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WHICH DO YOU CHOOSE, MARRIAGE OR CAREER? : ECONOMETRIC ANALYSIS USING JPSC PANEL DATA

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ABSTRACT

This research investigates the marriage decision and continued regular employment decision for women in Japan. There is still a negative correlation between marriage and continued regular employment which affects household formation and career success for women. The marriage decision changes females' later working life. Married women, especially married regularly employed women, often resign from their job. In this paper, we assume that women decide to marry and still keep working through considering "imputed income" for marriage and employment. These are important prognostic factors for the choice of marriage or employment. We are also interested in the degree of "marriage intention". There is a possibility that marriage intention describes a preference for being a full-time housewife, and affects not only marriage but also employment. We examine the mechanism of marriage and continued regular employment decisions for women by estimating the bivariate probit model with *the Japanese Panel Survey of Consumers* data from 1993 to 2007. From our estimation results, we found that 1) women decide to marry when imputed income for marriage is high, and imputed income for employment is low, 2) women decide to continue working as regular employees when imputed income for marriage is low even if the effect of imputed income for marriage is not strong, and imputed income for employment is high, 3) marriage intention affects the marriage decision but does not affect continued regular employment decision, 4) the relationship between marriage and continued regular employment for women is negative even if we control for both imputed incomes and marriage intention.

Key words: Imputed income, Marriage intention, Joint equation model.

JEL Classification: J12, J24, C25

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1. INTRODUCTION

This research investigates marriage decision and continued regular employment decision for women in Japan. The choice of marriage or employment is important with respect to long-term partnership. Burdett and Coles(1999) mention that marriage and employment are different. Nevertheless, marriage and employment face a similar problem of finding a long-term partner. Indeed, forming long-term partnerships is a common occurrence in life.

Marriage and employment are alternative choices for women. This alternative problem arises not only in Japan but also in the United States. According to Greenstone and Looney (2012), increasing opportunities for income and employment for women, combined with declining opportunities for less-skilled men have reduced marriage rates in the United States from 1970 to 2010[1]. Opportunities in the workplace have allowed women to become more financially independent, making the economic necessity of marriage less important.

Marriage decision changes females' later working life. Married women, especially regularly employed married women, often resign from their job. This causes the problem that women's career success is hindered. There are some reasons why it is difficult to balance marriage life and working life for women. For example, according to the statistical discrimination theory by Phelps (1972) and Arrow (1976), employers hesitate to give married women chances for job training and promotion because these costs for female employees seem to be sunk costs. This discrimination problem happens because employers do not have enough information whether or not female employees will quit their job soon, and statistically married women tend to resign from their job more often than unmarried women. In fact, Ueda (2007) clarifies that the probabilities of finding full-time work after career interruption are about 18% for university educated women and 12-13% for less educated women, from structural estimation using Japanese data. This may imply that it is difficult for married women who have resigned once to build their career up. In order to remove the difficulty of balancing marriage and employment, the Japanese government has enhanced the Equal Employment Opportunities Law in 1985 and enacted that law in the following year. However, there is still a negative correlation

[1] During the same period, 44% of women aged 30-50 had no independent earnings in 1970 but the value declined to 25% in 2010. Additionally, the median wage for female workers aged 30-50 has risen from roughly $19,000 in 1970 to $30,000 in 2010. Then the crude marriage rate per 1,000 populations has declined from 10.6% in 1970 to 6.8% in 2010 according to the U.S. Census. In the case of Japan, the crude marriage rate has also declined from 10.0% in 1970 to 5.5% in 2010.

between marriage and continued regular employment for women. This correlation has partially affected the low gender empowerment measure[2] in Japan, where the rank is 57th in 109 countries (United Nations Development Programme (2009)).

With respect to marriage, Becker (1973, 1974) made the first economical analysis. According to these analyses, marriage is chosen when the utility from marriage is larger than that from non-marriage. Following Becker's research, many studies were published (Boulier and Rosenzweig (1984), McElroy (1985), Johnson and Skinner (1986, 1988), Haurin (1989), Lichter et al. (1991), Wood (1995), van der Klaauw (1996), Higuchi (2001), Burgess et al. (2003), and Sakai (2009)). Previous studies found that an increase in females' actual earnings decrease marriage utility, while an increase in husbands' earnings increase it. However, the effect of imputed income on both marriage and labor supply for women is not clear. For example, Higuchi (2001) considers imputed income in the labor market and focuses on the effects of imputed income on marriage and continued work in his analysis. However, the estimation does not consider the simultaneity problem of both marriage and female labor supply. Burgess et al. (2003) and Sakai (2009) said that the effect of females' income on marriage is not clear theoretically.

In this paper, we assume that women decide to marry and keep working by considering imputed income for marriage and employment. We regard them as important prognostic factors for women. We are also interested in the degree of marriage intention. There is a possibility that marriage intention describes a preference for being a full-time housewife, and affects not only marriage but also labor supply. We clarify the marriage and continued regular employment decisions for women by estimating the bivariate probit model using *the Japanese Panel Survey of Consumers* data from 1993 to 2007. This paper is organized as follows. In Section 2, we describe the theoretical model. Next, we introduce our research design about the decision rule of marriage and employment in Section 3. Section 4 explains the data set and empirical method in order to investigate marriage and continued regular employment. Section 5 presents and interprets the estimation results. Finally, Section 6 includes conclusions from our study.

