" by others are low for every available alternative that the women could choose including using no method.

Another important characteristic of these subjective beliefs data is their dispersion, even within groups defined by socioeconomic status and demographic characteristics. If every woman with similar observable characteristics held the same beliefs, then there would be no need to collect subjective beliefs data to identify their preferences for different aspects of family planning — population averages (e.g., on the chance of pregnancy within 12 months for given observable characteristics) would suffice. This is however not the case. There is much variation in beliefs, as illustrated by the standard deviations reported in Table A-5. This is true even within demographic/SES group. For instance, the expected probability of pregnancy within 12 months varies much within age group, as shown in Figure A-2.

In the next section, we use these data to identify women's preferences regarding the wide range of contraceptive characteristics about which we elicited beliefs and predict the effect of several interventions on contraceptive use.

4 Model and Estimation

4.1 Intuition

The idea of our modeling exercise is that women choose the alternative (no method, injections, pill, condoms or implants) associated with the highest utility when taking into account all the expected consequences of choosing each method in their choice set. The combination of the contraceptive choice they make and their beliefs about the consequences of this choice provides information about how much they care about each of the perceived characteristics of each method. For illustration, consider the distribution of beliefs about partner approval for each potential method (rows) by method used (columns) (Table 2). Except for women using no method, for whom the highest expected level of partner approval would be achieved by using condoms, the method chosen is the one with the highest average expected rate of approval by partners. There is therefore a strong correlation between the perceived likelihood of partner approval and a woman's current method. If confirmed after controlling for women's method-invariant characteristics — including whether their partner wants more children or wants them earlier — and beliefs about the many other aspects of contraceptive methods, this would indicate that women have a strong preference for method approval by their partners.

Table 2: Perceived Probabilities of Approval by Partner

	Current users of:				
	No Method	Injections	Pill	Implants	Male Condom
No Method	0.46	0.38	0.37	0.37	0.41
Injections	0.49	0.70	0.56	0.49	0.58
Pill	0.52	0.61	0.70	0.56	0.63
Implants	0.49	0.54	0.53	0.65	0.56
Male Condom	0.53	0.52	0.56	0.51	0.72

Source: Survey described in Section 2.2. Average perceived probabilities that the respondents' partners would approve of the woman choosing the alternative appearing in the row heading, by current method.

Similarly, we can compare, for each method used, women's expected risk of pregnancy within 12 months (Table 3). On average, women do not systematically choose the method they believe to have the lowest pregnancy risk. On the other hand, compared to women using contraceptive methods, women who do not use any method also have the lowest expected risk of pregnancy when not using any method. Without controlling for other women's characteristics and perceived methods attributes, however, it is difficult to say how much utility women derive from a reduction in the risk of pregnancy.

4.2 Decision Model

To shed light on women's preferences, we estimate an additive random utility model (ARUM) consistent with utility maximization, similar to Delavande (2008) but adapted to our context. In particular, we include beliefs about the method's concealability given findings in Ashraf et al. (2014), and study heterogeneity by partner's fertility preferences and women's intention to limit or simply delay pregnancy. A further notable departure from Delavande (2008) is that we use a nested logit including a "no method" nest since

Table 3: Perceived Probabilities of Pregnancy within 12 Months

	Current users of:				
	No Method	Injections	Pill	Implants	Male Condom
No Method	0.71	0.82	0.84	0.77	0.76
Injections	0.20	0.18	0.21	0.20	0.17
Pill	0.35	0.38	0.32	0.38	0.36
Implants	0.25	0.25	0.25	0.23	0.22
Male Condom	0.15	0.16	0.15	0.20	0.22

Source: Survey described in Section 2.2. Average perceived probabilities that the respondent would get pregnant within 12 months if she used the alternative appearing in the row heading, by current method.

many women in our sample use no contraception and we find evidence of correlation between hormonal methods' random shocks affecting method choice. Formally, we start by modeling women as maximizing the following utility function:

$$\max_{m \in M_i} \left\{ \sum_{j=1}^{J} \int u_j(e_j, z_i) dP_{im}(e_j) + \beta_m^\top z_i - \alpha E_i(c_m) + \xi_m + \varepsilon_{im} \right\},$$

where m corresponds to the contraception method and the index set M_i is woman i's choice set (i.e., the methods she knows of including the "no method" method). The index j corresponds to the events for which we elicited beliefs in our survey (e.g., pregnancy within 12 months, contracting a STD within 12 months, ..., listed on p.9). Each one of these possible events is represented by a binary random variable $e_j, j = 1, \ldots, J$, recording whether the woman gets pregnant within 12 months, contracts a STD within 12 months, etc. The function u_j is the utility or disutility derived from event j happening and may also depend on z_i, a set of woman characteristics that do not vary by method. The perceived probability that the event j happens depends in turn on the contraception method adopted and is denoted by P_{im}. The method invariant characteristics z_i, encompassing, for example, age, education, ..., may also affect the utility for the method differentially through $\beta_m^\top$. $E_i(c_m)$ is the subjective expected cost of using method m by woman i and ε_{im} is an idiosyncratic method$\times$individual-specific random component of utility. Finally, ξ_m captures method-specific characteristics unobserved by us but relevant to the woman which we capture by method-specific intercepts as in the demand literature.[12]

[12] If income enters the indirect utility linearly, it cancels out in pairwise comparisons as highlighted in footnote 14. A richer specification, following Berry et al. (1995), would have the indirect utility for method m equal $(y_i - E_i(c_m))^\alpha \exp(\sum_{j=1}^{J} \int u_j(e_j, z_i) dP_{im}(e_j) + \beta_m^\top z_i + \xi_m + \varepsilon_{im})$ where y_i represents income. Taking logs

With binary events e_j and data on the expected probability of event e_j happening and on the expected cost of each method, the probability of choosing method $\bar{m}$ can be written as:

$$
\begin{aligned}
&Pr(\bar{m}|z_i, \{P_{im}(e_j), E_i(c_m)\}_{j\in 1,\dots,n}^{m\in M_i}, M_i) \\
&= Pr\Bigg(\sum_{j=1}^{J}[\Delta u_j(z_i)P_{i\bar{m}}(e_j=1)] + \beta_{\bar{m}}^{\top} z_i - \alpha E_i(c_{\bar{m}}) + \xi_{\overline{m}} + \varepsilon_{i\bar{m}} > \\
&\sum_{j=1}^{J}[\Delta u_j(z_i)P_{im}(e_j=1)] + \beta_m^{\top} z_i - \alpha E_i(c_m) + \xi_m + \varepsilon_{im}, \forall m \in M_i, m \neq \bar{m}\Bigg) \qquad (1)
\end{aligned}
$$

where $\Delta u_j(z_i) = u_j(e_j = 1, z_i) - u_j(e_j = 0, z_i)$ is the difference in utility levels resulting from event j happening rather than not happening. In the empirical implementation we model these $\Delta u_j(z_i)$ as j-specific parameters allowing for (linear) dependence on z_i (namely, individual- and partner fertility preference measures) for specific js. Given data on woman i's subjective beliefs $P_{im}(e_j = 1)$ for every event category j and each method m in their choice set, expected methods costs $E_i(c_m)$ (e.g., waiting time, direct and other monetary costs) for every method and a distributional assumption on ε_{im}, we can estimate Equation (1) and thus identify women's preferences (Δu_j and α).[13]

Consistent with our sample, which only includes women who express the wish to avoid pregnancy, we do not model the choice of having a(nother) child but control for whether women wish to limit or simply delay pregnancy. Relatedly, we do not explicitly model the decision to abort an unwanted pregnancy. However the parameter $\Delta u_j(z_i)$ associated with $j =$"pregnancy within 12 months" captures the woman's disutility from getting pregnant which depends on the strength of her desire to avoid pregnancy and includes the disutility associated with obtaining an abortion if she expects to terminate a pregnancy in case it

and using the approximation $\ln(y_i - E_i(c_m)) \approx \ln y_i - E_i(c_m)/y_i$ for $y_i \gg E_i(c_m)$, one gets a (log-)utility equal to $\sum_{j=1}^{J} \int u_j(e_j, z_i) dP_{im}(e_j) + \beta_m^{\top} z_i - \alpha E_i(c_m)/y_i + \xi_m + \varepsilon_{im}$ plus the method-invariant term $\alpha \ln y_i$, which cancels out in pairwise comparisons. While we do not have data on income, specifications interacting expected monetary costs with age, age squared and education, usually employed in wage regressions, do not yield statistically significant estimates for those interactions. The p-value for a joint test on those coefficients is 0.29 and the effect of removing all supply-side barriers is +1.02p.p., even smaller than the one we encounter.

[13] We use a subjective expected utility maximization approach, assuming that the precision of beliefs does not affect the decision process. Taking the precision of beliefs into account would require data on the dispersion of beliefs and thus add substantially to an already long survey. It would also require making assumptions about how this precision enters the utility function. While we did not collect these data, the good level of understanding of the beliefs survey instruments by respondents suggests that it would be feasible, in future work, to elicit more complex beliefs potentially involving uncertainty or ambiguity regarding the beliefs.

occurs.

If we assume that the ε_{im} are independent Type I extreme value random variables, then the probability of choosing $\bar{m}$ can be modeled as a conditional logit. A limitation of this model is its implied independence of irrelevant alternatives (IIA): the relative choice probabilities for any two alternatives does not depend on characteristics of other methods. This assumption is unlikely to be satisfied for methods which share many similarities, which is the case for the three hormonal methods. We relax the IIA assumption by adopting instead a nested logit, in which women are thought of choosing between three independent top-level limbs (no method, condoms, or hormonal methods) as well as choosing between three bottom-level branches (injections, implants, or the pill) within hormonal methods as depicted in Figure 1. Consequently the random shocks affecting the choice between no method, condoms, or hormonal methods are assumed to be independent, but random shocks affecting the choice between different hormonal methods are allowed to be correlated Type I extreme value random variables (see Cardell, 1997).

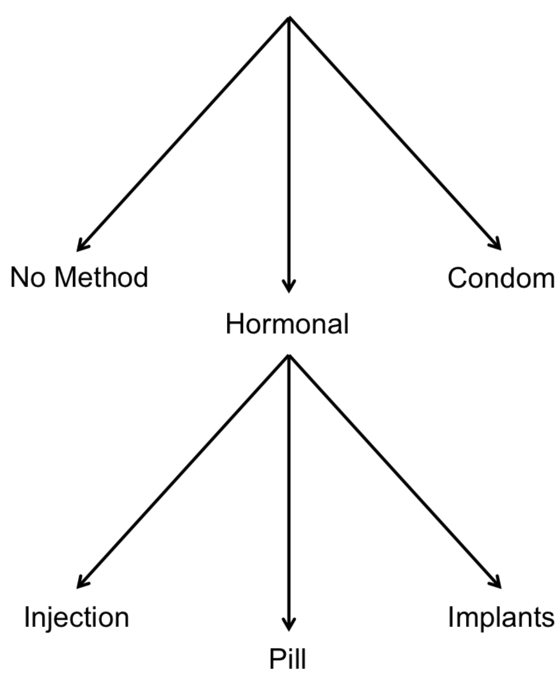

Figure 1: Nested Logit Tree

In this nested logit model, we estimate (i) the effect of method-invariant variables (z_i) on the choice of broad type of method (no method, condoms, or hormonal methods) using the variation between women in these variables (e.g., education level, desire to limit vs. desire to space fertility) and (ii) the effect of method-specific variables (P_{im} and $E_i(c_m)$) using the variation in beliefs within woman between methods. The logit specification implies that any woman-specific additive "fixed effect" affecting beliefs over a given characteristic of methods (e.g., over a given $e_j = 1$ and/or over $E_i(c_m)$) is "factored-out" as long as it applies to all methods.[14] For instance, if a woman systematically underestimates or understates her expected chance of approval by her partner irrespective of the method used, this tendency to underestimate expected approval could be systematically correlated with the choice of method without leading to bias in our estimates.

4.3 Preferred Specification

Our preferred specification includes *all* method-invariant variables such as woman's age group and method-specific variables — e.g., perceived probability of pregnancy with the index method — listed in Tables A-1 (Panel A) and A-5, respectively. In brief, our method-invariant covariates control for age, education, religion, urban location, province, having a partner who wants more children (if a woman does not want any more) or wants them earlier (if she simply wants to delay fertility), a woman's number of children, and a woman's desire to limit (as opposed to simply delay) fertility. These method-specific variables are listed on p.9.

Additionally, to increase our model's flexibility, our preferred specification also includes in the set of method-invariant covariates (z_i) a woman's expected probability of becoming pregnant within 12 months absent contraception and a woman's expected probability of contracting a STD within 12 months absent contraception — i.e., her "default" pregnancy and STD risks. There are several benefits of doing so. First, this allows the alternative-specific expected pregnancy and STD risks to differentially affect the utility of the "no method" and other alternatives.[15] Second, doing so allows a woman's default pregnancy and STD risks to affect choices between alternatives other than "no method."[16]

[14] More specifically, denoting P_{i1m} the subjective probability which woman i associates with event $e_1 = 1$ when using method m, then adding α_i to P_{i1m} for all methods m is cancelled out in pairwise comparisons.

[15] For instance, in Equation 1, the utility associated with the "no method" alternative can now be affected by the perceived risk of pregnancy absent contraception through the relevant Δu_j, which is constant across alternatives, *and* through the alternative-specific coefficient associated with the perceived pregnancy risk absent contraception included in z_i.

[16] When eliciting beliefs about pregnancy (STD) risk under the use of each method, we ask the respondent to choose the number of beans which best reflects her chance of getting pregnant (contracting a STD) "as long as she continues to use the method (and assuming that she is using the method with all her partners, if there is more than one)." In their answers, women may therefore not reflect that they expect their use of

We allow for heterogeneity in preferences for three method-specific variables by interacting them with individual- and partner fertility preference variables, as we next explain. Our sample comprises two groups: women who simply want to space fertility — i.e., they want to have a(nother) child after two years — and those who want to limit fertility — i.e., they do not want another child in the future. Women who want to limit fertility may care more about the ability of a method to protect them against pregnancy than women who simply want to space fertility. Similarly, women who want to have children in the future may care more about the ability to resume fertility after discontinuation of the method. We therefore model $\Delta u_j(z_i)$ as a linear function of z_i where j is, in turn: (1) the pregnancy risk and (2) the probability of managing to get pregnant within 12 months of discontinuation and z_i is, in turn, an indicator for having (i) a "need for spacing" or (ii) a "need for limiting" fertility.[17]

Women may also value more the ability to conceal the use of a method from their partner if their partners disagree with their fertility intentions. Thus we also interact the subjective probability of being able to hide the use of the method from her partner with whether the woman's partner has or not higher fertility preferences.[18] In other words, we also model $\Delta u_j(z_i)$ as a linear function of z_i where j is the "probability of being able to hide the method" and z_i is, in turn, an indicator for having a partner who (i) has or (ii) does not have higher fertility preferences.

5 Estimation Results and Counterfactual Analysis

5.1 Estimation Results

Full nested logit estimates for a range of alternative specifications are reported in Tables A-6, A-10 and A-11. In this subsection we discuss the findings obtained using our preferred model (column 9 of Table A-6), which we use to produce the counterfactuals of Section 5.2, and then discuss the robustness of our findings to alternative specifications (including

the method to be discontinuous. Including the risk of pregnancy (STD) absent contraception in z_i addresses that since it is the pregnancy (STD) risk women revert to when they do not use a condom or miss pills. For instance, if women expect to not use condoms every time they have sex, then their "default" pregnancy risk may influence their choice of condoms relative to injections.

[17]Note that we do not include a constant in this linear function as the two categories "need for spacing" and "need for limiting" exhaust all the possibilities given our sample selection criteria.

[18]I.e., whether she thinks or not that her partner wants more children (if she does not want to have any more) or wants another child sooner than her (if she simply wants to delay for at least 2 years).

restricting the sample to women with no item non-response) in Section 5.3.

Confirming the pattern observed in the raw data, women do not significantly choose the alternative that they believe to be more effective to prevent pregnancy, but they are significantly less likely to go without contraception if their expected risk of pregnancy absent contraception — the woman's "default" pregnancy risk — is higher. The added flexibility coming from the inclusion of the woman's expected probability of pregnancy absent contraception in z_i therefore turns out to be empirically important. If beliefs about pregnancy risks across the different contraceptive methods were very highly correlated within woman, it could explain why the effect of the alternative-specific pregnancy risk is not statistically significant. There is however quite a lot of within-woman variation, as shown in Table A-7, where only two pairwise correlation coefficients are above 0.5 (0.515 and 0.717).

