ECONOMIC RESEARCH CENTER
DISCUSSION PAPER

E-Series

No.E12-3

Determinants of Contraceptive Choice among Japanese Women: Ten Years after the Pill Approval

by

Sayaka Nakamura

October 2012

ECONOMIC RESEARCH CENTER
GRADUATE SCHOOL OF ECONOMICS
NAGOYA UNIVERSITY

Determinants of Contraceptive Choice among Japanese Women: Ten Years after the Pill Approval[*]

Sayaka Nakamura[a]

[a] School of Economics, Nagoya University

Furo-cho, Chikusa-ku, Nagoya, 464-8601, Japan

nakamuras@soec.nagoya-u.ac.jp

Phone & Fax: +81-52-789-5961

JEL Codes: J13 (family planning); I18 (government policy; regulation; public health); D81 (criteria for decision-making under risk and uncertainty)

Key words: contraceptive choice, learning from experience, subjective probability

[*] I gratefully acknowledge financial support from a Grant-in-Aid for Young Scientists (*start-up*, No. 20830070) by the Japan Society for Promotion of Science (JSPS). I am also grateful to Haruko Noguchi, Yoshiro Tsutsui and seminar participants at Nihon University for their helpful comments.

Abstract

The Japanese government approved the use of oral contraception in 1999, but oral contraceptive (OC) users remain a small minority in Japan. Based on an online survey conducted in 2010, I examine the factors determining Japanese women's choice of contraceptive methods by estimating multinomial choice models. The estimation results indicate that OC use is positively associated with age, willingness to pay (WTP) for contraceptive effectiveness, frequency of intercourse, and experience with abortion or emergency contraception. These findings suggest that OC use increases as women learn from experience and that the low and declining trend in the frequency of intercourse in Japan offers one explanation for the slow diffusion of OCs. Additionally, the prevalent OC use among women with a higher risk of unintended pregnancies suggests that OC approval may have significantly reduced the incidence of unintended pregnancies despite the low average prevalence of OC use. Subjective probabilities regarding each method's effectiveness and disruption to mood, partner disapproval, side benefits and minor side effects are important determinants of contraceptive choice. Somewhat surprisingly, the correlations between subjective probabilities and women's demographic and socioeconomic characteristics are weak. Overall, the results imply that increased contraceptive knowledge among both men and women could significantly increase the use of OCs in Japan. (206 words)

"Birth control pills cause a woman's physiology to malfunction and work by altering the body's state from normal to abnormal. I feel that it is rather strange if there are no side effects. … Another thing I am afraid of is the spread of AIDS. … If approval of the pills leads to the reduced use of condoms, then it runs the risk of interfering with measures against AIDS."

Junichiro Koizumi, former minister of health (1996-1998) and former prime minister (2001-2006), excerpt from "Junichiro Koizumi's Let's Talk Straight: Pills Approved! Are They Safe?" Bart, March 24, 1997.

1. Introduction

Previous studies indicate that legal access to OCs had a significant impact on American society, including increasing women's enrollment in professional graduate schools, increasing their ages at their first marriage (Goldin and Katz 2002), decreasing the birth rate (Guldi 2008) and improving the well-being of children (Ananat and Hungerman 2012). This raises the following question: What are the effects of the Japanese government's approval of OCs? In contrast to other developed countries, physicians in Japan could not legally prescribe low-dosage hormonal pills for family planning purposes until 1999.[1] The rate of OC use was approximately 1% in Japan in the 1980s and early 1990s, and researchers expected it to significantly increase after the legalization of low-dosage OCs (Population Problems Research Council 1990; Oddens and Lolkema 1998). However, the diffusion of OCs among Japanese women has been slow. Specifically, according to a report by the United Nations, only 1% of married (or in-union) women aged 15 to 49 use OCs in Japan compared to 16.8% in North America

[1] Physicians could legally prescribe higher-dosage pills for medical reasons such as irregular menstrual periods.

and 45.5% in Western Europe (United Nations 2011). Additionally, based on the National Fertility Survey conducted in 2005, the percentage of pill users is 1.4% among sexually active Japanese women aged 18 to 34 who have never been married (Kaneko et al. 2008). This is in sharp contrast to what occurred in the United States in the 1960s and 1970s: the diffusion of OCs was rapid once women were able to legally access them.

The remarks by Junichiro Koizumi quoted above represent the negative attitudes of Japanese politicians and bureaucrats, as well as the mass-media, toward OCs. In addition, the Japanese Ministry of Health and Welfare argued that the pill could encourage promiscuity and lower sexual morality by allowing women to have multiple sexual partners without the risk of pregnancy (Hollander 2006). While this type of "anti-pill" attitude, which is prevalent in Japan (Matsumoto 2005), could certainly be related to low OC use, it is unclear how it affects Japanese women's preferences and perceptions regarding contraceptive methods. Prior studies find that the most common reason given by Japanese women for not using OCs is concern about side effects. Specifically, Suga and Kitamura (2009) find that 53% of Japanese women who do not intend to use the pill report concerns about side effects as a reason. Similarly, according to Matsumoto et al. (2011), 50% of Japanese women who have never used OCs list concern about side effects as a reason compared to only 25% and 17% of their American and French counterparts, respectively. Nevertheless, the relative importance of concerns about side effects in contraceptive choice has not been examined.

This study examines determinants of Japanese women's choice of contraceptive methods based on an online survey conducted in 2010, approximately ten years after the legalization of low-dose OCs in Japan. The Japanese context offers a unique setting in

which a birth control technology became available after it had been widely adopted in other countries and evidence of its efficacy and safety had been collected. To my knowledge, there are no other studies that estimate a regression model of contraceptive choice using Japanese data either before or after OC approval.[2] As possible determinants of contraceptive choice, I examine not only women's demographic and socioeconomic characteristics but also their subjective beliefs regarding the costs and benefits of each contraceptive method as explanatory variables, following Delavande (2008).