[2] The gender empowerment measure consists of several measures such as seats in parliament held by women (% of total), female legislators, senior officials and managers (% of total), female professional and technical workers (% of total), and ratio of estimated female to male earned income. In developed countries such as U.S., France, Germany, Australia and U.K., the percentages of female legislators, senior officials and managers have already reached over 30%, while that in Japan was 9% in 2008. See United Nations Development Programme (2009) for details. In Japan, the percentage of senior officials and managers is 12.4% in 2011 in the Labour Force Survey. Additionally, the percentages of female assistant managers, section chiefs and senior officials (% of total) are only 15.3%, 8.1% and 5.1% in 2011 in the Survey on Wage Structure. Japan's percentages are still low in the world. The shortage of female senior officials and managers creates few job experiences according to the Basic Survey of Gender Equality in Employment Management.

2. THEORETICAL MODEL

This section explains the theoretical model. We propose a joint model involving both spouse search model and job search model[3]. Women seek to maximize $E\sum_{t=0}^{T}\beta^t x_t$[4], where β is the discount factor, x is income at t, and E denotes the expectation operator. Income is ① $x = y + w$ if a marriage proposal at marriage partner's wage, y, and a job offer at wage, w[5], are accepted, ② $x = w$ if a marriage proposal is rejected but a job offer at wage, w, is accepted, ③ $x = y + b$ if a marriage proposal at marriage partner's wage, y, is accepted but a job offer is rejected, and no benefit such as a parents' pecuniary assistance or unemployment insurance, b, is received, ④ $x = b$ if a marriage proposal and a job offer are rejected, and the benefit of being single or having no job, b, is received[6]. However, we formulate the model of both marriage and employment decisions as different optimized actions, while the results of spouse search model and job search model are eventually summarized and affect subjects' utility. We describe the spouse search model and the job search model in order.

2.1. Spouse Search Model

In this sub-section, we explain the spouse search model, focusing on the spouse search correlated with job search model for women. We characterize the spouse search problem as follows;

$$Y(y) = y + \beta Y(y) + wk(w, w^*) \tag{1}$$

$$U^S = b\big(1 - k(w, w^*)\big) + wk(w, w^*) - c(e) + \alpha(e)\beta \int_0^{\bar{y}} \max[Y(y), U^S] dF(y|H) \tag{2}$$

where $Y(y)$ represents the present value of accepting a proposal, and U^S represents the single state utility of continued search. Women may either accept or reject the proposal and cannot reconsider the proposal at a later date. Assume, ceteris paribus, women prefer high wage males to low wage males and so search for marriage partners, in part, over the male wage distribution. We can think of women as essentially drawing male marriage proposals (characterized by the wage) from some known conditional marriage partner's wage distribution, $F(y|H)$. H

[3] A similar approach was suggested by Neal (1999). Unlike our model, Neal's model deals with the two decisions asymmetrically.

[4] We assume that women search for a long time, T, not ad infinitum. In recent years, we can see the tendency to marry later in Japan year by year. So we also dare not set up a definite time span.

[5] In our estimation, we regard imputed income for marriage as marriage proposal, y, and imputed income for employment as job offer, w.

[6] Although we refer to y as the marriage partner's wage, more generally it can capture some measure of the desirability of marriage depending on male's charm. Additionally, we regard w as the set of benefits of a job. b can also include the value of leisure.

represents a set of male observable demographic characteristics such as age, job and education, and y is the marriage partner's wage. Consistent with positive assortative mating, the particular wage distribution over which they search is conditional on their own characteristics. From an empirical standpoint, however, we merely assume that a particular woman's search behavior is affected most strongly by changes in the wage distribution of men who have characteristics similar to her own. b is a parents' pecuniary assistance or unemployment insurance. $k(w, w^*)$ is the dummy variable which is 1 when a woman works and 0 otherwise. Here, the work decision is decided whether a job offer, w, is larger than or equal to the reservation wage, w^*. (We explain this mechanism in the next sub-section.) Thus, both marriage and employment are correlated. $c(e)$ is a search cost and $\alpha(e)$ is an arrival rate for high-wage marriage proposal. $c(e)$ and $\alpha(e)$ are affected by marriage intention, e[7]. The increase in e raises c and α. However, we cannot predict which effect is larger. In Section 5, we confirm this point.

Substituting $Y(y) = y/(1-\beta)$ and $U^s = y^*/(1-\beta)$ into equation (2), we have $y^* = (1-\beta)\left[b\left(1-k(w,w^*)\right) + wk(w,w^*) - c(e)\right] + \alpha(e)\beta\int_0^{\bar{y}} \max[y, y^*]dF(y|H)$. Then, subtracting βy^* from both sides of this equation, simplifying and using integration by parts gives marriage partner's reservation wage as follows;

$$y^* = b\left(1-k(w,w^*)\right) + wk(w,w^*) - c(e) + \alpha(e)\frac{\beta}{1-\beta}\int_{y^*}^{\bar{y}}[1-F(y|H)]dy \qquad (3)$$

Equation (3) indicated that marriage partner's reservation wage, y^*, is just indifferent between accepting a marriage proposal and receiving $Y(y^*)$, and continuing to search in the next period and receiving, U^s. The woman should accept $y \geq y^*$ and reject $y < y^*$. We assume that women remain married after accepted a marriage proposal. Marriage partner's reservation wage equation (3) suggests that the increase in b and w raises y^*.

