Impact of Access to Emergency Contraceptives on Risk Behavior: Evidence from a Policy Change in India

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Selected Paper prepared for presentation at the 2017 Agricultural & Applied Economics Association Annual Meeting, Chicago, Illinois, July 30-August 1

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Abstract

Risk compensation theory suggests that people adjust their behavior according to their perceived level of risk, acting with greater care when the perceived risk is higher and with less care when it is lower. This paper studies the existence of such risk behavior in the context of access to emergency contraceptive, or morning after pills, to women in India. Using an exogenous policy change, we test whether having access to emergency contraceptive pills leads people to indulge in riskier sexual behavior knowing that they can prevent pregnancy using these post-coital contraception methods. If people are risk compensating, we should see a decrease in use of other contraceptive methods and possible increase in rates of sexually transmitted infections since these pills, while reducing the risk of pregnancy, have no impact on preventing the spread of sexually transmitted infections. We find evidence for risk compensation in terms of reduced contraception use but none for increase in rates of sexually transmitted infections. The evidence suggests emergency contraceptive pills are being used as a substitute for other contraceptives but only in safer sexual interactions that do not involve a high probability of sexually transmitted infections.

I. INTRODUCTION

When Peltzman (1975) proposed the theory of risk compensation behavior resulting from mandatory automobile safety regulation, it led many social scientists to look for evidence of similar risk behavior in a variety of fields. There is no dearth of empirical literature trying to measure behavioral responses to risk reducing technologies like seat belts, bicycle helmets, protective

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sports gear, sunscreen etc. More recently, similar work has been focused on public health issues like HIV, vaccinations etc. This paper looks for evidence of risk compensation in sexual behavior when given access to a new method of postcoital contraception that, while reducing the risk of pregnancy, does little to reduce the risk of sexually transmitted infections (STIs).

The benefits from access to multiple methods of contraception can be jeopardized if accompanied by risk compensation behavior. If the perceived risk from risk-reducing techniques (like the use of seat belts) is so low that it encourages people to indulge in riskier behavior (like reckless driving), then the net benefits of these techniques might be overestimated. In the recent past, some researchers have looked at similar risk compensation responses in the context of HIV and whether a difference in perceived risk of infection changes people's behavior. We use a similar framework to test for risk behavior changes in context of access to Emergency Contraceptive Pills (ECPs) in India.

In 2005, ECPs or morning-after pills became available over-the-counter in India. To promote their use, the Indian government incorporated them in the national family planning and rural health programs making them available at highly subsidized rates in rural areas. With prices ranging from USD 0.03 to 0.05 in rural areas and USD 0.35 to 1.60 in urban areas, the ECP sector saw a growth rate in sales of over 245 percent[3] between 2007 and 2010. Figure 1 presents a graph showing the increase in ECP sales in India (Dixit *et al*., 2015). It is still one of the fastest growing sub-sectors within the pharmaceutical industry. In addition to being big business for the companies, the use and availability of ECPs is also an important issue for women's reproductive health.

[3] Relph, Mridu Khullar. "In India, Banking on the 'Morning After' Pill." *Time*, May 26, 2010.

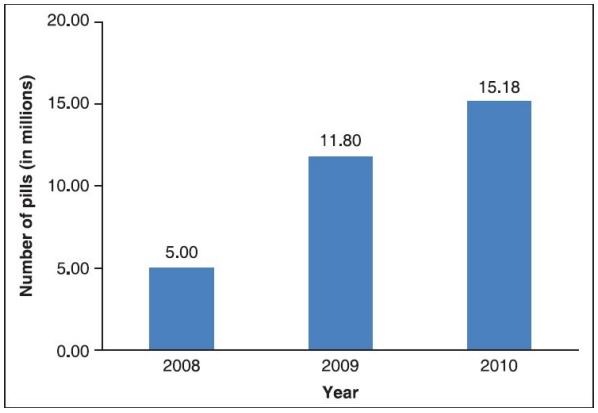

Figure – 1: ECP use in India (2008-10)

In India, 78 percent of pregnancies are unplanned, and at least 25 percent of all pregnancies are unwanted[4]. This results in the nearly 11 million induced abortions and over 20,000 deaths from abortion-related complications recorded officially every year, which does not include the possibly larger number of unrecorded abortions and deaths. In a WHO study on sexual and reproductive health, Grimes *et al.* (2006) found that around one-third of Indian women seeking abortions reported first attempting self-abortions. According to some measures reported using government-owned data, one woman in India dies every two hours because of abortions gone wrong[5]. The cost of unwanted pregnancies and abortions is high for women in terms of time and health, both physical and mental. These statistics reflect the large unmet need for contraception in India and thus, estimating the impact of easy availability of ECPs becomes an important issue.

With this information alone, and the belief that having greater control over one's reproductive cycle is empowering, it may seem that the easy availability of ECPs to women can only be a positive development for women's health. Bailey (2006) puts forth compelling evidence that the introduction of oral contraceptives in the US in 1960 had large and permanent effects on women's

[4] According to the Federation of Obstetric and Gynecological Societies of India (FOGSI)
[5] As reported by the national daily newspaper The Hindu. Retrieved here: http://www.thehindu.com/news/national/unsafe-abortions-killing-a-woman-every-two-hours/article4686897.ece

labor market participation. However, the case of emergency contraceptives may be different in multiple ways. Objections to ECP range from moral to behavioral. One objection to making ECPs more widely available is the concern that women who know they can use ECPs may become less diligent with their ongoing contraceptive method. If used as a substitute for regular contraceptive, ECPs would be far less effective than most other contraceptive methods; if an average woman used ECPs for a year instead of her regular contraceptive method, her risk of pregnancy would increase between 20 to 35 percent (Trussell *et al.* 2017). Behavioral concern expressed about making emergency contraception available over-the-counter is that easy access would encourage women, particularly (but not limited to) adolescents, to increase risky sexual behavior resulting in a higher instance of STIs. This is the same phenomenon explained by the risk compensation theory used in this paper.

India has the third highest number of people living with HIV with the number reaching 2.4 million in 2013[6]. The three highest HIV prevalence states in India are Andhra Pradesh, Karnataka and Tamil Nadu with the latter limiting access to ECPs, whereas the former two experienced an increase in the annual sales of ECPs. If people are risk compensating when ECPs become easily accessible, especially in high HIV incidence areas, policy makers might want to complement the easy availability of ECPs with awareness programs about its safe use. Conversely, if there is no evidence of risk compensation, the state of Tamil Nadu should have one less reason to keep the ECPs banned given the large unmet need for contraception.

The attitudes and beliefs of healthcare providers have played a key role in policy formulation on access to and uptake of ECPs by women in India. According to a study by the Population Council

[6] According to the World Bank HIV Report released in 2013.

of India, gynecologists believed that women who have access to ECPs have premarital sex with multiple sexual partners, engage in risky sexual behavior, are more likely to have STIs and could substitute ECP for other family planning methods (Dixit *et al*., 2015). If used in correct dosage, ECPs have no long term side effects and some short term side effects including headaches, painful menstruation, nausea and lower abdomen pain, all of which resolve within approximately 24 hours (Trussell *et al.* 2017). However, concern about overusing ECPs as substitute for other family planning methods is a legitimate one. In India, advertisement campaigns run by pharmaceutical companies to promote ECPs have failed to stress the emergency nature of the drug. If used as a substitute for regular contraception, the efficacy of ECPs decline significantly. Multiple claims of long term adverse effects like hormonal imbalance, weight gain, polycystic ovary syndrome and fertility due to overuse remain unsubstantiated and need more research[7].

