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by

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Abstract

This paper empirically examines the life-time joint decision problem of marriage, childbearing, and labor force participation for women in Japan, motivated by the recent decrease in the number of marriages and the total fertility rate. Using the 1993-95 Japanese Panel Surveys of Consumption, the structural estimation result of a dynamic decision model suggests that women bene…t from labor force participation, and that this gain exceed …nancial bene…ts from earnings. However, the probability of …nding full-time work within a year for housewives or part-time workers is estimated as less than 20%, and is even lower for less-educated women. As regards family formation, utility gains and losses from the …rst child are insigni…cant or rather negative, those from the second child are signi…cantly positive, those from the third or subsequent child are generally insigni…cant. Utility gains and losses from marriage are signi…cantly negative if one leaves out …nancial advantages gained from the husband's earnings. The estimation using a recent sample suggests that the sum of the estimated values of marriage and two children as a typical family unit is negative for women in the labor force.

Keywords: dynamic programming, female labor supply, fertility, marriage

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1 Introduction

In the last two decades, the Japanese society has experienced a drastic transformation in perspectives regarding family formation behavior and women's social roles. A rapid decline in fertility increases speed in addition to level of aging of the society, and thus increases the need of immediate reform of the social security system. At the same time, participation of women in the labor force has steadily proceeded across all age groups; this change calls for adequate social services that support working mothers.

Nowadays, an increasing number of young people delay or avoid marriage; the ratio of never-married women aged 25-34 increased from 14.8% in 1975 to 34.4% in 1995. In Japan, most newborn babies are from married mothers. The recent decline in married rates has led to a rapid decline in fertility; in fact, the total fertility rate fell down to 1.34 in 1999, which is one of the lowest rates among advanced countries.

The timing of marriage, childbearing, and labor force participation in a woman's life are likely to a¤ect her welfare. It goes without saying that labor force participation directly contributes to her …nancial situation. Moreover, formation of a family within the context of a marriage is considered to bring a woman …nancial bene…ts (Becker, 1973; 1974). In addition, however, there are …nancial costs in raising children. Satisfaction with social and private life might be another factor to be considered. Furthermore, labor force participation and family structure are deeply related to a woman's welfare through the allocation of time (Becker, 1965; Gronau, 1973). This is particularly the case in Japan, where the average time a husband spends on housework is exceptionally short (Juster and Sta¤ord, 1991).

A number of empirical studies have shown that the female labor supply is closely related to the family's situations as regards income of the husband or the existence of children (Killingsworth and Heckman, 1986). Most of these studies, however, have analyzed the female labor supply by focusing only on married women and treating family conditions as exogenous. Contrary to this line of studies, there is an increasing awareness of the importance of the simultaneity in decisions regarding labor

supply and family formation; these include marital status and childbearing as wells as life-cycle aspects such as the timing and spacing of family formation that a¤ects female labor supply (Mo¢t, 1984).

Recently, a growing literature has applied estimable stochastic dynamic models of discrete choice for women's life-cycle choice problems (Eckstein and Wolpin, 1989b). Wolpin (1984)'s pioneering work sets up a complete framework of a structural estimation of a dynamic programming model; it analyzes a fertility decision problem along with uncertainty in infant survival in Malaysia. Also, Ahn (1995) empirically analyzes a choice problem of fertility to estimate the perceptive value of children according to gender in Korea. As regards the female labor supply, Hotz and Miller (1988), Eckstein and Wolpin (1989a), and Hsylop (1999) examine the decision of labor force participation of married women. Their models include contraceptive choices with uncertainty (Hotz and Miller, 1988), the existence of children (Eckstein and Wolpin, 1989a), and the uncertainty of job search (Hsylop, 1999).

These studies on fertility and female labor supply in life-cycle remain focused on the behavior of women who are continuously married. However, as addressed by the seminal work by Becker (1973, 1974), utility gains from marriage can di¤er according to …nancial bene…ts, and thus, the decision of marital timing could be endogenously chosen depending on the (potential) life-cycle income of the woman and her mate. Work by Van Der Klaauw (1996) marks the …rst contribution to an integration of decisions regarding marital status into the labor supply behavior of women. That study …nds that utility gains from marriage are a¤ected by female wage rates and the husband's earnings.

This paper attempts to integrate a life-cycle perspective with all three issues; namely, marriage, childbearing, and labor force participation among women. We will investigate costs and bene…ts of marriage, children, and market work as perceived by women in Japan, where fewer marriages and children have become a social problem as described. This study applies a dynamic utility maximization problem that involves utility gains and losses from market work, children by birth order, and marriage. The model also allows for uncertainty as regards …nding full-time work; the purpose of this is to investigate whether or not job opportunities are limited for Japanese women who hope to return to the labor market after a career interruption across childbearing.

Findings from a structural estimation of the dynamic decision model indicate several interesting aspects of Japanese women's decisions as regards marriage, childbearing, and labor force participation. The estimation result suggests that women bene…t from labor force participation, and that this gain exceed …nancial bene…ts from earnings. However, the probability of …nding full-time work within a year for housewives or part-time workers is estimated as less than 20%, and is even lower for less-educated women. As regards family formation, utility gains and losses from the …rst child are insigni…cant or rather negative, those from the second child are signi…cantly positive, those from the third or subsequent child are generally insigni…cant. Utility gains and losses from marriage are signi…cantly negative if one leaves out …nancial advantages gained from the husband's earnings. The estimation using a recent sample suggests that the sum of the estimated values of marriage and two children as a typical family unit is negative for women in the labor force.