2.2. Job Search Model

In this sub-section, we explain the model on the job search side. Under similar assumptions as the spouse search model, we set up the job search model as follows;

$$W(w) = w + \beta W(w) + ym(y, y^*) \qquad (4)$$

$$U^n = b + ym(y, y^*) - q(v) + \gamma(v)\beta\int_0^{\bar{w}} \max[W(w), U^n]dG(w|R) \qquad (5)$$

[7] We do not have data about search cost and arrival rate for spouse search, but marriage intention is surveyed by JPSC. In our empirical analysis, we use marriage intention and interpret the result as the mixed effect on search cost and arrival rate for spouse search.

where $W(w)$ represents the present value of accepting a job offer, w, and U^n represents the no job state utility of rejecting a job offer. We calculate the problem in the same way as the spouse search model. Then, the reservation wage is described as follows;

$$w^* = b + ym(y, y^*) - q(v) + \gamma(v)\frac{\beta}{1-\beta}\int_{w^*}^{\overline{w}}[1 - G(w|R)]dw \quad (6)$$

where b is a parents' pecuniary assistance or unemployment insurance. $m(y, y^*)$ is the dummy variable, which is 1 when a woman marries, $y \geq y^*$, and 0 otherwise, $y < y^*$. y is a marriage proposal, and y^* is a marriage partner's reservation wage. The increase in b and y raises w^*. $q(v)$ is a search cost, and $\gamma(v)$ is the arrival rate for a high-wage job offer. $q(v)$ and $\gamma(v)$ are affected by work intention, v. The increase in v raises q and γ. $G(w|R)$ is the conditional female wage distribution. R represents a set of job offers' observable characteristics. The woman should accept $w \geq w^*$, that is, $k = 1$, and reject $w < w^*$, that is, $k = 0$.

3. RESEARCH DESIGN

In this section, we refer to our research design based on the theoretical model in Section 2. Related literature does not focus on these two decisions. We investigate two theoretical models: 1) the spouse search model in which women marry when a marriage proposal is larger than or equal to their reservation wage and vice versa[8], and 2) the job search model in which women work when a job offer is larger than or equal to their reservation wage and vice versa[9]. Table 1 summarizes the female decision rule between marriage and employment assumed in the above theoretical models.

Table 1: Female Decision Rule between Marriage and Employment

(Marry, Work)		Job Offer	
		≧ Reservation Wage	＜ Reservation Wage
Marriage Proposal	≧ Reservation Wage	① (1, 1)	③ (1, 0)
	＜ Reservation Wage	② (0, 1)	④ (0, 0)

・In Table 1, marry=1 and work =1 means women decide to marry and to work, and vice versa.
Source: Authors made.

In case ①, when a marriage proposal and a job offer are not less than their reservation wage, women decide to marry and to work. In case ②, when a marriage proposal is less than

[8] Lippman and McCall (1976) and Rogerson et al. (2005) are literature surveys in this subject.
[9] For example, Mortensen (1988) and Ermish (2003) were already published as related literature.

their reservation wage, but a job offer is not less than their reservation wage, women decide not to marry and to work. In case ③, when a marriage proposal is not less than their reservation wage, but a job offer is less than their reservation wage, women decide to marry and not to work. In case ④, when a marriage proposal and a job offer are less than their reservation wage, women decide not to marry and not to work. In Section 5, we estimate the model in order to investigate the proposed female decision rule[10].

4. DATA SET AND ECONOMETRIC METHOD

4.1. Data Set

In this sub-section, we explain the data set and empirical method in order to investigate women's decision rule between marriage and continued regular employment. The data we use is *the Japanese Panel Survey of Consumers* (JPSC) from 1993 to 2007. Women, whether married or single, aged 24-34 years old in the first year are surveyed. In 1993, when the first survey was conducted, there were 1500 participants (cohort a). After that, 500 participants were added in 1997 (cohort b) and 836 participants were added in 2003 (cohort c). JPSC has a lot of information about women and their relations such as husband, parents and so on. It is useful to investigate marriage decision and employment decision. We use this data as a statistical sample here.

Table 2 presents the descriptive statistics divided into four combinations. Self-employed business owners, family employees, freelance professionals, students, women who did not work as regular employees in the previous term, married women in the previous term, and women with children are all excluded from the sample. That is, the sample is composed of women who do not have a husband and children, and who worked as regular employees in the previous term[11]. In order to consider causal relationships, we use independent variables as lagged variables.

[10] In our estimation, however, we deal with the continued regular employment case because we need a sample in which women worked in the previous term in order to calculate imputed incomes for marriage and continued regular employment. So in our empirical model, we assume that women continue working when a job offer is larger than or equal to their reservation wage, and vice versa.

[11] Thus, a divorce case is beyond our research. In this sample, women start searching since when they do not have a spouse and work as a regular employee, and they finish searching when they get married. So the rate of married women is low.