Women also respond to their expected probability of experiencing side-effects: they are less likely to use methods associated with higher risks of nausea/vomiting, less likely to use methods associated with side effects not listed in our questions ("other negative effects"), but more likely to choose methods associated with menstrual irregularities — presumably because they value not having their periods or having lighter periods.

In addition, women prefer methods associated with a higher expected chance of conceiving after discontinuation, irrespective of their desire to have a(nother) child after two years. This suggests that women value fecundity in itself and/or believe that they may change their minds in the future.

The strongest explanatory factor in the choice of method is however a woman's expected probability that her partner would approve of the alternative. Recall that these estimates are net of the effect of the method-invariant variables listed in Table A-1 (Panel A) including whether the woman's partner has higher fertility preferences than her. Therefore, here we find that a woman's expected approval by her partner is a key factor in her choice of family planning (FP) strategy even after conditioning on perceived disagreement between partners about fertility targets.

Interestingly, women whose partners have similar fertility desires to themselves are significantly *less* likely to opt for more concealable FP approaches, whereas concealability has no effect on method choice for women whose partners have higher fertility desires. This suggests that women have a distaste for concealability — consistent with Ashraf et al. (2014)'s finding that using concealable methods has a psychological cost — but that they are more willing to incur this utility cost when their partners do not want them to use contraception.

There is also much to learn from characteristics which do not appear to matter in women's choices. Strikingly, women do not choose methods associated with a lower risk of contracting STDs, suggesting that the decision to use protection against STDs studied, e.g., in Cassidy et al. (2020), may be largely independent from that of using contraception in the setting we examine. This is not to say that women do not respond to STD risk when deciding whether to use condoms. Following the DHS wording, we asked women whether they "currently used any method to delay or prevent a pregnancy", and find similar rates of condom use (Table A-3). Due to the question wording, women who use condoms exclusively to prevent STDs may not report using them. Given our focus on modeling demand for contraception, this wording is however appropriate — if instead we categorized women as choosing the condom alternative when they are not doing so to prevent pregnancy, we may overstate the role of STD prevention in contraception decisions.[19] The expected probability of reduced libido and/or sexual pleasure of either partner and/or interference with romance does not appear to affect contraceptive choices.[20] In stark contrast with expected approval by her partner, expected approval by coreligionists, parents, or friends do not have any significant effect on the woman's choice of method when controlling for expected partner's approval, which points towards the importance of communication and/or bargaining between partners as opposed to fundamental religious or cultural barriers to contraceptive use. Finally, none of the supply-side factors have a statistically significant effect except for expected costs of travel and other indirect costs, which have a negative effect on demand.

Table 4, which reports selected average partial effects and their standard errors indicate that standard errors associated with alternative-specific variables are small enough to detect subtle effects, suggesting that lack of statistical power is not driving our finding that a number of variables do not significantly affect demand.

Turning now to the effect of women's socioeconomic and demographic characteristics, we find that older women, women whose partners have higher fertility preferences and atheists are more likely to use no method relative to their likelihood of using a hormonal method, while women who do not want any more children are less likely to use no method.

[19]If beliefs about STD risks across the different contraceptive methods were very highly correlated within woman, it could explain why the effect of alternative-specific pregnancy risk is not statistically significant. Table A-7 shows that pairwise correlation between STD risk within-woman is below 0.5 except for the correlation of this risk between hormonal methods.

[20]This is the case whether we control for partner's expected approval of the method or not (full results available on request).

Women who have more children are less likely to use condoms relative to their likelihood of using hormonal methods. Finally, belonging to a small religious category (accounting for 3% of the sample or less) also affects the probability of using condoms (e.g., Protestants are less likely to use them).

Table 4: Selected Average Partial Effects Estimates

Average Partial Effect on Probability of Choosing :	No Method	Injections
Probability of Pregnancy Absent Contraception	-0.011	0.005
	(0.003)	(0.001)
Probability of Other Negative Effect of Injections	0.001	-0.008
	(0.004×10^{-1})	(0.003)
Probability of Partner Approving of Injections	-0.004	0.034
	(0.001)	(0.008)
Indirect Cost of Injections	0.005×10^{-2}	-0.004×10^{-1}
	(0.002×10^{-2})	(0.002×10^{-1})
Partner Wants More Kids	0.087	-0.036
	(0.039)	(0.020)
Woman Wants to Limit- Rather than Space Fertility	-0.11	0.033
	(0.043)	(0.026)
Sample size	584	556

Authors' calculations based on the results reported in column 9 of Table A-6, expressed in terms of a one-unit increase. Units are beans for the first three rows and Meticais for the fourth row. Standard errors obtained by the Krinsky-Robb method in parentheses (Krinsky and Robb, 1986; Krinsky et al., 1990; Dowd et al., 2014). Point estimates in the first four rows are obtained by taking the relevant derivative of the choice probabilities reported in footnote 21, evaluating it at the values of the regressors for each observation, and then averaging over the sample. For the binary indicators corresponding to the last two rows, point estimates are obtained by taking the difference in the choice probabilities when the binary indicator is equal to one and when it is equal to zero, for each observation, and then averaging over the sample.

The signs of the nested logit coefficients show the direction of their effect on the probability of choosing each alternative. And provided the regressors are measured in the same unit (e.g., probability of pregnancy out of 20 and probability of nausea/vomiting out of 20), the magnitude of the coefficients reflects the relative importance of each method characteristic in the choice of method. Selected average partial effects are reported in Table 4 to illustrate the economic significance and precision of the point estimates. We report own- and cross-partial effects on the probabilities of choosing no method and choosing the most popular method (injections) for a range of variables. Expressing the effects of small deviations in terms of a one-unit change, a one-bean (5%-point) increase in the probability of pregnancy absent contraception corresponds to a negative average partial effect on the probability of choosing no method of 1.1pp, and about half of this decrease translates into a positive average partial effect on the use of injections. Even considering the type of side effect with the largest nested logit coefficient ("other negative effects"), a one-bean (5%-point) decrease in the probability of injections side effects only produces a negative 0.1%-point partial effect on non-use. A one-bean (5%-point) increase in the probability of the partner approving of injections leads to a 3.4%-point partial effect on the use of injections, but most of this increase comes from substitution away from other methods, with a negative partial effect on non-use of only 0.43%-point. The effect of increasing the indirect cost of using injections by one unit (Metical) is small, as the partial effect on the demand for injections is only negative 0.04%-point. If we went from none- to all the women's partners having higher fertility desires than them, non-use would increase by 8.8pp and demand for injections would decrease by 3.6pp. This is not dissimilar to the effect of going from all women wanting to limit fertility to simply wanting to space it (11pp and 3.2pp, respectively).

In Section 5.2, we present a number of counterfactuals which illustrate further the absolute- and relative importance of different barriers to contraceptive use.

5.2 Counterfactual Analysis

We now turn to predicting the effect of alternative interventions on the method mix using estimates from our preferred specification (column 9 of Table A-6).[21] We consider the effect of five alternative interventions on the predicted probabilities of using each of the five family planning strategies considered in our estimation. Results are reported in Figure 2 and in Panel A of Table A-8. For concision, here we focus on the effect on the predicted probability of not using any method.

First, we estimate the effect of increasing by 25 percentage points (pp) the expected risk of pregnancy absent contraception for women who have a baseline expected probability under 85% (the WHO reference risk). This is estimated to increase contraceptive use by

[21]The choice probability for option $\bar{m}$ is given by $Pr(\bar{m}|z_i, \{P_{im}(e_j), E_i(c_m)\}_{j\in 1,\ldots,n}^{m\in M_i}, M_i) = \frac{\exp(V_{\bar{m}}/\tau(\bar{m}))}{\exp(\mathrm{IV}(\bar{m}))}\frac{\exp(\tau(\bar{m})\mathrm{IV}(\bar{m}))}{\sum_n \exp(\tau_n \mathrm{IV}_n)}$. The variable $V_{\bar{m}}$ denotes $\sum_{j=1}^{J}[\Delta u_j(z_i)P_{i\bar{m}}(e_j=1)] + \beta_{\bar{m}}^{\top} z_i - \alpha E_i(c_{\bar{m}}) + \xi_{\bar{m}}$. IV_n denotes the "inclusive value" (i.e., expected utility) for nest n and is given by $\ln\left(\sum_{m\in B_n}\exp(V_m/\tau_n)\right)$, where B_n is the set of alternatives in nest n and $1-\tau_n^2$ is the correlation among alternatives in nest n. For limbs with only one alternative, like those for condoms and no method, τ is one. We estimate τ in the hormonal nest to be between 0.13 and 0.68 depending on specification (see Table A-6). The notation $\mathrm{IV}(\bar{m})$ and $\tau(\bar{m})$ corresponds to the inclusive value and τ for the nest to which alternative $\bar{m}$ belongs. These expressions are used to generate the predicted choice probabilities in our different counterfactual scenarios.

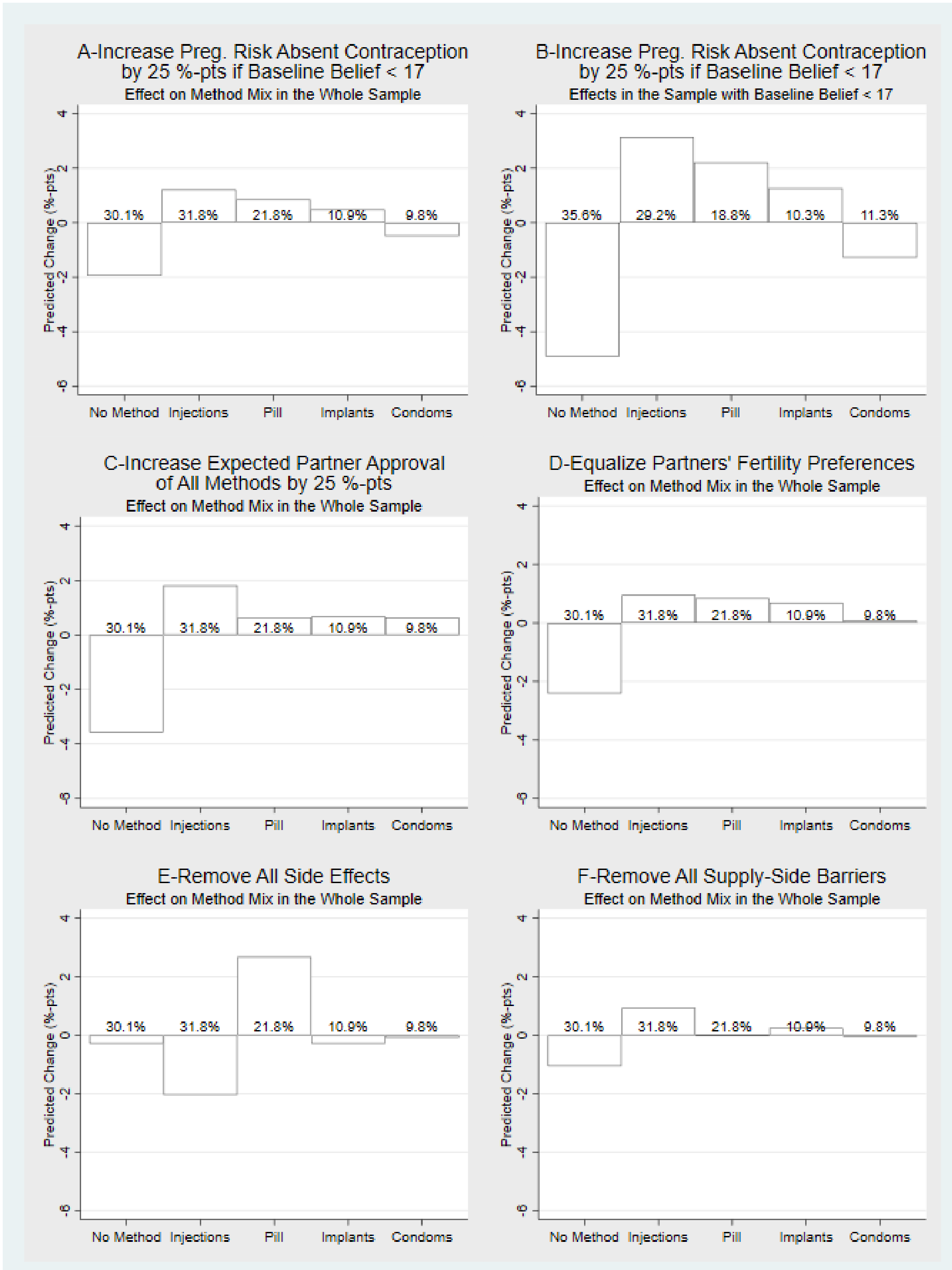

Figure 2: Counterfactuals

Note: The baseline share for each alternative is the share of women who choose the alternative among those who know of the alternative. Shares therefore add up to slightly more than 1 (up to 1.05). Since "No method" is in every woman's choice set, the reported changes in the share of women using no contraception can be interpreted as changes in prevalence for the whole sample.

4.9pp among this group of women (Figure 2-B) or 1.9pp overall (Figure 2-A). Women in our sample believe that the risk of method failure is much higher than population estimates suggest. But recall that our model estimates show that women do not significantly choose contraceptive methods that they believe to be more effective to prevent pregnancy, so we should not expect much change in demand from recalibrating beliefs about failure rates. Indeed, in a counterfactual setting women's beliefs about method effectiveness to be equal to population estimates, contraceptive prevalence only increases by 0.1pp.

Second, we consider policies involving partners. Increasing by 25pp the expected rate of approval by partners of all modern methods would increase contraceptive use by 3.6pp (Figure 2-C), while aligning the woman's partner's preferences for fertility with the woman's would increase contraceptive uptake by 2.4pp (Figure 2-D).

Third, we turn to an intervention targeting side effects. A major scientific breakthrough removing all side effects accompanied by a successful campaign convincing women of this progress would only increase contraceptive use by 0.3pp (Figure 2-E). This is not to say that women do not care about side effects: rather, they value some side effects (menstrual irregularities — likely due to mild or no periods) while avoiding methods associated with a higher chance of nausea/headaches and of other negative effects. Indeed, if one could remove only the perceived negative side effects of hormonal methods but not their perceived side benefit, our model would predict an increase in contraceptive use by 1.8pp driven by an increase in the use of the contraceptive associated with the highest perceived chance of nausea/headaches, namely the pill (2.3pp). From a policy point of view, however, this does not seem feasible since the same hormones used in contraceptives are responsible for multiple side effects, good and bad.

Fourth, we turn to interventions targeting access to contraceptive supply both in terms of direct- and indirect monetary costs and in terms of supply reliability and availability. Removing all supply-side constraints — i.e., setting the expected probability of obtaining the method when needed to 100% and setting all monetary costs and waiting times to zero — would reduce unmet need by 1.1pp (Figure 2-F).

These counterfactual scenarios broadly match the main reasons generally self-reported for not using any contraception despite not wanting to get pregnant (low perceived risk of pregnancy, side effects, disapproval by the women themselves or those close to them, Sedgh et al., 2016), and additionally consider the effect of removing all supply-side barriers. Of these four approaches to reducing unmet need for family planning, two would likely be very costly (removing side effects and removing supply-side constraints). Our predictions indicate that they would also not be particularly effective in our setting, suggesting low cost-effectiveness. Much more encouragingly, increasing perceived method approval by partners and aligning fertility preferences within the couple would be a powerful tool to decrease unmet need, thus suggesting a fruitful direction for future work. The cost of increasing the rate of method approval by partners is however unclear *a priori* and may be very high if it is due to aversion to contraceptive methods deep-rooted in patriarchal social norms. Although decreasing men's fertility preferences is possible (see, e.g., Ashraf et al., 2018), doing so to the extent that they would match the women's is likely to be costly too. Our counterfactuals however suggest that sizeable increases in contraceptive uptake would result from a potentially low-cost recalibration of women's beliefs about the risk of pregnancy absent contraception.

Having investigated the individual effect of addressing one type of barriers to contraceptive use at a time, we now illustrate what our estimates tell us about what would be needed to drastically reduce unmet need in our setting.

We first assess the overall contribution of demand-side factors to unmet need. The three demand-side interventions considered so far target, in turn, beliefs about the risk of pregnancy absent contraception, partners' fertility preferences, and partners' contraceptive approval. In an illustrative scenario where these three sources of unmet need are simultaneously and successfully addressed (namely, the expected risk of pregnancy absent contraception is set to 17 out of 20 for women with beliefs below 17, all partners are set to have the same fertility preferences as their wives, and the expected chance of partner approval is set to 20 for all four methods), unmet need is predicted to decrease by as much as 39% (from about 30 ppts to 18 ppts).