This paper tries to test whether having access to emergency contraceptive pills leads people to indulge in riskier sexual behavior knowing they can prevent pregnancy using these post-coital contraceptive pills. The study exploits a plausibly exogenous policy change in the state of Tamil Nadu in India which curtailed over-the-counter access to ECPs while neighboring states did not. We use two empirical strategies – a standard double difference estimation and parametric difference-in-difference estimator incorporating propensity scores (PSM – DiD) – to test for the impact of this policy change. Our estimates indicate that easy access to ECPs resulted in a substitution away from some methods of contraception. However, there is no evidence for impact on the rates of STI. These results are robust to multiple alternative model specifications including

[7] As reported from interviews with gynecologists in India in the magazine India Today. Retrieved from: http://indiatoday.intoday.in/story/quick-fix-pills-unwanted-pregnancies-teenage-girls/1/260843.html

limiting the sample to border districts of the treatment and control states in a standard double difference strategy.

The rest of the paper is organized in sections where Section II presents a review of the existing literature, Section III highlights the theoretical framework, Section IV discusses the data used in this paper, Section V talks about the methodology and Section VI and VII conclude with a discussion of the results.

II. LITERATURE REVIEW

II. A Risk Compensation in Sexual Behavior

Thornton *et al*. (2011) examined the impact of a change in the perceived level of risk on sexual behavior of men in rural Malawi. In a randomized control trial, they informed circumcised and uncircumcised men that circumcision significantly reduces the risk of HIV infection in men. With this new information given to the participants, they tested whether a reduction in the perceived level of risk in circumcised men led to risk compensation and thus, riskier sexual behavior. They found no evidence that the information led circumcised men to engage in riskier sex. In addition, they found that among uncircumcised men, there was a decrease in risky sexual behavior.

The next sub-section provides a more comprehensive review of literature focusing on ECPs and risk compensation behavior, most of which comes from public health and related fields.

II. B Do ECPs lead to Risk Compensation Behavior?

Many studies argue that making ECPs more widely available does not increase risk-taking or adversely affect regular contraceptive use. Marston *et al.* (2005) examined the impact on

contraceptive practice of making emergency hormonal contraception available over the counter from 2000-02 in the UK. They found that after emergency hormonal contraception was made available over the counter, levels of use of different types of contraception by women aged 16-49 remained similar. No significant change occurred in the proportion of women using emergency hormonal contraception or having unprotected sex. They found no evidence for a significant change in the proportion of women using more reliable methods of contraception, such as the oral contraceptive pill, or in the proportion of women using emergency hormonal contraception more than once during a year. An important difference between their study and the context of this study was that the percentage of women using ECPs in the UK decreased each year, a trend which was the opposite of what happened in India.

Moreau *et al.* (2006) also examined the effect of access to ECPs on women's use of highly effective contraceptives using a representative cohort of French women in 1999 with follow up to 2004. Their results too suggested that the elimination of the prescription requirement for ECPs did not impede a switch to more-effective contraceptive use. Glasier (1998) also found that making emergency contraception more easily obtainable did no harm in terms of adverse health effects and may have reduced the rate of unwanted pregnancies.

The evidence suggesting the contrary - prevalence of risk compensation in women when ECPs are easily available - is smaller but considerable. Raine *et al.* (2000) found in a controlled trial in women's health clinics in San Francisco, California that women aged 16-24, who had precoital access to ECPs were three times as likely to use it. Although the treatment group did not report higher frequencies of unprotected sex than the control group immediately after the intervention, women in the treatment group were more likely than those in the control group to report using less effective contraception at follow-up compared with at the time enrollment. Weaver *et al.* (2009)

explored the attitude and behavior effects in a randomized trial of increased access to emergency contraception. They found that on average, women in the increased access group had significantly stronger perceptions of the "relative benefit" of emergency contraception. Women in the increased access group were also significantly more likely to report that they had ever used emergency contraception because they did not want to use either condoms or another contraceptive method. A more recent study by Atkins *et al.* (2015) looks at the effect of changes in policy for over the counter access to ECPs on young adults across New England states. They found that switching ECPs to a nonprescription status had no systematic effect on the probability of sexual activity or of hormonal birth control use, but that it significantly reduced the probability that public school students used condoms by between 5.2 and 7.2 percent. Their result is similar to what we find in this study wherein easy access to ECPs has resulted in a significant reduction in the use of other types of contraception methods.

While little research is available on the impact of easy ECP access in India, there is some evidence that suggests concerns regarding awareness about proper ECP use. Joseph *et al.* (2015) study the awareness and attitudes towards ECPs among college students in India. They found that while over 85 percent students had heard of ECPs, fewer than 34 percent knew that they do not prevent STIs. Almost half of the students interviewed said they would recommend ECPs to their friends. In an effort to understand the level of awareness among pharmacists who regularly dispense ECPs over the counter, Saxena *et al.* (2016) used the mystery shopper technique and found that around 79 percent were unclear about the side effects of ECP use, 86 percent did not know whether subsequent unprotected intercourse would lead to pregnancy and only 16 percent were able to discuss the risk of STIs when asked leading questions.

In a survey conducted by Urban Health Initiative and funded by Bill and Melinda Gates foundation in India, they found that almost twice as many men reported knowledge of ECPs than women across age groups and regions. The same survey also stated that over 66 percent of the men who had knowledge about ECPs asked their female partners to use them at least once a month. A potential reason for this could be the perception of reduced sexual pleasure from condom use and fear of deteriorated sexual performance due to vasectomies among men. For these reasons, among others, contraception largely remains a women's responsibility in India with condom use and vasectomies declining by 52 and 73 percent respectively from 2008 to 2016[8].

In most studies reviewed for this paper, the use and impact of ECPs was estimated for women whose access to ECPs was accompanied with education and in-person counselling for proper use by trained medical professionals. These were also women – largely from urban areas in developed countries – with much higher exposure to media and healthcare services compared to the Indian women included in the data set analyzed in this paper. The women participants in these studies are likely to be different from the Indian women included in our sample– in terms of information about ECPs, inter-temporal discount rates and intra-household bargaining power over the preferred method of contraception.

II. C India's Experience with ECPs

Since their launch in 2002 in India, ECPs have met with mixed reactions from central and state governments. Figure 2 shows the history of ECP availability in India together with the dates that

[8] According to an article published by Business Standard using data from Health Management Information System of the Ministry of Health & Family Welfare on Feb 23, 2017. Available online: http://www.business-standard.com/article/economy-policy/thanks-to-indian-men-s-reluctance-to-use-contraceptives-population-surges-117022300242_1.html

national demographic and health surveys were conducted. A major step by the government of India was the incorporation of ECPs in the National Rural Health Mission (NRHM) and National Family Planning Programs in 2005. This was done to make ECPs available in rural areas at highly subsidized rates. However, in September 2006, the state government of Tamil Nadu banned over-the-counter sales and any form of advertisement of ECPs in the state.