The rest of this paper is organized as follows. Section 2 presents a dynamic model of the joint decision problem for fertile-aged women regarding marriage, childbearing, and labor force participation with uncertain job search for a full-time position; an empirical framework in included. Section 3 discusses the data sources and variables, as well as assumptions and limitations. Section 4 presents and evaluates the estimation results, and examines alternative speci…cations and estimations. Section 5 gives concluding remarks.

2 The Model

2.1 Life-time Optimization Problem

In considering women's choices during one life-cycle, it can be helpful to note that some choices can be re-selected, whereas other choices may not be easily cancelled; parents must take care of children until they come of age, and divorce is (…nancially and socially) costly or even, at times, legally impossible without spousal consent in Japan. In addition, it is possible that a woman will face di¢culty when trying to …nd a full-time position after she resigns from the labor market [1].

[1] According to Nihon Rodo Kenkyu Kiko (1993), at least 61% of the companies that newly employed women at age 30 or older set an age limit; almost 40% of these companies had age limits of 40 or younger. They speculate that the actual conditions are more severe. In Japan, it is common practice for married women to return to the labor market as part-time workers; regular employment accounts for as little as 29.7% of working wives aged 35-54. In contrast, 76.5%

Therefore, a dynamic framework presented here integrates a woman's decisions as regards marriage, childbearing, and labor force participation in a life-cycle. Furthermore, these issues are considered simultaneously. Socio-economic conditions in Japan are also considered. Several assumptions, described later, are imposed to maintain simplicity of the analytical model, the tractability of the empirical analysis, computability, and due to limitations of data.

It is assumed that, after leaving school, a woman will behave in a manner that will maximize the present value of utility over a known …nite horizon T by choosing whether or not to get married, whether or not to have an additional child, and whether or not to work. The woman expects that she will live without uncertainty until the last economic period T. The objective of the woman is to maximize

$$E \sum_{t=1}^{T} \pm^{t-1} u(c_t; m_t; b_t; j_t; \bar{\ }); \tag{1}$$

where E denotes the expectations operator, ± is a discount factor, u() is an instantaneous utility function, c_t is consumption, m_t is marital status, b_t is a vector re‡ecting children, j_t is job status, subscript t is period, and ¯ is a set of parameters. The utility function includes costs and bene…ts that are measured based on market work, children, and marriage in a woman's social and private life in addition to consumption. The budget constraint is given by

$$c_t = g(y_t; m_t; b_t);$$

where y_t is the household income, and g is a function for how much she consumes goods and services, which depends on the total household income (y_t) and family structure (m_t, b_t).

It is assumed that the husband works full-time in each period, and that no savings and loans are passed on to later periods of time. The former assumption is not very restrictive, because 98% of married men regularly work (i.e., students and housekeepers comprise less than 2%) and 96% of the male employees aged 25-59 are regular employees or executives[2]. Although the latter assumption

of never-married women are regular employees (the 1992 Employment Status Survey of Japan).

[2] The 1992 Employment Status Survey of Japan.

appears more restrictive[3], earnings are treated as a proxy of consumption in order to focus on the dynamic decision problem regarding female labor force participation and family formation.

2.2 State, Choice, and Transition of States

States in each period are characterized by job status j_t (0, not working; 1, working full-time; and 2, working part-time), marital status m_t (0, unmarried status; and 1, married status), and the number and ages of children, b_t; that consists of the number of children n_t (0, 1, 2, and 3 for 3 or more) and the age of the youngest child q_t (0, 1, 2, and 3 in case without infants age 0-2), and thus $b_t = \{n_t; q_t\}$ and the state $s_t = \{j_t; m_t; n_t; q_t\}$.

It is assumed that a woman maximizes the objective by choosing (i) whether or not to get married when she is unmarried: $dm_t = 0$ (to continue to be unmarried) or 1 (to get married); (ii) whether or not to have an additional baby: $db_t = 0$ (not to have an additional child), or 1 (plan for an additional child); and (iii) labor force participation: $dj_t = 0$ (not to work), 1 (to work full-time), 2 (to work part-time), or 3 (to quit job only when an additional baby is born, otherwise to stay in the same) at the end of period t. The choice $dj_t = 3$ is available only when the woman is working and plans for an additional child[4]. Thus, the decision is de…ned as $d_t = \{dj_t; dm_t; db_t\}$.

The state at the beginning of period t + 1 evolves according to the current state and the decision made at the end of the current period. However, as mentioned earlier, the choice (or plan) is not necessarily realized in the following period. Table 1 summarizes probabilistic transformation from the current state s_t and the decision d_t to the next state s_{t+1}.

First, the job status j_t evolves according to the decision dj_t partly with some uncertainty. It is assumed that anyone can freely quit, switch to part-time work, or continue with the current job. However, transfer to full-time work ($dj_t = 1$) from part-time work ($j_t = 2$) or not working ($j_t = 0$) can be successful only with a probability of ¼; due to the limited opportunities in …nding a full-time

[3] A similar assumption in described in, for example, Eckstein and Wolpin (1989a), Ahn (1995), and Hyslop (1999). If some common ratio of income can be assumed as saved in each period for the retired period after T, this assumption does not a¤ect the estimation.

[4] Nakamura and Ueda (1999) reported that about half of the women studied chose to resign from full-time position (not as part of maternity leave) at childbirth.