Finally, we ask how much of the gap between fertility intentions and contraceptive use we can account for using the variables which statistically significantly influence the decision to use contraception according to our model estimates. The two following scenarios are not plausible policy outcomes but provide a useful accounting exercise. We first predict the effect of fully removing all the barriers to use contraception without changing women's characteristics, their own fertility preferences (i.e., whether women want to space or limit fertility), or leveraging women's taste for hormone-induced menstrual changes or their distaste for concealability.[22] In this scenario, unmet need is predicted to decrease by 51%.

[22] More specifically, we set all beliefs about the chances of experiencing nausea and any other negative side effect to zero, set beliefs about the chances of managing to get pregnant within 12 months of discontinuation of a method to be equal to the highest probability across all alternatives in the woman's choice set, set the expected chance of approval by partners of all contraceptive methods to 20 (out of 20), set partners' fertility

If in addition we assign all women to the 18-24 age group, assume that they all wish not to have any more children as opposed to some women simply wanting to wait at least two years, set the perceived chances of experiencing menstrual irregularities when using contraception to 20 out of 20 and finally set the probability of being able to hide the use of all methods to 0 when men and women have similar fertility preferences, our model would predict a 74% decrease in unmet need.

In the next subsection, we assess the robustness of our conclusions so far to changes in specification and samples. In Section 6, we further investigate the potential for increasing contraceptive use by recalibrating beliefs regarding the pregnancy risk about contraception through an exogenous "shock" to these beliefs implemented towards the end of our survey.

5.3 Robustness Checks

In our preferred model, missing values about method-specific characteristics are set to zero and we include one binary variable per method-specific belief indicating missing values. We do so because most women answer most beliefs questions and, given the large number of characteristics-by-method questions, excluding women on the basis of having any missing answer substantially reduces sample size and may lead to a selected sample.[23] In this subsection we show that our our main conclusions are not affected by this imputation or a number of other potential concerns about data reliability.

Reassuringly, women answer 95.4% of beliefs questions on average, 72% of women have at most 5% of missing answers and only 2% of women have 25% or more missing answers (see Table A-4). The large number of beliefs variables asked from respondents (75.6 on average) however leads to a significant reduction in sample size when keeping only women with no missing answers (49%), and the pattern of non-response appears to be non-random. For instance, better educated women, women in urban areas and women whose partners have higher fertility preferences than themselves are significantly more likely to answer all the questions.

In Table A-6, we report estimates for a number of specifications, starting from a model controlling only for women's characteristics and the subjective risk of pregnancy associated with each method, and building up the set of covariates up to our preferred model

preferences to align with those of the respondents, set indirect monetary costs to be equal to zero, and set the expected risk of pregnancy absent contraception to 20.

[23]In the linear regression model, there is a trade-off between potential biases arising from the use of indicators to account for missing values when missingness is related to covariates as suggested below and the loss of precision resulting from the exclusion of observations with missing values (see Jones, 1996).

(column 9). For each model we estimate, we report (i) results obtained with the full sample (2761 observations from 584 women), where missing values are set to zero and missing value indicators included and (ii) results obtained when women with any missing value are excluded from the sample. Across all samples and specifications in which they are included, the expected probability of partner's approval of the method, the probability of other negative effects, woman's age and the perceived risk of pregnancy absent contraception are consistently statistically significant determinants of women's decisions (with little variation in the magnitude of these effects across specifications). For a given set of covariates, results obtained with or without imputing are largely qualitatively similar despite some quantitative differences. To assess the extent to which this affects our counterfactuals, in Table A-8 we compare counterfactuals obtained with our preferred specification with (column 9 of Table A-6) and without (column 10 of Table A-6) imputing missing values. While there are some quantitative differences between the two sets of estimates, the qualitative pattern and overall conclusions are robust to the exclusion of women with any missing value. In particular, the predicted effect on contraceptive use of increasing by 25% points the expected risk of pregnancy absent contraception of women with beliefs below the population average (17 out of 20) is almost identical (among women with beliefs below 17, it is 0.049 in one case and 0.047 in the other).

We additionally test the robustness of our estimates to the possibility that non-response is systematically correlated with high- or low- subjective probabilities. To do so, we set missing observations for a given regressor to either all be equal to small values (mean minus one standard deviation) or all to be equal to large values (mean plus one standard deviation) and re-estimate the model using the data thus obtained. We first do so for one regressor at a time — resulting in 42 sets of estimates — and report in Table A-9 the minimum (Column (2)) and maximum values (Column (3)) of each parameter estimate across all these sets of estimates. In addition, we re-estimate the model after assigning all missing values of each regressor to either a small or large value with probability 0.5,[24] and report the results in the last column of Table A-9. Results are largely stable, both qualitatively and quantitatively. The few sign reversals observed pertain to coefficients that are too small to be statistically significant in our baseline model, except for that associated

[24] I.e., we assign all missing values for regressor 1 to its mean value minus one standard deviation with probability 0.5 or all missing values for this regressor to its mean value plus one standard deviation with probability 0.5, and assign all missing values for regressor 2 to its mean value minus one standard deviation with probability 0.5 or all missing values for this regressor to its mean value plus one standard deviation with probability 0.5, etc....

with the expected value of "other costs", which is small but negative and significant at 10% in our main analysis, but has a very small, counter-intuitively positive coefficient in some small/large value imputation scenarios.

In Table A-10, we report results from further robustness checks in which we estimate our preferred model on three additional samples in which we exclude observations for which our beliefs data might be less reliable. As can be seen by comparing the first column of Table A-10, which reports our baseline results, with each of the other three columns, results are largely robust to (i) excluding the five respondents who concentrate all their answers in the values 0, 5, 10, 15 or 20 out of 20 beans (column 2) (ii) excluding methods which may not genuinely belong to the woman's consideration set, operationalized here as methods for which a woman answered fewer than 13 out of the 16 questions used to construct our method-specific variables (column 3) and (iii) excluding the 28 women who answered a higher chance that they would get pregnant within 12 months than within 5 years in the training section of the interview (column 4). The only noticeable difference is that, in the latter set of results, the effect of expected costs is qualitatively similar but the pattern is more extreme as the coefficient associated with direct (indirect) monetary costs becomes more positive (negative).

In Table A-11, we compare our baseline results (column 1) with estimates obtained with only two nests in the model (no method vs. any method) (column 2) or when focusing on the choice between contraceptive methods among current users only (column 3). Results are qualitatively similar across the three sets of results. The only notable differences are that (i) chances of pregnancy after discontinuation do not significantly affect choices in the two-nest model (column 2) and (ii) quantitatively, choices are more responsive to alternative-specific characteristics when focusing on the choice of method among users (column 3).

5.4 Threats to Identification

As explained in Section 4, the variation used to identify our model coefficients comes from both within-woman variation in beliefs about the attributes of each alternative and from between-women differences in characteristics and use. One limitation of the counterfactuals of section 5.2, as with any modeling exercise relying on observational data, is therefore that confounding factors correlated with both beliefs and contraceptive choices might bias estimates — although this risk is mitigated here by the collection of data covering a large array of factors that may influence contraceptive decisions and which would normally fall in the "unobservables" category.

In particular, one concern may be that women systematically report more favorable beliefs about the alternative they are currently using in order to justify their choices — i.e., they may practice "ex-post rationalization."[25] Or there might be learning effects — i.e., women's beliefs such as those regarding partner's expected approval may be influenced by use. If this were the case, then this may bias the nested logit estimates so that our model predictions may not be informative regarding the effect of changing beliefs.

Ex-post rationalization and learning effects do not, however, seem likely to be an important issue in our data for two reasons. First, women do not report more favorable beliefs about all aspects of the method they are currently using. For instance, women do not report a systematically lower risk of pregnancy for the contraceptive method they are currently using (Table 3). In particular, women using methods where the user has little role in the method's efficacy do not hold significantly more accurate beliefs about these methods' failure rates (t-test p-value: .34 (.59) for injections (implants)). Second, there is no evidence that women who have been using a contraceptive method for a longer period of time are more likely to report favorable beliefs about this method (including a higher expected probability of approval by their partners). As noted by Delavande and Zafar (2019), ex-post rationalization should arguably be stronger among individuals who have been with their current alternative for a longer period of time — i.e., their chosen university in the case of Delavande and Zafar (2019). However, in our data as in theirs, there is no indication that individuals who have been with their current alternative for a longer period of time report more favorable beliefs about this alternative. Table A-12 reports estimates obtained when regressing each belief variable in turn on the year the woman started using the contraceptive method she is currently using, a constant, and all the method-invariant characteristics included in Panel A of Table A-1. Only 2 out of 16 coefficients are statistically significant, and only marginally so. In one case (women who have started using the method more recently report higher probabilities of menstrual irregularities), the sign of the significant coefficient does not suggest ex-post rationalization.[26] In the other (women who have started using the method more recently report higher expected waiting times), the magni-

[25]Ex-post rationalization bias has previously been discussed in the context of fertility intentions — an area in which women may be thought to be particularly prone to ex-post rationalization since admitting that a child was unwanted may bear a high psychological cost. Pritchett (1994), however, finds that actual fertility is equally correlated with different measures of self-reported desired fertility, irrespective of whether the measure is retrospective, suggesting very low bias.

[26]Recall that the estimates reported in Table A-6 indicate that women prefer methods associated with menstrual irregularities (e.g., because this generally means light or no periods).

tude of the effect is very small — starting use one year later increases the expected waiting time by less than 30 seconds. More generally, the weakness of the correlation between stated beliefs and the duration of use of contraceptive methods also suggests that learning from use — which could bias our estimates — is limited. Taken together, the data are consistent with women relying on information about their wider peer group or other common sources of information rather than extrapolating from their own, single experience when forming beliefs about themselves — thus meeting a precondition for women to respond to new information based on population-level statistics.

Another concern might be that women state beliefs to justify their choices. The structure of the questions however means that a significant degree of sophistication would be required to provide a pattern of answers that artificially points to a particular reason for choosing a method. Women are never asked directly why they chose their current alternative. Instead, they are asked, in turn for each event, about the chances of an event happening under each method in turn. If, for instance, women wanted to "pretend" that they had chosen their current alternative because of partner approval instead of side effects, for the effect of side effects to not appear significant in the demand model they would have had to manipulate answers to questions about beliefs about side effects without knowing that questions about beliefs about their partner's approval were coming. One particular concern may be that women report a high expected chance of side-effects and/or unreliable supply with methods which they do not use for some more difficult reason to acknowledge (e.g., their partner disapproves). However in this case we would find these two factors to play an important role in contraceptive decision, which, as reported in Section 5.2 is not the case.

In the next section, we present findings based on an exogenous information shock that corroborate our model estimates and hence further bolster our confidence in these estimates.

6 Validation Exercise

To test the plausibility of our model predictions, we created an exogenous "shock" to beliefs about the probability of pregnancy absent contraception. First, this allows us to evaluate — without making any modeling assumptions — the effect of a simple information message on the perceived risk of pregnancy absent contraception and on intentions to use contraception in the future. We then compare the observed effect on intentions to use contraception to the effect on contraceptive use predicted by our model for the observed change in beliefs following our information message.

6.1 Information Treatment

After eliciting the woman's beliefs about contraceptive methods, we asked her whether she intended to use contraception in the future (for the exact wording of the question, see p. 10). We then asked a number of questions including the respondent's level of trust in health information messages obtained from (nine) different potential sources.[27]

Next, we proceeded to our experiment. We selected a random subsample of women whom the enumerator informed that:[28]

> "Studies show that, on average, out of 20 sexually active women of reproductive age who do not use any contraception, 17 will get pregnant within the next 12 months"

The enumerator then asked the respondent again about their intention to use contraceptives in the future, as well as asking them *two* questions about the expected probability of pregnancy within 12 months if not using any contraceptive. The first question was worded closely to the information message the participants had just received, except for asking specifically about women "like them":

> (i) "Imagine 20 women exactly like you at this moment. That is, 20 women identical in all aspects, including with the same lifestyle as yourself, a husband identical to yours, etc... Choose the number of beans which best reflects, in your opinion, the number of women among these 20 who will get pregnant in the coming 12 months, if they do not use any contraception?"

The second question asked specifically about the respondent herself, and in exactly the same way as when the question was put to them in the main beliefs module — 40 or so minutes earlier:

[27] We found that there was a high level of trust in health professionals, especially in government facilities: 80.6% (93.9%) of respondents said that they would certainly trust a message about pregnancy risks if it came from a nurse (doctor) in a government facility compared to 70% if this information came from a radio or TV program, 63.9% if it came from a pharmacist or 47% if it came from a school teacher, for instance.

[28] We did not treat all the women in our sample in case further funding became available to measure additional outcomes in follow-up surveys. This, however, did not materialize within the time frame during which the IRB permitted us to retain respondents contact details (12 months). The randomization however ensures that the average treatment effect on the treated should be equal to the average treatment effect on the non treated. See Table A-13 for a comparison of characteristics of women who received- and did not receive our information message.

(ii) "Choose the number of beans which best reflects, in your opinion, the chance that you will get pregnant in the coming 12 months, if you do not use any contraception?"

The exogenous variation exploited in the present analysis is the difference between answers given by the same women before and after they received our information message. In the next subsection, we discuss how we address the concern that women may just say what they think the experimenter wants to hear after receiving the information message.

6.2 Mitigating Experimenter Demand Effects

Experimenter demand effects (EDE) — defined here as the difference between true and reported post-treatment outcomes — are a pervasive concern in experimental work. Recent studies find variable levels of treatment effect biases due to measurement error, with smaller levels found in common survey- and lab-experiment tasks in high-income countries (De Quidt et al., 2018; Mummolo and Peterson, 2019) than in a field experiment in a low-income country (Blattman et al., 2019). We address EDE concerns in three ways.

First, we look for indicative signs of EDE by studying the two measures of posterior beliefs we elicit. Our design gives respondents an opportunity to meet experimenter demand — if they perceive some — in a way that does not affect our analysis, by asking them about the risk of pregnancy "out of 20 women like them" (question (i) in the previous subsection). This may offer respondents an opportunity to "please" the interviewer if they wish to do so without affecting our estimates of the effect of the information message since we do not use responses to question (i) in our impact evaluation. Enumerators then ask the more personal question of what respondents think is their own probability of pregnancy absent contraception, which we use for impact evaluation purposes. Interestingly, we can reject that the average answer to the first question (15.7) is 17 (p-value of less than 0.0001), but not that the average answer to the second question (16.7) is 17 (p-value: 0.12). This does not suggest the presence of EDE since a question more closely worded to the information message would seem likely to encourage more social desirability bias. Figure 3 then plots answers to questions (i) and (ii). Unsurprisingly, answers are positively correlated ($\rho = 0.472$) but very few women simply answer 17 at either question, which is also encouraging from the point of view of EDE.[29]

[29] The dispersion of both variables is similar (3.84 for answers to (i) and 3.71 for answers to (ii)), suggesting that the use of beans in question (ii) does not introduce additional sampling variation.

While we did not probe women about differences in their answers to questions (i) and (ii), the pattern of responses would be consistent with respondents believing that women "like them" are less fecund than average, but that they themselves are more fecund than the average woman which they understood as being "like them." A comparison of answers to question (i) and (ii) also suggests that women are unlikely to under-report their expected pregnancy risk within 12 months to avoid the potential stigma associated with frequent sex. Indeed, if this were the case we would not expect women to report a *higher* expected risk of pregnancy for themselves than among 20 women like them.

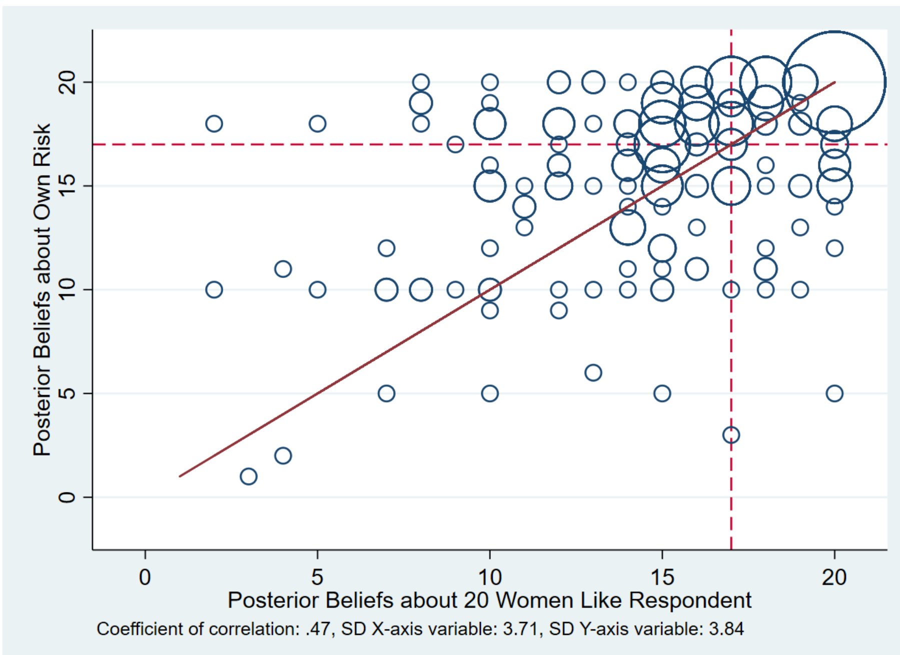

Figure 3: Posterior Beliefs About Own Risk of Pregnancy Absent Contraception vs. Risk Among 20 Women Like Respondent

Source: Survey described in Section 2.2.