Table 2: Descriptive Statistics

Variables' Name	Obs	Mean	St. Dev.	Min	Max
Marriage Dummy	2091	0.035	0.185	0	1
Continued Regular Employment Dummy	2091	0.903	0.296	0	1
Sample 1: (m, w) = (1, 1)					
Imputed Income for Marriage	45	6.512	0.179	6.222	7.070
Imputed Income for Employment	45	5.494	0.207	4.964	5.913
Marriage Intensity Dummy	45	0.933	0.252	0	1
Living with Parents Dummy	45	0.667	0.477	0	1
City Dummy	45	0.600	0.495	0	1
Town Dummy	45	0.111	0.318	0	1
Sample 2: (m, w) = (0, 1)					
Imputed Income for Marriage	1843	6.518	0.182	6.164	7.266
Imputed Income for Employment	1843	5.549	0.229	4.724	6.196
Marriage Intensity Dummy	1843	0.748	0.434	0	1
Living with Parents Dummy	1843	0.711	0.454	0	1
City Dummy	1843	0.531	0.499	0	1
Town Dummy	1843	0.122	0.327	0	1
Sample 3: (m, w) = (1, 0)					
Imputed Income for Marriage	29	6.429	0.130	6.273	6.796
Imputed Income for Employment	29	5.413	0.178	5.052	5.757
Marriage Intensity Dummy	29	0.862	0.351	0	1
Living with Parents Dummy	29	0.621	0.494	0	1
City Dummy	29	0.655	0.484	0	1
Town Dummy	29	0.138	0.351	0	1
Sample 4: (m, w) = (0, 0)					
Imputed Income for Marriage	174	6.468	0.153	6.208	6.893
Imputed Income for Employment	174	5.394	0.227	4.850	5.837
Marriage Intensity Dummy	174	0.730	0.445	0	1
Living with Parents Dummy	174	0.724	0.448	0	1
City Dummy	174	0.540	0.500	0	1
Town Dummy	174	0.115	0.320	0	1

・The independent variables are lagged variables.
・Outliers that are larger and smaller than average value ± standard deviation × 3 are excluded.
・The gray zone indicates dependent variables.
・we show the descriptive statistics in the case of Model 4 including all independent variables in Table 3.
Source: JPSC, 1993-2007

The variables using this empirical analysis are as follows. We use marriage dummy and continued regular employment dummy as dependent variables. Marriage dummy is a dummy variable which is 1 when women get married and 0 otherwise. Continued regular employment dummy is a dummy variable which is 1 when women continue to work as regular employees and 0 otherwise. Then we define the women who continue to work as regular employees as women who worked as regular employees in previous term, and still work as regular employees

in this term. We estimate the model using the sample of women who decide to work as regular employees, who decide to work as non-regular employees, and who decide not to work in this term. Because career accumulation can be achieved only by working as regular employees, we focus on whether women work as regular employees or not.

We use the following variables as independent variables. In order to investigate the female decision rule between marriage and continued regular employment, we need the value of marriage proposals and job offers. However, we have a problem that the latent incomes for unmarried and unemployed women cannot be observed in general. In order to deal with this problem, we use imputed income as the proxy variable of marriage proposal and job offer. Then, we calculate two imputed incomes by using a statistical method. In particular, we estimate the earning function and calculate imputed incomes from the estimated incomes. However, when we estimate the earning function, it is a possibility that we will face the problem of sample selection bias. We deal with this problem by using Heckman's two-stage estimation model[12]. This method was also used by Higuchi (2001).

First, we explain the method used to calculate imputed income for marriage. In the first stage, we use age, square of age, schooling dummy (The reference category is high school) as independent variables, and marriage dummy as dependent variable. In the second stage, we estimate the husband's earning function using female's variables. We use female's tenure of work, square of tenure of work, regular employment dummy (The reference employment is non-regular employment), industry dummy (The reference industry is agriculture and forest industry), company size dummy (The reference size is company size ($1 \sim 4$)), schooling dummy (The reference category is high school), year dummy (The reference year is 1993) as independent variables, and the logarithmic value of husband's actual income as dependent variables. (See the descriptive statistics in Appendix Table A1 and the estimation result in Appendix Table A2 for details.) Based on the estimation results in Appendix A2, we calculate imputed income for marriage for both married and unmarried women.

Next, we explain the method used for imputed income for employment. In the first stage, we use the same independent variables as we used to estimate the first stage regression with respect to imputed income for marriage, and employment dummy as dependent variable. In the second stage, we estimate the female's earning function using the same independent variables as we used to estimate the second stage regression with respect to imputed income for marriage, and the logarithmic value of female's actual income as dependent variable. See the descriptive

[12] This estimation method was devised by Heckman (1979). It enables us to solve the employment function and the earning function. See Heckman (1979) for details.

statistics in Appendix Table A3, and the estimation result in Appendix Table A4 for details. Based on the estimation results in Appendix A4, we calculate imputed income for employment for both employed and unemployed women. The purpose of our study is to confirm the sign of the coefficient of imputed income for marriage and employment. Before estimation, we predict that imputed income for marriage has a positive effect on marriage but has a negative effect on continued regular employment, and imputed income for employment has a negative effect on marriage but has a positive effect on continued regular employment. Although we focus on incomes, studying the effect of marriage on income change, such as marriage premium and marriage penalty is beyond the scope of our study.