Table 1: Transition of States

Job Status

(j_t, dj_t)	j_{t+1}	$Pr(j_{t+1} \mid j_t, dj_t)$
(any, 0)	0	1
(0, 1)	1	¼
	0	1 ¡ ¼
(1, 1)	1	1
(2, 1)	1	¼
	2	1 ¡ ¼
(any, 2)	2	1
(1, 3)	0	P_b
	1	1 ¡ P_b
(2, 3)	0	P_b
	2	1 ¡ P_b

Marital status

(m_t, dm_t)	m_{t+1}	$Pr(m_{t+1} \mid m_t, dm_t)$
(0, 0)	0	1
(0, 1)	1	1
(1, NA)	0	P_m
	1	1 ¡ P_m

Number of children

(n_t, db_t)	n_{t+1}	$Pr(n_{t+1} \mid n_t, db_t)$
$(n_t, 0)$	n_t	1
$(n_t, 1)$	$\max[3; n_t + 1]$	P_b
	n_t	1 ¡ P_b

position. Thus, continuously staying at home involves choosing to continue to not work and failing to …nd a full-time position. Estimation of the probability of ¼ is one focus of this paper, because it is suspected that opportunities are limited for women who wish to return to full-time work; this situation could lead women to hesitate to have family in order to pursue careers.

Second, this study considers only the choice of marital status for unmarried women. It is assumed that any unmarried woman ($m_t = 0$) is able to get married whenever she wishes ($dm_t = 1$)[5]. Although it is ideal to introduce marital search process, as in Van Der Klaauw (1996), this paper avoids this complicated decision process in order to focus on the joint decision issue with childbearing and market work. Married women are assumed to continue the current marriage except for in the case of divorce or death of the husband, which occur with a given probability, P_m.

Third, as regards childbearing, it is assumed that a woman will successfully have an additional baby in the next period with a given probability of P_b, at the planned time ($db_t = 1$). Unexpected childbirth is not considered here, considering that inexpensive methods of contraception and abortion are accessible in Japan. No childbirth is expected in case of dissolution of marriage.

[5] One rationale for this is that the current marriage market in Japan is likely to be in favor of women; for ages 25-34, 53.9% (or 4.6 million) of men are unmarried, while only 37.2% (or 3.1 million) of women are unmarried (the 1995 Population Census of Japan). Furthermore, for ages 30-34, almost three out of four never-married women think that they do not have to get married until they …nd ideal partners, whereas half of never-married men hope to get married before reaching a certain age (The 10th Japanese National Fertility Survey in 1992).

Finally, the number of children n_t is assumed to increase by one at each delivery, irrespective of the number of newborn babies delivered at the same time. Age of the youngest child q_t is separately considered for ages 0-2 in order to control for additional costs and bene…ts that go along with raising infants and to account for the spacing of childbirth. The variable q_t evolves according to childbirth and growth of existing children, and q_t equals three whenever there are no children younger than age three.

It goes without saying that fertile ages are rather limited in one's economic life. In order to focus on the joint decision problem regarding marriage, childbearing, and labor force participation, and also due to the restrictions of data described later, decision periods are limited to the most fertile period which is regarded as being from the initial period after graduating from school to the last decision period, ¿. Thus, the optimization problem (1) can be rewritten as

$$\max_{\{d_1;d_2;\dots;d_¿\}} E[\sum_{t=1} \pm^{t\,i\,1} u(c_t; m_t; b_t; j_t; \bar{\ })] + E[\sum_{t=¿+1}^{\bar{X}} \pm^{t\,i\,1} u(c_t; m_t; b_t; j_t; \bar{\ }) \mid s_{¿+1}]: \tag{2}$$

The second component after the last decision period in equation (2) can be calculated for every state $s_{¿+1}$ with a given probabilistic process between the periods ¿ + 1 and T (the last economic period). Then, the single optimal choice at the last decision period $d_¿$ is determined for each state $s_¿$. By backward recursion, the optimal choice for each state can be obtained throughout the decision periods.

2.3 Econometric Speci…cation

Now the process is characterized by the state: $s_t = \{j_t; m_t; n_t; q_t\}$ from the set of state S, and the decision $d_t = \{dj_t; dm_t; db_t\}$ from the set of decision $D(s_t)$ that depends on the current state. The decision rule is determined from Bellman's equation:

$$V_t(s_t) = \max_{d_t \in D(s_t)} \{u(s_t; \bar{\ }) + \pm E V_{t+1}(s_t; d_t)\};$$

where $V_t(s_t)$ is the value function at time t; given state s_t: The expected value function at the next period, given the current state and decision, is de…ned as:

$$E V_{t+1}(s_t; d_t) = E[\sum_{k=t+1}^{\bar{X}} \pm^{k\,i\,t\,i\,1} u(s_k; \bar{\ }) \mid s_t; d_t]: \tag{3}$$

The utility function is parameterized as

$$u(s_t; \bar{\ }) = \ln y(j_t; m_t; t) + \bar{\ }^0 \cdot h(s_t) + \text{"}_t(d_t) \tag{4}$$

The first component stands for utility from consumption that depends on earnings

$$y(j_t; m_t; t) = \begin{cases} y_1(j_t; t) & \text{for unmarried women} \\ w \cdot (y_1(j_t; t) + y_2(t)) & \text{for married women,} \end{cases} \tag{5}$$

where $y_1(j_t; t)$ represents the earnings of the woman, depending on her job status and age under the seniority system, $y_2(t)$ represents the earnings of the husband depending on age (the husband assumed to work full-time). Thus, time t represents age from now on. A discount of w adjusts for consumption on the part of the wife. The second component consists of additional utility and disutility that arises from labor force participation, children, and marriage, as follows.