Second, after reporting our experimental results on beliefs, we test formally for EDE. Appendix A-5 shows that the presence of EDE in either beliefs about pregnancy risk absent contraception or intended use would lead to inconsistent estimates of the effect of beliefs on intentions in the post-treatment data. Comparing estimates of the effect of beliefs on intentions before and after receiving the information treatment can thus provide a combined test of EDE on beliefs and intended use.

To fix ideas, denoting reported intended take-up in period t=0 ("before information provision") or t=1 ("after information provision") by y_t, and reported beliefs in period t by

b_t, the linear probability model for y_t is given by

$$y_t = \beta_0 + \beta_1 b_t + u_t.$$

Noting that $b_1 = b_0 + \Delta b$, we can express the regression for period $t = 0$ as

$$y_0 = \beta_0 + \beta_1 b_0 + u_0$$

and the regression for period $t = 1$ as

$$y_1 = \beta_0 + \beta_1 b_0 + \beta_1 \Delta b + u_1$$

In the presence of experimenter demand on beliefs, $b_1 = b_1^* + v$ and $b_0 = b_0^*$, where $b_t^*, t = 0, 1$ are true beliefs and v is the EDE on beliefs. In an OLS regression of y_0 on b_0, the coefficient on b_0 provides a consistent estimate of β_1 whether or not beliefs or contraceptive intentions are misreported after the information treatment. But as shown in Appendix A-5, in the presence of EDE, the OLS estimator for the coefficients on b_0 and on Δb in a regression of y_1 on b_0 and Δb leads to inconsistent estimates of β_1.

Setting now aside its repercussions for beliefs, if experimenter demand affects reported intended take-up, then

$$\mathbb{E}(y_1 | b_0, \Delta b) = (\alpha_0 + \beta_0) + (1 - \alpha_0 - \alpha_1)\beta_1 b_0 + (1 - \alpha_0 - \alpha_1)\beta_1 \Delta b,$$

where $\alpha_0 = \mathbb{P}(y_1 = 1 | y_1^* = 0)$ and $\alpha_1 = \mathbb{P}(y_1 = 0 | y_1^* = 1)$ are miss-classification probabilities and y_1^* is true take-up intention as opposed to reported take-up intention, y_1 (see Hausman et al. (1998)). Consequently, if when regressing y_0 on b_0 and y_1 on b_1 and Δb, the three coefficient estimates associated with beliefs are similar, there is no evidence for experimenter's demands effects on either beliefs or reported take-up intention.

Finally, we carry out our validation exercise. Namely, we compare the effect of the information shock on intentions to use contraception to the effect on *actual* contraceptive use which our ARUM model would predict given the observed pre-post information shock change in beliefs. Finding consistent results is reassuring both in terms of the soundness of our ARUM model and in terms of EDE concerns.

6.3 Results

In Table 5, we report, for four samples of treated women, changes in average beliefs about the risk of pregnancy absent contraception, changes in intentions to use contraception in the future, and the p-values corresponding to two tests. The first is a t-test of differences in the before- and after-information answers. For the binary outcome, we also implement a McNemar test, which is a popular test for before-after treatment comparisons of this type of outcomes (Fagerland et al., 2013).[30]

We find that women update their stated expected chance of pregnancy in line with the new information (from 15.8 to 16.7 out of 20, on average, Table 5 Panel A) and these updates are statistically significant. As can be seen in Panel B, as expected a much larger upwards beliefs revision is observed among women who expected a risk of pregnancy absent contraception below 17 at baseline. The extent of the recalibration is striking, as it nearly fully realigns the women's beliefs with the information provided: women who expected a risk lower than 17 increase their belief by 0.90 (standard error: 0.08) bean for each bean below 17 at baseline. Conversely, women who at baseline expected a risk equal to 17 or larger reduce their belief of the risk of pregnancy by 0.98 (standard error: 0.23) bean for each bean above 17 at baseline, resulting in an average drop from 18.9 to 17.2 in this subsample (Table 5 Panel C). This suggests that, while women may have private information about how their own fecundity and frequency of sexual intercourse differs from the population average, most of the baseline discrepancy between the sample's beliefs and the population average is due to miscalibrated beliefs about the population average.

Next, we test for the presence of EDE. More specifically, we first estimate a linear probability model (LPM) regressing baseline future contraceptive intentions on baseline beliefs about the risk of pregnancy when not using contraception (b_0), controlling for all the woman characteristics listed in Panel A of Table A-1. We then estimate a LPM regressing post-treatment intentions on baseline beliefs about the risk of pregnancy when not using contraception and their before-after treatment change in this belief (Δb), controlling for the same woman characteristics. We do so separately for women who have a baseline expected risk below the reference figure of 17 (85%) and for those with baseline beliefs equal to 17 and above, and then compare, within each of these two groups, the three estimates of the

[30] We follow Fagerland et al. (2013)'s recommendation and use the "mid-p" version of the test. The mid-p test avoids the loss of power associated with the exact test version while not violating the nominal level of the test in any of Fagerland et al. (2013)'s simulations, and it is well-suited to cases where the binary indicator has a small number of "zeroes" as we have here.

effect of beliefs on intentions. If we cannot reject that all three estimates are the same, then we cannot reject the absence of EDE. One concern could be that our information, while it is narrowly targeted at one belief, might also change other beliefs that matter for contraceptive decisions. If this were the case, then it would bias our post-treatment estimates of the effect of beliefs about the risk of pregnancy absent contraception on intended contraceptive use and would make it *more* likely to reject the null of no EDE. In this sense, our proposed test is conservative.

The analysis is done separately for women who have priors below- and above the value of 17 provided in the experiment because they would seem likely to perceive different experimenter demand effects, if there were such effects. In particular, if there are experimenter demand effects on intentions to use contraception, then the estimated effects of beliefs on stated intentions depend on two misclassification probabilities: the probability to report intending to use contraception when in fact the woman does not intend to use it (α_0) and vice-versa (α_1). These two misclassification probabilities are likely to differ depending on women's prior beliefs being above or below 17 since the latter may feel expected to over-report intending to use contraception but not the former.

Table 5: Experimental Results

	Before	After	#Obs	Difference	P-value of T-test	P-value of McNemar Mid-P test
Panel A: Whole sample receiving the information message						
Expected probability of pregnancy within 12 months (out of 20 beans)	15.84	16.68	287	0.85	0.010	
Intends to use contraception in the future	0.88	0.91	288	0.035	0.007	0.007
Panel B: Sample of women with baseline beliefs $<$17						
Expected probability of pregnancy within 12 months (out of 20 beans)	11.20	15.92	113	4.73	0.000	
Intends to use contraception in the future	0.85	0.89	113	0.044	0.058	0.070
Panel C: Sample of women with baseline beliefs $\geq$17						
Expected probability of pregnancy within 12 months (out of 20 beans)	18.85	17.18	174	-1.67	0.0000	
Intends to use contraception in the future	0.90	0.93	175	0.029	0.059	0.070
Panel D: Sample of women not using contraception						
Expected probability of pregnancy within 12 months (out of 20 beans)	15.07	16.56	84	1.49	0.020	
Intends to use contraception in the future	0.64	0.72	85	0.082	0.019	0.021

Details of the experiment are provided in Section 6. As in the t-test, the null hypothesis of the McNemar test is that the treatment has no effect.

Table 6: Testing for Experimenter Demand Effects

	$b_0 < 17$		$b_0 \geq 17$	
	b_0	Δb	b_0	Δb
Before Treatment	.0130		.0200	
	(.0051)		(.0149)	
After Treatment	.0178	.0139	.0192	.005
	(.0095)	(.0077)	(.0157)	(.0050)

Estimated effect of baseline beliefs about pregnancy risk absent contraception (b_0) and before-after treatment changes in these beliefs (Δb) on intentions to use contraception. Linear probability model estimates with dependent variable defined either as baseline intentions to use contraception ("Before" row) or post-treatment intentions to use contraception ("After" row), controlling for all the woman characteristics listed in Panel A of Table A-1. See Appendix A-5 for the econometric results underpinning our tests.

Table 6 reports these results. We cannot reject the absence of EDE on either beliefs or intentions either for women with $b_0 < 17$ or $b_0 \geq 17$, with p-values for tests of equality between the different estimates for the effect of beliefs on intentions equal to a minimum of 0.327 (the p-value for the difference between the effect of Δb and that of b_0 in the post-treatment data among women with $b_0 \geq 17$). While no test of a null of "no EDE" can completely rule out the presence of EDE, there is a clear consistency across the three estimates for the main target — women who underestimate the risk of pregnancy absent contraception at baseline — which would be unlikely to be the case if there was sizable EDE in either beliefs about pregnancy risk or intentions among this group. For women with $b_0 \geq 17$, there is a statistically insignificant but substantial difference between the estimated effect of Δb and that of b_0, so that we are cautious not to put as much weight on results for this group — who is fortunately also not the main group of interest for our treatment.

Two other implications of the similarity between the estimated effects of belief revisions and baseline beliefs on intention to use contraception among women underestimating this risk at baseline are worth noting. First, they suggest that these women appear to both trust the information we provided and fully internalize perceived *increases* in the risk of pregnancy. Second, the similarity in estimated effects before and after receiving the information message makes it unlikely that the effect on intentions simply comes from a salience effect. One concern could have been that we observe an increase in intentions to use contraception simply because women temporarily put more weight on pregnancy risk after receiving our information message. But in this case one would expect a larger marginal effect of expected pregnancy risk absent contraception on intended use post-treatment.

On the other hand, the very small estimated effect of beliefs updates for women who do not underestimate the pregnancy risk at baseline, although statistically indistinguishable from the effect of their baseline beliefs, suggests that women do not respond to *reductions* in the perceived risk of pregnancy. The asymmetric responses to "good" and "bad" news are consistent with women preferring to err on the side of caution. This finding is reassuring because one potential concern about our information intervention would have been that, when we inform women with $b_0 > 17$ of the population average risk, they may *reduce* their contraceptive use, which is not the case here. In fact, they *increase* slightly their intention to use contraception (by 2.9 percentage points) despite decreasing their expected risk of pregnancy, on average (Table 5 Panel C). This could be due to, e.g., the information message leading to more precise beliefs about the high risk of pregnancy absent contraception, or to a degree of EDE since our EDE test is less conclusive for this group.

Finally, we investigate the effect of our information message on intention to use contraception in the future and compare these experimental estimates to our model estimates. Among women with baseline beliefs about the risk of pregnancy without contraception below 17 (Panel B), the average increase in the expected probability of pregnancy without protection is 4.7 beans out of 20 (and the p-value of a t-test comparing before- and after-treatment beliefs is < 0.001). A counterfactual increasing beliefs among women who expect a risk below 17 at baseline by the average change observed in the data and thus matching this increase in beliefs on average predicts an increase by 4.8pp in contraceptive use among this group (based on the model in Table A-6 column 9).[31] In our within-subject experiment, we find that intention to use contraception among this group increases by 4.4pp in the experiment. Although less statistically significant than the effect observed in the (much larger) full sample (Panel A), this figure is close to our model prediction of 4.8pp, which is reassuring both from the point of the reliability of our structural model estimates and in terms of EDE concerns.

Finding similar results is also reassuring from the point of view of other concerns which our experiment alone could have raised. One concern might have been that women's stated intentions may abstract from their partners' preferences. If this were the case, however,

[31] For 36 women, this leads to beliefs of 20.7 out of 20. If we cap beliefs at 20, the counterfactual analysis predicts an increase by 4.7pp. If instead we restrict the sample to treated women only and predict the change in contraceptive use based on their revised individual beliefs, the model predicts an increase in contraceptive use of 5.3pp among this group.

we would expect the structural estimates, which take partner's expect approval and fertility preferences into account, to be much smaller, which is not the case.

Women who are not currently using contraception are likely to be more responsive to new information about the risk of pregnancy absent contraception, although we cannot model this heterogeneity in our ARUM model in which not using is a possible outcome. Among women who are not using contraception, our treatment increases intention to use contraception by as much as 8.2pp (p-value of McNemar test: 0.03). Unsurprisingly, this is much larger than the predicted effect using the coefficients obtained when estimating the ARUM model on the whole sample — namely a 1.6%-point increase in actual use.[32]

7 Conclusion

Many women in low-income countries are not using contraception despite wanting to avoid pregnancy. This is especially puzzling given policy efforts to ensure that modern contraceptives are readily available at low- or no cost to the user. In this paper we document, in a Mozambican setting, the subjective beliefs regarding contraception of women who wish to avoid pregnancy. We find that they hold plausible beliefs overall, except that they tend to underestimate the risk of pregnancy absent contraception and overestimate the risk of failure associated with hormonal methods.

Using these data to estimate a structural model of the choice between the main alternatives adopted by women in this country (including using no contraception), we find that supply issues and side-effects taken as a whole do not contribute much to low take-up, which calls for interventions beyond the current policy focus of improving the quantity and quality of contraceptive supply. Our structural estimates also point to the importance of partners' preferences for contraceptive methods — as well as- and independently to partners' fertility preferences. Our findings therefore highlight the importance of involving men in interventions aimed at increasing contraceptive take-up. The extent to which men's preferences are amenable to change may however be limited in the short run.

Crucially, we identify a new, promising avenue for immediate change, namely recalibrating beliefs about the risk of pregnancy absent contraception. We find support for this intervention via two independent exercises: first, in our structural model — identified from

[32]This is the predicted effect on contraceptive use when increasing beliefs by the 1.5 beans average increase in the expected probability of pregnancy absent contraception observed in the sample of women who are currently not using contraception (see Table 5 Panel D).

variation in beliefs and actual contraceptive use in our observational data — and second, through a validation exercise comparing women's beliefs and intentions to use contraception before- and after we inform them of the pregnancy risk absent contraception in the general population. Importantly, our structural model estimates and predictions based on those estimates hold constant a rich set of other constraints including cost and partner approval. In addition, the concordance between our structural estimates and our findings based on an exogenous information shock suggest that miscalibrated beliefs about pregnancy risk act as a barrier to contraceptive use independently of other barriers such as partner disapproval.

More precisely, our structural estimates indicate that increasing by 23.5pp the expected pregnancy risk absent contraception among the women who underestimate this risk would increase contraceptive take-up by about 4.8pp among this group (1.9pp overall). Among this group of women, our experiment increases the expected risk of pregnancy absent contraception by 23.5pp and intention to use contraceptives in the future by 4.4pp, which is close to our structural estimate of 4.8pp. Among women not currently using contraception, intention to use contraceptives increases by as much as 8.2pp after informing them of the pregnancy risk absent contraception in the general population.

In Mozambique, modern contraceptive use (unmet need for contraception) went from 20.8% (18.9%) in 2003 to 25.3% (23.1%) in 2015. In Sub-Saharan Africa as a whole, contraceptive use (unmet need for contraception) went from 16% (25.6%) in 2000 to 26.3% (24%) in 2014 (all figures taken from World Development Indicators, 2019). Given this slow pace of progress — and even negative trend in the case of unmet need for contraception in Mozambique, the targeted information message we propose here appears to be a valuable low-cost instrument to increase contraceptive take-up in the short run.

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Online Appendix - Not for Publication

A-1 Respondents' Characteristics

In Panel A of Table A-1, we report demographic and socioeconomic characteristics of the women in our analytical sample. In Panel B, we report key descriptive statistics regarding contraception.

While all the women in our sample say — as per our sample selection criteria — that they do not want to have a child (at least in the coming two years), 30% are not using any contraceptive method. The most popular contraceptive method is injections, followed by the pill, implants and male condoms.

In 30% of cases, women report that their partners have higher fertility preferences than them.[33] There is however only limited correlation between not using a method and having a partner who has higher fertility preferences. In particular, a larger share of women are not using contraception when their partners have higher fertility preferences (37%), but the rate of women not using contraception is still high among women whose partners have similar fertility preferences (27%) (Table A-2).