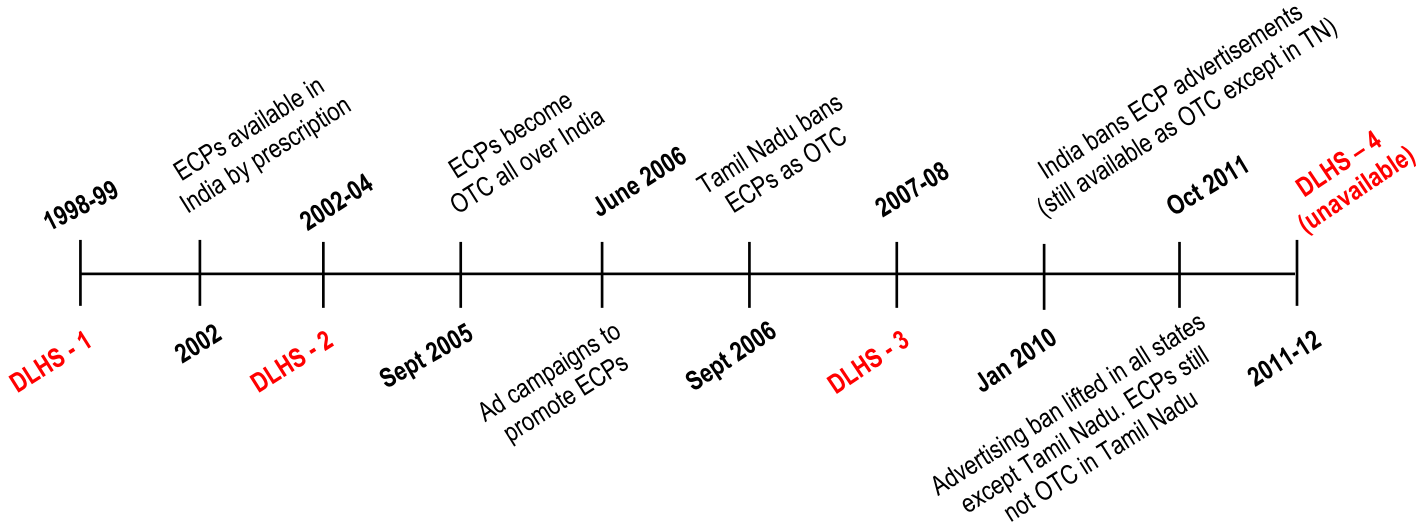

Figure – 2: Timeline of ECP availability in India

With major pharmaceutical companies launching an aggressive ad campaign to promote ECP use, the advertisement and sale of ECPs continued until early 2010 in the rest of the country. In January 2010, the central government placed a nationwide ban on advertising of ECPs in mass media. While the aggressive advertising carried out by ECP manufacturers led to a drastic increase in demand for ECPs, their incomplete disclosure on the approved use of ECPs (i.e., not as a regular contraceptive method) and side effects resulted in the ban being placed on advertising even though ECPs were still available over-the-counter.

In October 2011, the ban on nationwide advertising was lifted with very little change in the content of ad campaign that was being aired before the ban. Currently, ECPs are available over-the-counter in all the states of India except Tamil Nadu where ECPs are neither advertised nor available as OTC. However, as mentioned, ECP use has continued to rise in the rest of the country, including in the states adjoining Tamil Nadu.

The social context in which most Indian women must navigate their options related to fertility and contraception is complex. For unmarried young women, the social cost of failed contraception is enormously high, regardless of urban or rural areas. Moreover, given the lower intra-household bargaining power of women in India, fertility decisions and the choice of contraceptives are largely driven by the preferences of their male partners, and more men than women have shown awareness and preference for ECPs in recent years.

III. THEORETICAL FRAMEWORK

Following the framework posited by Peltzman (1975), we can think about risky behavior – in this case, unprotected intercourse – as a desirable good that provides some utility in terms of increased satisfaction, pleasure, thrills etc. Thus, the equilibrium will be a tradeoff between perceived avoidance of (an unwanted) pregnancy and unprotected intercourse, i.e. more of one can be achieved by forgoing some of the other. If the equilibrium level of perceived risk to an individual is altered by a risk-reducing technology, their willingness to engage in riskier behavior increases. Studies trying to measure the effectiveness of ECPs (or any risk reducing technology for that matter) usually measure the effectiveness without taking into account the possibility of risk compensation. If people are risk compensating, the new equilibrium of optimal level of risky behavior will most certainly be higher than the one measured.

Moreover, unlike ECPs, regular oral contraceptives require women to follow a more diligent schedule of taking the daily medication. The psychic costs of following a strict schedule might be small yet non-zero for women. With the price of oral and emergency contraceptives being comparable, this small non-zero cost might become a determining factor in making the choice between regular oral contraceptives and ECPs. Additionally, the short term but unpleasant side effects of ECPs might also play a role in this decision.

IV. DATA

We use the District Level Household and Facility Survey on Reproductive and Child Health (DLHS) conducted by International Institute of Population Sciences (IIPS) in India. It is a representative household sample survey at the district level with round one carried out in 1998-99, round two in 2002-04 and round three in 2007-08. Each round of the survey covered approximately 600 districts in India with 1000 to 1500 households in each district. This results in a sample size of over 720,000 households and 644,000 ever-married women. The surveys are designed to provide information on family planning, maternal and child health, reproductive health of ever married women (aged 15-49), and utilization of maternal and child healthcare services at the district level for India. In addition, the surveys also provide information on post-natal care, health institutions and facilities, and coverage of all maternal and child health programs at the district level. Divided in three parts, they consist of a village questionnaire, household questionnaire and married/unmarried women questionnaire in both English and the vernacular. The women's questionnaire consists of detailed questions about awareness and use of contraception methods, including ECPs, and incidence of STIs among other things, which are of particular interest for the analysis in this paper.

V. METHODOLOGY

The state of Tamil Nadu, unlike all other states, has not allowed advertisement or sale of ECPs over-the-counter since September 2006. It has also been very proactive in implementing this ban with frequent raids, fines and closing down of pharmaceutical stores[9]. Tamil Nadu is bordered by three other states – Kerala, Andhra Pradesh and Karnataka – all of which have seen a significant increase in the use of ECPs in the past few years. The timing of the Tamil Nadu ban and the DLHS surveys (see figure -1 for timeline) give us an opportunity to estimate the impact of easy ECP access on sexual behavior using the ban as a natural experiment. We first use a double difference estimator followed by a parametric difference-in-difference estimator incorporating propensity scores (PSM – DiD) as an additional robustness check. We also limit our sample to border districts to again estimate a double difference and find that our results remain robust.

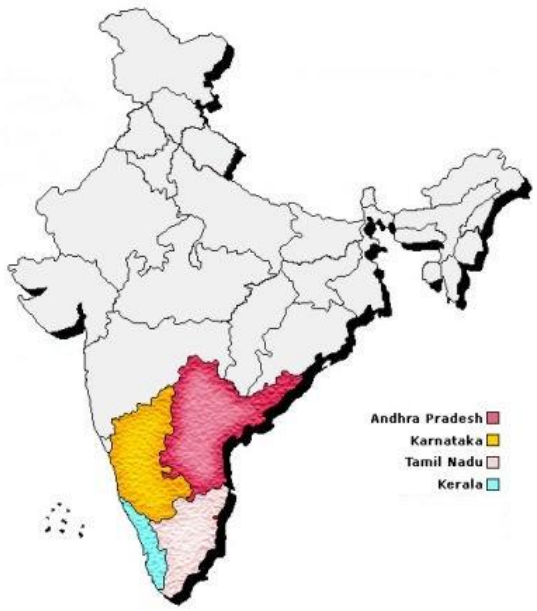

Figure – 2: Location of Tamil Nadu and other comparison states on a map of India

[9] Ramalingam, K. (2006, October 10). Morning-after pills seized in Chennai. Retrieved from http://www.indiatogether.org/otcecs-women

For this analysis to be valid, two key concerns would be whether Tamil Nadu is a good counterfactual for the other states and whether the ban in Tamil Nadu was indeed exogenous and uncorrelated to any baseline characteristics specific to the state. In the following sub-section, we present evidence and argue that both these assumptions hold true.

V.A Case for an exogenous policy change

In September 2005, the Drug Controller General of India (DCGI) officially made the Levonorgestrel-based ECP available over-the-counter in all states in India, including the state of Tamil Nadu. In large part, this was seen as a step towards promoting women's reproductive rights in India. However, in most states – Tamil Nadu, Karnataka, Andhra Pradesh and Kerala included – fringe organizations like Responsible Parents Forum, Swarna Bharat Trust and some religious interest groups protested against the move. The protest alone was not enough in any state to persuade the state administration to place a ban on over-the-counter sale of ECPs. As a result, even though ECPs had not yet gained popularity, they were easily available in Tamil Nadu until September 2006.