$$\begin{aligned} \bar{\ }^0 \cdot h(s_t) \quad = \quad & \bar{\ }_1 \cdot I(j_t = 1) + \bar{\ }_2 \cdot I(j_t = 2) + \bar{\ }_3 \cdot I(n_t \ , \ 1) + \bar{\ }_4 \cdot I(n_t \ , \ 2) + \bar{\ }_5 \cdot I(n_t = 3) \\ & + \bar{\ }_6 \cdot I(q_t = 0) + \bar{\ }_7 \cdot I(q_t = 1) + \bar{\ }_8 \cdot I(q_t = 2) + \bar{\ }_9 \cdot I(m_t = 1); \end{aligned}$$

where $h(s_t)$ is a vector of dummy variables converted from state s_t, $I()$ is the indication function which assumes a value of 1 if its argument is true, and a value of 0 otherwise. As regards labor force participation, $\bar{\ }_1$ and $\bar{\ }_2$ indicate utility gains and losses from full-time and part-time work; this includes costs (such as reduction of time spent on leisure and housework) and benefits (such as satisfaction gleaned from social position), as perceived by women. Here, the effect of earnings is already included in the first component $y(j_t; m_t; t)$, and this is not included here. As regards children, $\bar{\ }_3$, $\bar{\ }_4$, and $\bar{\ }_5$ indicate marginal utility gains and losses from the first, second, and third and consecutive children, respectively. These utility gains and losses include financial costs, time allocated to raise children, and also perceived costs and benefits from having children; the latter would include happiness gained from family life or possible social pressure to have one's own children as a tradition. $\bar{\ }_6$, $\bar{\ }_7$, and $\bar{\ }_8$ indicate additional utility gains and losses from infants; if their total equals zero, these effects simply control spacing preferences to have multiple children; if the total is positive (negative), it could indicate additional gains (losses) by raising infants. Finally, $\bar{\ }_9$ measures the costs and benefits

of being married leaving out …nancial advantage of marriage; a sense of stability and satisfaction in family and social life is one example of the bene…ts. Household work, …nancial restraint, or restraints on time are considered to be the costs of marriage for women. The third component of $\varepsilon_t(d_t)$ is an unobserved component of utility, depending on the choice. Now the sample likelihood function is

$$L = \prod_{n=1}^{N} \prod_{t=t_n}^{\tau_n} p(s_{n;t+1} | s_{n;t}; d_{n;t}; \pi; P_m; P_b) P(d_{n;t} | s_{n;t}; \bar{\ }),$$

where N is the number of sample women, t_n is the initial age after graduating from school or the initial age in the sample; τ_n is the last decision age or the sample age at the survey if before τ; p is the transitional probability from the current state and decision to the next state with a probability of 1, π, $(1 - \pi)$, P_m, $(1 - P_m)$, P_b, $(1 - P_b)$, or their combination from Table 1. Probability P to choose d_t is assumed to take the multinomial logit formula with assuming the disturbance $\varepsilon_t(d_t)$ in the utility function (4) that are independently and identically distributed with the type I extreme-value distribution[6].

$$\begin{aligned} P(d_t | s_t) &= \frac{\exp\{\ln y(j_t; m_t; t) + \bar{\ }' x_t + \beta EV_{t+1}(s_t; d_t)\}}{\sum_{z_t \in D(s_t)} \exp\{\ln y(j_t; m_t; t) + \bar{\ }' x_t + \beta EV_{t+1}(s_t; z_t)\}} \\ &= \frac{\exp\{EV_{t+1}(s_t; d_t)\}}{\sum_{z_t \in D(s_t)} \exp\{EV_{t+1}(s_t; z_t)\}}. \end{aligned}$$

For the estimation, the expected value function EV_{t+1} of equation (3) is numerically calculated for all states and decisions at each decision period, because the function is not analytically obtained. The estimation method is based on work by Rust (1987, 1988), who developed a structural estimation framework of dynamic discrete decision problems[7].

3 Data Description and Empirical Speci…cations

3.1 Data Source

The data are obtained from 1993, 1994, and 1995 waves of the Japanese Panel Surveys of Consumption (JPSC). The JPSC started as a panel survey on 1,500 women ages 24-34 in 1993, from the entire

[6] For similar speci…cations, see Rust (1986), Ahn (1995), and Van Der Klaauw (1996).

[7] The estimation is carried out with the simulated annealing optimization program by Go¤e (1996). Needless to say, all remained errors are the author's.

country, according to a strati…ed two-stage sampling method. In the 1993 wave, 498 women were unmarried (42 of them were divorced, and none of them were widowed); 1,002 women were married. The Institute of Household Economy (1995) explains that the sample generally represents characteristics of women, including the married rate, at the same ages in Japan.

The survey includes age, marital status, and job information. Moreover, family members' characteristics such as ages and educational levels are included. The …nal sample include 1,392 women, or 2,705 person-year observations including the transition from 1993 to 1994 and from 1994 to 1995 (henceforth, "panel sample"). Observations in school and those with non-working husbands were omitted. The number of decision periods is 12 and range of age in the panel sample was 24 to 35.