My empirical analysis (i) uncovers the characteristics of OC-adopters and (ii) examines possible reasons for the slow diffusion of OCs in Japan. With respect to (i), the impact of OC approval depends not only on the prevalence of OC use but also on the characteristics of new OC users. In particular, if women with a higher risk of unintended pregnancy use OCs, the impact on abortion and/or unplanned childbirths could be greater. Similarly, if OC use is more prevalent among women who incur greater losses in career opportunities due to unintended childbirth, then the legal access to OCs could have a greater impact on the career choices and participation of women in the labor market. Regarding (ii), I examine whether hypotheses regarding the reasons for low OC use in Japan are consistent with the observed differences between users and non-users of OCs among Japanese women in my sample.

[2] Ogawa and Retherford (1991) estimate a binary logit model using data on married Japanese women, in which the dependent variable is whether a woman *intends* to use OC, conditional on government approval. They find that the coefficient of abortion intention in the case of contraceptive failure is significantly positive and that of the extended family dummy is significantly negative.

The remainder of this paper is organized as follows. The next section describes the data. Section 3 describes the regression model of contraceptive choice on women's characteristics and presents the estimation results. In section 4, I add subjective probabilities to the explanatory variables of the regression model. Section 5 discusses the estimation results obtained in sections 3 and 4, and section 6 concludes.

2. Data

With the collaboration of INTAGE Interactive, Inc., online survey data are collected from 2,141 young women (18-30 years old) who live in Japan and are registered as monitors with a web-based survey system (Cue monitors). The survey is conducted in two steps. First, a screening survey is conducted with a random sample of 11,696 young female monitors to select those (1) who had sexual intercourse with a male partner within the last 12 months, (2) who currently do not intend to become pregnant, and (3) who have not undergone sterilization and whose partner has not undergone sterilization.[3] The 4,820 women who met the criteria of the screening were invited to participate in the full survey, and 2,141 of them completed it. Of these respondents, the 1,873 women who reported that they currently used contraception were

[3] All of these randomly selected monitors participated in the screening survey. Regarding (1), 60% report having this experience, 33% deny having this experience, and 6% do not answer. Regarding (2), 21% report a positive intention, 75% report a negative intention, and 4% do not answer. Regarding (3), 87% answer that neither the respondent nor her partner has undergone sterilization, 2% answer that either the respondent or her partner have undergone sterilization, and 11% do not answer.

asked for further details on their choice of contraceptive method.

Women who are in their twenties have the highest number of abortions per capita in Japan (Baba et al. 2005). In addition, women who are younger than 35 are less likely to use sterilization and IUDs compared to their older counterparts (Sato and Iwasawa 2006). Thus, limiting the analysis to 18- to 30-year-old women and excluding women who have undergone sterilization or whose partner has undergone sterilization allows me to focus on a smaller number of contraceptive methods, therefore simplifying the analysis. The other selection criteria are intended to limit the sample to those who will realistically make contraceptive choices.

Table 1 shows the currently used contraceptive methods of all respondents. The male condom is by far the most commonly used method. Ineffective non-modern methods (i.e., rhythm and withdrawal) are the second most common. The rate of OC use is 6.9%, which is much higher than the overall 1-2% prevalence of OC use in Japan reported by prior studies (Kaneko et al. 2008; United Nations 2011). The reason for this could be that my sample is restricted to women who do not intend to become pregnant and have had at least one intercourse experience within the past 12 months. Only 22 women choose contraceptive methods other than these three methods, such as the female condom. The male condom will henceforth be referred to as “condom” because the use of female condoms is rare. When estimating a regression model of contraceptive choice, I exclude these 22 observations and limit the analysis to the 2,119 women who choose condoms, OCs, a combination of condoms and OCs, and non-modern methods (the full sample). The respondents were asked about their knowledge of each method and their subjective risk perceptions regarding each of the methods they know only if they reported current use of contraception. Therefore, when analyzing how

contraceptive choice is associated with subjective risk perceptions, I further exclude women who do not use contraception from the analysis. This limits my analysis to the 1,535 women who choose among condoms, OCs, a combination of condoms and OCs, and ineffective methods, and who know about at least two of these methods (the sub-sample).

Definitions of the variables are provided in Table 2. The respondents are asked which contraceptive method they currently use, and those who report the current use of contraception are further asked whether they know each of the three most common methods: condoms, OCs, and ineffective methods. Following Delavande (2008), WTP is determined based on a scenario where only two methods are available: one is 85% effective (i.e., 15% probability of getting pregnant) and is free of charge, and the other is 100% effective (i.e., 0% probability of getting pregnant). Respondents are asked about their WTP for the 100% effective method. Both methods require taking one pill per week and are completely identical except for the level of contraceptive effectiveness. The summary statistics of the variables are shown in Table 3. The statistics from the full sample are presented on the left, and those from the subsample are presented on the right. The use of ineffective methods is less prevalent in the subsample than in the full sample, which is expected because women who report not using contraception are excluded from the subsample. The mean values of the explanatory variables are generally similar between the two samples. The definitions and summary statistics of the subjective probability variables are presented and discussed in Section 4.

3. Case-Specific Conditional Logit Analysis

3.1. Estimation Method

I use a multinomial logistic model to regress contraceptive choice on women's individual characteristics. Because all the explanatory variables are individual characteristics and are thus case-specific (i.e., do not vary by alternative), I use a case-specific conditional logit model. The choice categories are: condom without OC, OC with or without condom, and no modern methods.[4] When I estimate the model using the full sample, the last category includes both no contraception and ineffective no-modern methods. When I use the subsample, thus limiting my sample to women who are currently using contraception, the last category only includes the use of ineffective non-modern methods. The explanatory variables are the intercepts for non-base alternatives and individual characteristics. I use robust standard errors. I conduct a Hausman-McFadden Test and confirm that the independence of irrelevant alternatives (IIA) assumption holds with both samples because excluding each of the alternatives does not significantly change the estimates (Hausman and McFadden 1984).

