Determinants of Contraceptive Choice among Japanese Women:

Ten Years after the Pill Approval

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Abstract

The Japanese government approved the use of oral contraception (OC) in 1999, but OC users remain a small minority in Japan. Using the results of an online survey conducted in 2010, I examine the factors determining Japanese women's choice of contraceptive method 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 frequency of intercourse in Japan offers one explanation for the slow diffusion of OC. Additionally, the findings indicate that OC use is more prevalent among women with a higher risk of unintended pregnancies. Subjective probabilities regarding each contraceptive method's contraceptive effectiveness, disruption of romantic moods, partner disapproval, side benefits and minor, non-life-threatening side effects are important determinants of contraceptive choice. The perceived risk levels of OC side effects are significantly higher than the population-based probabilities, implying that increased medical knowledge might increase OC use. (195 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 (acquired immune deficiency syndrome). … 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, translated by the author, 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 oral contraception (OC) had a significant impact on American society, including increasing female enrollment in professional graduate schools, increasing female age at first marriage (Goldin and Katz 2002), decreasing the birth rate (Guldi 2008) and improving the well-being of children (Ananat and Hungerman 2012). These findings in the American context raise the following question: what have been the effects of the Japanese government's approval of OC? Unlike in other developed countries, physicians in Japan could not legally prescribe low-dose hormonal pills for family planning purposes until 1999.[1] In contrast to the rapid diffusion of OC in the United States that occurred once women were granted legal access to it, the diffusion of OC among Japanese women has been slow since the legalization of low-dose OC. Specifically, according to a report by the United Nations, only 1% of married (or in-union) women aged 15 to 49

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[1] Physicians could legally prescribe higher-dose pills for medical reasons.

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use OC in Japan, compared to 16.8% in North America and 45.5% in Western Europe (United Nations 2011).

Additionally, 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).

The remarks by Junichiro Koizumi quoted above represent the negative attitudes of Japanese politicians and mass media toward OC. Additionally, the Japanese Ministry of Health and Welfare argued that the pill may encourage promiscuity and lower sexual morality by allowing women to have multiple sexual partners without the risk of pregnancy (Hollander 2006). While these views could certainly be related to low OC use, it is unclear how they affect Japanese women's preferences and perceptions regarding contraceptive methods. Prior studies find that the most common reason given by Japanese women for not using OC is their concern about side effects (Matsumoto et al. 2011; Suga and Kitamura 2009). In particular, 50% of Japanese women who have never used OC cite this concern, compared to only 25% and 17% of their American and French counterparts, respectively (Matsumoto et al. 2011). Nevertheless, the relative importance of this particular concern in Japanese women's contraceptive choice has not been examined.

This study examines determinants of Japanese women's choice of contraceptive method based on an online survey conducted in 2010, approximately ten years after the legalization of low-dose OC. 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, no other studies estimate a regression model of contraceptive choice using Japanese data before or after OC approval.[2] I

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[2] Ogawa and Retherford (1991) estimate a binary logit model using data on married Japanese women collected before OC approval, in which the dependent variable is whether a woman *intends* to use OC, conditional upon

examine women's demographic and socioeconomic characteristics as possible determinants of contraceptive

choice; I also include their subjective beliefs regarding the pros and cons 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 OC 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 OC, the impact on abortions 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, legal access to OC could have a greater impact on career choices and participation of

women in the labor market. While this study does not test causal effects of OC approval on unintended birth or

on women's lifestyle, characteristics of OC users identified in this study provide important inferences on these

issues. Regarding (ii), I suggest how observed differences between users and non-users of OC among Japanese

women might contribute to low OC use, although this approach does not allow me to examine potential

explanatory factors that vary greatly across countries but that are largely uniform within Japan.[3]

government approval. They find that the coefficient on abortion intention in the case of contraceptive failure is
significantly positive and that the coefficient on the extended family dummy is significantly negative.

[3] Financial and psychological burdens of OC use could be higher in Japan than in other developed countries.
Japan has a universal health insurance system but it does not cover OC. The average monthly out-of-pocket cost
of OC use in Japan is 3,314 yen (about US $33) in 2007 including medical examinations required for OC
prescription, which is considerably higher than that in the United States of US $16 (Kitamura and Nakamura
2007, Liang et al. 2012). Additionally, until the revision in 2005 the Japan Society of Obstetrics and
Gynecology's guidelines for OC prescriptions were much more restrictive than recommended by World Health

2. Analytical Framework

Outside of Japan, previous studies have identified demographic, socioeconomic and relationship characteristics and past experiences related to pregnancy and contraception as important determinants of contraceptive choice (Frost and Darroch 2008; Kavanaugh et al. 2011, Kusunoki and Upchurch 2011; Manlove et al. 2011). Most studies on the choice of contraceptive methods are in the field of public health, with fewer studies based on economic models of utility maximization. Among the economic studies, Delavande (2008) presents a model in which women's utility depends on the binary outcomes associated with contraception, such as pregnancy and contracting an STD, and thus the expected utility when choosing a method is a linear function of products of the utility associated with an outcome and the subjective probability of the realization of the outcome conditional on the use of the method. Based on this model women's choice of contraceptive methods is regressed to their subjective probabilities, and most of the subjective probability variables are statistically significant.