There were only three waves in which microdata were ready to be released. Thus, the number of observations appears to be rather limited. Therefore, an "extended sample" is o¤ered here, which includes both the panel sample and the constructed sample that dates back to the age of graduation, or age 20 (when marriage is legitimized without necessitating parental consent). The extended sample utilizes retrospective information such as job history, year of graduation, and married age for the current marriage. The …nal extended sample includes 12,797 person-year observations, and the number of decision periods is 16 from age 20 to 35. However, it should be noted that the extended sample fails to involve retrospective periods of divorced women due to the lack of information concerning age at marriage and divorce, and information about job history prior to the year of onset of the previous job, if the woman had changed jobs 4 times or more[8].

3.2 Variables

As regards job status, "full-time" is considered as regular employment, and "part-time" includes part-time employment and all other jobs (such as family business); the average annual earnings of "full-time" subjects exceeds three million yen, while that of "part-time" subjects is less than half of that of the "full-time" subjects. Women taking either legitimated maternity leaves (6 weeks before and

[8] This was a rare case, because it has been common (at least for full-time regular employees) to work at the same company in Japan with relatively limited mobility in the labor market. Also, it has been uncommon to return to school after working for years.

8 weeks after the delivery) or child-care leaves (for infants younger than one year old) are considered as though they had continued to work full-time; this is because such women maintain their full-time positions and receive full or partial …nancial support during these leaves. In the 1994 wave of the JPSC, only 0.57% of the women claimed childcare leave.

As regards marital status, the class of "unmarried" women includes those who never married, as well as divorced and widowed women. The survey did not speci…cally instruct women about common-law marriage (which is rather rare in Japan). Probabilities regarding the transition from married to unmarried status (P_m) are retrieved from national surveys by 5-year age groups as shown in the Appendix. It is assumed that a woman gets married to a husband two years her senior, which is the national average[9]. All children are considered as having lived; in addition, it is assumed that children stay with the mother when a couple divorces[10].

Table 2 presents the characteristics of the sample as considered from the perspective of marital status. The extended sample includes more unmarried and younger women than the panel sample. Almost three out of four unmarried women work full-time, while half of married women do not participate in the labor market. On average, more than 10% of unmarried women get married in a year. Also, more than 10% of working women withdraw from the labor market within one year.

As regards children, 86.5% (77.4%) of married women have at least one children; 55.5% (69.1%) of married mothers have infants age 2 or younger, and 13.2% (20.5%) of married women gave birth during the sample year in the panel (extended) sample. Unmarried mothers generally experience divorce. As regards education, the better-educated women are less likely to be married than less-educated women. The high-school educated group (44.5%) completed compulsory 9-year education (2.1%), and the junior college group (40.9%) completed technical school education[11] (19.8%). University education (12.6%) includes undergraduate and graduate levels.

[9] The 1995 Vital Statistics of Japan.

[10] 93.1% of single-parent households with children at age 5 or younger were single-mother households (1995 Population Census of Japan).

[11] This type of school accepts students at any level of education and provides 1-2 years of practical education such as accounting or information processing; a majority of students are enrolled after graduating high school.

Table 2: Sample Characteristics

	Panel Sample			Extended Sample		
	Total	Married	Unmarried	Total	Married	Unmarried
number of sample (t)	2,705	1,871	834	12,798	6,625	6,173
(%)		(69.2%)	(30.8%)		(51.8%)	(48.2%)
number of sample (t+1)		1,958	747		7,392	5,406
(%)		(72.4%)	(27.6%)		(57.8%)	(42.2%)
age (t)	29.4	30.3	27.4	25.9	27.9	23.8
Job Status						
full-time (t)	33.8%	16.5%	72.4%	46.1%	18.2%	76.1%
full-time (t+1)	31.9%	16.9%	71.2%	42.6%	18.2%	76.0%
part-time (t)	24.4%	26.8%	19.2%	15.2%	19.8%	10.4%
part-time (t+1)	27.1%	30.0%	19.4%	16.8%	20.9%	11.2%
Change of status (% among the previous state)						
full-time to part-time	6.8%	-	-	2.3%	-	-
part-time to full-time	8.8%	-	-	4.3%	-	-
ceased working	11.2%	-	-	10.5%	-	-
newly married	11.4%	-	-	12.6%	-	-
divorced	0.4%	-	-	0.1%	-	-
Children						
number of children (t)	1.14	1.60	0.12	0.68	1.29	0.02
number of children (t+1)	1.24	1.66	0.14	0.80	1.36	0.02
with children (t)	62.3%	86.5%	8.2%	40.7%	77.4%	1.3%
youngest age 0 (t)	11.3%	16.2%	0.1%	11.3%	21.7%	0.1%
youngest age 1 (t)	12.8%	18.3%	0.4%	9.9%	19.0%	0.1%
youngest age 2 (t)	9.6%	13.5%	1.0%	6.7%	12.8%	0.2%
new childbirth (t+1)	9.6%	13.2%	0.0%	11.9%	20.5%	0.1%
Education						
university or higher	12.3%	9.1%	19.4%	10.5%	8.3%	12.9%
junior college level	40.4%	38.1%	45.6%	41.2%	38.0%	44.7%
high school or less	47.3%	52.8%	35.1%	48.3%	53.6%	42.6%

Percentages in parentheses are of the whole sample.
Other Percentages are of each column, unless noted.