3.2. Results

The estimation results are shown in Table 4, where the estimated coefficients are presented as marginal effects. The results from the full sample are presented on the left, and those from the subsample are presented on the right. Both samples yield similar results, except for the marginal effects of *Frequency_0*, *Single*, *Emergency*, *Frequency_unknown*, and *Education_unknown*. Among women who are not in

[4] A specification with an additional choice category of dual condom and OC use is not feasible because only 27 women choose this category. Case-specific conditional logit models cannot be identified unless each alternative is chosen by a sufficient number of individuals.

relationship and those who do not experience intercourse frequently, some may answer that they currently use contraception and report which contraceptive method they would use if they were to have an intercourse, while others may answer that they do not use contraception because they do not have intercourse and report no use of modern methods. Such potential variation in reporting might account for the different estimation results between the samples regarding *Frequency_0* and *Single*. Additionally, relatively small variations in *Emergency*, *Frequency_unknown*, and *Education_unknown* might lead to significant changes in the estimated coefficients when a non-negligible portion of observations are removed from the sample. The marginal effects of most of the women's characteristics on the choice probabilities for condoms and OCs are highly similar across the samples, suggesting that removing women who report not using contraception does not affect the results regarding the predictors of OC and condom use.

Willingness to pay for contraceptive effectiveness, frequent intercourse, unmarried marital status, older age, experience with emergency contraception, and experience with abortion are strong predictors of OC use. Among these factors, frequency of intercourse and age are negatively associated with condom use. Years of education is positively correlated with condom use, negatively correlated with use of non-modern methods and insignificantly associated with OC use. The overall number of partners, full-time working status, and smoking status have little predictive power.

4. Alternative-Specific Conditional Logit Analysis: Incorporating Subjective Probabilities

In this section, I examine the association between subjective risk perceptions and contraceptive choice by regressing contraceptive choice on both individual women's

characteristics and the reported subjective probabilities regarding the pros and cons of each contraceptive method.

4.1. Subjective Probability Variables

Women who reported currently using contraception are asked about their subjective probabilities regarding the pros and cons of each contraceptive method. Definitions of the subjective probability variables are provided in Table 5. The respondents were asked about the percent chance of each of the following occurring, conditional on the use of each contraceptive method:

- the respondent gets pregnant in the next 12 months, conditional on her use of the method during this period;
- the respondent contracts STDs in the next 12 months, conditional on her use of the method during this period;
- the respondent's partner disapproves her use of the method;
- the respondent's religion or social norms do not align with her use of the method;
- the method ruins the mood.

In addition, respondents were asked the percent chance that they would experience the following events in the next 12 months, conditional on OC use during this period:

- minor (i.e., non-life-threatening) adverse effects such as weight gain, nausea, headache, bleeding, vaginitis, swelling;
- serious (i.e., life-threatening) adverse effects;
- side benefits (i.e., non-contraceptive benefits).

The construction of these variables largely follows Delavande (2008), though the questions were slightly modified to better reflect the Japanese context. Because respondents may use “50%” to avoid reporting precise numbers (Bruine de Bruin et al.

2000), I prohibit answering “50%” and instruct the respondents to choose between 49% and 51% if their subjective probability is 50%.

Table 6 shows the summary statistics of the subjective probabilities conditional on each of the four contraceptive methods. On one hand, the reported subjective probabilities are partly consistent with medical knowledge. Specifically, the mean values of the subjective probability that respondents will become pregnant conditional on the use of each method indicate that the order of perceived contraceptive effectiveness is, from the strongest to the weakest, dual use of OC and condom, single use of OC, single use of condom, ineffective methods. Likewise, the mean values of the probability of contracting STDs indicate that most women know that condoms are effective in preventing STDs and OCs are not.[5] In addition, the average subjective probability of the side benefits of OCs is 21.8%, consistent with the medical literature that demonstrates significant beneficial effects of OCs on menorrhagia (excessive bleeding during menstruation), dysmenorrhoea (painful menstruation), and acne (Maia and Casoy 2008). On the other hand, the average subjective probabilities regarding the side effects of OCs are considerably higher than those indicated by the medical

[5] The mean of the subjective probability that respondents would contract STDs is lower conditional on the single use of OCs than ineffective methods (i.e., no use of OC or condom), and lower conditional on the dual use of OCs and condoms than single use of condoms. This might indicate that some women mistakenly believe that OCs reduce the risk of STDs. Alternatively, this might be due to the differences in risk evaluation between women who know about OCs and those who do not because the latter do not report subjective probabilities regarding OCs.

literature. Large cohort studies find no harmful effect of OCs on all-cause mortality (Beral et al. 1999; Vessey et al. 2003), and recent placebo-controlled randomized trials find little evidence that OCs have nonspecific side effects, such as headache, nausea, or weight gain (Grimes and Schulz 2011).

The mean values of the subjective probabilities that the use of each method ruins the mood indicate that some women expect the use of condoms and ineffective methods such as withdrawal to be detrimental in this respect. The average subjective probabilities regarding religious and social disapproval suggest that few Japanese women feel religious or moral concerns regarding the use of condoms and OCs despite the conservative ideas that link OC use with promiscuity (Hollander 2006). The mean values of the subjective probabilities of the partner's disapproval of the use of each method indicate that the order of perceived partner disapproval is, from the strongest to the weakest, ineffective methods, dual use of OCs and condoms, single use of OCs, and single use of condoms. This relatively strong aversion to OCs among Japanese men is consistent with Suga and Kitamura (2009).

4.2. Estimation Method

In the previous section, I regress contraceptive choice on individual women's characteristics, and in this section, I add subjective probabilities to the explanatory variables. Because subjective probability variables vary by alternative, I use an *alternative-specific* conditional logit model instead of the *case-specific* conditional logit model used above. I estimate a multinomial logistic model of contraceptive choice in which the explanatory variables include subjective probabilities in addition to individual characteristics. Because subjective probability questions are only asked to the women

who report currently using contraception, I limit my sample to these women (the subsample). For this analysis, I assume that women only choose from the four most common categories: condoms without OCs, OCs without condoms, a combination of condoms and OCs, and ineffective methods. In contrast to the estimation in the previous section, I distinguish between single use of OCs and dual use of OCs and condoms because subjective probabilities are reported separately for these methods in the survey. The effects of women's characteristics are aggregated for OC use both with and without condom use because only 27 women choose dual use of condoms and OCs. I use robust standard errors.