Marriage intention is a dummy variable which is 1 when women have high marriage intention and 0 otherwise. The JPSC panel data asks respondents with no spouse about their marriage intention. For the question on marriage intention, "Do you want to marry?", there are five responses available: 1) I am going to marry soon, 2) I want to marry as soon as I can, 3) I want to marry, but not right now, 4) I do not necessarily want to marry, and 5) I do not want to marry. We define the samples as high marriage intention when women reply with answer 2 and 3, and define as low marriage intention when women reply with answer 4, or 5. We exclude the samples which women choose the answer 1 because women who choose this answer already decided to marry. Sakai (2009) also removed these samples. As for married women, we use the response before marriage. Marriage intention is an important variable in order to control for preference for being a full-time housewife, and test our hypothesis about marriage and continued regular employment decisions for women precisely. In our theoretical model, there is a possibility that marriage intention negatively or positively affects the marriage decision through search cost and arrival rate. Additionally, if marriage intention and work intention are symmetrically correlated, this variable may affect the continued regular employment decision, that is, it will be a proxy variable of work intention. So we also test whether this variable has a statistically significant effect on continued regular employment decision.

We also use the following independent variables as control variables. Living with parents is a dummy variable which is 1 when women live with their parents and the family budget is consolidated. We think that women living with their parents are satisfied with the convenience which may affect both marriage and employment. This variable may be useful to observe the effect of benefit for single or no job. If this estimator has a negative sign, we interpret that the increase in the benefit for single or no job increases the reservation wages for marriage and employment, and prevents acceptance of a marriage proposal and a job offer. City size dummies are large city dummy, city dummy and town dummy, and we use the large city as the reference

city size. The definition of each city size depends on JPSC. The reason for including this dummy is that some previous literature also point out the relationship between marriage and heterogeneity of the local marriage market (Lichter et al. (1991), Wood (1995)).

4.2. Econometric Method

In this sub-section, we explain the econometric method. The concern of this paper is to confirm the effects of imputed income for marriage and employment, and marriage intention on female decisions such as marriage and continued regular employment, and the negative relationship between marriage and continued regular employment explicitly. Previous studies, which estimate the joint equation model of marriage and female labor supply such as McElroy (1985), Johnson and Skinner (1986, 1988), Haurin (1989), van der Klaauw (1996), also focus on the endogeneity problem. In order to consider this problem, we estimate the bivariate probit model[13]. This model considers two binary outcomes. The outcomes are potentially related after conditioning on regressors. The relatedness occurs via correlation of the error that appears in the index function model formation of the binary outcome model. Thus, the bivariate probit model is a kind of seemingly unrelated regression (SUR) model, where outcomes do not directly depend on each other, that is, the error terms for the outcomes are correlated. From this point, we think that to use the bivariate probit model is consistent with the theoretical model. The estimation model is described as follows;

$$
\begin{gathered}
m^* = \mathrm{x}_1'\beta_1 + u_1, \quad m = \begin{cases} 1 & \text{if } m^* > 0 \\ 0 & \text{if } m^* \le 0 \end{cases} \\
k^* = \mathrm{x}_2'\beta_2 + u_2, \quad k = \begin{cases} 1 & \text{if } k^* > 0 \\ 0 & \text{if } k^* \le 0 \end{cases} \\
E(u_1) = E(u_2) = 0, \quad Var(u_1) = Var(u_2) = 1, \quad Cov(u_1, u_2) = \rho \\
i = 1, \dots, N; \; t = 1, \dots, T
\end{gathered} \tag{7}
$$

where m is the marriage dummy, k is the continued regular employment dummy, m^* and k^* are unobserved latent variables, $m^* = y - y^*$ and $k^* = w - w^*$. x_1 and x_2 are vectors of independent variables (see on sub-section 4.1 in details). β_1 and β_2 are vectors of parameters. u_1 and u_2 are error terms, $E(u_1)$ and $E(u_2)$ are means of error terms, $Var(u_1)$ and $Var(u_2)$ are variances of error terms, and $Cov(u_1, u_2)$ is a covariance of error terms. The error terms are jointly normally distributed with means of 0, variances of 1 and correlations of ρ. Here, ρ, the

[13] As for the joint equation model, see on Nelson and Olson (1978), Amemiya (1979), Lee et al. (1980) and Lee (1981) in details.

covariance between the error terms of marriage decision and continued regular employment decision, describes the relationship between marriage and continued regular employment. If this value is negative, marriage and continued regular employment are alternatives. And also, the model collapses to two separate probit models for m and k if $\rho = 0$.

One of the merits of using the bivariate probit model is that we can obviously show the relationship between marriage and continued regular employment. In addition, we can estimate the two probit models and find whether imputed incomes for marriage and employment, and marriage intention affect both marriage and continued regular employment decisions. Using this method, we clarify the effects of two imputed incomes and marriage intention on female decisions, and the negative relationship between marriage and continued regular employment[14].

5. ESTIMATION RESULTS

Table 3 shows the estimation results of the bivariate probit model. We estimate 4 different models in order to check the robustness. We comment on the estimation results for each independent variable in Table 3.

5.1. Effect on Marriage

The coefficients of imputed income for marriage are significantly positive in Model 1 and Model 3 in which marriage intention is not included. These results suggest that imputed income for marriage encourages women to get married. It is also consistent with the female decision rule. All coefficients of imputed income for employment are significantly negative. The negative sign means that women get married if the imputed income for employment is low. These results are also consistent with the female decision rule between marriage and employment, and imply that the proxy variable for job offers is valid. All coefficients of marriage intention are significantly positive. These results suggest that women with high marriage intention tend to get married as expected. We also found that the coefficients of imputed income for marriage are insignificant in the case of Model 2 and Model 4 which

[14] There may be problems from using answers of the same women for different years as data in the bivariate probit model. Since we cannot decide for how long a time we should use data of women who never marry, we generally use the unbalanced panel data for the search model. With respect to these problems, Wolpin (1987) also used unbalanced panel data in a similar way. We also confirm that the difference for the same respondent between two years, excluding the case that she married, is not small, even if women who never marry are included in the sample. For example, marriage intention often changes. In addition, we assume that women search randomly, and each search is independent of past searches. All things considered, the bivariate probit model using unbalanced panel data is not necessarily invalid. An alternative method for our research may be multiple hazard analysis. We intend to use this method in a future study.

include marriage intention. In the models including marriage intention, the significances of both imputed incomes for marriage and employment declines. So the effect of marriage intention on the marriage decision is stronger than that of two imputed incomes.