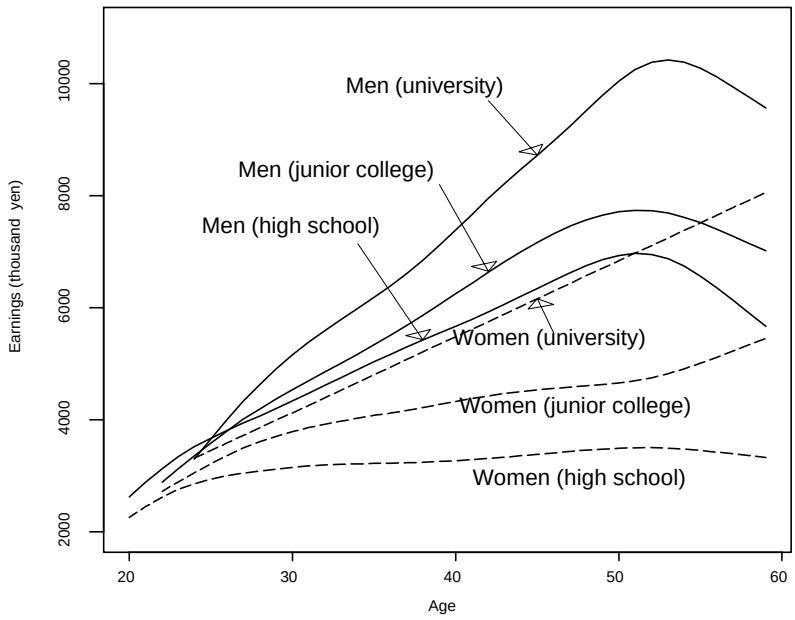

Figure 1: Earnings by Education and Gender

3.3 Potential Earnings and Terminal Conditions

This paper uses estimated earnings from an exogenous source in order to separate the subjective values of labor force participation from income e¤ects. Thus, a better estimation is obtained than by using the JPSC, which covers a limited range of ages[12]. Annual earnings are estimated by interpolation of average ages and earnings, by 5-year age group and education, from the 1993 Wage Census of Japan[13].

As illustrated in Figure 1, earning curves di¤er according to education and gender. Women earn less than men on average at each educational level, and earnings of less-educated women rise only slightly according to age. Earnings from part-time work are assumed to be one million yen a year in the case of married women; this is because a married woman working part-time tends to restrain her

[12] Ahn (1995) estimated the wage equation from an exogenous source; Hotz and Miller (1988) and Van Der Klaauw (1996) estimated the wage equation in the same data.

[13] Microdata from national surveys, including the Wage Census, are not usually accessible to researchers. The prediction using the JPSC estimates of a wage equation using age and squared of age by education with a selectivity bias correction coincides for the most part with the prediction using the Wage Census for the twenties and thirties, but is unreliably low for the forties and …fties.

annual income to less than one million yen in order to retain dependant privileges (such as income tax exemptions, exemption of social security payment, and family allowance paid to the husband)[14]. The 1993 wave of the JPSC indicates that the earnings of unmarried women working part-time are 1.4 million yen.

The last decision age ¿ is set at 35, because the JPSC covers up to age 36. From 37 to the last age of economic life, several assumptions are imposed to calculate the value function. As regards childbirth, most women appear to have children in their twenties or early thirties; 90.5% of newborns are from mothers aged 34 or younger, and 98.9% are from mothers aged 39 or younger[15]. Therefore, it is assumed that a woman aged 37-40 will have additional children only with small probabilities, and that a woman will not have additional babies at the age of 41 or older. In addition, the average rates of new marriage and rates of divorced/widowed are applied to the transition from married to unmarried status. Transitional probabilities of job status are applied by the marital status. These rates related to transitions are retrieved from national surveys of Japan to represent women's perception; estimated rates, the data source, and calculation procedure are described in the Appendix.

The last economic age T is set to 59, because the (mandatory) retirement age is typically 60 in Japan. Earnings of the husband, if aged 60-61, is conventionally assumed to be 60% of the earnings at age 59, considering that the husband work part-time or receive pension after retirement.

4 Estimation Results

4.1 E¤ects of Marriage, Children, and Labor Force Participation

The results of the estimation based on the dynamic model are presented in Table 3. These results also con…rm the e¤ects of the parameters that remain unspeci…ed; cases (1) and (2) estimate the probability of a woman's having a child when she plans to (P_b); case (3) assumes a probability of 40%[16] in order

[14] When working part time, 64.8% of married women receive .50-.99 million yen, 15.8% receive 1.0-1.49 million yen, and 11.2% receive less than .50 million yen (the 1992 Employment Status Survey). According to the 1996 wave of the JPSC, 80.7% of housewives expect that their earnings will be less than some upper limit with or without adjustment if they choose to participate in the labor market in the future.

[15] The 1995 Vital Statistics of Japan.

[16] Hotz and Miller (1988) estimated the monthly conception probability without contraception as 2.5% (which is equivalent to an annual probability of 26.2% as a compound rate), but they noted that this estimate could be somewhat lower than those from natural fertility population.