I conduct a Hausman-McFadden Test and confirm that the IIA assumption holds because excluding each one of the alternatives does not significantly change the estimates (Hausman and McFadden 1984). The only exception is that the coefficients of intersection terms between individual-specific characteristics and the dummy variable for OC use (with or without condoms) change significantly when the alternative of single use of OCs is excluded. Because the vast majority (82%) of OC users does not use condoms, these coefficients cannot be precisely estimated when the women who choose single use of OCs are excluded from the sample. I also estimate a mixed-logit model where the alternative-specific effect for condom use, including single use of condoms and dual use of condoms and OC, and that for OC use, including single use of OCs and dual use of condoms and OCs, are normally distributed. The estimated standard errors of these alternative-specific effects are statistically insignificant, and this modification does not cause significant changes to the estimation results. This suggests that unobservable similarities between single use of condoms and dual use of OCs and condoms and those between single use of OCs and dual use of OCs and condoms are

both small, consistent with the IIA assumption.

4.3. Results

Table 7 shows the estimation results, in which the base alternative is single use of condoms, and presents the odds ratios of the estimated coefficients.[6] Model 1 is identical to the model presented in the previous section, in which the explanatory variables only include individual characteristics and three alternatives are given: ineffective methods, condoms without OCs, and OCs with and without condoms. In Models 2 and 3, four alternatives are given: ineffective methods, condoms without OCs, OCs without condoms, and dual use of OCs and condoms. Model 2 includes both subjective probabilities and individual characteristics as explanatory variables, whereas Model 3 includes subjective probabilities only.

The estimated coefficients of subjective probabilities are similar between Models 2 and 3, except that *Prob(pregnancy)*WTP* is marginally significant in Model 3 but insignificant in Model 2.[7] In both models, the coefficients of *Pr(partner's disapproval)*, *Pr(interruption)*, and *Pr(minor adverse effects)* are significantly negative, and the coefficient of *Pr(side benefits)* is significantly positive. These results imply that the subjective risks of partner disapproval, interruption to the mood, and minor side effects prevent the use of the method and the subjective chance of side benefits

[6] Odds ratios are presented instead of marginal effects because, unlike the case-specific conditional logit analysis presented above, the marginal effects of the coefficients cannot be obtained for an alternative-specific conditional logit analysis.

[7] When both *Prob(pregnancy)* and *Prob(pregnancy)*WTP* are included as explanatory variables in Models 2 and 3, neither is significant.

increases OC use. *Pr(STD), Pr(immoral),* and *Pr(major side effects)* are insignificant in both Models 2 and 3, indicating that subjective risk perceptions regarding STDs, religious/social disapproval, and the serious life-threatening side effects of OCs are not significantly associated with contraceptive choice. *Pr(partner's disapproval)*OC* is also insignificant in both models, implying that the influence of partner disapproval does not differ between OC use and the other alternatives.

The estimated coefficients of individual characteristics on the choice probabilities are also similar between Models 1 and 2, with a few exceptions: *WTP* and *Married* are significantly associated with OC use relative to condom use in Model 1 but not in Model 2, and *Frequency_0* and *Income_married* are significantly associated with the use of ineffective methods relative to condom use in Model 2 but not Model 1. Table 8 presents the estimation results in which the base alternative is the use of ineffective methods and compares the estimated coefficients of individual characteristics between Models 1 and 2.[8] Again, these two models yield similar results, except that *WTP* is significantly associated with OC use relative to the use of ineffective methods in Model 1 but not Model 2 and that *Frequency_0* and *Income_married* are significantly associated with the single use of condoms relative to the use of ineffective methods in Model 2 but not Model 1. The differences in the coefficients of the intersection terms with *WTP* are not surprising because Model 2 includes *Pr(pregnancy)*WTP*, another intersection term with *WTP,* as an explanatory variable.

Therefore, adding subjective probabilities to the explanatory variables does not drastically change the estimated coefficients of individual characteristics, as suggested

[8] The estimated coefficients of subjective probability variables are omitted in Table 8 because they are independent of the choice of the base alternative.

by these similarities between the estimation results of Models 1 and 2. Nor does adding individual characteristics to the explanatory variables drastically change the estimated coefficients of the subjective probabilities, as indicated by the similarities between the estimation results of Models 2 and 3. These findings imply that the individual characteristics considered in this study offer little explanation for individual heterogeneity in subjective probabilities and that the variation in contraceptive choice associated with individual characteristics cannot be explained by differences in subjective probabilities. In other words, individual characteristics and individual subjective beliefs significantly and largely independently affect contraceptive choice.

5. Discussion

5.1. Women's Characteristics

The estimation results indicate that OC use is positively associated with more sexual experience (as measured by age and intercourse frequency), experience of incidents and near incidents of contraceptive failure (as measured by experience with abortion and emergency contraception), and individual valuation of contraception (as measured by WTP for contraceptive effectiveness). However, these factors are not positively associated with condom use. In contrast, age, intercourse frequency, and experience with abortion are negatively associated with the probability of condom use, suggesting that women shift from condoms to OCs as they accumulate sexual experience or experience contraceptive failure.

The positive association between intercourse frequency and OC use suggest that the low and declining frequency of intercourse in Japan offers one explanation for the low OC use in Japan. OC use incurs a relatively high fixed cost, including both

monetary costs and the burden of obtaining prescriptions and taking a pill every day, and zero marginal (i.e., incremental) costs because the cost of OC use does not vary with intercourse frequency. In contrast, the fixed costs of condoms and ineffective methods are small, if not zero, and these methods could incur nonnegligible marginal costs such as the psychological burden associated with administration. Thus, it is as expected that women with higher intercourse frequencies are more likely to use OCs. OC use is significantly lower in Japan than in other developed countries, as is the frequency of sexual intercourse. According to Durex (2005), the reported intercourse frequency in Japan of 45 times per year is the lowest among the 41 surveyed countries, and less than the half of the average frequency of 103 times per year. Additionally, the rate of OC use in Japan realized after its approval is lower than was expected prior to approval. According to the Population Problems Research Council (1990), in 1990, approximately 10% of married Japanese women under the age of 50 answered that they intended to use OCs if they became available. While I could not find any studies that demonstrate the evolution of intercourse frequency in Japan, the steady decline in pregnancy rates and domestic shipments of condoms in the 2000s implies a declining trend in intercourse frequency (Sato et al. 2008).