The effects of other independent variables are as follows. The coefficient of living with parents dummy is negative and significant at 10% level in Model 4, but insignificant in Model 3. So living with parents may delay the timing of marriage but the effect is not strong. All coefficients of city size dummy variables are not significant. Marriage probability is indifferent between town, city and large city.

5.2. Effect on Employment

The coefficients of imputed income for marriage are negative and significant at 10% level in Model 1 and Model 3, but insignificant in Model 2 and Model 4 in which marriage intention is included. These results suggest that imputed income for marriage does not have a strong effect on women who decide to keep working as regular employees. We think that regularly employed women earn enough income for their life, so imputed income for marriage does not have a large impact on the continued regular employment decision[15]. All coefficients of imputed income for employment are positive and significant at 1% level. These estimation results are as theoretically predicted. All coefficients of marriage intention are insignificant. High marriage intention does not have any effect on the decision whether to work as regular employees.

The effects of other independent variables are as follows. All coefficients of living with parents dummy variables are insignificant. So living with parents does not affect the continued regular employment decision. The coefficients of city size dummies are also insignificant. This estimation result suggests that the decision to keep working as a regular employee is not different among cities.

5.3. Relationship between Marriage and Employment

The relationship between marriage and continued regular employment for women is negative even if we control both imputed incomes and marriage intention. So there are other factors which cause a negative correlation between marriage and continued regular employment. In Section 1, we introduced the statistical discrimination theory of Phelps (1972) and Arrow (1976). Employers' discrimination against women is one such factor. However, JPSC does not have such information about companies where women work. This is a residual problem. The

[15] Another possibility is that imputed income for employment and imputed income for marriage are closely correlated. But the correlation coefficient is about 0.438.

other problem of fertility and female labor supply is often pointed out, and the Japanese government tried to increase both fertility and labor supply by the Child Care and Family Care Leave Act enhanced in 1991, and enacted in the following year. However, we found that the related problem of marriage and continued regular employment for women is still not resolved 20 years later.

Table 3: Estimation Results of the Bivariate Probit Model

Dependent Variable: Marriage Dummy	Model 1	Model 2	Model 3	Model 4
Imputed Income for Marriage	0.592	-0.149	0.596	-0.058
	[2.51]**	[-0.35]	[2.48]**	[-0.14]
Imputed Income for Employment	-0.942	-0.516	-0.944	-0.530
	[-5.43]***	[-1.71]*	[-5.32]***	[-1.79]*
Marriage Intensity Dummy		0.511		0.557
		[3.22]***		[3.59]***
Living with Parents Dummy			0.095	-0.206
			[1.12]	[-1.82]*
City Dummy			0.076	0.170
			[0.92]	[1.36]
Town Dummy			0.037	0.162
			[0.30]	[0.87]
Constant	-0.045	1.589	-0.186	1.047
	[-0.04]	[0.81]	[-0.15]	[0.51]
Dependent Variable: Continued Regular Employment Dummy	Model 1	Model 2	Model 3	Model 4
Imputed Income for Marriage	-0.427	-0.344	-0.384	-0.287
	[-1.92]*	[-1.30]	[-1.69]*	[-1.07]
Imputed Income for Employment	1.572	1.602	1.611	1.635
	[9.19]***	[8.16]***	[9.33]***	[8.21]***
Marriage Intensity Dummy		0.021		0.046
		[0.23]		[0.50]
Living with Parents Dummy			-0.0004	-0.010
			[-0.01]	[-0.12]
City Dummy			0.073	0.083
			[0.95]	[0.94]
Town Dummy			0.058	0.145
			[0.52]	[1.07]
Constant	-4.638	-5.282	-5.164	-5.896
	[-3.82]***	[-3.78]***	[-4.07]***	[-4.02]***
Rho	-0.611	-0.541	-0.601	-0.527
	[-10.63]***	[-6.69]***	[-10.39]***	[-6.42]***
Sample Size	2516	2097	2509	2091
Log Pseudolikelihood	-1518.668	-929.052	-1499.309	-911.434

・The independent variables are lagged variables.
・***, **, and * denotes statistically significant at 1%, 5%, 10% level, respectively. The estimated standard errors are a robust standard error. We show coefficients and z values in [ ].
Source: JPSC, 1993-2007.

6. CONCLUDING REMARKS

This study investigated the negative relationship between marriage and continued regular employment which affects household formation and career success for women. Recently, opportunities for income and employment for women have increased. Such situations allowed women to become more financially independent and caused the low marriage rate. We examine the mechanism of marriage and continued regular employment decisions for women by the empirical approach relying on the data from *the Japanese Panel Survey of Consumers* (JPSC) from 1993 to 2007. In this paper, we focused on the three prognostic factors of imputed incomes for marriage and employment, and marriage intention.