These previous findings imply that women's individual characteristics affect their choice of contraceptive methods through two channels, differences in utility associated with the outcomes and differences in subjective probabilities. To examine the former separately from the latter and study how subjective probabilities are associated with contraceptive choice, I specify a woman's utility when choosing a method as a function of individual characteristics and subjective probabilities. In this formulation individual characteristics

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Organization (WHO) and required extensive medical examinations including the screening for cervical cancer (Norgren 2001; Taketani 2006). This might have affected women's perceived financial and psychological burdens of OC use even after these requirements were abolished by the revision.

components account for differences in utility associated with various outcomes by women's characteristics. For

contraceptive-related outcomes I consider pregnancy, STD contraction, partner's disapproval of the method,

interruption to the romantic mood, religious/moral disapproval of the method, adverse effects of OC and side

benefits of OC. While these are certainly not the only outcomes that could affect women's choice of

contraceptive methods, the omission of an outcome with homogeneous effects across individuals would not bias

the estimation as its effects are absorbed in the method-specific effects.[4]

Following previous literature, I allow women's utility when choosing a method to vary with

demographic, socioeconomic and relationship characteristics, contraception-related experience, and

contraindications for taking OC. For demographic and socioeconomic characteristics I include age, the number

of children, education, income and occupation, and for relationship characteristics I include the frequency of

intercourse, partnership status and marital status. Past experience of abortion and emergency contraception are

included to account for effects of contraceptive failure and near failure experience. Smoking status is controlled

for because medical guidelines advise heavy smokers not to use OC. Additionally, I include WTP for

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[4] Another relevant outcome is the monetary cost. I did not control for perceptions regarding financial costs of
contraceptive methods because apparently method use has a reverse causal effect on the perceived cost of the
method. In particular, to the question asking the estimated monthly monetary cost of OC, 52.1% of non-OC users
answer zero, compared to only 1.4% among OC users. This suggests that many of the respondents unfamiliar
with the cost of OC indicate zero to avoid reporting precise numbers and that other factors prevent many women
from considering OC use before they collect information on its cost. While this finding raises a concern that
respondents might report 0% to subjective probability questions regarding the methods they are unfamiliar with,
that is unlikely the case. Specifically, only 27.1% of non-OC users indicate the subjective probability of minor
OC side effects to be 0%, a figure close to 27.0% among OC users.

contraceptive effectiveness because individual heterogeneity in disutility from unintended pregnancy could be large even though the above characteristics are controlled for. All of these individual characteristics could affect disutility from pregnancy, and disutility from partner's disapproval of the method and disutility from interruption to the romantic mood are expected to be particularly relevant to relationship characteristics. Cognitive ability could enable more accurate evaluation of utility levels in hypothetical situations, implying that socioeconomic characteristics, particularly education, might affect subjective utility associated with all outcomes. The depth of life experience and sexual experience, measured by age and intercourse frequency, could have similar effects.

3. Empirical Implementation

3.1 Data

In collaboration with INTAGE Interactive, Inc., online survey data were collected from 2,141 young women (18-30 years old) who lived in Japan and who were registered as monitors with a web-based survey system. The survey was conducted in two steps. First, a screening survey was 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 did not intend to become pregnant and (3) who had not undergone sterilization and whose partner has not undergone sterilization. The 4,820 women who met the screening criteria were invited to participate in the full survey, and 2,141 completed it. Women in the age range of 18-30 years are of particular interest because of their high risk of unintended pregnancy, as indicated by the highest number of abortions per capita among women in their twenties in Japan (Baba et al. 2005). Because OC is characterized by its profound

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contraceptive effectiveness, OC legalization might have a greater impact on women at a higher risk of unplanned

pregnancy. The other selection criteria were intended to limit the sample to those who would realistically make

contraceptive choices.

Table 1 shows the contraceptive methods used by respondents at the time of the survey. The male

condom was the most commonly used method. Ineffective methods (i.e., rhythm and withdrawal) were the

second most common. The rate of OC use was 6.9%, a considerably higher figure than the overall 1-2%

prevalence of OC use in Japan reported by prior studies (Kaneko et al. 2008; United Nations 2011). This

discrepancy could be because my sample is restricted to women who did not intend to become pregnant and who

had at least one intercourse experience within the past 12 months. Because only 22 women used contraceptive

methods other than the three most common methods, I exclude these 22 observations from the regression

analysis. I also exclude women who did not use contraception from the analysis. This limits my analysis to the

1,535 women who used condoms, OC, a combination of condoms and OC, or ineffective methods. In this study,

the male condom is referred to as "condom" because the use of female condoms is rare.