OC use is significantly more prevalent among women with a higher risk of unintended pregnancy, such as those with higher intercourse frequency and who have had experience with abortions. According to Goto et al. (2002), 40.1% of women who have had unintended pregnancies have had more than one unintended pregnancy. These findings imply that OC approval may have significantly reduced unintended pregnancies and artificial abortions despite the low average prevalence of OC use and that increased access to OCs could further reduce unintended pregnancies. Similarly, the

positive association between WTP for effectiveness and OC use implies that OC approval has reduced the rate of unintended pregnancies, especially among women whose perceived cost of pregnancy is high. Provided that WTP for effectiveness reflects the loss of individual women's career opportunities due to childbirth, the approval of OCs may have had a significant impact on the career choices and labor participation of women despite the low average rate of OC use.

A possible explanation for the negative association between being married and using OCs is that some married women without pregnancy intentions could have husbands with pregnancy intentions, whereas this type of disagreement in pregnancy intention is unlikely among unmarried couples because out of wedlock births are still considered taboo in Japan. If OC use is difficult for married women who do not have their husbands' consent, then married women whose husbands intend to have children are unlikely to use OCs. The result that women with higher levels of education are more likely to choose condoms but are no more likely to choose OCs is difficult to interpret, but one possibility is that the partners of well-educated women proactively use condoms.

Finally, there is no statistically significant relationship between OC use and a woman's number of sexual partners, controlling for other factors. This finding does not support the claim that OCs encourage promiscuity by allowing women to have multiple sexual partners without the risk of pregnancy. However, a woman's number of partners is weakly associated with a decreased probability of condom use, which raises concerns regarding STDs.

5.2. Subjective Probabilities

The subjective probabilities could reflect important determinants of contraceptive choice other than women's individual characteristics, such as relationship characteristics (Chao 2002; Kusunoki and Upchurch 2011) and social learning (Kohler 1997; Behrman et al. 2002). In particular, subjective beliefs regarding the risk of STDs, the effectiveness of male-oriented methods (e.g., condoms), and partners' disapproval of each method are likely to be influenced by the relationship context. Similarly, information communicated by close acquaintances could affect individuals' risk perceptions, while the effect of social learning on contraceptive choice might be weaker in information-oriented societies such as contemporary Japan, in contrast to the findings of Kohler (1997) and Behrman et al. (2002) in the developing world. Local differences in OC use rates are small in my sample, which does not support the effect of localized social learning on the diffusion of OCs.

The most commonly reported reason for not using OCs among Japanese women is concern about side effects (Suga and Kitamura 2009; Matsumoto et al. 2011). Consistent with this result, the subjective probability that OCs cause minor side effects is negatively and significantly associated with OC use. However, the subjective probability that OCs have life-threatening side effects is insignificantly associated with contraceptive choice. Overall, the estimation results indicate that concerns regarding the minor side effects of OCs are an important but not dominant factor in contraceptive choice. The finding that OC use is positively and significantly associated with the subjective probability of the side benefits of OCs is consistent with Suga and Kitamura (2009).

The results show that partner disapproval is a strong predictor not only of the use of male-oriented methods such as condoms and withdrawal but also of OC use,

which is typically considered to be a female-oriented method because it does not require men's cooperation. According to Suga and Kitamura (2009), 80.5% of Japanese men are opposed to their partners' use of OCs, and 55.7% of them report concerns about side effects as a reason. Therefore, Japanese men's negative perceptions of OCs could offer at least a partial explanation for the low OC use in Japan. The subjective probability that a method interferes with the mood is also significantly associated with contraceptive choice, while religious or social concerns are insignificantly associated with contraceptive choice.

The subjective risk of STD contraction is insignificantly associated with contraceptive choice. This might imply that it is difficult to infer the probability that a partner has contracted or will contract an STD rather than women's lack of concern regarding STDs. Nevertheless, this result raises concerns and demands further investigations on STD awareness in Japan. This finding differs from Delavande (2008), who reports a significant association of the subjective probability of STD contraction with contraceptive choice, whereas my other findings are generally consistent with hers. Delavande (2008) collects data via interviews and the majority of respondents are American college students. Thus, differences in data collection methods and study subject characteristics might account for the differences in results.

6. Conclusion

This study examines the determinants of Japanese women's choice of contraceptive methods. I conducted a web-based survey in 2010 and estimated multinomial models of contraceptive choice using the data from the survey. The estimation results imply that women's tendencies to use OCs increase as they learn from

experience. The estimation results also imply that the low and declining frequency of intercourse in Japan offers one explanation for the slow diffusion of OCs among Japanese women. In addition, the finding that OC use is much more prevalent among women with a higher risk of unintended pregnancy suggests that OC approval may have significantly reduced unintended pregnancies despite the low average rate of OC use. Subjective beliefs regarding each method's effectiveness, disruption to the mood, partner disapproval, and the side benefits and minor side effects of OCs are also important determinants of contraceptive choice, whereas the subjective probability that OCs cause serious, life-threatening side effects is insignificantly associated with contraceptive choice. Somewhat surprisingly, the correlations between subjective probabilities and women's demographic and socioeconomic characteristics are weak, which might imply that the variations in subjective probabilities reflect unsubstantiated beliefs rather than actual differences in individual situations.