In Table A-3, we compare key characteristics of women in our sample (Col. 1) with two samples from the latest relevant representative survey, the 2015 AIDS Indicator Survey (AIS). Col. 2 reports summary statistics for women who were interviewed in the same three provinces and meet our analytical sample's eligibility criteria, while Col. 3 reports summary statistics for women who meet the same criteria and were interviewed in the whole of Mozambique. The women in our sample tend to be younger. At least in part because of this, on average they have fewer children than their counterparts in the AIS and are also more likely to have secondary education and above. They are quite similar in terms of whether they use contraception and which method they use (e.g., 30% of our sample reports not using contraception vs. 28% in the same three provinces in the 2015 AIS). The only notable difference is that they are 5 percentage points less (more) likely to use the pill (implants). A comparison of Columns (2) and (3) confirms that the three provinces we targeted have higher levels of economic development than the rest of country as well as higher levels of contraceptive use conditional on not wanting another child within two years.

[33] More precisely, 30% of respondents answer "yes" when asked, towards the end of the interview, whether her partner wants to have more children (if the respondent said she did not want anymore) or whether her partner wants to have a child sooner than her (if she said that she wanted to have another child, but wanted to wait at least 2 years).

A-2 Detailed Discussion of Beliefs Descriptive Statistics

Respondents have a very high expected unprotected probability of contracting a STD in the coming 12 months, and a good understanding of the fact that condoms, and condoms only, protect against STDs.

As in many other developing countries today, family planning is available free of charge in government facilities in Mozambique, and are also available at a cost from private providers. Consistent with the fact that, except for male condoms, at least 85% of users in the last DHS (2011) obtained their contraceptives from public providers, expected costs are low (from 14 to 27 Meticais per month or an annual cost of no more than about 1% of GDP per capita)

Monthly indirect costs such as transport costs associated with each method vary from 23 (condom) and 37 (injections) Meticais per month, and the ranking of method by costs reflects what would be expected given the accessibility and frequency of administration of each method.[34]

Other variables related to supply also reflect the relative ease with which modern FP methods can be obtained, with an average expected waiting time of 19 (condoms) to 23 (injections and implants) minutes and an expected probability of being able to obtain the method when needed of 82% (implants) to 90% (condoms).

The women interviewed hold plausible beliefs regarding the probability of side effects. First, they understand that the risk of side effects is very low with condoms, but that hormonal methods come with a risk of nausea/vomiting, menstrual irregularities, and other side effects. It is difficult to compare the reported probabilities with an "objective" measure, but the range of values appears reasonable (from around 20% for nausea (injections) to 58% for menstrual irregularities (injections)) in light of reliable information stating that these and other side effects are "common to very common" for each of the three hormonal methods covered here (e.g., https://bnf.nice.org.uk).

Interestingly, on average women also hold reasonable beliefs about the effect of contraceptive methods on the ability to conceive after discontinuation. The average expected probability of managing to conceive in the 12 months following discontinuation if they decided that they wanted to get pregnant is 69% for implants and injections, 73% for the pill and 81% for condoms, compared to a 75% expected probability of managing to conceive within the coming 12 months if they decided that they wanted to get pregnant and were not currently using any contraceptive. In this sample, there is therefore no evidence of the mistaken belief that modern contraception has long-term effects on the ability to conceive.

[34]In particular, the indirect cost of the pill and condoms, which are obtained from a range of providers including pharmacies, is lower than that of injections, which are overwhelmingly obtained from public health posts (MISAU, INE and ICF, 2013) and the indirect cost of obtaining implants, which are also obtained from a restricted range of providers, is lower than the indirect cost of obtaining injections, as would be expected by the difference in frequency of application.

We also elicited women's expected probability of approval of each alternative contraceptive method by their coreligionists (i.e., individuals who share the same religion, whose opinions may or not align with the position of religious *authorities*), as well as their parents, friends and partner. Expected approval by coreligionists, friends and parents are thought of as capturing both opposition from people whose opinions women may value and opposition by the woman herself due to religious or cultural reasons. The women's expected probability of approval by others is generally low (60% or less), especially in the case of coreligionists. As expected, women who say that their partners want more children or want them earlier than them have a lower expected probability that their partners would approve of them using a method relative to not using a method.[35] Partners' fertility preferences — which do not vary within woman — are however not the only driver of differences in expected approval across alternatives: the pairwise coefficient of correlation in partner approval across the three hormonal methods is between .67 and .71, and that between condoms and hormonal methods between .37 and .47. Similarly, approval of the "no method" alternative is overall largely uncorrelated with that of specific contraceptive methods (ρ between -.06 and -.01) even though, unsurprisingly, over a quarter of women expecting a high chance (15/20 and above) of partner approval of injections expect a zero chance of approval of the no method alternative, for instance. Taken together, these data suggest that (i) many women believe that their partners are willing to use contraception to achieve the women's family plan even though they personally do not wish to avoid a pregnancy and (ii) method-specific attributes influence partners' willingness to use them.

Women's answers to questions about the probability of being able to hide from their partner the use of each method or non-use of any method are also plausible. Reassuringly, the vast majority of respondents do not think they would be able to use male condoms without the knowledge of their partners. For the other methods and for using no method, the expected probability of being able to hide use or non-use from partners varies between 32% (implants and doing nothing) and 42% (injections). This suggests that women took into consideration the fact that men can infer the use or non-use of contraception based not only on the direct observation of use of the method but also from side effects such as menstrual irregularities and pregnancy (non-)occurrences.

In summary, women in our sample are, on average, well informed about the failure rate of the male condom method, but underestimate somewhat the probability of pregnancy when not using any contraception and vastly overestimate (by a factor of between about 3 and 5) the probability of pregnancy when using hormonal methods — resulting in a large underestimation of the ability of hormonal methods to protect women against pregnancy relative to using no method. Women also understand perfectly well that only condoms protect against STDs, and have a high expected

[35] For instance, the expected probability of approval if using injections minus the expected probability of approval if not using any method is 25 (2) pp on average among women whose partners have similar (higher) fertility preferences.

risk of contracting STDs when using no protection. Expected monthly costs, waiting times and other issues with supply are low. The expected probability of side effects is high (and within a reasonable range). Finally, expected rates of approval by others are low for any action that the women could take including using no method.

A-3 Appendix Tables

Table A-1: Summary Statistics for Method-Invariant Variables

	Mean	SD	Count
Panel A			
Age 18-24	0.32		584
Age 25-34	0.43		584
Age 35-44	0.22		584
Age 45-49	0.03		584
# Children	2.61	1.72	584
No Schooling	0.14		584
Some Primary Schooling	0.44		584
Some Secondary Schooling	0.42		584
Urban	0.47		584
Maputo City	0.22		584
Maputo Province	0.38		584
Gaza Province	0.39		584
Partner Wants More Children or Wants them Earlier	0.30		584
Muslim	0.03		584
Christian	0.47		584
Catholic	0.13		584
Protestant	0.03		584
Other Religion	0.30		584
No Religion	0.04		584
Doesn't Know Religion	0.01		584
Panel B			
No Method	0.30		584
Injections	0.32		556
Pill	0.21		557
Implants	0.11		502
Male Condom	0.10		562
Sex Last Month	0.88		584
Sex Last Quarter	0.11		584
Sex Activity Missing	0.01		584
# Methods Known	4.40	1.63	584
# Methods Known (Main Four)	2.73	0.60	584
N			584

Source: Survey described in Section 2.2. Panel B reports the share of women who are using each method among the sample of those who know about this method. The number of observations reported in the last column is less than 584 for modern methods because not all women in our sample know every method.

Table A-2: Summary Statistics by Partner's Fertility Preferences

Partner Fertility Preferences:	Wants The Same			Wants More		
	Mean	SD	Count	Mean	SD	Count
Panel A						
Age 18-24	0.32		411	0.32		173
Age 25-34	0.40		411	0.49		173
Age 35-44	0.24		411	0.17		173
Age 45-49	0.04		411	0.02		173
# Children	2.73	1.75	411	2.31	1.62	173
No Schooling	0.13		411	0.17		173
Some Primary Schooling	0.47		411	0.37		173
Some Secondary Schooling	0.40		411	0.46		173
Urban	0.44		411	0.56		173
Maputo City	0.22		411	0.24		173
Maputo Province	0.42		411	0.30		173
Gaza Province	0.37		411	0.46		173
Partner Wants More Children or Wants them Earlier	0.00		411	1.00		173
Muslim	0.02		411	0.04		173
Christian	0.47		411	0.45		173
Catholic	0.13		411	0.13		173
Protestant	0.04		411	0.01		173
Other Religion	0.30		411	0.30		173
No Religion	0.03		411	0.05		173
Doesn't Know Religion	0.01		411	0.02		173
Panel B						
No Method	0.27		411	0.37		173
Injections	0.35		396	0.26		160
Pill	0.23		395	0.19		162
Implants	0.11		354	0.12		148
Male Condom	0.09		395	0.12		167
Sex Last Month	0.87		411	0.89		173
Sex Last Quarter	0.12		411	0.10		173
Sex Activity Missing	0.01		411	0.01		173
# Methods Known	4.40	1.59	411	4.39	1.74	173
# Methods Known	2.75	0.57	411	2.68	0.68	173
N			411			173

Source: Survey described in Section 2.2.

Table A-3: Comparison Between Sample and Population Characteristics

	Dataset	AIS 2015 (3 Provinces)	AIS 2015 (All)
Panel A			
Age 18-24	0.32	0.23	0.27
Age 25-34	0.43	0.39	0.36
Age 35-44	0.22	0.31	0.29
Age 45-49	0.03	0.07	0.08
# Children	2.61	3.70	4.20
No Schooling	0.14	0.09	0.22
Some Primary Schooling	0.44	0.61	0.53
Some Secondary Schooling	0.42	0.30	0.25
Panel B			
No Method	0.30	0.28	0.44
Injections	0.32	0.30	0.30
Pill	0.21	0.26	0.17
Implants	0.11	0.06	0.05
Male Condom	0.10	0.10	0.04
N	584	475	1469

Sources: Survey described in Section 2.2 (column 1); Maputo City, Maputo Province and Gaza Province samples of the 2015 AIDS Indicators Survey (MISAU, INE and ICF, 2016) meeting the same sample selection criteria as in column 1 (column 2); All women interviewed for the 2015 AIDS Indicators Survey (MISAU, INE and ICF, 2016) meeting the same sample selection criteria as in column 1 (column 3). Selection criteria: age between 18-49, cohabiting, does not want to have a(nother) child within two years, is not infecund, is not pregnant and uses one of the five alternatives listed in Panel B.

Table A-4: Non-Response Across Women, by Belief, and by Method

Distribution Across Women	
Average Missing	0.047
0 missing answers	0.49
<5% missing	0.72
≥25% missing	0.02
Share Missing by Belief	
P(Pregnancy w/i 12 months)	0.031
P(STD)	0.016
P(Method Cost)	0
P(Other Costs)	0
P(Obtaining on Time)	0.014
E(Waiting Time)	0.031
P(Nausea or Headache)	0.080
P(Menstrual Irreg.)	0.061
P(Altered libido, etc...)	0.081
P(Other Negative Effects)	0.060
P(Pregnancy after Disc.)	0.037
P(Parents Approval)	0.071
P(Relig. Approval)	0.144
P(Partner Approval)	0.016
P(Friends Approval)	0.057
P(Hide from Partner)	0.015
Share Missing by Method	
No Method	0.026
Condoms	0.033
Implants	0.074
Injections	0.044
Pill	0.047

Source: Survey described in Section 2.2.

Table A-5: Summary Statistics for All Method-Specific Variables

	If using:	Condoms	Implants	Injections	No Method	Pill
	# in choice set[a]	562	502	556	584	557
P(Pregnancy w/i 12 months)	Mean	0.17	0.25	0.19	0.78	0.35
	SD	0.268	0.252	0.231	0.258	0.3
	Obs.	553	469	537	579	540
P(STD)	Mean	0.14	0.79	0.78	0.75	0.78
	SD	0.267	0.235	0.238	0.269	0.24
	Obs.	557	494	550	566	549
E(Method Cost)	Mean	22.47	25.64	27.03	0	14.07
	SD	130.848	190.582	196.857	0	99.159
	Obs.	554	498	549	584	545
E(Other Costs)	Mean	22.58	27.37	36.55	0	24.07
	SD	171.702	194.499	249.779	0	208.577
	Obs.	554	498	550	584	547
P(Obtaining on Time)	Mean	0.9	0.82	0.84	1	0.86
	SD	0.169	0.223	0.224	0	0.201
	Obs.	554	486	551	584	549
E(Waiting Time)	Mean	18.75	23.34	23.46	0	21.56
	SD	12.716	19.625	19.714	0	16.747
	Obs.	536	464	525	584	535
P(Nausea or Headache)	Mean	0.03	0.24	0.21	0	0.44
	SD	0.116	0.265	0.258	0	0.319
	Obs.	539	414	507	584	503
P(Menstrual Irreg.	Mean	0.06	0.52	0.58	0	0.46
or Vaginal Infections)	SD	0.175	0.259	0.296	0	0.306
	Obs.	540	430	529	584	517
P(Other Negative Effects)	Mean	0.06	0.33	0.31	0	0.31
	SD	0.164	0.266	0.296	0	0.272
	Obs.	539	440	523	584	516
P(Altered Libido,	Mean	0.26	0.15	0.19	0	0.14
Pleasure or Romance)	SD	0.323	0.219	0.271	0	0.235
	Obs.	533	418	513	584	497
P(Pregnancy after	Mean	0.81	0.69	0.69	0.73	0.75
Discontinuation)	SD	0.293	0.24	0.245	0.291	0.23
	Obs.	552	462	534	575	539
P(Parents Approval)	Mean	0.61	0.5	0.53	0.28	0.54
	SD	0.31	0.304	0.311	0.278	0.313
	Obs.	529	465	516	532	522
P(Relig. Approval)	Mean	0.49	0.39	0.39	0.3	0.39
	SD	0.35	0.309	0.307	0.299	0.317
	Obs.	488	435	470	490	479
P(Partner Approval)	Mean	0.55	0.54	0.58	0.4	0.6
	SD	0.32	0.303	0.324	0.335	0.31
	Obs.	554	491	550	574	549
P(Friends Approval)	Mean	0.56	0.49	0.51	0.27	0.54
	SD	0.321	0.312	0.315	0.27	0.317
	Obs.	535	471	529	544	526
P(Hide from Partner)	Mean	0.05	0.32	0.42	0.32	0.38
	SD	0.177	0.298	0.343	0.33	0.316
	Obs.	558	487	550	573	551

Source: Survey described in Section 2.2. [a] Number of respondents who know about the method. P(.) stands for "probability of event happening" and E(.) is the expectation operator. "Pregnancy" and "STD" refer to the perceived probability of pregnancy occurring or of contracting a STD, respectively, within 12 months. Costs are expected monthly costs. Waiting time corresponds to the middle of the interval chosen by respondents and is expressed in minutes. Top 1% in terms of costs and waiting times removed.