Table 2 compares the currently used contraceptive methods among women conducting contraception in

this study with those in the Japanese National Fertility Survey (JNFS), a mail survey with high response rates

(National Institute of Population and Social Security Research 2007a; 2007b). This study differs from JNFS in

several ways. In particular, this study asks for a single answer but JNFS allows for multiple answers.

Additionally, this study limits the population to women who have had an intercourse in the past 12 months, but

JNFS includes all sexually active women in the population. The rate of condom use is slightly higher in JNFS

than in this study, and the rate of OC use is about four times higher in this study than in JNFS. These differences could arise from differences in target populations and from the difference between a web-based survey and a mail survey. In JNSF 2.4% use rhythm and 13.3% use withdrawal with or without other methods, and in this study 8.7% use ineffective methods without other methods. The use of other methods than condom, OC, rhythm and withdrawal is extremely rare in both surveys.

Definitions and summary statistics of the variables are provided in Table 3. Following Delavande (2008), willingness to pay (WTP) is determined based on a scenario in which only two methods are available: one is 85% effective (i.e., there is a 15% probability of getting pregnant) and is free of charge, and the other is 100% effective (i.e., there is 0% probability of getting pregnant). These methods are otherwise identical. Respondents were asked about their WTP for the 100% effective method. Women in my sample are more likely to be students and better-educated than indicated by nationally-representative government surveys. Specifically, among women aged 20 to 29 in my sample, 26% are students, compared to 14% in 2010 Population Census. Among nonstudent women aged 20 to 29, 45% have a university degree in my sample, compared to 23% in 2010 Population Census.[5]

Definitions of the subjective probability variables are provided in Table 4. Respondents were asked about the percent chance of various events conditional upon the use of each contraceptive method, taking full account of the respondent's own lifestyle and constitution. The construction of these variables largely followed Delavande (2008), although the questions were slightly modified to better reflect the Japanese context. Because

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[5] Unfortunately, the sample distribution of other individual characteristics such as occupation and income is not comparable with that in nationally-representative surveys due to different definitions and categorizations.

respondents may indicate "50%" to avoid reporting precise numbers (Bruine de Bruin et al. 2000), I prohibited

the response of "50%" and instructed respondents to select either 49% or 51% if their subjective probability was

50%.

Table 4 also shows the summary statistics of the subjective probabilities conditional upon each of the

four contraceptive methods. On the one hand, the reported subjective probabilities are partly consistent with

medical knowledge. Specifically, the mean values of the subjective probability that respondents would become

pregnant conditional on the use of each method were ordered in accordance with the medical literature. The

respondents' average rankings were (from most to least effective) dual use of OC and condom, sole use of OC,

sole use of condom and ineffective methods. Likewise, the mean values of the probability of contracting an STD

indicate that most women know that condoms are effective in preventing STDs but that OC is not. Additionally,

the average subjective probability of the side benefits of OC was 21.8%, consistent with the medical literature

indicating that there are significant beneficial effects of OC on menorrhagia (excessive bleeding during

menstruation), dysmenorrhoea (painful menstruation) and acne (Maia and Casoy 2008). On the other hand, the

average subjective probabilities regarding OC side effects were considerably higher than those indicated by the

medical literature. Large cohort studies have found no harmful effect of OC on all-cause mortality (Beral et al.

1999; Vessey et al. 2003), and recent placebo-controlled randomized trials have found little evidence that OC has

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 would ruin the romantic

mood indicate that some women expect the use of condoms and ineffective methods, such as withdrawal, to be

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detrimental. 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 OC, despite conservative views that link OC use with promiscuity. The mean values of the subjective probabilities of the partner's disapproval of each method indicate that the order of perceived partner disapproval is (from strongest to weakest) ineffective methods, dual use of OC and condoms, sole use of OC and sole use of condoms. This relatively strong aversion to OC among Japanese men is consistent with Suga and Kitamura (2009), as discussed further in section 4.

3.2 Estimation Method

I regress contraceptive choice on individual women's characteristics and their reported subjective probabilities regarding the pros and cons of each contraceptive method using a multinomial logistic model. In the model women choose from the four most common categories: condoms without OC, OC without condoms, a combination of condoms and OC and ineffective methods. Methods are excluded from the choice set if the individual does not know about the method. The effects of women's characteristics are aggregated for OC use both with and without condom use because only 27 women indicated dual use of condoms and OC. I use robust standard errors. I conduct a Hausman-McFadden Test and confirm that the IIA (independence of irrelevant alternative) assumption holds because excluding each one of the alternatives does not significantly change the estimates (Hausman and McFadden 1984).