In March 2006, an ex-official of the Drugs Control Authority of Tamil Nadu moved the State High Court to remove the then Director of Drugs Control Authority on the basis that he did not meet the educational qualifications required for the position[10]. The petition supported the promotion of junior officials who met the eligibility criteria to the position. In light of support for the petition from the High Court, the Tamil Nadu State Department of Health removed the then Director and

[10] Subramani, A. "Plea Seeks Removal of Director of Drugs Control of Tamil Nadu." The Hindu. March 26, 2006. Accessed August 12, 2015.

in June 2006, promoted and appointed Mr. N. Selvaraju as the new Director of Drugs Control Authority[11]. Among others, one of the important duties of the Director of Drugs Control Authority is to issue approval for the sale and distribution of various drugs in state and enforce the Drugs and Cosmetics Act, 1940 and Drugs and Magical Remedies Act, 1954[12]. Within a couple of months of assuming office, citing moral reasons, Mr. Selvaraju placed a ban on over-the-counter sale of ECPs in the state under the Drugs & Cosmetics Act, 1940 and Drugs & Magical Remedies Act (Objectionable Advertisements), 1954. Following is a quote from one of his interviews on the issue:

> *"We are not against women's rights, but this is a moral concern. The advertising of this drug will mean that women will think, 'I can do anything and there is an easy way not to get pregnant'. We can't allow such an attitude to grow."*[13]

Against medical information and evidence, he also claimed that ECPs are in fact abortifacient and not contraceptives and thus, cannot be made available over-the-counter.

We argue that given the circumstances, the change in administration of the Drug Control Authority was an exogenous one leading to the appointment of a supporter of the ban. We perform balance test using key baseline characteristics from the treatment and control groups and find no significant differences. We use normalized differences – a statistic proposed in Imbens *et al.* (2008) – instead of t-test due to the former's significant advantages over t-tests. Normalized differences are a more appropriate measure compared to t-statistic when the estimated average treatment effect based on

[11] Babu, Gireesh. "State Govt Appoints Selvaraju as Drug Controller." - Pharma People. June 16, 2006. Accessed August 12, 2015.
[12] Selvaraju, Thiru "Department of Drug Control Administration Handbook." State Government of Tamil Nadu Right to Information Act, 2005. November 10, 2006. Accessed August 12, 2015. http://www.tn.gov.in/rti/proactive/hfw/handbook-drugcontrol.pdf.
[13] Ravindran, Nirmala. "Problem Pill." India Today. November 19, 2009. Accessed August 12, 2015.

regression methods may be biased in cases where the linear approximation is not accurate globally. T-statistic is more sensitive to sample sizes than normalized differences, particularly but not limited to, cases where unconfoundedness is not a reasonable assumption. Mathematically, if,

$$\overline{X}_c = \frac{1}{N_c} \sum_{i:W_i=0} X_i \qquad S_c^2 = \frac{1}{N_c - 1} \sum_{i:W_i=0} \left(X_i - \overline{X}_c\right)^2$$

$$\overline{X}_t = \frac{1}{N_t} \sum_{i:W_i=1} X_i \qquad S_t^2 = \frac{1}{N_t - 1} \sum_{i:W_i=1} \left(X_i - \overline{X}_t\right)^2$$

Normalized difference:

$$\text{nd} = \frac{\overline{X}_t - \overline{X}_c}{\sqrt{(S_c^2 + S_t^2)/2}}$$

As a rule of thumb, if a normalized difference exceeds one quarter, linear regression methods tend to be sensitive to the specification.

To further support our claim, we use the first two rounds of the DLHS data to empirically test the parallel trends assumption and find that there are no significant differences in the rates of change in contraception use, STI prevalence etc. between the comparison states and Tamil Nadu. Finally, we also empirically test for differences in outcome variables between treatment and control states before the policy change and find no statistically significant differences, thus lending further credibility to our assumption.

The first empirical method we use to estimate the impact of the policy change is a standard double difference estimation for the full sample followed by the same estimation for a sample limited to border districts while trying multiple different model specifications. We then perform a double difference using propensity score matching to further check our estimates. In the following sub-section, we outline the empirical underpinnings of both our strategies along with the underlying assumptions that we need to test for its validity.

V.B Double Difference

Before we perform a standard double difference estimation, we check the validity of the underlying assumption of common trends between the treatment and control states in the pre-treatment period. As an additional robustness check, we then limit our sample to border districts and perform the same tests.

Given that our assumption on common trends is valid, we estimate a regression model of the following form in the analysis:

$$Y_{ist} = \beta_0 + \gamma_s + \delta_t + \beta_1(Non\_TN_s * d_t) + \beta_2 X_{ist} + \varepsilon_{ist} \quad (1)$$

Here Y_{ist} is the outcome variable for individual i in state s in period t. γ_s is a set of state fixed effects and δ_t is a set of survey year fixed effects. Non_TN_s is a dummy variable for three states that did not have the ban, and d_t is a dummy for the after (treatment) period. The estimated impact is β_1. We also control for individual characteristics that are likely to have an influence on the outcome variable.

The main outcome variables of interest are rates of contraceptive use and incidence of STIs. We restrict the analysis to contraceptives that are close substitutes for ECPs, for example, condoms, regular oral contraceptives, the withdrawal method and the rhythm or abstinence method. We do not compare any changes in the use of permanent methods of contraception, like sterilization, or semi-permanent methods like IUDs, since those are not close substitutes for over the counter ECPs which are short term methods and require no planning, invasive medical procedure or intervention from a trained medical staff.

If ECP use is likely to substitute for other contraceptives, we should see that the coefficient β_1 on the interaction of $Non\_TN_s * d_t$ would be negative in equation (1) with contraceptive use as the

outcome variable. Intuitively, this means that with the increased access to ECPs, less people tend to use other contraceptives as compared to Tamil Nadu. This would be evidence for ECPs being used as substitute for other contraceptives like condoms. Furthermore, if people are risk compensating, using incidence of STIs as an outcome variable should result in a positive coefficient for β_1 in the above estimating equation. This would imply that compared to Tamil Nadu, the rates of STI increased in the states that had easy access to ECPs.

The set of individual characteristics used as control variables include years of woman's education, years of husband's education, woman's age and age at marriage, religion, location (rural or urban) and some indicators of household wealth level (like type of house).

We replicate the model using only the observations from border districts in Tamil Nadu and the adjoining states since these districts are likely to be share many common cultural features that would reduce any bias in the initial estimates. One of the concerns while analyzing only the border districts of these states would be the possible illicit trade of ECPs across the border. It is important to note that Tamil Nadu faces not only a ban on ECP sales but also on any advertisement of the product in Tamil Nadu. The ban on advertisement since the launch of the product will affect both the awareness about and demand for the product. Since these states in India are divided along linguistic lines, any exposure to advertising in the control state from the treatment states is limited, if not unlikely. Nevertheless, there is still a possibility of some spillover between border districts of treatment and control states. However, without the government subsidy for ECPs, the price would range from USD 0.35 cents to 1.60 which is comparatively much higher than other means of contraception provided under the government programs. In any case, if there is spillover of information accompanied by illegal sale across the border from treatment to control states, our

results would be an underestimation of the actual impact of the policy. The results of this estimation are presented in section VI.

V.C Double Difference using Propensity Score Matching (PSM – DiD)

We use a parametric difference-in-difference estimator incorporating propensity scores (PSM – DiD) for this analysis. We limit our sample to the border districts using only the last two rounds of survey data - DLHS 2 and DLHS 3.