Table 3: Estimation Result

	Panel Sample			Extended Sample		
	Case(1) w = 0:6	Case (2) w = 0:7	Case (3) w = 0:6 P_b = 0:4	Case(1) w = 0:6	Case (2) w = 0:7	Case (3) w = 0:6 P_b = 0:4
Full-time	1.047 **	1.338 **	1.047 **	1.151 **	1.452 **	1.162 **
	(0.044)	(0.045)	(0.043)	(0.017)	(0.018)	(0.016)
Part-time	0.839 **	1.121 **	0.839 **	0.605 **	0.887 **	0.599 **
	(0.042)	(0.042)	(0.042)	(0.024)	(0.024)	(0.024)
First child	-0.065	-0.120	-0.052	-0.232 **	-0.332 **	-0.393 **
	(0.231)	(0.334)	(0.179)	(0.088)	(0.127)	(0.120)
Second child	1.004	1.477	0.856 **	0.978 **	1.293 **	1.568 **
	(0.491)	(0.758)	(0.181)	(0.129)	(0.193)	(0.122)
Third child	0.067	0.117	0.053	0.114	0.142	0.177
	(0.239)	(0.312)	(0.200)	(0.071)	(0.093)	(0.104)
Youngest child	-6.303 **	-7.210 **	-5.906 **	-6.808 **	-8.114 **	-9.063 **
at age 0	(0.953)	(1.261)	(0.813)	(0.406)	(0.509)	(0.481)
Youngest child	2.120	2.944	1.797	3.180 **	4.442 **	5.455 **
at age 1	(1.319)	(1.841)	(1.000)	(0.469)	(0.700)	(0.500)
Youngest child	-1.962 *	-2.967 *	-1.653 *	-0.892 **	-1.446 **	-1.881 **
at age 2	(0.968)	(1.413)	(0.673)	(0.264)	(0.413)	(0.458)
Marriage	-1.053 **	-1.162 **	-1.053 **	-1.022 **	-1.126 **	-1.019 **
	(0.030)	(0.030)	(0.030)	(0.010)	(0.010)	(0.010)
Probability of …nding	0.174 **	0.176 **	0.174 **	0.159 **	0.167 **	0.159 **
a full-time job (¼)	(0.016)	(0.016)	(0.016)	(0.008)	(0.008)	(0.008)
Probability of	0.364 **	0.291 **		0.567 **	0.456 **	
childbirth (P_b)	(0.080)	(0.056)		(0.045)	(0.035)	
Log-Likelihood	-2839.8	-2859.1	-2839.8	-13381.1	-13524.1	-13392.9
Restr. log-L	-4106.6	-4384.7	-4011.8	-19972.8	-21062.3	-19589.2
Sample number	2,705	2,705	2,705	12,797	12,797	12,797

Asymptotic standard errors are in parentheses.
** (*) indicates statistically signi…cant at the the 1% (5%) level.

to test whether or not an assumption regarding this probability a¤ects the estimation results. Also, the discount of household income of w (in case of being married in the equation (5)) is assumed 0.6 in cases (1) and (3), and 0.7 in case (2), because economies of scale, by sharing an apartment and cooking for example, can be an advantage of marriage (Becker, 1973). Here, applied (potential) earnings for full-time work represent, according to gender, junior-college educated subjects. It may be of use to note that the log of the highest earnings for men is 3.89 in order to evaluate magnitude of other e¤ects.

In addition, an assumption of 50% for the consumption weight w (that is, the couple divides any

income equally) and di¤erent assumptions regarding discount factor ±[17] (assumed to be 0.90 in the table) are con…rmed. Overall, any of these assumptions do not appear to a¤ect the estimation results. Thus, it is assumed that the probability of childbearing (P_b) is 40% (in order to be common between the panel sample and the extended sample), the consumption weight (w) equals 0.6, and 0.90 of the discount factor (±) in the estimation as in case (3).

Some of the e¤ects using the extended sample are insigni…cant using the panel sample. One reason for the discrepancy may be the di¤erence in the sample number and sampling method, and another reason may be due to changes in social conditions, i.e., the extended sample involves retrospective observations from the early 1980s. Nonetheless, …ndings from the estimation indicate several interesting features.

First, utility gains and losses from market work are signi…cantly positive when one leaves out the income e¤ect of earnings. Besides, estimates of the gains from full-time work are larger than those from part-time work, particularly when one considers the extended sample. This result suggests that market work is worthwhile not only due to earnings but also due to perceived bene…ts for women (such as improvement of the wife's position in the family or social satisfaction).

Second, (marginal) utility gains and losses due to children are insigni…cant or signi…cantly negative for the …rst child, signi…cantly positive for the second child, and insigni…cant for the third (and subsequent) child. This result indicates that costs tend to surpass bene…ts (e.g., perceived happiness) of having the …rst child. On the other hand, bene…ts surpass costs of raising the second child. One explanation is that new mothers spend more time and money on the …rst child, whereas mothers who have already had the …rst child are able to utilize hand-me-downs and previous experience upon having the second child. However, in the case of a third or subsequent child, it is possible that marginal bene…ts from the additional child is reduced whereas marginal costs are not reduced much.

Third, as regards the e¤ect of ages of the youngest child, the e¤ect is signi…cantly negative at age zero, positive (but insigni…cant if the panel sample is used) at age one, and signi…cantly negative at

[17] Discount factors of 0.85, 0.90, 0.95, and 0.99 are con…rmed.

age two. The considerably large negative e¤ect of age zero seems to indicate that newborn babies are costly in terms of care taking demands. Other e¤ects of infants suggest spacing as a consideration. It is likely that a mother with a newborn may not be physically ready soon after the delivery, and that she is busy taking care of the newborn. If the woman avoids to have an additional baby continuously, she can bene…t from the positive e¤ect of the youngest baby at age one. On the other hand, the mother can avoid utility losses due to the youngest at age two if she gives birth to an additional baby after a one-year pause.