4. Results

Table 5 presents the estimation results as the odds ratios of the estimated coefficients. An odds ratio less than

unity indicates a negative association and an odds ratio greater than unity indicates a positive association. The

upper panel reports the estimated coefficients of alternative-specific variables. *Prob(pregnancy)*WTP* is

insignificant, but an additional statistical test (not shown in the table) indicates that it is jointly significant with

WTP. I also try an alternative specification where *WTP* is excluded from the explanatory variables, and find that

the coefficient of *Prob(pregnancy)*WTP* becomes significantly negative. 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 indicate that the subjective probabilities of contraceptive

failure, partner disapproval, interruption of the romantic mood and minor side effects are negatively associated

with the use of the method and that the subjective probability of side benefits is positively associated with OC

use. *Pr(STD)*, *Pr(immoral)* and *Pr(major side effects)* are insignificant, indicating that subjective risk

perceptions regarding STDs, religious/social disapproval and serious life-threatening side effects of OC are not

significantly associated with contraceptive choice. *Pr(partner's disapproval)*OC* is also insignificant, implying

that the influence of partner disapproval does not differ between OC use and other alternatives.

The middle panel of Table 5 reports the estimated coefficients of individual-specific variables. The

second and third columns report the estimates where the base alternative is sole use of condoms, and the fourth

and fifth columns report the estimates where the base alternative is ineffective methods.[6] Relative to condom use,

Frequency_6, *Age*, *Emergency* and *Abortion* are positively associated with OC use, whereas *Age* is positively

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[6] The chi^2, log likelihood and estimated coefficients of subjective probability variables are independent of the

choice of the base alternative.

associated and *Frequency_0*, *Education* and *Income_married* are negatively associated with the use of

ineffective methods. Relative to the use of ineffective methods, *Frequency_6*, *Emergency and Abortion* are

positively associated and *Married* is negatively associated with OC use. While *WTP* is not significantly

associated with any of the alternatives in either specification, it is jointly significant with *Prob(pregnancy)*WTP*

in both specifications. Moreover, when *Prob(pregnancy)*WTP* is excluded from the explanatory variables, *WTP*

becomes positively associated with OC use in both specifications.

Thus, higher willingness to pay for contraceptive effectiveness, older age, frequent intercourse,

unmarried marital status, 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 associated with condom use, negatively associated with the use of

ineffective methods and insignificantly associated with OC use. Other individual characteristics such as

occupation and overall number of partners have little predictive power.

The base model estimated above has two potential problems. One is the possible endogeneity of WTP

and subjective probability variables. WTP might be affected by the price of chosen contraceptive method, and

subjective probabilities could be influenced by method use. If these subjective variables are correlated with

objective individual characteristics, inclusion of subjective variables as explanatory variables might bias the

estimated coefficients of individual characteristics variables. The other possible problem is the exclusion of

women who do not conduct contraception from the sample. To take account of these concerns, I conduct two

additional estimations. First, I estimate a model without WTP and subjective probability variables using the same

sample and choice categories as in the base analysis. Second, I estimate a model without WTP and subjective

probability variables including women who did not use any methods in the sample. In this model women choose

from three categories; condoms without OC, OC with or without condoms and no use of modern methods, where

the last category includes both the use of ineffective methods and use of no methods.

The estimation results from the first alternative model are presented in Table 6. The results are highly

similar to those obtained from the base model, except for that *Married* is negatively associated with OC use

relative to the single use of condom and that *Income_married* is not significantly associated with the use of

ineffective methods relative to the single use of condom. The similarity of the estimation results suggests that the

potential endogeneity of WTP and subjective probability variables causes very little bias, if any, to the estimated

coefficients of individual characteristics variables. It also implies that subjective variables are significantly

associated with contraceptive choice independently with objective individual characteristics.

Table 7 presents the estimation results from the second alternative model. Compared with the results

from the base model presented in Table 5, the signs and significance of the estimated coefficients are remarkably

similar regarding OC use with only two significant differences: *Married* is negatively associated with OC use

relative to condom use and *Single* is negatively associated with OC use relative to the use of no modern methods

in the alternative specification only. The latter difference is not surprising because the reference alternative

differs between the two models. The factors associated with the use of no modern methods estimated in this

alternative model differ from those associated with the use of ineffective methods estimated in the base model.

These differences between different choice categories would not undermine the credibility of the base model,

and the consistent results regarding the determinants of OC use in both models imply that the bias resulting from

the endogeneity of subjective variables and the exclusion of women not conducting contraception from the

sample is small.[7]

5. Discussion

5.1. Subjective Probabilities

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 OC and 55.7% of them report concerns about side effects as a reason.

Therefore, the negative perception of OC among Japanese men may offer a partial explanation for the low rate of

OC use.[8]

The mean subjective probability that OC causes minor side effects is significantly higher than the

population-based probabilities (Grimes and Schulz 2011) and negatively associated with OC use, consistent with

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[7] For another robustness check, I conduct a subsample analysis limiting the sample to women who have at least one intercourse per month and confirm that the results remain largely unchanged. The results of this subsample analysis are available from the author upon request.