A number of studies have utilized PSM-DiD estimators, mostly in panel settings (van de Walle *et al.* 2007). These studies use pre-treatment variables to construct propensity scores, and then estimate the impact using a weighted regression in first-differences (Khandekar et al. 2009). However, integrating PSM in DiD under repeated cross-section setting is different owing to the fact that we have effectively four groups - treatment pre (G_1), treatment post (G_2), comparison pre (G_3), and comparison post, as opposed to the binary treatment-control under usual PSM settings. To implement PSM in this setting we follow the multiple group propensity score weighting methodology proposed in Stuart *et al.* (2014). Their method is similar to the Inverse Probability of Treatment Weighted (IPTW) estimator with multiple treatments. They propose a weighting strategy in which the four groups are weighted in a manner that reflects the distribution of the individual covariates in the treatment group in the pre-policy change period. To do so we estimate a multinomial logistic model to predict the group in which an individual observation belongs to a function of covariates. We select covariates that are not likely to be influenced by the policy change. Here we use individual age, education, age at marriage, fertility, and indicators for rural/urban, religion, caste and housing condition. We allow for flexible functional form using the levels of the covariates as well as a mixture of their interactions. The resulting multinomial model

is used to predict four propensity scores for each observation. Following the notation in Stuart *et al.* (2014), the propensity scores are $e_k(X_i)$ – where:

$$e_k(X_i) = \Pr(i \in g_k), k = 1,2,3,4$$

$$\sum_{k=1}^{4} e_k(X_i) = 1 \; \forall \; i.$$

These predicted probabilities are then used to construct individual weights w_i :

$$w_i = \frac{e_1(X_i)}{e_g(X_i)}$$

where g is the group to which individual i belongs. By construction, all individuals in the treatment group in the pre-policy period receive a weight of one. Individuals in other groups receive weights proportional to how similar they are to observations in group 1 relative to individuals in their own group. We then estimate a DiD weighted linear regression. The results of this estimation are presented in the following section.

VI. RESULTS

Table 1 presents descriptive statistics for the three rounds of DLHS data for all the four states used for analysis in this paper. As seen from the table below, a large proportion of the population reports awareness of STIs in the dataset. The survey asks women if they have heard about STIs, RTIs (Reproductive Tract Infections), AIDS or HIV while listing their symptoms. If the respondent answers 'Yes' to any one of those, the survey considers them as aware of STIs. Given the relatively high awareness of AIDS – owing largely to the efforts of the central government body National AIDS Control Organization (NACO) – the survey registers a high overall awareness of STIs. We

see an increasing trend in the share of women who use any Family Planning (FP) method – around 59 percent in the first round to close to 65 percent in the third round.

Table – 1: Descriptive statistics of main variables[14]

	Round 1 (1998-99)	Round 2 (2002-04)	Round 3 (2007-08)	Total
Current age of woman	30.09 (7.403)	30.26 (7.166)	31.95 (8.224)	30.73 (7.665)
Years of educ - woman	4.479 (4.866)	8.898 (3.387)	8.452 (3.574)	6.872 (4.623)
Years of educ - husband	6.158 (5.168)	9.762 (3.681)	8.706 (5.179)	7.888 (5.078)
Age when started living with husband	17.55 (3.304)	19.31 (3.498)	19.25 (3.574)	18.54 (3.546)
Fertility	2.239 (1.467)	1.901 (1.136)	2.081 (1.208)	2.103 (1.316)
Aware of STI	0.770 (0.421)	0.943 (0.232)	0.943 (0.233)	0.869 (0.337)
Symptoms of STI (past 3 months)	0.245 (0.430)	0.145 (0.352)	0.106 (0.308)	0.175 (0.380)
Currently use any FP method?	0.586 (0.492)	0.635 (0.481)	0.649 (0.477)	0.619 (0.486)

One of the limitations of our data is the low rate of ECP adoption in the timeframe for which data is available. Figure 3 shows the percentage of current contraception use by ever married women who are not sterilized and report using at least one method of family planning. In the graph, traditional methods include periodic abstinence, withdrawal etc.

[14] The sudden increase in the years of woman's education and husband's education from round 1 to round 2 is due to a change in definition of the variable between the rounds. However, the definition of this variable remains consistent within rounds and across states for each round.

Figure – 3: Current Contraception Use

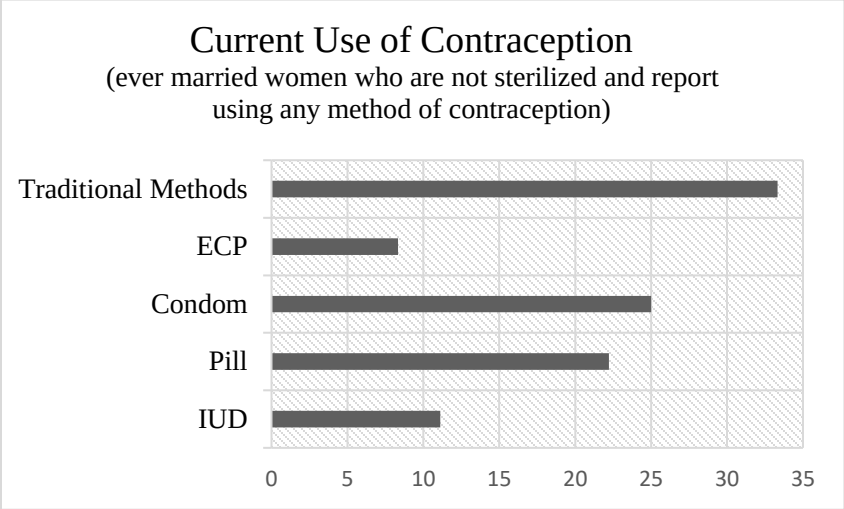

Table 2 presents a summary of reported awareness among ever-married women on contraception methods from round 1 to round 3 for all four states.

Table – 2: Awareness about contraceptive methods

	Round 1		**Round 2**		**Round 3**	
Aware of? (% reporting yes)	Rural	Urban	Rural	Urban	Rural	Urban
Female sterilization	99.3	99	99.4	99.3	99.3	99.6
Male sterilization	86.5	90.2	74.7	82.9	78.4	84
IUD/copper-t	62.2	77.4	59.6	76	65.6	82.3
Oral pill	59.3	74.4	60.2	75.5	68.3	82
ECP	-	-	-	-	35.6	48.7
Condom	42.8	57	43.4	62.8	52.7	73.2
Periodic Abstinence	38.0	52.7	31.5	37.9	35.2	45.9
Withdrawal	25.9	34.7	18.3	24.3	21.2	25.1
Observations	49415	18738	48581	27809	61811	26828

We now estimate a standard double difference and to ensure its validity, we first perform balance test for treatment and control states using normalized differences, followed by empirical test for common trends using the first two rounds of survey data. Table 3A shows that normalized differences between treatment and control states are insignificant for variables that are likely to affect the outcome variables. Furthermore, Table 3B shows that normalized differences between treatment and control states for the outcome variables and their subcategories are insignificant in the time period before the treatment. This further makes the case that before the policy change, the outcome variables were comparable between the treatment and control states.

Table 4 shows evidence for validity of common trends assumption which is crucial for the use of a double difference strategy. As shown in the table, the interaction term between treatment state and pre-treatment period has no significant impact on the outcome variables. This lends further support for the common trend assumption.