From our estimation results, we found that 1) women decide to marry when imputed income for marriage is high, and imputed income for employment is low, 2) women decide to continue working as regular employees when imputed income for marriage is low but the effect of imputed income for marriage is not strong, and imputed income for employment is high, 3) marriage intention affects the marriage decision but does not affect continued regular employment decision, 4) the relationship between marriage and continued regular employment for women is negative even if we control both imputed incomes and marriage intention.

One of our contributions is that we used a joint model involving both a spouse search model and a job search model. In previous studies, these search models were investigated separately. Since we used this joint search model, we could find that the imputed incomes for marriage and employment affect both marriage and continued regular employment decisions, and that these decisions are negatively correlated. From our empirical analysis, we confirmed that the conflict between marriage and continued regular employment for women exists even now, although several counter-measures were implemented.

In addition, we found that the effect of marriage intention on marriage decision is stronger than that of both imputed incomes. This result indicates that there is the possibility that women do not accept a marriage proposal even if they meet a high-wage marriage partner. Thus, the increase in marriage intention is more effective to raise the marriage rate. In our study, we assumed that marriage intention is an exogenous variable. However, we need to examine the factors which positively affect marriage intention. We considered only the financial benefit from marriage. In a future study, we will investigate other factors which encourage women to get married, and use an empirical procedure which can identify other benefits from marriage and continued regular employment.

Appendix Table A1: Descriptive Statistics

Variables' Name	Obs	Mean	St. Dev.	Min	Max
Earning Function					
Husband's Actual Income	5270	6.132	0.437	2.890	7.218
Tenure	5270	8.856	5.453	1	30
$Tenure^2$	5270	108.164	123.489	1	900
Regular Employment Dummy	5270	0.368	0.482	0	1
Marine Products Ind. Dummy	5270	0.002	0.050	0	1
Mining Ind. Dummy	5270	0.0002	0.014	0	1
Building Ind. Dummy	5270	0.019	0.138	0	1
Manufacturing Ind. Dummy	5270	0.153	0.360	0	1
Wholesale & Retailing Ind. Dummy	5270	0.268	0.443	0	1
Finance, Insurance & Real Estate Ind. Dummy	5270	0.070	0.255	0	1
Transport & Telecom Ind. Dummy	5270	0.025	0.157	0	1
Electric, Gas, Water & Heat Supply Ind. Dummy	5270	0.005	0.071	0	1
Service Ind. Dummy	5270	0.318	0.466	0	1
Official Business Dummy	5270	0.133	0.339	0	1
Other Inds. Dummy	5270	0.001	0.028	0	1
Company Size(５～９) Dummy	5270	0.088	0.283	0	1
Company Size(10～29) Dummy	5270	0.161	0.368	0	1
Company Size(30～99) Dummy	5270	0.154	0.361	0	1
Company Size(100～499) Dummy	5270	0.186	0.389	0	1
Company Size(500～999) Dummy	5270	0.059	0.235	0	1
Company Size(1000 or more) Dummy	5270	0.122	0.327	0	1
Public Office Dummy	5270	0.137	0.344	0	1
Jr. College Dummy	5270	0.374	0.484	0	1
University Dummy	5270	0.112	0.316	0	1
Year Dummy			YES		
Marriage Function					
Marriage Dummy	10470	0.503	0.500	0	1
Age	10470	33.949	5.790	24	48
Age^2	10470	1186.020	404.779	576	2304
Jr. College Dummy	10470	0.379	0.485	0	1
University Dummy	10470	0.155	0.362	0	1

・Outliers that are larger or smaller than average value ± standard deviation × 3 are excluded.
・The gray zone indicates dependent variables.
・We also use year dummies. However we cannot display these descriptive statistics because there is insufficient space.
Source: JPSC, 1993-2007

Appendix Table A2: Estimation Result of Heckman's Two-Stage Estimation Model

Dependent Variable: Husband's Actual Income			
Tenure	0.002	Company size(５～９) Dummy	0.003
	[0.41]		[0.10]
$Tenure^2$	-0.0001	Company size(10～29) Dummy	-0.042
	[-0.68]		[-1.78]*
Regular Employment Dummy	-0.058	Company size(30～99) Dummy	-0.070
	[-3.94]***		[-2.93]***
Marine Products Ind. Dummy	-0.262	Company size(100～499) Dummy	0.002
	[-1.83]*		[0.10]
Mining Ind. Dummy	0.485	Company size(500～999) Dummy	0.041
	[1.33]		[1.32]
Building Ind. Dummy	-0.070	Company size(1000 or more) Dummy	0.092
	[-0.74]		[3.50]***
Manufacturing Ind. Dummy	-0.265	Public Office Dummy	0.097
	[-3.05]***		[1.23]
Wholesale & Retailing Ind. Dummy	-0.210	Jr. College Dummy	0.108
	[-2.44]**		[7.30]***
Finance, Insurance & Real Estate Ind. Dummy	-0.152	University Dummy	0.342
	[-1.71]*		[14.64]***
Transport & Telecom Ind. Dummy	-0.179	Year Dummy	YES
	[-1.93]*	Constant	6.612
Electric, Gas, Water & Heat Supply Ind. Dummy	0.115		[66.21]***
	[0.97]	Inverse Mills Ratio	-0.464
Service Ind. Dummy	-0.250		[-16.12]***
	[-2.90]***		
Official Business Dummy	-0.265		
	[-2.28]**		
Other Inds. Dummy	0.263		
	[1.22]		
Dependent Variable: Marriage Dummy			
Age	0.458	Jr. College Dummy	-0.051
	[17.04]***		[-1.79]*
Age^2	-0.005	University Dummy	-0.321
	[-14.11]***		[-8.32]***
		Constant	-9.098
			[-19.56]***
Number of Observations	10470		
Censored Observations	5200		
Uncensored Observations	5270		

・***, **, and * denotes statistically significant at 1%, 5%, 10% level, respectively. We show coefficients and z values in [ ].