[8] The mean of women's subjective probability that the partner disapproves of the single use of OC is only 13.1% (Table 4), implying that women in my sample might underestimate their partners' opposition toward OC use. While male partners' intentions would not affect women's contraceptive choice if women are unaware of them, women's misperceptions about their partners' intentions regarding a contraceptive method likely decrease once women start using the method.

Suga and Kitamura (2009) and Matsumoto et al. (2011). At the same time, the subjective probability that OC has

life-threatening side effects is not significantly associated with contraceptive choice. Using the estimation results

from the base model, I estimate how the predicted choice probability would have changed if all women had

evaluated the probability of OC side effects to be zero. In this hypothetical scenario the rate of OC use increases

from 9.2% to 14.0%, reducing condom use from 80.5% to 76.5% and the use of ineffective methods from 10.4%

to 9.5%. The finding that OC use is positively associated with the subjective probability of the side benefits of

OC is also consistent with Suga and Kitamura (2009).

The subjective risk of STD contraction is not significantly associated with contraceptive choice. This

finding might reflect the difficulty of inferring the probability that a partner has contracted or will contract an

STD rather than an overall lack of concern regarding STDs. Nevertheless, this result raises concerns and

demands further investigations. This finding differs from Delavande (2008), who reports a significant association

between the subjective probability of STD contraction and contraceptive choice; however, my other findings are

generally consistent with hers. Delavande (2008) collected data via interviews, and the majority of respondents

were American college students. Thus, differences in data collection methods and study subject characteristics

might account for differences in results.

The subjective probabilities may reflect important determinants of contraceptive choice other than

women's individual characteristics controlled for in this study, such as relationship commitment (Kusunoki and

Upchurch 2011) and social learning (Behrman et al. 2002; Kohler 1997). Specifically, subjective beliefs

regarding the risk of STDs, and partner's disapproval of a method are likely to be influenced by the relationship

context. Similarly, information communicated by close acquaintances may affect individuals' risk perceptions;

however, 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 the previous studies in the developing world.

5.2. 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. On the contrary, age, intercourse frequency and experience with abortion are

negatively associated with the probability of condom use, suggesting that women shift from condoms to OC as

they accumulate sexual experience or experience contraceptive failure. The coefficients of individual

characteristics variables in the base model likely reflect both different preferences and different risk perceptions

that are not fully captured by the stated subjective probabilities.

The positive association between intercourse frequency and OC use suggests that the low and declining

frequency of intercourse in Japan is an explanation for the low rate of OC use, although reverse causality is a

concern.[9] OC use is associated with a relatively high fixed cost; this cost includes both monetary costs and the

burden of obtaining prescriptions and taking a pill every day. However, marginal (i.e., incremental) costs are zero

because the cost of OC use does not vary with intercourse frequency. In contrast, the fixed costs of condoms and

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[9] Recent studies, including a randomized, controlled study, do not find support for the positive effect of OC use on intercourse frequency (Caruso et al. 2004; Gabalci and Terzioglu 2010; Guida et al. 2005).

ineffective methods are small, if not zero; however, these methods may be associated with non-negligible

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 OC. According to Durex (2005), the reported

intercourse frequency in Japan of 45 times per year is the lowest among 41 countries surveyed and less than the

half of the average frequency of 103 times per year in surveyed countries. Additionally, 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).[10] Similarly, among men and women aged 20-39 years the percentage of those who

have never been married and are not in relationship steadily increased in all age groups from 1992 to 2010

(National Institute of Population and Social Security Research 2012). The possible decline in intercourse

frequency could explain why the rate of OC use after 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 indicated that they intended to use OC if it became available, which is

significantly higher than the rate of OC use of 1% in 2005 among married Japanese women aged 15 to 49

(United Nations 2011).

OC use is significantly more prevalent among women with a higher risk of unintended pregnancy, such

as those with higher intercourse frequency and those who have experienced an abortion. According to Goto et al.

(2002), 40.1% of women reporting unintended pregnancies reported more than one unintended pregnancy. These

findings imply that OC approval may have significantly reduced unintended childbirths and abortions despite the

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[10] Another explanation for the findings of Durex (2005) and Sato et al (2008) is population aging in Japan.

low average prevalence of OC use. Additionally, these results suggest that increased access to OC could further reduce unintended pregnancies. Similarly, the positive association between WTP for contraceptive 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 an individual woman's career opportunities due to childbirth, the approval of OC may have had a significant impact on the career choices and labor participation of women despite the low average rate of OC use in Japan.