Table – 3A: Normalized difference between treatment and control states

	(1) Treatment States	(2) Control State (TN)	(3) Normalized Difference
Current age of woman	28.16713	30.41451	0.1898329
Years of educ – husband	7.70139	8.175882	0.0547528
Years of educ – woman	7.612119	7.782885	0.0261267
Age when started living with husband	18.16781	19.48132	0.243829
Religion			
Hindu	0.750208	0.866258	0.2062086
Muslim	0.180172	0.078914	-0.2108382
Christian	0.063686	0.052913	-0.0325032
Other	0.005935	0.001916	-0.0454302
Caste			
Scheduled caste	0.165509	0.232688	0.1185379
Schedule tribe	0.07053	0.015521	-0.1899544
Other backward caste	0.470001	0.729295	0.3617504
Housing characteristics			
Concrete	0.392262	0.371346	-0.0304347
Semi-concrete	0.431522	0.439951	0.0120198
Mud	0.176216	0.188703	0.0228574

Table – 3B: Normalized difference between treatment and control states - outcome variables in pre-period

	(1) Treatment States	(2) Control State (TN)	(3) Normalized Difference
Condom	0.0373	0.0358	-0.0056597
Oral pill	0.0152	0.0058	-0.0652295
Periodic Abstinence	0.0512	0.0397	-0.0774293
Withdrawal method	0.0299	0.0161	-0.0652141
Symptoms of possible STI (past 3 months)	0.0735	0.0607	-0.0362629
Vaginal discharge (past 3 months)	0.1093	0.1908	0.1601894
Pain during urination (past 3 months)	0.0490	0.0369	-0.0422275
Pain during intercourse (past 3 months)	0.0478	0.0390	-0.0301315

Col (1) and (2) report mean values of the characteristics for control and treatment groups. Col (3) reports the normalized difference (Imbens and Wooldridge, 2008).
A normalized difference greater than 0.25 indicates significant differences between treatment and control. Sample of observations is women who are not sterilized and not pregnant

Table – 4: Test for Parallel Trends Assumption

	(1) Condom	(2) Oral pill use	(3) Periodic Abstinence	(4) Withdrawal method	(5) STD
Non TN X Survey Round 2	-0.00594	0.00242	0.00206	0.00494	0.00862
	(0.00464)	(0.00156)	(0.00815)	(0.0105)	(0.00553)
Woman's Age	0.00216*	0.000219	0.00173	0.00108***	0.00468**
	(0.000889)	(0.000210)	(0.00102)	(0.000164)	(0.00146)
Woman's Age (squared)	-0.0000436**	-0.00000906	-0.0000207	-0.0000165**	-0.0000787**
	(0.0000126)	(0.00000490)	(0.0000177)	(0.00000488)	(0.0000243)
Years of educ - Woman	-0.00174***	0.0000963	-0.000639	0.00136	0.000128
	(0.000148)	(0.000240)	(0.000453)	(0.000956)	(0.000925)
Years of educ - Woman(squared)	0.000303***	0.0000236	0.000239*	-0.0000155	-0.0000745
	(0.0000352)	(0.0000232)	(0.0000905)	(0.0000310)	(0.0000841)
Years of educ - Husband	-0.000480	0.0000275	0.00138*	0.00102	0.000785
	(0.000324)	(0.000175)	(0.000556)	(0.000595)	(0.000415)
Years of educ - Husband(squared)	0.0000728	0.0000119	-0.0000761	-0.0000985	-0.000122**
	(0.0000433)	(0.0000136)	(0.0000417)	(0.0000597)	(0.0000319)
Age when started living w/ husband	0.00167	0.00148*	-0.000701	0.000661	-0.00296
	(0.00163)	(0.000505)	(0.00203)	(0.00270)	(0.00493)

Age when started living w/ husband (squared)	0.00000563 (0.0000471)	-0.0000283** (0.00000727)	0.0000874 (0.0000748)	0.0000287 (0.0000482)	0.0000864 (0.0000958)
Fertility	0.000671 (0.000464)	0.000801*** (0.000116)	-0.000970 (0.000776)	-0.00106 (0.000678)	-0.00212 (0.00141)
=1 if rural locality	-0.00391 (0.00266)	-0.00208 (0.00102)	0.00977 (0.00728)	0.00505 (0.00308)	0.00528 (0.00228)
Religion - Hindu	ref.	ref.	ref.	ref.	ref.
- Muslim	0.00951*** (0.00142)	0.00647** (0.00168)	0.0107 (0.00581)	0.0126* (0.00465)	0.00983 (0.00604)
- Christian	0.00206 (0.00207)	-0.00353 (0.00191)	0.0421* (0.0167)	0.0155* (0.00552)	0.0112 (0.00776)
- Other	0.00258 (0.00425)	0.00147 (0.00254)	-0.00279 (0.00782)	-0.000587 (0.00218)	-0.00471 (0.00358)
Caste - Upper caste	ref.	ref.	ref.	ref.	ref.
- Scheduled caste	-0.00235 (0.00300)	-0.00283** (0.000792)	-0.00355 (0.00384)	0.00577 (0.00466)	0.0154** (0.00422)
- Schedule tribe	-0.00258 (0.00339)	0.000513 (0.00109)	0.00148 (0.00911)	0.00138 (0.00195)	0.00356 (0.00415)
- Other backward caste	0.00220 (0.00277)	-0.00295** (0.000676)	0.000243 (0.00525)	0.00692 (0.00393)	0.00439 (0.00507)
Housing - Concrete	ref.	ref.	ref.	ref.	ref.
- Semi-concrete	-0.00524 (0.00343)	-0.000226 (0.000437)	-0.00710 (0.00454)	-0.00712 (0.00428)	-0.000318 (0.00509)
- Mud	-0.00576 (0.00387)	-0.000761 (0.000741)	-0.00751 (0.00416)	-0.00708 (0.00461)	0.00308 (0.00350)
Constant	-0.0500* (0.0190)	-0.0129 (0.00674)	-0.0532 (0.0287)	-0.0445 (0.0376)	0.0359 (0.0476)
Observations	110529	110529	110529	110529	110529

Standard errors in parentheses and clustered at state level. All specifications include state and survey year fixed effects. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5 presents results of the double difference estimation. Our coefficient of interest is the interaction between treatment states and the treatment period (β_1). We see that when given easy access to ECPs without counseling for proper use, condom use decreases significantly in the treatment states as compared to the control state, Tamil Nadu where ECPs are not easily available. Comparing the estimate to control group mean, condom use decreased by more than 13 percent in the treatment states. There is also a statistically significant decrease in the use of abstinence method, though it is only significant at the 10 percent level. Apart from these, there is no significant change in any of the other outcome variables – oral pill usage, withdrawal method or STI symptoms. This implies that there is some evidence for substitution between ECPs, condoms and abstinence but none for ECPs and other methods. We also find that easy access to ECPs has not resulted in an increase in the incidence of STIs.

Table – 5: Impact of Easy Access to ECPs (using full sample)

	(1) Condom	(2) Oral pill use	(3) Periodic Abstinence	(4) Withdrawal method	(5) STD
Non TN X Treatment Period	-0.00475***	0.00177	-0.0141*	-0.00230	0.0113
	(0.000233)	(0.00126)	(0.00582)	(0.00155)	(0.0153)
Non TN X Survey Round 2	-0.00896	0.00220	-0.00236	0.00151	0.0208
	(0.00382)	(0.00145)	(0.00628)	(0.00830)	(0.00995)
Woman's Age	0.00170	0.000136	0.00155*	0.000440	0.00262
	(0.000840)	(0.000192)	(0.000489)	(0.000313)	(0.00126)
Woman's age (squared)	-0.0000392**	-0.00000753	-0.0000245*	-0.0000122**	-0.0000544*
	(0.00000720)	(0.00000489)	(0.0000103)	(0.00000316)	(0.0000186)
Years of educ - Woman	-0.00270**	0.000360	-0.00157*	0.0000810	-0.000209
	(0.000597)	(0.000309)	(0.000514)	(0.000233)	(0.00122)
Years of educ – Woman (squared)	0.000329***	0.00000638	0.000234*	0.0000146	-0.000103
	(0.0000434)	(0.0000206)	(0.0000737)	(0.0000130)	(0.0000981)
Years of educ - Husband	-0.000823**	0.0000777	0.0000262	0.0000377	0.000204
	(0.000166)	(0.0000467)	(0.000340)	(0.0000916)	(0.000343)