Table A-6: Full Nested Logit Estimates for Alternative Specifications and Samples

	Method's P(pregnancy) w/i 12 months		Add P(STD) and P(partner's approval)		Add No Method P(pregnancy)		Add supply-side		All	
Impute Missing Values?	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Method-Specific Variables										
Spacing × P(pregnancy	-0.008	-0.013	-0.003	0.002	0.001	0.004	0.001	0.005	0.001	0.009
w/i 12 months	(0.014)	(0.016)	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.009)
Limiting × P(pregnancy)	-0.024	-0.034**	-0.015*	-0.011	-0.010	-0.008	-0.009	-0.007	-0.009	-0.003
w/i 12 months	(0.024)	(0.016)	(0.009)	(0.009)	(0.008)	(0.007)	(0.007)	(0.006)	(0.007)	(0.007)
P(STD)			0.012	0.012	0.007	0.006	0.005	0.002	0.003	-0.006
			(0.010)	(0.011)	(0.010)	(0.010)	(0.009)	(0.009)	(0.010)	(0.008)
P(partner's approval)			0.065***	0.068***	0.066***	0.066***	0.059***	0.054***	0.061***	0.048***
			(0.011)	(0.012)	(0.011)	(0.012)	(0.014)	(0.014)	(0.012)	(0.016)
P(obtain when needed)							0.012	0.013*	0.011	0.017*
							(0.008)	(0.007)	(0.009)	(0.010)
E(waiting time)							-0.001	-0.002	-0.002	-0.002
							(0.001)	(0.002)	(0.002)	(0.002)
E(direct costs)							0.001	0.002***	0.001	0.002**
							(0.001)	(0.001)	(0.001)	(0.001)
E(other costs)							-0.001	0.000	-0.001*	0.000
							(0.000)	(0.001)	(0.000)	(0.002)
P(nausea)									-0.009*	-0.008
									(0.004)	(0.005)
P(menstrual irreg.)									0.010**	0.004
									(0.005)	(0.005)
P(other neg. effect)									-0.014**	-0.016**
									(0.006)	(0.008)
P(affect libido romance)									0.006	0.006
									(0.006)	(0.006)
P(preg. after disc.)									0.019**	0.018
× Spacing									(0.009)	(0.012)
P(preg. after disc.)									0.024**	0.011
× Limiting									(0.010)	(0.010)
P(parents approval)									0.011	0.015
									(0.008)	(0.009)
P(coreligionists approval)									0.004	0.003
									(0.009)	(0.010)
P(friends' approval)									0.007	-0.000
									(0.009)	(0.009)

Partner wants the same									-0.013**	-0.005
× P(hide method)									(0.006)	(0.006)
Partner wants more									-0.002	-0.005
× P(hide method)									(0.011)	(0.011)
No Method Nest: Method-Invariant Variables (Relative to Hormonal Nest)										
Age 25-34	0.161	0.014	0.163	-0.293	0.111	-0.276	0.057	-0.149	0.069	-0.196
	(0.249)	(0.267)	(0.261)	(0.288)	(0.268)	(0.291)	(0.269)	(0.321)	(0.279)	(0.404)
Age 35-44	1.016***	0.989***	1.017***	0.830**	0.870**	0.764*	0.851**	0.871**	0.954**	0.934*
	(0.344)	(0.366)	(0.366)	(0.396)	(0.375)	(0.392)	(0.377)	(0.424)	(0.402)	(0.565)
Age 45-49	1.758**	1.679**	1.651**	1.726**	1.686**	1.773**	1.672**	1.740**	1.680**	1.707*
	(0.689)	(0.698)	(0.687)	(0.686)	(0.705)	(0.703)	(0.697)	(0.728)	(0.718)	(0.937)
Some Primary	0.135	0.100	0.262	0.171	0.334	0.136	0.343	0.424	0.343	0.150
	(0.291)	(0.320)	(0.313)	(0.387)	(0.326)	(0.379)	(0.326)	(0.399)	(0.353)	(0.562)
$\geq$ Secondary	-0.600*	-0.612*	-0.437	-0.403	-0.320	-0.354	-0.311	-0.375	-0.235	-0.540
	(0.334)	(0.361)	(0.353)	(0.421)	(0.368)	(0.417)	(0.368)	(0.438)	(0.399)	(0.589)
Urban	0.110	0.236	-0.030	-0.033	-0.063	-0.111	-0.024	0.083	-0.049	0.255
	(0.251)	(0.270)	(0.264)	(0.292)	(0.272)	(0.293)	(0.269)	(0.312)	(0.286)	(0.425)
Maputo Province	0.380	0.476	0.223	0.199	0.175	0.106	0.176	0.071	0.109	0.017
	(0.332)	(0.346)	(0.344)	(0.361)	(0.360)	(0.372)	(0.361)	(0.407)	(0.373)	(0.524)
Gaza Province	0.138	0.170	0.227	0.172	0.228	0.158	0.293	0.089	0.349	0.319
	(0.313)	(0.325)	(0.326)	(0.344)	(0.343)	(0.353)	(0.344)	(0.389)	(0.362)	(0.466)
Partner wants more	0.655***	0.670***	0.358	0.386	0.452*	0.438*	0.453*	0.321	0.531**	0.932***
kids	(0.216)	(0.233)	(0.230)	(0.265)	(0.237)	(0.265)	(0.238)	(0.292)	(0.246)	(0.340)
No. of children	-0.115	-0.109	-0.073	-0.065	-0.070	-0.061	-0.065	-0.026	-0.011	-0.052
	(0.082)	(0.086)	(0.081)	(0.090)	(0.084)	(0.090)	(0.085)	(0.094)	(0.085)	(0.117)
Limiting	-0.325	-0.256	-0.407	-0.325	-0.415	-0.377	-0.418	-0.361	-0.524*	-0.220
	(0.296)	(0.342)	(0.292)	(0.322)	(0.294)	(0.318)	(0.289)	(0.342)	(0.302)	(0.416)
Catholic	-0.421	-0.192	-0.409	-0.360	-0.219	-0.241	-0.231	-0.032	-0.221	0.188
	(0.333)	(0.347)	(0.344)	(0.359)	(0.347)	(0.357)	(0.346)	(0.374)	(0.347)	(0.440)
Muslim	0.230	0.271	0.250	0.047	0.341	0.068	0.358	0.089	0.385	0.926
	(0.594)	(0.597)	(0.630)	(0.668)	(0.656)	(0.688)	(0.653)	(0.904)	(0.649)	(1.122)
Protestant	0.722	0.700	0.777	0.983*	0.826	0.932	0.813	1.087*	0.888	1.046
	(0.505)	(0.525)	(0.601)	(0.578)	(0.594)	(0.573)	(0.569)	(0.595)	(0.582)	(0.882)
Other religion	-0.077	-0.062	-0.079	-0.073	0.043	-0.041	0.049	-0.173	0.001	-0.433
	(0.228)	(0.247)	(0.240)	(0.272)	(0.247)	(0.273)	(0.246)	(0.292)	(0.257)	(0.430)
Atheist	0.752	0.745	0.713	0.641	0.892**	0.742	0.951**	0.366	1.101**	1.115*
	(0.482)	(0.505)	(0.444)	(0.509)	(0.448)	(0.512)	(0.450)	(0.610)	(0.487)	(0.648)
Doesn't know religion	1.442	0.829	1.472	0.067	1.041	0.138	0.362	-15.977***	0.279	-13.688***
	(1.178)	(1.283)	(1.369)	(1.698)	(1.456)	(1.781)	(1.751)	(0.929)	(1.842)	(1.255)
P(preg.) absent contra.					-0.083***	-0.071***	-0.081***	-0.080***	-0.068***	-0.081**
					(0.022)	(0.024)	(0.022)	(0.026)	(0.022)	(0.034)

P(STD) absent contra.					0.034	0.027	0.034	0.021	0.027	-0.004
					(0.021)	(0.022)	(0.022)	(0.025)	(0.022)	(0.030)
Condom Nest: Method-Invariant Variables (Relative to Hormonal Nest)										
Age 25-34	0.304	0.066	0.235	-0.037	0.212	0.013	0.360	0.233	0.368	0.113
	(0.360)	(0.382)	(0.351)	(0.383)	(0.355)	(0.394)	(0.371)	(0.448)	(0.374)	(0.528)
Age 35-44	0.790	0.642	0.767	0.617	0.768	0.682	0.878	1.045	0.943	0.990
	(0.538)	(0.580)	(0.541)	(0.598)	(0.563)	(0.631)	(0.569)	(0.645)	(0.582)	(0.898)
Age 45-49	0.566	0.266	0.468	0.139	0.587	0.335	0.597	-0.111	0.296	-13.926***
	(1.206)	(1.181)	(1.073)	(0.976)	(1.072)	(1.003)	(0.984)	(0.986)	(1.025)	(1.078)
Some primary	0.420	0.449	0.416	0.405	0.445	0.457	0.299	0.558	0.271	0.687
	(0.612)	(0.679)	(0.586)	(0.691)	(0.583)	(0.691)	(0.539)	(0.677)	(0.569)	(0.826)
$\geq$ Secondary	0.403	0.343	0.330	0.211	0.393	0.292	0.193	0.071	0.270	0.041
	(0.632)	(0.691)	(0.604)	(0.703)	(0.598)	(0.694)	(0.558)	(0.695)	(0.594)	(0.861)
Urban	0.438	0.310	0.373	0.144	0.339	0.116	0.353	0.546	0.367	0.206
	(0.390)	(0.419)	(0.392)	(0.425)	(0.399)	(0.435)	(0.404)	(0.494)	(0.402)	(0.593)
Maputo Province	0.751	0.581	0.704	0.613	0.760	0.680	0.750	0.897	0.829*	0.559
	(0.479)	(0.501)	(0.480)	(0.517)	(0.480)	(0.508)	(0.484)	(0.557)	(0.481)	(0.645)
Gaza Province	0.523	0.420	0.429	0.284	0.580	0.444	0.536	0.530	0.511	0.454
	(0.427)	(0.435)	(0.410)	(0.441)	(0.401)	(0.428)	(0.407)	(0.456)	(0.406)	(0.502)
Partner wants more	0.221	0.177	0.103	0.022	0.125	0.010	0.188	-0.148	0.216	0.096
kids	(0.343)	(0.352)	(0.344)	(0.369)	(0.337)	(0.362)	(0.337)	(0.398)	(0.353)	(0.486)
No. of children	-0.511***	-0.465***	-0.499***	-0.443***	-0.499***	-0.447***	-0.537***	-0.519***	-0.496***	-0.540**
	(0.149)	(0.158)	(0.148)	(0.155)	(0.154)	(0.164)	(0.158)	(0.176)	(0.155)	(0.243)
Limiting	0.674	0.668	0.724*	0.713	0.678	0.641	0.646	0.823*	0.572	1.081*
	(0.419)	(0.443)	(0.413)	(0.447)	(0.413)	(0.447)	(0.407)	(0.487)	(0.421)	(0.596)
Catholic	0.060	0.114	-0.037	-0.175	-0.004	-0.128	0.036	0.049	-0.057	0.269
	(0.450)	(0.473)	(0.453)	(0.503)	(0.453)	(0.509)	(0.459)	(0.551)	(0.465)	(0.603)
Muslim	0.844	0.837	0.860	0.855	0.854	0.812	0.683	-0.293	0.995	0.485
	(0.735)	(0.716)	(0.711)	(0.716)	(0.732)	(0.737)	(0.780)	(1.518)	(0.764)	(1.782)
Protestant	-14.011***	-13.402***	-13.398***	-13.408***	-14.615***	-13.647***	-14.615***	-14.629***	-14.615***	-13.879***
	(0.413)	(0.435)	(0.443)	(0.466)	(0.455)	(0.482)	(0.460)	(0.550)	(0.502)	(0.754)
Other religion	-0.081	-0.227	-0.155	-0.324	-0.178	-0.378	-0.182	-0.032	-0.156	0.059
	(0.369)	(0.388)	(0.357)	(0.385)	(0.363)	(0.396)	(0.363)	(0.421)	(0.370)	(0.512)
Atheist	-0.306	-0.383	-0.301	-0.374	-0.316	-0.442	-0.388	-0.552	-0.324	-13.960***
	(1.105)	(1.092)	(1.093)	(1.084)	(1.121)	(1.157)	(1.162)	(1.290)	(1.281)	(1.198)
Doesn't know religion	2.567*	2.275	2.552*	2.388*	2.349*	2.557**	2.777**	3.331**	2.933**	2.590**
	(1.361)	(1.394)	(1.449)	(1.350)	(1.391)	(1.264)	(1.270)	(1.463)	(1.262)	(1.228)
P(preg.) absent contra.					-0.051	-0.055*	-0.058*	-0.031	-0.055*	-0.073
					(0.033)	(0.034)	(0.033)	(0.038)	(0.033)	(0.047)
P(STD) absent contra.					-0.028	-0.041	-0.032	-0.074**	-0.039	-0.082*
					(0.033)	(0.034)	(0.033)	(0.037)	(0.034)	(0.042)

Method-Specific Intercepts (Relative to No Method)										
Condoms	-1.604**	-1.260	-1.379*	-1.082	-0.895	-0.512	-0.443	-0.696	-0.390	0.121
	(0.803)	(0.839)	(0.792)	(0.885)	(0.959)	(1.061)	(0.959)	(1.144)	(0.987)	(1.337)
Implants	0.338	-0.272	0.297	0.176	-0.295	-0.525	-0.087	-0.223	0.243	-0.161
	(0.721)	(0.791)	(0.544)	(0.624)	(0.677)	(0.755)	(0.687)	(0.833)	(0.731)	(1.035)
Injections	0.619	0.396	0.512	0.362	-0.079	-0.348	0.100	-0.074	0.437	-0.021
	(0.563)	(0.590)	(0.534)	(0.615)	(0.674)	(0.751)	(0.686)	(0.833)	(0.731)	(1.037)
Pill	0.540	0.203	0.397	0.271	-0.208	-0.440	-0.022	-0.162	0.334	-0.071
	(0.593)	(0.638)	(0.535)	(0.617)	(0.675)	(0.753)	(0.685)	(0.833)	(0.730)	(1.035)
No Method τ	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	(72.036)	(1.420)	(5.849)	(1.282)	(3.518)	(4.288)	(6.526)	(11.102)	(7.971)	(10.209)
Condom τ	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	(4.517)	(16.898)	(2.353)	(2.025)	(247.185)	(97.815)	(4.689)	(355.785)	(10.611)	(77.518)
Hormonal τ	0.286	0.683**	0.225***	0.202***	0.224***	0.190***	0.191***	0.152***	0.189***	0.134***
	(0.273)	(0.342)	(0.055)	(0.057)	(0.050)	(0.051)	(0.053)	(0.043)	(0.047)	(0.049)
Miss. Val. Indicators	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Alternatives	2761	2491	2761	2336	2761	2336	2761	2047	2761	1360
Women	584	527	584	491	584	491	584	428	584	285

Source: Estimates of Equation (1) using own survey data described in Section 2.2. Robust standard errors in parentheses, * $p<0.10$ ** $p<0.05$ *** $p<0.01$. Missing values set to zero and indicators for missing values included in Columns (1), (3), (5), (7) and (9). All the other columns exclude cases with any missing value for any of the included variables. The method-specific intercept for the "no method" alternative is normalized to zero. The effect of method-invariant variables on the utility associated with alternatives in the hormonal nest is normalized to zero.

Table A-7: Within-Woman Correlation of Beliefs about Pregnancy and STD Risks

	P(Pregnancy)					P(STD)				
	Condom	Implants	Injections	No method	Pill	Condom	Implants	Injections	No method	Pill
P(Pregnancy):										
Condom	1									
Implants	0.282	1								
Injections	0.245	0.717	1							
No method	-0.0793	-0.0848	-0.0751	1						
Pill	0.515	0.477	0.369	-0.0394	1					
P(STD):										
Condom	0.366	0.0128	-0.0850	-0.0182	0.260	1				
Implants	-0.119	-0.127	-0.122	0.178	-0.0361	0.0623	1			
Injections	-0.108	-0.139	-0.114	0.200	-0.0696	0.0303	0.887	1		
No method	-0.121	-0.161	-0.104	0.270	-0.0764	-0.0144	0.457	0.424	1	
Pill	-0.0949	-0.146	-0.156	0.139	-0.0495	0.0382	0.894	0.835	0.424	1

Table A-8: Counterfactual Analysis With and Without Imputing Missing Values

Panel A: Including Missing Values Indicators (Col. 9 Table A-6)					
	Condom	Implants	Injections	No Method	Pill
P(0) + 25 pp if P(0)<17, P(0)<17 Sample	-0.013	0.013	0.031	-0.049	0.022
P(0) + 25 pp if P(0)<17, Whole Sample	-0.005	0.005	0.012	-0.019	0.009
Approval + 25 pp	0.007	0.007	0.018	-0.036	0.006
Same Fertility Preferences	0.001	0.007	0.010	-0.024	0.009
No Side Effects	-0.001	-0.003	-0.020	-0.003	0.027
No Supply Barriers	-0.001	0.002	0.009	-0.011	0.000
Panel B: Excluding Women With Any Missing Value (Col. 10 Table A-6)					
	Condom	Implants	Injections	No Method	Pill
P(0) + 25 pp if P(0)<17, P(0)<17 Sample	-0.025	0.014	0.033	-0.047	0.029
P(0) + 25 pp if P(0)<17, Whole Sample	-0.010	0.006	0.013	-0.019	0.011
Approval + 25 pp	0.006	0.006	0.009	-0.027	0.008
Same Fertility Preferences	0.006	0.007	0.019	-0.045	0.016
No Side Effects	-0.005	-0.002	-0.017	-0.012	0.037
No Supply Barriers	-0.003	-0.002	0.016	-0.009	-0.002

Predicted changes in the probability of choosing each alternative based on the model reported in the relevant column of Table A-6. Beliefs are capped at 20 where an increase by 25pp would lead to beliefs above 20 out of 20. Side effects are defined as nausea or headaches, menstrual irregularities or vaginal infections, and "other" side effects. Supply barriers refer to direct and indirect monetary costs as well as waiting times and the inability to obtain the method when needed. P(0) stands for "perceived probability of pregnancy within 12 months absent contraception." "Same Fertility Preferences" means that the partners of all women want to limit (space) fertility if the woman says she wants to limit (space) it.