A possible explanation for the negative association between being married and using OC is that some married women without pregnancy intentions could have husbands with pregnancy intentions, whereas this type of disagreement in pregnancy intention is less likely among unmarried couples. The result that women with higher levels of education are more likely to use condoms but are no more likely to use OC is difficult to interpret. One possibility is that the partners of well-educated women are more positive about using condoms or use condoms more effectively and thus the merits of OC use relative to those of condom use are smaller for well-educated women.[11] Another possible explanation is that more educated individuals are more sensitive not only to scientifically supported health scares but also to unfounded ones, as suggested by the findings regarding parental responses to a health scare about child vaccination (Anderberg et al. 2011). Thus, well-educated women might be more concerned with OC side effects. Finally, there is no statistically significant relationship between OC use and a woman's overall number of sexual partners. This finding does not support the claim that the availability of OC encourages promiscuity by allowing women to have multiple sexual partners without the risk

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[11] The estimated failure rate of male condom is 15% under typical use but it is reduced to 2% under perfect use (Trussell 2004).

of pregnancy.

6. Conclusion

This study examines the determinants of Japanese women's choice of contraceptive methods. The estimation results indicate that OC use is positively associated with age, WTP for contraceptive effectiveness, intercourse frequency and experience with abortion or emergency contraception. Among these factors, age, intercourse frequency and experience with abortion are negatively associated with the probability of condom use. Subjective beliefs regarding each method's disruption of the romantic mood, partner disapproval and side benefits and minor side effects of OC are also important determinants of contraceptive choice.

OC use is more prevalent among women with a higher risk of unintended pregnancy, implying that OC approval may have significantly reduced unintended childbirths and abortions despite the low average prevalence of OC use, and that increased access to OC could further reduce unintended pregnancies. The estimation results also suggest that increased contraceptive knowledge among men and women may significantly increase OC use in Japan for three reasons. First, the perceived risk of minor side effects among women included in this study was negatively associated with OC use and was significantly higher than population-based probabilities (Grimes and Schulz 2011). Thus, knowledge of recent medical findings may reduce Japanese women's concerns regarding OC side effects and increase their OC use. The estimation results predict that the rate of OC use in my sample would increase by about 50% if the sampled women's subjective probability of OC side effects were reduced to zero. Second, this study finds a significant effect of male partners' disagreement on

the use of both male-oriented and female-oriented contraceptive methods; according to a previous study, the majority of Japanese men are opposed to their partners' use of OC, often due to concerns about side effects (Suga and Kitamura 2009). Thus, increased medical knowledge may reduce men's concerns of side effects and thereby increase their partners' OC use. 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 toward OC use 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 may increase OC use among young and inexperienced women to a rate similar to that of older and more experienced women.

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Table 1: Current contraceptive use among surveyed women (N=2141)

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

Table 2: Currently used contraceptive methods in this study and in Japanese National Fertility Survey (JNFS)

	JNSF	This study
Sample characteristics		
N	1479	1854
Year	2005	2009
Age	18-29	18-30
Single/multiple answers	Multiple	Single
Currently used method*		
Condom	87.5	82.4
OC	2.0	8.0
Rhythm	2.4	
Withdrawal	13.3	
Ineffective methods only		8.7
Other	1.1	1.0
Unknown	0.3	0.0

Source: Compiled by the author based on National Institute of Population and Social Security Research (2007a; 2007b).

Notes: JNSF asks currently used methods to married women but asks methods used in the last intercourse to unmarried women.

Table 3: Definition and summary statistics of the variables

Variable name	Definition	Mean	SD
Choice_ineffective	=1 if respondent uses ineffective methods only, 0 otherwise	0.104	0.305
Choice_condom	=1 if respondent uses male condom, with or without ineffective methods but with no other modern methods, 0 otherwise	0.805	0.397
Choice_OC	=1 if respondent uses OC (excluding emergency OC), with or without ineffective methods but with no other modern method, 0 otherwise	0.074	0.262
Choice_OC&condom	=1 if respondent uses OC (excluding emergency OC) and male condom, with or without ineffective methods but with no other modern method, 0 otherwise	0.018	0.131
Know_ineffective	=1 if respondent knows of any ineffective methods, 0 otherwise	0.781	0.414
Know_condom	=1 if respondent knows of male condom, 0 otherwise	0.996	0.062
Know_OC	=1 if respondent knows of OC (excluding emergency OC), 0 otherwise	0.939	0.239
WTP	willingness to pay for hypothetical, perfectly effective contraceptive method	2241.9	3015.8
Frequency_0	=1 if frequency of intercourse per month is less than 1, 0 otherwise	0.231	0.421
Frequency_6	=1 if frequency of intercourse per month is 6 or more, 0 otherwise	0.177	0.382
Frequency_unknown	=1 if frequency of intercourse is unknown, 0 otherwise	0.042	0.200
Single	=1 if respondent is not in a relationship, 0 otherwise	0.094	0.292
#Partner_5	=1 if respondent has ever had 5 or more partners, 0 otherwise	0.361	0.480
Married	=1 if respondent is legally married, 0 otherwise	0.273	0.446
Age	respondent's age	24.9	3.4
Education	years of non-compulsory education completed	4.880	2.203
Education_unknown	=1 if years of completed non-compulsory education is unknown, 0 otherwise	0.017	0.129
Income_unmarried	=own annual income (in million yen) if unmarried, 0 otherwise	0.894	1.264
Income_married	=annual couple income (in million yen) if married, 0 otherwise	0.842	1.820
Income_unknown	=1 if annual income is unknown, 0 otherwise	0.058	0.234
Student	=1 if respondent is a student, 0 otherwise	0.283	0.451
Fulltime	=1 if respondent works fulltime, 0 otherwise	0.414	0.493
Smoking	=1 if respondent smokes at least 1 cigarette per day, 0 otherwise	0.141	0.349
Emergency	=1 if respondent has ever had emergency contraception, 0 otherwise	0.105	0.307
Abortion	=1 if respondent has ever had artificial abortion, 0 otherwise	0.130	0.337
#Children	number of respondent's children	0.311	0.682