Years of educ – Husband (squared)	0.000112**	0.00000728	0.0000339	0.00000151	-0.0000684**
	(0.0000229)	(0.00000319)	(0.0000366)	(0.00000291)	(0.0000191)
Age when started living w/ husband	0.00166	0.00162**	-0.00171	-0.00118*	-0.00281
	(0.00158)	(0.000395)	(0.00200)	(0.000412)	(0.00356)
Age when started living w/ husband (squared)	-0.0000132	-0.0000275**	0.0000747	0.0000444**	0.0000770
	(0.0000332)	(0.00000676)	(0.0000510)	(0.0000113)	(0.0000753)
Fertility	0.00108	0.000992**	-0.000486*	-0.000243	-0.000905
	(0.000691)	(0.000228)	(0.000171)	(0.000156)	(0.00108)
=1 if rural locality	-0.00626**	-0.00159	0.000468	-0.000645	-0.000379
	(0.00177)	(0.00126)	(0.00350)	(0.000397)	(0.00363)
Religion - Hindu	ref.	ref.	ref.	ref.	ref.
- Muslim	0.00364	0.00771**	-0.00295	0.00171	0.00186
	(0.00374)	(0.00228)	(0.00255)	(0.00118)	(0.00314)
- Christian	-0.00352	-0.00172**	0.0298*	0.00328**	0.00145
	(0.00286)	(0.000507)	(0.0100)	(0.000863)	(0.00437)
- Other	0.00892**	0.000185	-0.000925	0.000115	-0.00598
	(0.00255)	(0.00199)	(0.00541)	(0.000636)	(0.00431)
Caste - Upper caste	ref.	ref.	ref.	ref.	ref.
- Scheduled caste	-0.00363*	-0.00176*	-0.00704***	0.000498	0.0103
	(0.00151)	(0.000557)	(0.000417)	(0.00101)	(0.00584)
- Schedule tribe	-0.00306	-0.000330	-0.000333	0.000578	0.00190
	(0.00300)	(0.00102)	(0.00578)	(0.00146)	(0.00561)
- Other backward caste	0.000996	-0.00147	-0.00318	0.00172	0.00196
	(0.00119)	(0.000722)	(0.00215)	(0.00151)	(0.00568)
Housing - Concrete	ref.	ref.	ref.	ref.	ref.
- Semi-concrete	-0.00407**	-0.00145	-0.00166*	-0.00129	0.00806*
	(0.00110)	(0.000731)	(0.000525)	(0.000642)	(0.00323)
- Mud	-0.00349	-0.000995	-0.00178	-0.00193	0.0128**
	(0.00210)	(0.000743)	(0.00128)	(0.00180)	(0.00267)
Constant	-0.0353	-0.0154	-0.0146	0.00450	0.107**
	(0.0287)	(0.00825)	(0.0253)	(0.00656)	(0.0323)
Observations	167658	167658	167658	167658	167658

Standard errors in parentheses and clustered at state level. All specifications include state and survey year fixed effects. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

As an additional check, we limit our sample to the border districts of the treatment and control states and perform the analysis again – including testing for common trends and estimating the impact of policy change. Table 6 supports the validity of common trends assumption when the sample is limited to border districts. For brevity, we present only the coefficient of interest in Table 6 and suppress the coefficients on other variables in the model. As required for a double difference estimation, the interaction term between treatment state and pre-treatment period has no significant impact on the outcome variables, thus supporting our assumption of parallel trends.

Table – 6: Test of common-trend assumption - border districts sample

	(1) Condom	(2) Oral pill use	(3) Periodic Abstinence	(4) Withdrawal method	(5) STD
Non TN X Survey Round 2	-0.000537	0.00307	0.0205	0.0131	0.0151
	(0.00403)	(0.00162)	(0.00956)	(0.00866)	(0.0229)
Observations	32190	32190	32190	32190	32190

Standard errors in parentheses and clustered at state level. All specifications include state and survey year fixed effects. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table – 7: Impact of Easy Access to ECPs (using border districts only)

	(1) Condom	(2) Oral pill use	(3) Periodic Abstinence	(4) Withdrawal method	(5) STD
Non TN X Treatment Period	-0.00347*	0.00153	-0.0159**	0.00177	0.00678
	(0.00143)	(0.00118)	(0.00335)	(0.00106)	(0.0242)
Non TN X Survey Round 2	-0.000859	0.00281	0.0217	0.0131	0.0180
	(0.00365)	(0.00141)	(0.00954)	(0.00834)	(0.0218)
Woman's Age	0.000978	0.000269	0.00126*	-0.000447	0.00241
	(0.00157)	(0.000323)	(0.000407)	(0.000890)	(0.00246)
Woman's Age (squared)	-0.0000337	-0.00000961	-0.0000273*	-0.00000041	-0.0000521
	(0.0000163)	(0.00000543)	(0.0000105)	(0.00000541)	(0.0000364)
Years of educ - Woman	-0.00332**	0.000327	-0.00288*	0.000243	0.000501
	(0.000585)	(0.000237)	(0.000948)	(0.000501)	(0.00179)

Years of educ - Woman (squared)	0.000345*** (0.0000548)	-0.0000116 (0.00000774)	0.000324* (0.000105)	0.0000153 (0.0000252)	-0.000182 (0.0000983)
Years of educ - Husband	-0.000764** (0.000237)	0.000156 (0.000266)	0.0000335 (0.000629)	0.000279 (0.000657)	0.0000680 (0.000546)
Years of educ - Husband (squared)	0.000126** (0.0000329)	0.000000933 (0.0000226)	0.0000458 (0.0000586)	-0.0000188 (0.0000482)	-0.0000489 (0.0000315)
Age when started living w/ husband	0.00239 (0.00184)	0.00109 (0.000808)	-0.00159 (0.00169)	-0.000456 (0.00103)	-0.00125 (0.00447)
Age when started living w/ husband (squared)	-0.0000331 (0.0000494)	-0.0000199 (0.0000136)	0.0000663 (0.00004)	0.0000314 (0.0000139)	0.0000264 (0.000107)
Fertility	0.00127* (0.000461)	0.000813** (0.000229)	-0.000464** (0.0000885)	-0.00117 (0.000529)	-0.00153 (0.00145)
=1 if rural locality	-0.00935** (0.00187)	-0.00202 (0.00157)	0.00193 (0.00426)	-0.00321 (0.00198)	-0.00816 (0.00423)
Religion - Hindu	ref.	ref.	ref.	ref.	ref.
- Muslim	0.00482 (0.00707)	0.00570 (0.00389)	0.00167 (0.00406)	-0.00148 (0.00249)	-0.00114 (0.000529)
- Christian	-0.00351** (0.000906)	-0.00209 (0.00118)	0.0286* (0.00913)	0.00836 (0.00579)	-0.00177 (0.000783)
- Other	0.0137 (0.0109)	0.00336 (0.00246)	0.000167 (0.0155)	0.00171 (0.00412)	0.00382 (0.0269)
Caste - Upper caste	ref.	ref.	ref.	ref.	ref.
- Scheduled caste	-0.00630** (0.00124)	-0.00314*** (0.000248)	0.000819 (0.00484)	-0.000725 (0.000884)	0.00729* (0.00286)
- Schedule tribe	-0.00962* (0.00310)	0.00168 (0.00223)	0.0120 (0.0159)	-0.00265 (0.00276)	-0.00549 (0.00936)
- Other backward caste	-0.00124 (0.00201)	-0.00173* (0.000574)	0.00412 (0.00640)	0.00173 (0.00267)	-0.00309 (0.00479)
Housing - Concrete	ref.	ref.	ref.	ref.	ref.
- Semi-concrete	-0.00719 (0.00348)	-0.00196* (0.000763)	-0.00137 (0.000912)	-0.000202 (0.000551)	0.00491 (0.00266)
- Mud	-0.00844	-0.00223*	-0.00230	-0.00515	0.0103**

	(0.00512)	(0.000701)	(0.00214)	(0.00514)	(0.00208)
Constant	-0.0210	-0.00802	-0.0132	0.0148	0.0942
	(0.0458)	(0.0130)	(0.0123)	(0.0101)	(0.0577)
Observations	48780	48780	48780	48780	48780

Standard errors in parentheses and clustered at state level. All specifications include state and survey year fixed effects. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7 presents the results of the double difference analysis and impact of the policy change limiting the sample to border districts only. The decrease in condom use is still statistically significant with a 10 percent decrease in the states where ECP is easily available, also accompanied by an almost 35 percent decrease in abstinence method of contraception. Apart these, we find no statistically significant change in any other method of contraception or the incidence of STIs.