Overall, the empirical results imply that increased contraceptive knowledge among both men and women could significantly increase the use of OCs in Japan. First, the perceived risk of minor side effects among the Japanese women included in this study is negatively and significantly associated with OC use and is significantly higher compared to the population-based probabilities (Grimes and Schulz 2011). This finding implies that learning about recent medical findings could reduce Japanese women's concerns regarding the side effects of OCs and increase their OC use. Second, this study finds a significant association of male partners' disagreement with the use of both male-oriented and female-oriented contraceptive methods, and according to a previous survey, the majority of Japanese men is opposed to their partners' use of OCs, often raising concerns regarding side effects (Suga and Kitamura 2009). Thus, increased

medical knowledge could reduce men's concerns over side effects and thus reduce their aversion toward OCs. Third, age, frequent intercourse, and experience with abortion are positively associated with OC use and are negatively associated with condom use, suggesting that Japanese women become more inclined to use OCs and more averse to condoms as they accumulate sexual experience or experience contraceptive failure. If learning population-based statistical information has similar effects on contraceptive behavior as learning from experience, this type of information could increase OC use among young and inexperienced women to a rate similar to that of older and more experienced women.

References

Ananat EO, and Hungerman DM (2012) The power of the pill for the next generation: oral contraception’s effects on fertility, abortion, and maternal and child characteristics. Review of Economics and Statistics 94(1):37-51.

Baba S, Tsujita S, Morimoto K (2005) The analysis of trends in induced abortion in Japan: an increasing consequence among adolescents. Environmental Health and Preventive Medicine 10:9-15.

Behrman JR, Kohler HP, and Watkins SC (2002) Social networks and changes in contraceptive use over time: evidence from a longitudinal study in rural Kenya. Demography 39(4):713-738.

Beral V, Hermon C, Kay C, Hannaford P, Darby S, Reeves G (1999) Mortality associated with oral contraceptive use: 25 year follow up of cohort of 46 000 women from Royal College of General Practitioners' oral contraception study. British Medical Journal 318(7176):96-100.

Bruine de Bruin W, Fischhoff B, Millstein SG, and Halpern-Felsher BL (2000) Verbal and numerical expressions of probability: 'It's a fifty-fifty chance'." Organizational Behavior and Human Decision Process 81(1):115-131.

Chao LW (2002) A comparison of consensus and nonconsensus approaches to modeling contraceptive choice behavior. Health Economics 11(7):599-622.

Delavande A (2008) Pill, patch or shot? subjective expectations and birth control choice." International Economic Review 49(3):999-1042.

Durex (2005) 2005 Global sex survey results. www.durex.com/en-jp/sexualwellbeingsurvey/documents/gss2005results.pdf Accessed April 21 2012

Goldin C, Katz L (2002) The power of the pill: oral contraceptives and women's career and marriage decisions. Journal of Political Economy 110(4):730-770.

Goto A, Yasumura S, Reich MR, Fukao A (2002) Factors associated with unintended pregnancy in Yamagata, Japan. Social Science & Medicine, 54(7):1065-1079.

Grimes DA, Schulz KF (2011) Nonspecific side effects of oral contraceptives: nocebo or noise? Contraception 83(1):5–9.

Guldi M (2008) Fertility effects of abortion and birth control pill access for minors." Demography 45(4):1-11.

Hausman J, McFadden, D (1984) Specification tests for the multinomial logit model," Econometrica 52(5):1219-1240.

Hollander I (2006) Viagra's rise above women's health issues: an analysis of the social and political influences on drug approvals in the United States and Japan. Social Science & Medicine 62:683-693.

Kaneko R, Sakai T, Kamano S, Iwasawa M, Mita F, Morizumi R (2008) Attitudes

toward marriage and the family among Japanese singles. Japanese Journal of Population 6(1):51-75.

Kohler HP (1997) Learning in social networks and contraceptive choice. Demography 34(3):369-383.

Kusunoki Y, Upchurch DM (2008) Contraceptive method choice among youth in the United States: the importance of relationship context. Demography 48(4):1451-1472.

Maia H, Casoy J (2008) Non-contraceptive health benefits of oral contraceptives. European Journal of Contraception and Reproductive Health Care 13(1):17-24.

Matsumoto A (2005) Why is the Pill unwelcomed? Keisoshobo: Tokyo (in Japanese).

Matsumoto Y, Yamabe S, Sugiyama T, and Geronazzo D (2011) Perception of oral contraceptives among women of reproductive age in Japan: a comparison with the USA and France. Obstetrics and Gynaecology Research, 37(7):887-892.

Oddens BJ, Lolkema A (1998) A scenario study of oral contraceptive use in Japan: toward fewer unintended pregnancies. Contraception 58:13-19.

Ogawa N, Retherford RD (1991) Prospects for increased contraceptive pill use in Japan. Studies in Family Planning, 22(6):378-383.

Population Problems Research Council (1990) Summary of twentieth national survey on family planning. Mainichi Shimbun: Tokyo (in Japanese).

Sato R, Iwasawa M (2006) Contraceptive use and induced abortion in Japan: how is it so unique among the developed countries?" The Japanese Journal of Population 4(1):33-54.

Sato R, Shiraishi N, Bando R (2008) Induced abortion in Japan: a demographic analysis of its trends and causes. National Institute of Population and Social Science

Research Working Paper.

Suga M, Kitamura K (2009) The fourth survey on life and attitudes of men and women: attitudes and realities regarding sexual behavior and contraception. Research Report for Health Labour Sciences Research Grant (in Japanese).

United Nations (2011) World contraceptive use 2011. www.un.org/esa/population/publications/contraceptive2011/contraceptive2011.htm Accessed August 7 2011

Vessey M, Painter R, Yeates D (2003) Mortality in relation to oral contraceptive use and cigarette smoking. Lancet 362:185-191.