Table 4: Definition and summary statistics of subjective probability variables

Variable name	Definition	Ineffective methods		Condom		OC		OC & condom	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Pr(pregnancy)	subjective probability of getting pregnant if respondent uses the method for next 12 months	32.6	32.0	10.3	18.1	5.6	13.0	3.0	9.0
Pr(STD)	subjective probability of contracting a STD if respondent uses the method for next 12 months	20.5	28.0	7.3	14.9	15.8	24.6	4.9	11.7
Pr(partner's disapproval)	subjective probability that partner disapproves of the method	20.7	31.9	10.8	21.0	13.1	25.6	15.1	26.6
Pr(interruption)	subjective probability that the method ruins the romantic mood	12.1	22.6	15.4	22.6	2.5	10.3	11.0	20.6
Pr(immoral)	subjective probability that respondent's religion or social norms contraindicate the method	13.5	29.2	1.3	7.5	3.8	14.4	2.6	11.5
Pr(minor adverse effect)	subjective probability of experiencing a minor adverse side effect if respondent uses OC for the following 12 months (e.g., weight gain, nausea, headache, breeding, vaginitis, swelling, etc.)	-	-	-	-	35.0	32.2	35.0	32.2
Pr(serious adverse effect)	subjective probability of experiencing a serious, life-threatening adverse side effect if respondent uses OC for the following 12 months	-	-	-	-	14.0	21.1	14.0	21.1
Pr(side benefit)	subjective probability of experiencing side benefits (i.e., non-contraceptive benefits) if respondent uses OC for the following 12 months	-	-	-	-	21.8	29.2	21.8	29.2

Table 5: Multinomial logit analysis of contraceptive choice: the base model
(N=1535, *Odds-ratios* of the estimated coefficients are presented)

Alternative-specific variables				
Pr(pregnancy)*WTP	0.993			
Pr(STD)	0.999			
Pr(partner's disapproval)	0.968 ***			
Pr(partner's disapproval)*OC	0.995			
Pr(interruption)	0.991 ***			
Pr(immoral)	1.002			
Pr(minor adverse effect)	0.983 ***			
Pr(serious adverse effect)	0.997			
Pr(side benefit)	1.018 ***			

Individual-specific variables	Base alternative: condom without OC		Base alternative: ineffective methods	
	OC with or without condom	**Ineffective methods**	**OC with or without condom**	**Condom without OC**
WTP	1.530	0.556	2.752	1.799
Frequency_0	0.661	0.644 *	1.025	1.552 *
Frequency_6	2.152 ***	1.116	1.928 **	0.896
Frequency_unknown	0.955	0.929	1.028	1.077
Single	0.500	0.513	0.976	1.951
#Partner_5	1.176	1.249	0.941	0.801
Married	0.426	1.929	0.221 **	0.518
Age	1.160 ***	1.110 ***	1.045	0.901 ***
Education	0.927	0.894 **	1.037	1.118 **
Education_unknown	1.114	0.286	3.897	3.498
Income_unmarried	0.888	0.996	0.892	1.004
Income_married	1.003	0.864 **	1.160	1.158 **
Income_unknown	0.898	0.529	1.696	1.890
Student	1.026	0.710	1.445	1.408
Fulltime	1.470	0.865	1.699	1.155
Smoking	0.912	1.042	0.876	0.960
Emergency	2.378 ***	0.902	2.636 **	1.108
Abortion	1.992 **	1.045	1.907 *	0.957
#Children	0.691	0.739	0.935	1.353

Statistics				
chi^2	945.8			
log likelihood	-762.1			

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

Table 6: Multinomial logit analysis of contraceptive choice: using the same sample and choice categories as in the base model without WTP and subjective probability variables (N=1535, *Odds-ratios* of the estimated coefficients are presented)