・We also use year dummies in the estimation. However we cannot display the estimation result because there is insufficient space.

Source: JPSC, 1993-2007.

Appendix Table A3: Descriptive Statistics

Variables' Name	Obs	Mean	St. Dev.	Min	Max
Earning Function					
Female's Actual Income	9310	5.158	0.831	0.693	6.510
Tenure	9310	8.483	5.293	1	29
$Tenure^2$	9310	99.971	116.829	1	841
Regular Employment Dummy	9310	0.532	0.499	0	1
Marine Products Ind. Dummy	9310	0.004	0.065	0	1
Mining Ind. Dummy	9310	0.001	0.036	0	1
Building Ind. Dummy	9310	0.038	0.192	0	1
Manufacturing Ind. Dummy	9310	0.156	0.363	0	1
Wholesale & Retailing Ind. Dummy	9310	0.236	0.425	0	1
Finance, Insurance & Real Estate Ind. Dummy	9310	0.084	0.278	0	1
Transport & Telecom Ind. Dummy	9310	0.034	0.180	0	1
Electric, Gas, Water & Heat Supply Ind. Dummy	9310	0.004	0.065	0	1
Service Ind. Dummy	9310	0.328	0.470	0	1
Official Business Dummy	9310	0.109	0.312	0	1
Other Inds. Dummy	9310	0.001	0.027	0	1
Company Size(５～９) Dummy	9310	0.076	0.266	0	1
Company Size(10～29) Dummy	9310	0.150	0.357	0	1
Company Size(30～99) Dummy	9310	0.150	0.357	0	1
Company Size(100～499) Dummy	9310	0.198	0.399	0	1
Company Size(500～999) Dummy	9310	0.067	0.250	0	1
Company Size(1000 or more) Dummy	9310	0.163	0.369	0	1
Public Office Dummy	9310	0.112	0.316	0	1
Jr. College Dummy	9310	0.382	0.486	0	1
University Dummy	9310	0.150	0.357	0	1
Year Dummy			YES		
Employment Function					
Employment dummy	16053	0.580	0.494	0	1
Age	16053	33.981	5.448	24	48
Age^2	16053	1184.363	381.584	576	2304
Jr. College Dummy	16053	0.389	0.488	0	1
University Dummy	16053	0.134	0.340	0	1

・Outliers that are larger or smaller than average value ± standard deviation × 3 are excluded.
・The gray zone indicates dependent variables.
・We also use year dummies. However we cannot display these descriptive statistics because there is insufficient space.
Source: JPSC, 1993-2007

Appendix Table A4: Estimation Result of Heckman's Two-Stage Estimation Model

Dependent Variable: Female's Actual Income			
Tenure	0.023	Company size(５～９) Dummy	0.058
	[6.12]***		[2.00]**
$Tenure^2$	0.0002	Company size(10～29) Dummy	0.165
	[1.17]		[6.50]***
Regular Employment Dummy	0.934	Company size(30～99) Dummy	0.165
	[68.35]***		[6.47]***
Marine Products Ind. Dummy	0.518	Company size(100～499) Dummy	0.270
	[3.76]***		[10.97]***
Mining Ind. Dummy	0.444	Company size(500～999) Dummy	0.380
	[2.29]**		[12.31]***
Building Ind. Dummy	0.581	Company size(1000 or more) Dummy	0.391
	[5.33]***		[14.77]***
Manufacturing Ind. Dummy	0.534	Public Office Dummy	0.239
	[5.05]***		[2.72]***
Wholesale & Retailing Ind. Dummy	0.444	Jr. College Dummy	0.141
	[4.23]***		[10.35]***
Finance, Insurance & Real Estate Ind. Dummy	0.532	University Dummy	0.323
	[4.97]***		[14.86]***
Transport & Telecom Ind. Dummy	0.612	Year Dummy	YES
	[5.59]***	Constant	3.454
Electric, Gas, Water & Heat Supply Ind. Dummy	0.574		[28.56]***
	[4.16]***	Inverse Mills Ratio	0.231
Service Ind. Dummy	0.545		[2.94]***
	[5.18]***		
Official Business Dummy	0.661		
	[4.86]***		
Other Inds. Dummy	0.351		
	[1.48]		
Dependent Variable: Employmen Dummy			
Age	-0.270	Jr. College Dummy	0.003
	[-12.56]***		[0.12]
Age^2	0.004	University Dummy	0.224
	[13.06]***		[7.11]***
		Constant	4.589
			[12.41]***
Number of Observations	16053		
Censored Observations	6743		
Uncensored Observations	9310		

・***, **, and * denotes statistically significant at 1%, 5%, 10% level, respectively. We show coefficients and z values in [ ].

・We also use year dummies in the estimation. However we cannot display the estimation result because there is insufficient space.

Source: JPSC, 1993-2007.

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