Table 1: Current contraceptive choice of surveyed women (N=2141)

Currently used primary method of contraception	%	Included in full sample (N=2119)	Included in sub-sample (N=1535)
No modern methods			
No methods (i.e., does not use contraception)	12.5%	Y	N
Ineffective methods (e.g., rhythm and withdrawal) without modern methods	7.6%	Y	Y
Modern methods (with or without ineffective methods)		Y	Y
Male condom	71.9%	Y	Y
OC without male condom	5.7%	Y	Y
OC & male condom	1.3%	Y	Y
Female condom	0.2%	N	N
Spermicide	0.2%	N	N
Spermicide & male condom	0.1%	N	N
IUD	0.0%	N	N
Other (e.g., pessary)	0.4%	N	N

Table 2: Definition of the variables

Variable Name	***Definition***
Choice_nomodern	=1 if does not use any modern method, 0 otherwise
Choice_ineffective	=1 if uses ineffective methods only, 0 otherwise
Choice_condom	=1 if uses male condom, with or without ineffective but with no other modern methods, 0 otherwise
Choice_OC	=1 if uses OC (excluding emergency OCs), with or without ineffective method but with no other modern method, 0 otherwise
Choice_OC&condom	=1 if uses OC (excluding emergency OCs) and male condom, with or without ineffective method but with no other modern method, 0 otherwise
Know_ineffective	=1 if knows any of ineffective methods (e.g., rhythm and withdrawal), 0 otherwise
Know_condom	=1 if knows male condom, 0 otherwise
Know_OC	=1 if knows OC (excluding emergency OCs), 0 otherwise
WTP	willingness to pay for hypothetical, perfectly effective contraceptive method
Frequency_0	=1 if frequency of intercourse per month is less than 1, 0 otherwise
Frequency_6	=1 if frequency of intercourse per month is 6 or more, 0 otherwise
Frequency_unknown	=1 if frequency of intercourse is unknown, 0 otherwise
Single	=1 if not in relationship, 0 otherwise
#Partner_5	=1 if ever had 5 or more partners, 0 otherwise
Married	=1 if legally married, 0 otherwise
Age	respondent's age
Education	years of non-compulsory education completed
Education_unknown	=1 if years of completed non-compulsory education is unknown, 0 otherwise
Income_unmarried	=own annual income (in million yen) if unmarried, 0 otherwise
Income_married	=annual couple income (in million yen) if married, 0 otherwise
Income_unknown	=1 if annual income is unknown, 0 otherwise
Student	=1 if student, 0 otherwise
Fulltime	=1 if works fulltime, 0 otherwise
Smoking	=1 if smokes at least 1 cigarette per day, 0 otherwise
Emergency	=1 if ever had emergency contraception, 0 otherwise
Abortion	=1 if ever had artificial abortion, 0 otherwise
#Children	number of respondent's children

Table 3: Summary statistics

Full Sample (N=2119)			Subsample: Women using contraception (N=1535)		
	Mean	SD		Mean	SD
Choice_nomodern	0.203	0.403	Choice_ineffective	0.104	0.305
Choice_condom	0.727	0.446	Choice_condom	0.805	0.397
Choice_OC	0.057	0.232	Choice_OC	0.074	0.262
Choice_OC&condom	0.013	0.112	Choice_OC&condom	0.018	0.131
			Know_ineffective	0.781	0.414
			Know_condom	0.996	0.062
			Know_OC	0.939	0.239
WTP	2123.6	2851.1	WTP	2241.9	3015.8
Frequency_0	0.270	0.444	Frequency_0	0.231	0.421
Frequency_6	0.160	0.367	Frequency_6	0.177	0.382
Frequency_unknown	0.051	0.221	Frequency_unknown	0.042	0.200
Single	0.123	0.328	Single	0.094	0.292
#Partner_5	0.344	0.475	#Partner_5	0.361	0.480
Married	0.288	0.453	Married	0.273	0.446
Age	24.9	3.4	Age	24.9	3.4
Education	4.837	2.210	Education	4.880	2.203
Education_unknown	0.016	0.126	Education_unknown	0.017	0.129
Income_unmarried	0.866	1.268	Income_unmarried	0.894	1.264
Income_married	0.887	1.866	Income_married	0.842	1.820
Income_unknown	0.065	0.246	Income_unknown	0.058	0.234
Student	0.277	0.448	Student	0.283	0.451
Fulltime	0.399	0.490	Fulltime	0.414	0.493
Smoking	0.137	0.344	Smoking	0.141	0.349
Emergency	0.088	0.284	Emergency	0.105	0.307
Abortion	0.123	0.328	Abortion	0.130	0.337
#Children	0.336	0.712	#Children	0.311	0.682

Table 4: Conditional logit analysis of contraceptive choice
(*Marginal effects* of individual characteristics on the choice probability of each alternative are presented)

	Full Sample (N=2119)						Women using contraception (N=1535)					
	Condom without OC		OC with or without condom		No modern method (ineffective methods or no contraception)		Condom without OC		OC with or without condom		Ineffective methods	
Marginal Effects												
WTP	0.027		0.031	***	-0.059		0.020		0.040	***	-0.060	
Frequency_0	-0.024		-0.015		0.040	*	0.044		-0.014		-0.030	
Frequency_6	-0.071	**	0.050	***	0.021		-0.085	***	0.066	***	0.019	
Frequency_unknown	-0.085	*	0.000		0.085	*	-0.012		0.020		-0.008	
Single	-0.205	***	-0.026	**	0.231	***	0.072	*	-0.031		-0.040	
#Partner_5	-0.039	*	0.007		0.032		-0.042	*	0.009		0.033	
Married	-0.073		-0.050	***	0.123	***	-0.018		-0.068	***	0.085	
Age	-0.014	***	0.006	***	0.008	**	-0.018	***	0.008	***	0.009	**
Education	0.011	**	0.000		-0.011	**	0.013	**	-0.002		-0.011	**
Education_unknown	0.023		0.040		-0.064		0.042		0.032		-0.074	**
Income_unmarried	-0.003		-0.005		0.008		0.000		-0.004		0.004	
Income_married	-0.007		0.002		0.005		0.006		0.004		-0.010	
Income_unknown	0.025		-0.013		-0.012		0.049		-0.001		-0.048	
Student	0.044		-0.005		-0.040		0.045		-0.011		-0.034	
Fulltime	0.011		0.007		-0.018		0.001		0.003		-0.004	
Smoking	-0.023		-0.002		0.025		-0.017		-0.005		0.022	
Emergency	-0.015		0.071	***	-0.057	*	-0.064	*	0.077	***	-0.013	
Abortion	-0.052	*	0.054	***	-0.002		-0.062	*	0.076	***	-0.014	
#Children	0.028		-0.016		-0.012		0.040	*	-0.020		-0.020	
Statistics												
#maximum alternatives	3						3					
average #alternatives	3						2.7					
chi^2	247.8						133.2					
log likelihood	-1437.7						-833.7					

Notes: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Robust standard errors are used. Alternative-specific intercepts are included in the estimation but omitted from the table.