Individual-specific variables	Base alternative: condom without OC				Base alternative: ineffective methods			
	OC with or without condom		Ineffective methods		OC with or without condom		Condom without OC	
Frequency_0	0.783		0.717		1.092		1.395	
Frequency_6	2.246	***	1.294		1.736	*	0.773	
Frequency_unknown	1.233		0.958		1.287		1.044	
Single	0.595		0.598		0.994		1.671	
#Partner_5	1.157		1.396	*	0.829		0.716	*
Married	0.335	**	1.953	*	0.172	***	0.512	*
Age	1.134	***	1.109	***	1.022		0.902	***
Education	0.960		0.893	**	1.075		1.119	**
Education_unknown	1.418		0.336		4.218		2.974	
Income_unmarried	0.954		1.031		0.925		0.970	
Income_married	1.051		0.908		1.157		1.101	
Income_unknown	0.903		0.561		1.608		1.781	
Student	0.781		0.678		1.152		1.475	
Fulltime	0.997		0.963		1.035		1.038	
Smoking	0.994		1.221		0.814		0.819	
Emergency	2.351	***	0.942		2.495	**	1.061	
Abortion	2.227	***	0.964		2.310	**	1.037	
#Children	0.722		0.801		0.901		1.248	
Statistics								
chi^2	1087.973							
log likelihood	-905.123							

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

Table 7: Multinomial logit analysis of contraceptive choice: using full-sample without WTP and subjective probability variables (N=2119, *Odds-ratios* of the estimated coefficients are presented)

Individual-specific variables	Base alternative: condom without OC		Base alternative: no modern methods	
	OC with or without condom	No modern methods	OC with or without condom	Condom without OC
Frequency_0	0.753	1.274 *	0.591 *	0.785 *
Frequency_6	2.321 ***	1.223	1.898 **	0.818
Frequency_unknown	1.061	1.681 **	0.631	0.595 **
Single	0.800	3.196 ***	0.250 ***	0.313 ***
#Partner_5	1.170	1.253 *	0.933	0.798 *
Married	0.347 **	2.003 ***	0.173 ***	0.499 ***
Age	1.140 ***	1.061 **	1.074	0.942 **
Education	0.983	0.926 **	1.061	1.080 **
Education_unknown	1.783	0.629	2.835	1.590
Income_unmarried	0.925	1.044	0.887	0.958
Income_married	1.053	1.035	1.017	0.966
Income_unknown	0.719	0.909	0.792	1.100
Student	0.845	0.751	1.125	1.331
Fulltime	1.088	0.894	1.217	1.119
Smoking	1.035	1.162	0.890	0.860
Emergency	2.598 ***	0.704	3.692 ***	1.421
Abortion	2.214 ***	1.063	2.083 ***	0.941
#Children	0.696	0.905	0.769	1.105
Statistics				
chi²	254.4			
log likelihood	-1442.4			

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

Supplementary table: Multinomial logit analysis of contraceptive choice: using subsample of women who have at least one intercourse per month (N=1184, *Odds-ratios* of the estimated coefficients are presented) [NOT FOR PUBLICATION]

Alternative-specific variables				
Pr(pregnancy)*WTP	0.998			
Pr(STD)	1.000			
Pr(partner's disapproval)	0.968 ***			
Pr(partner's disapproval)*Pill	0.998			
Pr(interruption)	0.990 ***			
Pr(immoral)	1.002			
Pr(minor adverse effect)	0.981 ***			
Pr(serious adverse effect)	0.995			
Pr(side benefit)	1.020 ***			

Individual-specific variables	Base alternative: condom without OC		Base alternative: ineffective methods	
	OC with or without condom	Ineffective methods	OC with or without condom	Condom without OC
WTP	3.386 ***	0.771	4.395 **	1.298
Frequency_6	2.137 ***	1.131	1.889 *	0.884
Frequency_unknown	0.937	0.999	0.938	1.001
Single	0.561	0.527	1.064	1.896
#Partner_5	1.171	1.279	0.915	0.782
Married	0.477	1.855	0.257 *	0.539
Age	1.209 ***	1.097 **	1.102	0.911 **
Education	0.866 ***	0.910	0.951	1.098
Education_unknown	0.909	0.376	2.418	2.661
Income_unmarried	0.932	1.023	0.912	0.978
Income_married	0.962	0.814 **	1.182	1.229 **
Income_unknown	0.874	0.422	2.072	2.370
Student	1.227	0.537	2.283	1.861
Fulltime	1.412	0.807	1.750	1.239
Smoking	0.747	0.913	0.818	1.095
Emergency	2.575 ***	1.004	2.563 **	0.996
Abortion	1.900 **	0.984	1.931 *	1.016
#Children	0.675	0.863	0.782	1.159