As mentioned in the previous section, we now use our second strategy – a parametric difference-in-difference estimator incorporating propensity scores (PSM – DiD) to do our analysis. Table 8 presents a summary of the covariate means for observations in each group in the pre- and post-periods as well as the unweighted and weighted standardized difference in means. The weighted differences for almost all group-wise comparisons are less than 0.25, indicating that the weighted sample covariates are balanced across the four groups. This is crucial for the validity of PSM – DiD.

Table 9 presents the results of the weighted regression. For brevity, we present only the coefficient of interest for each estimation and suppress the coefficients on the other variables in the model. From column (1), we see that there is a significant overall decrease in the use of non-ECP family planning methods in the states where ECP is easily available. Specifically, we find a significant decrease in the use of condoms, abstinence and withdrawal methods when ECP is available over the counter. We find no evidence for any change in STI as a result of easy availability of ECPs. Comparing our estimates to control group means to understand the effect size, we find that when

ECPs are easily accessible, the use of overall non-ECP family planning methods decreases by 28 percent, with condom use decreasing by around 26 percent, abstinence by 20 percent and withdrawal method by approximately 15 percent. Our PSM – DiD estimates show evidence for risk compensation in terms of reduced non-ECP contraception use but provides no evidence for increases risk of STIs.

Table 8: Covariate means and normalized difference in means – weighted and unweighted

Covariate	Group				Unweighted normalized difference in means			Weighted normalized difference in means		
	1 Non TN pre	2 Non TN post	3 TN pre	4 TN post	2 vs 1	3 vs 1	4 vs 1	2 vs 1	3 vs 1	4 vs 1
Age	27.47	28.78	28.83	29.04	0.49	0.51	0.23	-0.07	-0.02	-0.08
Years of educ -woman	9.70	9.91	9.49	8.94	0.12	-0.11	-0.23	-0.03	-0.07	0.15
Year of educ - husband	9.86	9.65	10.30	8.87	-0.09	0.23	-0.28	-0.23	0.21	-0.06
Age at marriage	19.79	20.12	20.37	20.34	0.17	0.30	0.14	-0.04	0.07	0.13
Births (fertility)	1.44	1.64	1.33	1.59	0.18	-0.10	0.13	-0.02	-0.05	-0.13
= 1 if rural	0.62	0.73	0.41	0.43	0.17	-0.29	-0.38	0.00	-0.12	-0.13
Housing characteristics					0.23	-0.06	-0.14	-0.01	-0.02	0.01
Concrete	0.53	0.69	0.48	0.46	-0.25	0.03	0.14	0.01	-0.01	0.00
Semi-Concrete	0.41	0.24	0.43	0.48	0.02	0.04	0.00	0.00	0.05	-0.01
Mud	0.07	0.08	0.09	0.07	0.04	0.37	0.53	0.02	0.05	0.17
Religion					-0.01	-0.35	-0.52	-0.02	-0.05	-0.04
Hindu	0.59	0.61	0.83	0.85	-0.04	-0.05	-0.07	-0.01	-0.01	-0.16
Muslim	0.30	0.29	0.08	0.06	0.00	-0.01	-0.03	0.00	0.00	-0.01
Christian	0.12	0.09	0.09	0.09	-0.07	-0.46	-0.59	0.01	-0.02	-0.13
Other	0.00	0.00	0.00	0.00	0.03	0.08	0.24	0.01	0.02	0.03
Caste groups					0.02	-0.07	-0.12	0.00	-0.01	0.02
Upper caste	0.28	0.24	0.03	0.02	0.04	0.46	0.42	-0.03	0.00	0.08
Scheduled caste	0.12	0.14	0.17	0.20	0.49	0.51	0.23	-0.07	-0.02	-0.08
Scheduled tribe	0.03	0.04	0.01	0.01	0.12	-0.11	-0.23	-0.03	-0.07	0.15
Other backward caste	0.56	0.58	0.79	0.77	-0.09	0.23	-0.28	-0.23	0.31	-0.06
Observations	3419	3924	3194	2716						

Table – 9: Impact of policy change on contraceptive use and STI symptoms: PSM-DiD estimates

	(1) Non-ECP FP use	(2) Condom	(3) Oral Pill	(4) Periodic Abstinence	(5) Withdrawal Method	(6) STI
Non-TN X Treatment period	-0.114***	-0.0156*	-0.000068	-0.0803***	-0.0300***	-0.00861
	(0.0159)	(0.00864)	(0.00399)	(0.00907)	(0.00691)	(0.00678)
Observations	12459	12459	12459	12459	12459	12459
Control group (TN) mean in pre-period	0.3986	0.0598	0.0051	0.3931	0.1931	0.0544

Standard errors in parentheses
Results from weighted linear regression. Weights calculated from predicted probabilities based on multinomial logistic model.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

VII. CONCLUSION

So far there is only limited evidence of the impact of easy access to ECP on sexual behavior in developing countries. Most of this information comes from small sample focus group discussions and interviews of doctors, nurses, pharmacists but rarely users. This study provides one of the first quantitative analysis of the impact of ECP use on risk compensation in sexual behavior using a large, nationally representative dataset. Using a unique policy experiment in India, our study finds that ECP use does lead to a substitution away from other types of contraception – mostly condoms and withdrawal method – but has no impact on the rates of STI. A likely interpretation for it is that while ECPs are being used as substitutes for condoms in case of low risk sexual partnership (e.g. monogamous relationships), they are not used in cases of higher risk partnerships (e.g. multiple partners, sex workers etc.).

As reported by Stillman *et al.* (2014), in 2007‑2008, approximately 21 percent of married women had an unmet need for contraception – that is, they reported wanting to space or limit births but were not using any contraceptive method. Unmet need was higher among rural, low-income and young women across the country. In light of the evidence that easy availability of ECPs has not

resulted in increased rates of STI and the large unmet need for contraception among women in India, making ECPs available over the counter and incorporating them in the national family planning and rural health programs is a step in the right direction. Given the large number of unsafe self-administered abortions which account for almost 29 percent of all abortions, abortion-related deaths accounting for 9 percent of all maternal mortality in India (Stillman *et al.*, 2014), coupled with poor availability of public reproductive healthcare services and prohibitive costs of private healthcare services, not only should the government provide easy and subsidized access to ECPs, it should promote proper use through information campaigns.

Even though this paper finds evidence for risk compensation, the results do not justify a ban on ECPs given the lack of evidence for any increase in the prevalence of STIs. It is vital to stress that even if people are risk compensating, policy makers do not get rid of mandatory safety regulations. If seatbelts make one a reckless driver, instead of banning seatbelts, policy makers take the approach of educating people to reduce risk compensation and realize the full benefits of the risk reducing technology. Similarly, there is conclusive evidence that increased control over one's reproductive cycle is empowering. A ban on ECPs – as in Tamil Nadu – is an expensive and unnecessary burden on women's health in an environment where government fails to provide the required basic public healthcare support to women.

As mentioned in the literature review section of this paper, Marston *et al.* (2005) find a decreasing trend in ECP in the UK. Many other studies in developed countries find a similar decreasing pattern in ECP use among women. On the contrary, in developing countries, ECP use is on the rise. Examining the underlying causes for this divergent trend would be an important area of further research.

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