Table 5: Definition of subjective probability variables

Variable Name	***Definition***
Pr(pregnancy)	subjective probability of getting pregnant if respondent uses the method for next 12 months
Pr(STD)	subjective probability of contracting STD if respondent uses the method for next 12 months
Pr(partner's disapproval)	subjective probability that partner disapproves the method
Pr(interruption)	subjective probability that the method ruins the mood
Pr(immoral)	subjective probability that respondent's religion or social norm disapproves the method
Pr(minor adverse effect)	subjective probability of having minor adverse effect if respondent uses the method for one year (e.g., weight gain, nausea, headache, breeding, vaginitis, swelling, etc.)
Pr(serious adverse effect)	subjective probability of having serious, life-threatening adverse effect if respondent uses the method for next 12 months
Pr(side benefit)	subjective probability of having side benefits (i.e., non-contraceptive benefits) if respondent uses the method for next 12 months

Table 6: Summary statistics of subjective probabilities (N=1535)

	Ineffective		Condom		OC		OC&condom	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Pr(pregnancy)	32.6	32.0	10.3	18.1	5.6	13.0	3.0	9.0
Pr(STD)	20.5	28.0	7.3	14.9	15.8	24.6	4.9	11.7
Pr(partner's disapproval)	20.7	31.9	10.8	21.0	13.1	25.6	15.1	26.6
Pr(interruption)	12.1	22.6	15.4	22.6	2.5	10.3	11.0	20.6
Pr(immoral)	13.5	29.2	1.3	7.5	3.8	14.4	2.6	11.5
Pr(minor adverse effect)					35.0	32.2	35.0	32.2
Pr(serious adverse effect)					14.0	21.1	14.0	21.1
Pr(side benefit)					21.8	29.2	21.8	29.2

Table 7: Conditional logit analysis of contraceptive choice: condom without OC as base alternative (N=1535, *Odds-ratios* of the estimated coefficients are presented)

	Model1		Model2		Model3	
Alternative-specific variables						
Pr(pregnancy)*WTP			0.993		0.986	*
Pr(STD)			0.999		0.998	
Pr(partner's disapproval)			0.968	***	0.969	***
Pr(partner's disapproval)*OC			0.995		0.994	
Pr(interruption)			0.991	***	0.991	***
Pr(immoral)			1.002		0.999	
Pr(minor adverse effect)			0.983	***	0.985	***
Pr(serious adverse effect)			0.997		0.994	
Pr(side benefit)			1.018	***	1.021	***
Individual-specific variables	OC with or without condom	Ineffective methods	OC with or without condom	Ineffective methods		
WTP	1.671 ***	0.579	1.530	0.556		
Frequency_0	0.781	0.714	0.661	0.644 *		
Frequency_6	2.229 ***	1.305	2.152 ***	1.116		
Frequency_unknown	1.291	0.945	0.955	0.929		
Single	0.550	0.606	0.500	0.513		
#Partner_5	1.190	1.388	1.176	1.249		
Married	0.333 **	1.940	0.426	1.929		
Age	1.142 ***	1.108 ***	1.160 ***	1.110 ***		
Education	0.956	0.895 **	0.927	0.894 **		
Education_unknown	1.355	0.347	1.114	0.286		
Income_unmarried	0.946	1.033	0.888	0.996		
Income_married	1.046	0.912	1.003	0.864 **		
Income_unknown	0.931	0.558	0.898	0.529		
Student	0.815	0.688	1.026	0.710		
Fulltime	1.037	0.969	1.470	0.865		
Smoking	0.952	1.227	0.912	1.042		
Emergency	2.301 ***	0.960	2.378 ***	0.902		
Abortion	2.298 ***	0.948	1.992 **	1.045		
#Children	0.729	0.798	0.691	0.739		

Table 7: Conditional logit analysis of contraceptive choice: condom without OC as base alternative (N=1535, *Odds-ratios* of the estimated coefficients are presented) *(continued)*

	Model1	Model2	Model3
Statistics			
#maximum alternatives	3	4	4
average #alternatives	2.7	3.7	3.7
chi^2	141.0	945.8	994.6
log likelihood	-833.7	-762.1	-818.8

Notes: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Robust standard errors are used. Alternative-specific intercepts are included in the estimation but omitted from the table.

Table 8: Conditional logit analysis of contraceptive choice: ineffective methods as base alternative (N=1535, *Odds-ratios* of the estimated coefficients are presented)

	Model1		Model2	
Individual-specific variables	OC with or without condom	condom without OC	OC with or without condom	condom without OC
WTP	2.890 **	1.731	2.752	1.799
Frequency_0	1.091	1.399	1.025	1.552 *
Frequency_6	1.713 *	0.768	1.928 **	0.896
Frequency_unknown	1.355	1.054	1.028	1.077
Single	0.920	1.661	0.976	1.951
#Partner_5	0.856	0.720	0.941	0.801
Married	0.170 ***	0.513	0.221 **	0.518
Age	1.030	0.902 ***	1.045	0.901 ***
Education	1.070	1.118 **	1.037	1.118 **
Education_unknown	3.908	2.884	3.897	3.498
Income_unmarried	0.914	0.967	0.892	1.004
Income_married	1.148	1.097	1.160	1.158 **
Income_unknown	1.660	1.788	1.696	1.890
Student	1.177	1.449	1.445	1.408
Fulltime	1.067	1.031	1.699	1.155
Smoking	0.776	0.815	0.876	0.960
Emergency	2.417 **	1.048	2.636 **	1.108
Abortion	2.411 ***	1.053	1.907 *	0.957
#Children	0.914	1.253	0.935	1.353

Notes: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Robust standard errors are used. Alternative-specific intercepts are included in the estimation but omitted from the table. The estimated coefficients of subjective probability variables in Model 2 are also omitted from the table.