Table A-9: Robustness to Imputing Missing Values as Being All Equal to Small or Large Values

	Baseline	One Variable At a Time		All Variables At the Same Time
		Min	Max	
Spacing × P(pregnancy)	0.0014	0.0001	0.0018	0.0034
Limiting × P(pregnancy)	-0.0086	-0.0113	-0.0083	-0.0100
P(STD)	0.0034	0.0015	0.0056	-0.0006
P(nausea)	-0.0087	-0.0102	-0.0074	-0.0152
P(menstrual irreg.)	0.0104	0.0089	0.0129	0.0164
P(other neg. effect)	-0.0143	-0.0152	-0.0121	-0.0045
P(affect libido romance)	0.0058	0.0039	0.0091	-0.0049
Spacing × P(pregnancy after disc.)	0.0185	0.0167	0.0197	0.0160
Limiting × P(pregnancy after disc.)	0.0240	0.0215	0.0255	0.0215
P(parents approval)	0.0106	0.0072	0.0118	0.0153
P(coreligionists approval)	0.0042	0.0018	0.0071	0.0002
P(partner's approval)	0.0605	0.0580	0.0640	0.0503
P(friends' approval)	0.0068	0.0054	0.0087	0.0137
Partner wants the same × P(hide method)	-0.0133	-0.0157	-0.0121	-0.0147
Partner wants more kids × P(hide method)	-0.0025	-0.0033	-0.0008	-0.0007
P(obtain when needed)	0.0107	0.0079	0.0120	0.0131
E(waiting time)	-0.0018	-0.0032	-0.0015	-0.0008
E(direct costs)	0.0009	-0.0001	0.0009	0.0000
E(other costs)	-0.0007	-0.0007	0.0002	0.0000
No method: Age 25-34	0.0689	0.0276	0.1259	0.1159
No method: Age 35-44	0.9540	0.9191	0.9983	0.9388
No method: Age 45-49	1.6799	1.5806	1.8313	1.9453
No method: Some primary schooling	0.3430	0.2251	0.3827	0.2411
No method: Secondary schooling and above	-0.2349	-0.3095	-0.2124	-0.4208
No method: Urban	-0.0495	-0.1051	-0.0315	-0.2073
No method: Maputo Province	0.1095	0.0594	0.1577	0.0229
No method: Gaza Province	0.3489	0.3213	0.3788	0.2382
No method: Partner wants more kids	0.5308	0.4951	0.5460	0.5262
No method: No. of children	-0.0111	-0.0325	-0.0051	-0.0829
No method: Limiting	-0.5236	-0.5466	-0.4877	-0.4327
No method: Catholic	-0.2211	-0.2955	-0.1867	-0.3231
No method: Muslim	0.3849	0.3064	0.4266	0.2427
No method: Protestant	0.8876	0.8141	0.9520	0.8242
No method: Other religion	0.0014	-0.0691	0.0220	-0.0082
No method: Atheist	1.1008	1.0114	1.1276	0.8781
No method: Doesn't know religion	0.2781	0.1910	1.2545	1.2071
No method: P(pregnancy) absent contraception	-0.0684	-0.0749	-0.0617	-0.0933
No method: P(STD) absent contraception	0.0271	0.0251	0.0301	0.0503
Condoms: Age 25-34	0.3675	0.3140	0.3890	0.1638
Condoms: Age 35-44	0.9425	0.8784	0.9657	0.6817
Condoms: Age 45-49	0.2963	0.2293	0.4133	0.5617
Condoms: Some primary schooling	0.2709	0.2458	0.3320	0.4568
Condoms: Secondary schooling and above	0.2696	0.1975	0.3576	0.3987
Condoms: Urban	0.3664	0.3331	0.3885	0.2922
Condoms: Maputo Province	0.8288	0.7984	0.8584	0.7176
Condoms: Gaza Province	0.5111	0.4823	0.5659	0.5636
Condoms: Partner wants more kids	0.2161	0.1815	0.2410	0.2416
Condoms: No. of children	-0.4961	-0.5210	-0.4762	-0.4834
Condoms: Limiting	0.5712	0.5522	0.6239	0.7073
Condoms: Catholic	-0.0574	-0.0801	-0.0201	-0.0647
Condoms: Muslim	0.9951	0.8387	1.1893	0.9558

Condoms: Protestant	-14.6149	-14.6338	-14.6066	-14.6174
Condoms: Other religion	-0.1558	-0.1971	-0.1390	-0.1475
Condoms: Atheist	-0.3244	-0.3794	-0.2534	-0.3274
Condoms: Doesn't know religion	2.9320	2.7858	3.1782	2.4694
Condoms: P(pregnancy) absent contraception	-0.0554	-0.0579	-0.0518	-0.0438
Condoms: P(STD) absent contraception	-0.0392	-0.0412	-0.0368	-0.0226
Condoms: Constant	-0.3892	-0.6845	-0.2748	-1.4572
Implants: Constant	0.2435	0.0344	0.3474	-0.4628
Injections: Constant	0.4376	0.2216	0.5519	-0.2485
Pill: Constant	0.3342	0.1233	0.4380	-0.3249
No method τ	1.0000	1.0000	1.0000	1.0000
Condom τ	1.0000	1.0000	1.0000	1.0000
Hormonal τ	0.1893	0.1828	0.2140	0.2029

Source: own survey data described in Section 2.2. Column (1): missing values set to zero and indicators for missing values included (see column 9 of Table A-6). Column (2): minimum value among the 42 estimates obtained for the coefficient when the missing values for any one variable are all set to be equal to the mean minus one standard deviation or to the mean plus one standard deviation. Column (3): maximum value among the 4 estimates obtained for the coefficient when the missing values for any one variable are all set to be equal to the mean minus one standard deviation or to the mean plus one standard deviation. Column (4): coefficient estimate obtained when all the missing values for each variable are randomly set (with probability 0.5) to being either equal to the mean minus one standard deviation or to the mean plus one standard deviation for all missing observations. The method-specific intercept for the "no method" alternative is normalized to zero. The effect of method-invariant variables on the utility associated with alternatives in the hormonal nest is normalized to zero.

Table A-10: Robustness to Sample Restrictions

	Main Specification	Exclude if only $0, 5, 10, 15, 20$	Exclude if fewer than 13 out of 16 answers for method	Exclude if P(preg.) 5 yrs<1 yr
	(1)	(2)	(3)	(4)
Method-Specific Variables				
Spacing × P(pregnancy)	0.001	0.001	0.001	0.001
	(0.006)	(0.006)	(0.005)	(0.006)
Limiting × P(pregnancy)	-0.009	-0.009	-0.009	-0.012
	(0.007)	(0.007)	(0.007)	(0.007)
P(STD)	0.003	0.003	0.004	0.004
	(0.010)	(0.010)	(0.010)	(0.011)
P(nausea)	-0.009*	-0.009*	-0.009**	-0.008*
	(0.004)	(0.005)	(0.004)	(0.005)
P(menstrual irreg.)	0.010**	0.011**	0.010**	0.010**
	(0.005)	(0.005)	(0.005)	(0.005)
P(other neg. effect)	-0.014**	-0.014**	-0.014**	-0.014**
	(0.006)	(0.006)	(0.006)	(0.007)
P(affect libido romance)	0.006	0.006	0.006	0.006
	(0.006)	(0.006)	(0.006)	(0.006)
Spacing × P(pregnancy after disc.)	0.019**	0.019**	0.018**	0.017*
	(0.009)	(0.009)	(0.009)	(0.009)
Limiting × P(pregnancy after disc.)	0.024**	0.024**	0.024**	0.026***
	(0.010)	(0.010)	(0.009)	(0.010)
P(parents approval)	0.011	0.011	0.011	0.012
	(0.008)	(0.008)	(0.008)	(0.008)
P(coreligionists approval)	0.004	0.003	0.005	0.001
	(0.009)	(0.009)	(0.008)	(0.010)
P(partner's approval)	0.061***	0.061***	0.060***	0.062***
	(0.012)	(0.012)	(0.011)	(0.012)
P(friends' approval)	0.007	0.007	0.007	0.006
	(0.009)	(0.009)	(0.009)	(0.010)
Partner wants the same × P(hide)	-0.013**	-0.013**	-0.013**	-0.014**
	(0.006)	(0.006)	(0.006)	(0.006)
Partner wants more kids × P(hide)	-0.002	-0.002	-0.002	-0.005
	(0.011)	(0.011)	(0.011)	(0.011)
P(obtain when needed)	0.011	0.011	0.011	0.017*
	(0.009)	(0.009)	(0.009)	(0.009)
E(waiting time)	-0.002	-0.002	-0.002	-0.002
	(0.002)	(0.002)	(0.002)	(0.002)
E(direct costs)	0.001	0.001	0.001	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
E(other costs)	-0.001*	-0.001*	-0.001*	-0.004***
	(0.000)	(0.000)	(0.000)	(0.001)
No Method Nest: Method-Invariant Variables				
Age 25-34	0.069	0.094	0.052	0.054
	(0.279)	(0.281)	(0.280)	(0.290)
Age 35-44	0.954**	0.979**	0.923**	1.038**
	(0.402)	(0.403)	(0.404)	(0.420)
Age 45-49	1.680**	1.690**	1.680**	1.577**
	(0.718)	(0.716)	(0.706)	(0.725)
Some primary	0.343	0.311	0.336	0.434
	(0.353)	(0.359)	(0.356)	(0.364)
Secondary schooling and above	-0.235	-0.238	-0.287	-0.320
	(0.399)	(0.404)	(0.401)	(0.412)

Urban	-0.049	-0.043	-0.062	-0.025
	(0.286)	(0.287)	(0.287)	(0.296)
Maputo Province	0.109	0.087	0.097	0.027
	(0.373)	(0.375)	(0.371)	(0.389)
Gaza Province	0.349	0.340	0.342	0.249
	(0.362)	(0.364)	(0.361)	(0.381)
Partner wants more kids	0.531**	0.534**	0.501**	0.536**
	(0.246)	(0.247)	(0.247)	(0.260)
No. of children	-0.011	-0.000	-0.020	0.009
	(0.085)	(0.085)	(0.085)	(0.088)
Limiting	-0.523*	-0.531*	-0.503*	-0.490
	(0.302)	(0.303)	(0.302)	(0.312)
Catholic	-0.221	-0.210	-0.213	-0.162
	(0.347)	(0.348)	(0.351)	(0.354)
Muslim	0.385	0.391	0.389	0.344
	(0.649)	(0.649)	(0.645)	(0.723)
Protestant	0.888	0.910	0.894	1.039*
	(0.582)	(0.584)	(0.576)	(0.595)
Other religion	0.001	0.014	-0.040	0.068
	(0.257)	(0.259)	(0.259)	(0.263)
Atheist	1.101**	1.109**	1.053**	1.140**
	(0.487)	(0.487)	(0.493)	(0.492)
Doesn't know religion	0.278	0.309	0.237	0.439
	(1.842)	(1.845)	(1.839)	(1.795)
P(pregnancy) absent contraception	-0.068***	-0.069***	-0.062***	-0.084***
	(0.022)	(0.022)	(0.022)	(0.024)
P(STD) absent contraception	0.027	0.027	0.024	0.013
	(0.022)	(0.023)	(0.022)	(0.022)
Condoms Nest: Method-Invariant Variables				
Age 25-34	0.368	0.365	0.343	0.456
	(0.374)	(0.375)	(0.372)	(0.387)
Age 35-44	0.943	0.935	0.935	1.029*
	(0.582)	(0.583)	(0.578)	(0.600)
Age 45-49	0.296	0.270	0.328	0.338
	(1.025)	(1.025)	(1.016)	(1.026)
Some primary	0.271	0.253	0.253	0.193
	(0.569)	(0.573)	(0.572)	(0.584)
Secondary schooling and above	0.270	0.251	0.255	0.348
	(0.594)	(0.597)	(0.595)	(0.601)
Urban	0.367	0.367	0.337	0.438
	(0.402)	(0.401)	(0.403)	(0.414)
Maputo Province	0.829*	0.813*	0.827*	0.903*
	(0.481)	(0.481)	(0.479)	(0.510)
Gaza Province	0.511	0.492	0.510	0.833*
	(0.406)	(0.407)	(0.406)	(0.426)
Partner wants more kids	0.216	0.216	0.229	0.112
	(0.353)	(0.353)	(0.353)	(0.375)
No. of children	-0.496***	-0.489***	-0.506***	-0.492***
	(0.155)	(0.155)	(0.155)	(0.164)
Limiting	0.572	0.565	0.576	0.566
	(0.421)	(0.421)	(0.419)	(0.438)
Catholic	-0.058	-0.065	-0.069	-0.237
	(0.465)	(0.465)	(0.467)	(0.502)
Muslim	0.995	0.989	0.987	0.848
	(0.764)	(0.762)	(0.763)	(0.798)
Protestant	-14.615***	-14.609***	-14.895***	-14.399***

	(0.502)	(0.503)	(0.498)	(0.533)
Other religion	-0.156	-0.163	-0.148	-0.212
	(0.370)	(0.371)	(0.369)	(0.393)
Atheist	-0.324	-0.341	-0.367	-0.530
	(1.281)	(1.280)	(1.296)	(1.569)
Doesn't know religion	2.932**	2.928**	2.901**	3.089**
	(1.262)	(1.264)	(1.263)	(1.242)
P(pregnancy) absent contraception	-0.055*	-0.055*	-0.054*	-0.081**
	(0.033)	(0.033)	(0.033)	(0.034)
P(STD) absent contraception	-0.039	-0.038	-0.039	-0.040
	(0.034)	(0.034)	(0.034)	(0.037)
Method-Specific Intercepts				
Condoms	-0.389	-0.371	-0.398	-0.604
	(0.987)	(0.989)	(0.983)	(1.022)
Implants	0.244	0.251	0.198	-0.162
	(0.731)	(0.734)	(0.728)	(0.770)
Injections	0.438	0.442	0.390	0.038
	(0.731)	(0.733)	(0.728)	(0.765)
Pill	0.334	0.339	0.288	-0.072
	(0.730)	(0.733)	(0.727)	(0.767)
No Method τ	1.000	1.000	1.000	1.000
	(3.909)	(163.878)	(6.691)	(5.965)
Condom τ	1.000	1.000	1.000	1.000
	(4.069)	(18.856)	(24.710)	(4.278)
Hormonal τ	0.189***	0.193***	0.187***	0.194***
	(0.047)	(0.048)	(0.047)	(0.048)
Missing Value Indicators	Yes	Yes	Yes	Yes
Alternatives	2761	2737	2588	2638
Women	584	579	574	556

Source: Estimates of Equation (1) using own survey data described in Section 2.2. Robust standard errors in parentheses, * p<0.10 ** p<0.05 *** p<0.01. Missing values set to zero and indicators for missing values included in all columns. The main specification corresponds to column 9 of Table A-6. The method-specific intercept for the "no method" alternative is normalized to zero. The effect of method-invariant variables on the utility associated with alternatives in the hormonal nest is normalized to zero.

Table A-11: Robustness to Changes in Nesting Structure and to Modelling Demand Among Users Only

	(1) Preferred Specification	(2) Two Nests	(3) Users Only
Method-Specific Variables			
Spacing × P(pregnancy)	0.001	0.003	0.000
	(0.006)	(0.006)	(0.013)
Limiting × P(pregnancy)	-0.009	-0.009	-0.018
	(0.007)	(0.008)	(0.015)
P(STD)	0.003	0.015**	0.021
	(0.010)	(0.007)	(0.026)
P(nausea)	-0.009*	-0.009*	-0.021*
	(0.004)	(0.005)	(0.011)
P(menstrual irreg.)	0.010**	0.011**	0.021**
	(0.005)	(0.005)	(0.010)
P(other neg. effect)	-0.014**	-0.017**	-0.034**
	(0.006)	(0.007)	(0.015)
P(affect libido romance)	0.006	0.005	0.018
	(0.006)	(0.006)	(0.015)
Spacing × P(pregnancy after disc.)	0.019**	0.013	0.044**
	(0.009)	(0.009)	(0.022)
Limiting × P(pregnancy after disc.)	0.024**	0.014	0.052**
	(0.010)	(0.011)	(0.022)
P(parents approval)	0.011	0.005	0.026
	(0.008)	(0.008)	(0.022)
P(coreligionists approval)	0.004	-0.006	0.020
	(0.009)	(0.009)	(0.022)
P(partner's approval)	0.061***	0.057***	0.135***
	(0.012)	(0.010)	(0.036)
P(friends' approval)	0.007	0.015*	0.022
	(0.009)	(0.009)	(0.026)
Partner wants the same × P(hide method)	-0.013**	-0.015**	-0.032**
	(0.006)	(0.006)	(0.016)
Partner wants more kids × P(hide method)	-0.002	-0.003	-0.007
	(0.011)	(0.008)	(0.023)
P(obtain when needed)	0.011	0.007	0.032
	(0.009)	(0.009)	(0.020)
E(waiting time)	-0.002	-0.002	-0.005
	(0.002)	(0.002)	(0.004)
E(direct costs)	0.001	0.001	0.002
	(0.001)	(0.000)	(0.001)
E(other costs)	-0.001*	-0.000	-0.000
	(0.000)	(0.000)	(0.001)
No Method Nest: Method-Invariant Variables			
Age 25-34	0.069	-0.004	
	(0.279)	(0.264)	
Age 35-44	0.954**	0.780**	
	(0.402)	(0.390)	
Age 45-49	1.680**	1.580**	
	(0.718)	(0.673)	
Some primary schooling	0.343	0.289	
	(0.353)	(0.331)	
Secondary schooling and above	-0.235	-0.297	
	(0.399)	(0.369)	
Urban	-0.049	-0.114	

	(0.286)	(0.266)	
Maputo Province	0.109	-0.025	
	(0.373)	(0.351)	
Gaza Province	0.349	0.199	
	(0.362)	(0.340)	
Partner wants more kids	0.531**	0.522**	
	(0.246)	(0.231)	
No. of children	-0.011	0.042	
	(0.085)	(0.079)	
Limiting	-0.524*	-0.578**	
	(0.302)	(0.289)	
Catholic	-0.221	-0.164	
	(0.347)	(0.332)	
Muslim	0.385	0.187	
	(0.649)	(0.622)	
Protestant	0.888	1.095*	
	(0.582)	(0.575)	
Other religion	0.001	0.068	
	(0.257)	(0.241)	
Atheist	1.101**	1.051**	
	(0.487)	(0.464)	
Doesn't know religion	0.279	-0.633	
	(1.842)	(1.486)	
P(pregnancy) absent contraception	-0.068***	-0.067***	
	(0.022)	(0.020)	
P(STD) absent contraception	0.027	0.034	
	(0.022)	(0.021)	
Condoms Nest: Method-Invariant Variables			
Age 25-34	0.368		0.392
	(0.374)		(0.458)
Age 35-44	0.943		1.621**
	(0.582)		(0.651)
Age 45-49	0.296		-0.142
	(1.025)		(1.135)
someprimary	0.271		-0.044
	(0.569)		(0.638)
Secondary schooling and above	0.270		-0.063
	(0.594)		(0.629)
Urban	0.367		0.158
	(0.402)		(0.483)
Maputo Province	0.829*		0.976
	(0.481)		(0.597)
Gaza Province	0.511		0.580
	(0.406)		(0.488)
Partner wants more kids	0.216		0.356
	(0.353)		(0.444)
No. of children	-0.496***		-0.581***
	(0.155)		(0.198)
Limiting	0.572		0.432
	(0.421)		(0.505)
Catholic	-0.057		-0.439
	(0.465)		(0.571)
Muslim	0.995		1.392*
	(0.764)		(0.822)
Protestant	-14.615***		-13.097***
	(0.502)		(0.636)

Other religion	-0.156		-0.462
	(0.370)		(0.446)
Atheist	-0.324		0.445
	(1.281)		(1.102)
Doesn't know religion	2.932**		3.045**
	(1.262)		(1.349)
P(pregnancy) absent contraception	-0.055*		-0.074**
	(0.033)		(0.034)
P(STD) absent contraception	-0.039		-0.029
	(0.034)		(0.040)
Method-Specific Intercepts			
Condoms	-0.389	0.001	
	(0.987)	(0.651)	
Implants	0.243	0.188	-0.225
	(0.731)	(0.660)	(1.042)
Injections	0.437	0.463	0.234
	(0.731)	(0.660)	(1.032)
Pill	0.334	0.335	-0.012
	(0.730)	(0.659)	(1.034)
No Method τ	1.000		
	(3.638)		
Condom τ	1.000		
	(74.168)		
Hormonal τ	0.189***		
	(0.047)		
No Method τ		1.000	
		(17.431)	
Any Method τ		0.295***	
		(0.062)	
Condom τ			1.000
			(8.659)
Hormonal τ			0.449***
			(0.148)
Missing Value Indicators	Yes	Yes	Yes
Alternatives	2761	2761	1530
Women	584	584	406

Source: Estimates of variants of Equation (1) using own survey data described in Section 2.2. Robust standard errors in parentheses, * p<0.10 ** p<0.05 *** p<0.01. Missing values set to zero and indicators for missing values included in all columns. The main specification corresponds to column 9 of Table A-6. The method-specific intercept for the "no method" (condoms) alternative is normalized to zero in the first two columns (the last column). The effect of method-invariant variables on the utility associated with alternatives in the hormonal nest ("any method" nest) is normalized to zero in columns 1 and 3 (column 2).

Table A-12: Beliefs and Duration of Use

	Effect of Year Started Using Method		
	Coef.	S.E.	Observations
P(pregnancy)	0.104	(0.074)	393
P(STD)	0.045	(0.087)	394
P(nausea)	-0.024	(0.083)	391
P(menstrual irreg.)	0.163*	(0.093)	393
P(other neg. effect)	-0.035	(0.076)	392
P(affect libido romance)	0.083	(0.079)	390
P(pregnancy after disc.)	0.040	(0.064)	386
P(parents approval)	0.035	(0.083)	374
P(coreligionists approval)	0.083	(0.091)	334
P(partner's approval)	-0.062	(0.077)	395
P(friends' approval)	-0.022	(0.082)	383
P(hide method)	-0.001	(0.095)	395
P(obtain when needed)	-0.069	(0.053)	396
E(waiting time)	0.416*	(0.245)	379
E(direct costs)	1.337	(2.392)	390
E(other costs)	0.535	(2.519)	390

Each row corresponds to estimates obtained when regressing beliefs on the year the woman started using the contraceptive method she is currently using, a constant, and all the method-invariant characteristics included in n Panel A of Table A-1. Standard errors in parentheses, * $p<0.10$ ** $p<0.05$ ***.

Table A-13: Characteristics of Treated and Untreated Samples

	Untreated Mean	Treated Mean	Difference	T-test P-value
Age 25-34	0.39	0.46	-0.07	0.09
Age 35-44	0.26	0.18	0.08	0.03
Age 45-49	0.03	0.03	0.01	0.68
Some primary schooling	0.47	0.42	0.05	0.23
Secondary schooling and above	0.38	0.45	-0.08	0.06
Urban	0.47	0.48	-0.02	0.69
Maputo Province	0.40	0.37	0.03	0.50
Gaza Province	0.40	0.39	0.01	0.81
Partner wants more kids	0.29	0.30	-0.00	0.90
No. of children	2.76	2.45	0.32	0.03
Limiting	0.39	0.36	0.02	0.55
Catholic	0.16	0.09	0.07	0.02
Muslim	0.02	0.04	-0.02	0.12
Protestant	0.03	0.03	-0.00	0.95
Other religion	0.30	0.30	0.01	0.89
Atheist	0.02	0.05	-0.03	0.04
Doesn't know religion	0.01	0.01	-0.00	0.97
Not Using	0.31	0.30	0.01	0.75
Injections User	0.30	0.31	-0.00	0.97
Implant User	0.10	0.09	0.00	0.86
Pill User	0.20	0.20	-0.00	0.95
Condoms User	0.09	0.10	-0.01	0.60
(Before-treatment) Intention to Use	0.86	0.88	-0.02	0.47
Baseline Beliefs about Pregnancy Risk Absent Contraception	15.44	15.84	-0.40	0.35

Source: Survey described in Section 2.2. Treated women are women randomly selected to receive the pregnancy risk information message described in Section 6. Total sample size: 584, including 296 untreated and 288 treated women.

A-4 Appendix Figures

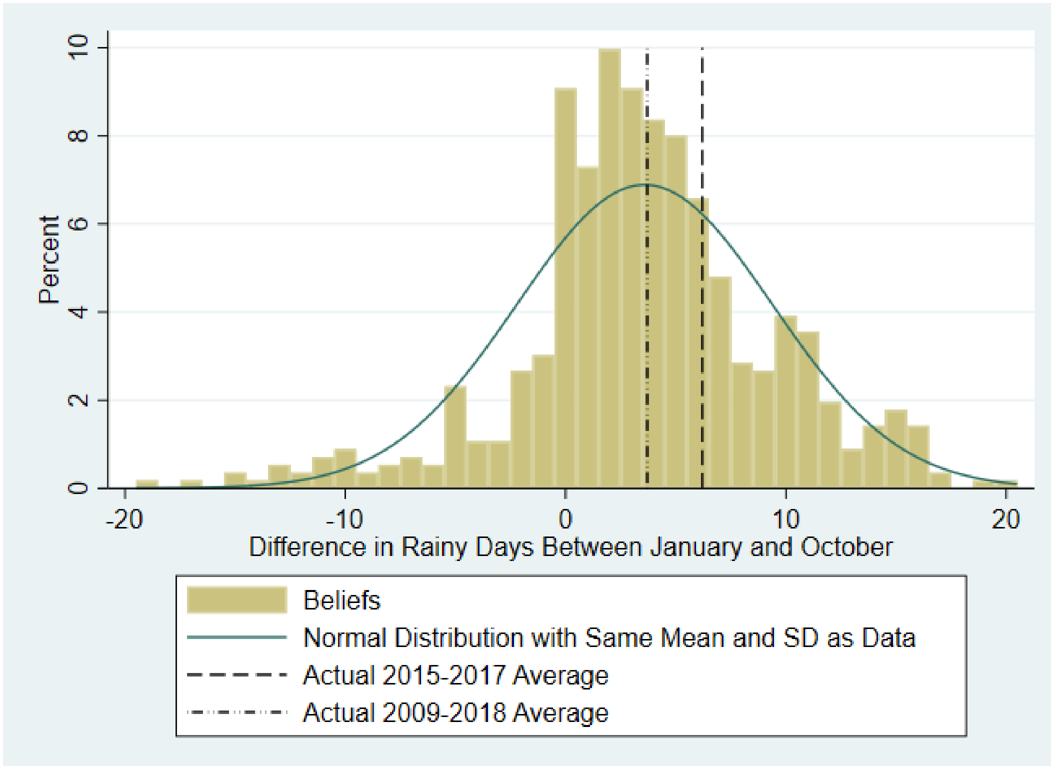

Figure A-1

Sources: `https://weather-and-climate.com/average-monthly-Rainy-days,maputo,Mozambique` ("Actual") and survey described in Section 2.2 ("Data").

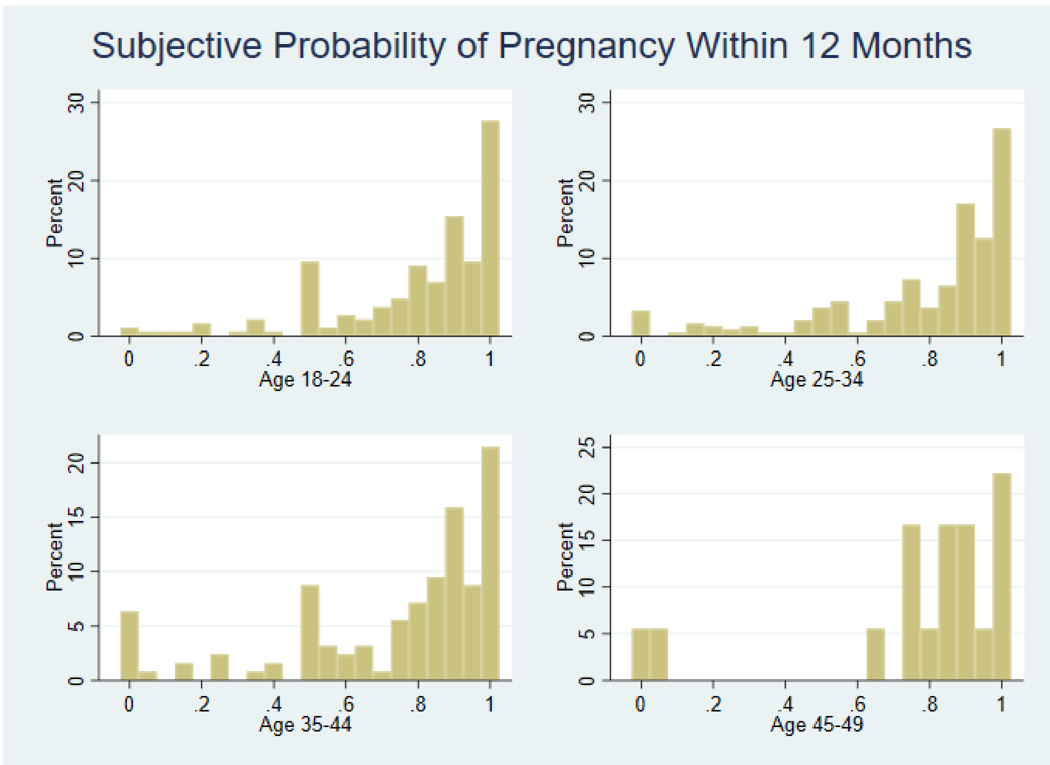

Figure A-2

Source: Survey described in Section 2.2.

A-5 Experimenter Demand Econometrics

For simplicity, we follow Blattman et al. (2019) and focus on experimenter's demand as introducing measurement error in a linear probability model.[36] Let reported intended take-up in period t=0 ("before information provision") or t=1 ("after information provision") be given by y_t. Reported beliefs in period t are denoted by b_t and unobserved determinants of intended take-up are represented by u_t. The linear probability model for y_t is thus given by:

$$y_t = \beta_0 + \beta_1 b_t + u_t.$$

We can express the regression for period $t = 1$ as

$$y_1 = \beta_0 + \beta_1 b_0 + \beta_1 \Delta b + u_1,$$

where $\Delta b = b_1 - b_0$. If reported beliefs respond to experimenter's demand in $t = 1$ but not in period $t = 0$,

$$b_1 = b_1^* + v \quad \text{and} \quad b_0 = b_0^*,$$

where $b_t^*, t = 0, 1$ are true beliefs. Let $\sigma_v^2 = \text{var}(v)$. In this case, one can establish that

$$\text{plim}(\hat{\beta}_{\Delta b}) = \beta_1 \left[1 - \frac{\sigma_v^2 + \text{cov}(v, \widetilde{\Delta b^*})}{\sigma_v^2 + (1 - R^2_{\Delta b^* b_0})\sigma^2_{\Delta b^*}} \right] \neq \beta_1$$

(see, e.g., Bound et al. (2001)). $\hat{\beta}_{\Delta b}$ is the OLS estimator for the coefficient on Δb, $R^2_{\Delta b^* b_0}$ is the population coefficient of determination for a linear regression of $\Delta b^* = b_1^* - b_0^*$ on b_0, and $\widetilde{\Delta b^*}$ is the residual from the best linear projection of Δb^* on b_0. If Δb^* and b_0 are independent and $\text{cov}(v, \widetilde{\Delta b^*}) = 0$, one gets the usual attenuation bias formula for a classical measurement error in a simple regression.

Similarly, experimenter's demand will imply that the OLS estimator for the coefficient on b_0 ($\hat{\beta}_{b_0}$) is not consistent for β_1 either (see Levi (1973) when measurement error is classical). Conversely, if there are no experimenter's demand repercussions for beliefs, both $\hat{\beta}_{b_0}$ and $\hat{\beta}_{\Delta b}$ will be consistent for β_1 as will the estimator for the slope coefficient of y_0 on b_0. If this is not the case, this is suggestive of experimenter's demand on beliefs after information provision.

Setting aside its repercussions for beliefs, if experimenter's demand affects reported intended take-up, then

$$\mathbb{E}(y_1 | b_0, \Delta b) = (\alpha_0 + \beta_0) + (1 - \alpha_0 - \alpha_1)\beta_1 b_0 + (1 - \alpha_0 - \alpha_1)\beta_1 \Delta b,$$

[36] Blattman et al. (2019) study experimenter's demand in the outcome variable in a treatment effect context.

where $\alpha_0 = \mathbb{P}(y_1 = 1|y_1^* = 0)$ and $\alpha_1 = \mathbb{P}(y_1 = 0|y_1^* = 1)$ are miss-classification probabilities and, as before, y_1^* is true take-up intention as opposed to reported take-up intention, y_1 (see Hausman et al. (1998)). Consequently, if the two coefficient estimators for β_1 ($\hat{\beta}_{\Delta b}$ and $\hat{\beta}_{b_0}$) are similar, but different from that of the regression of y_0 on b_0, there is evidence of experimenter's demand effects on take-up intentions. On the other hand, if those three coefficient estimates are similar, there is no evidence for experimenter's demands effects on beliefs or reported take-up intention. (Note that if there is evidence for experimenter's demand effects on beliefs, nothing can be concluded regarding experimenter's demand repercussions for reported take-up intentions.)