Fourth, utility gains and losses from marriage are signi…cantly negative. It should be noted that this e¤ect does not include the …nancial bene…ts of marriage that arise due to common consumption[18] and (possibly) higher earnings of the husband than those of the wife. This result suggests that a woman loses utility due to marriage without considering …nancial bene…ts. One reason may be the imbalance in responsibilities between husband and wife as regards housework and childcare; even in full-time dual-earner households, husbands spend only 12 minutes a day on housework and childcare, whereas wives spend 3 hours on home and children each weekday[19]. However, it should be noted that the total estimated e¤ect of having two children almost cancels out the negative e¤ects of marriage.

Finally, estimates of the probability of …nding a full-time position are as low as 15-18%. This implies that it is not easy for a woman to …nd a full-time position once she has resigned from a full-time position due to marriage or childbearing.

In order to check the performance of the estimation, Figures 2, 3, and 4 compare predicted and actual rates of marriage, average number of children, and rates of not working, conditional at the previous state in the panel sample. Predicted values are calculated using the estimate of case (3) in Table 3. The …gures show that predicted marriage rates and number of children both …t the actual data fairly well. Although predicted values capture low female economically active (working) rates in

[18] The assumed bene…t of common consumption is not very large; it is 0.08 when w = 0:6, as compared to the case of w = 0:5 (i.e., no common consumption). If the bene…t is assumed to be larger, the negative e¤ect of marriage may be larger than the estimates.

[19] 1996 Survey on Time Use and Leisure Activities.

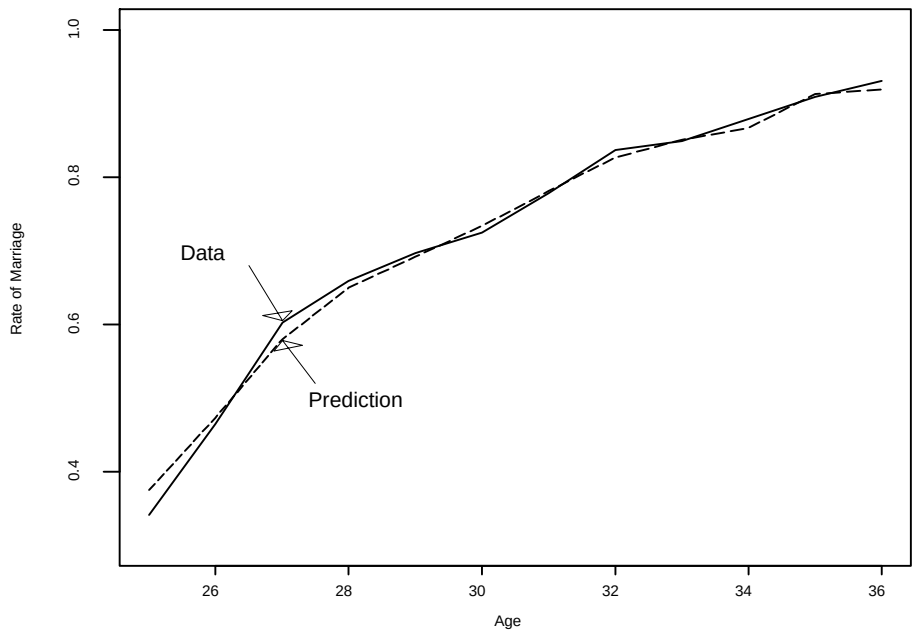

Figure 2: Predicted and Actual Rates of Marriage

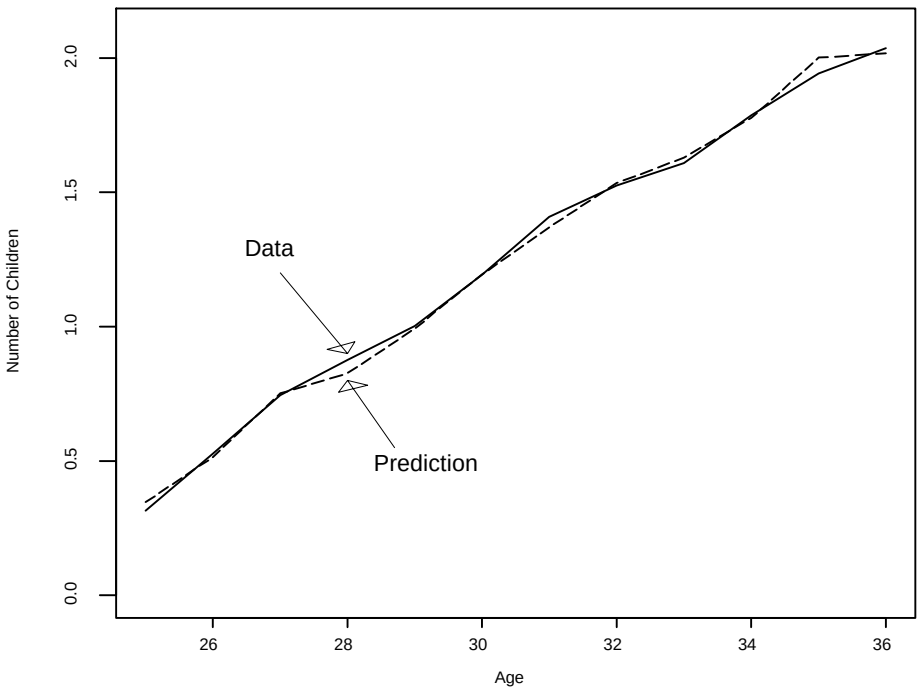

Figure 3: Predicted and Actual Number of Children

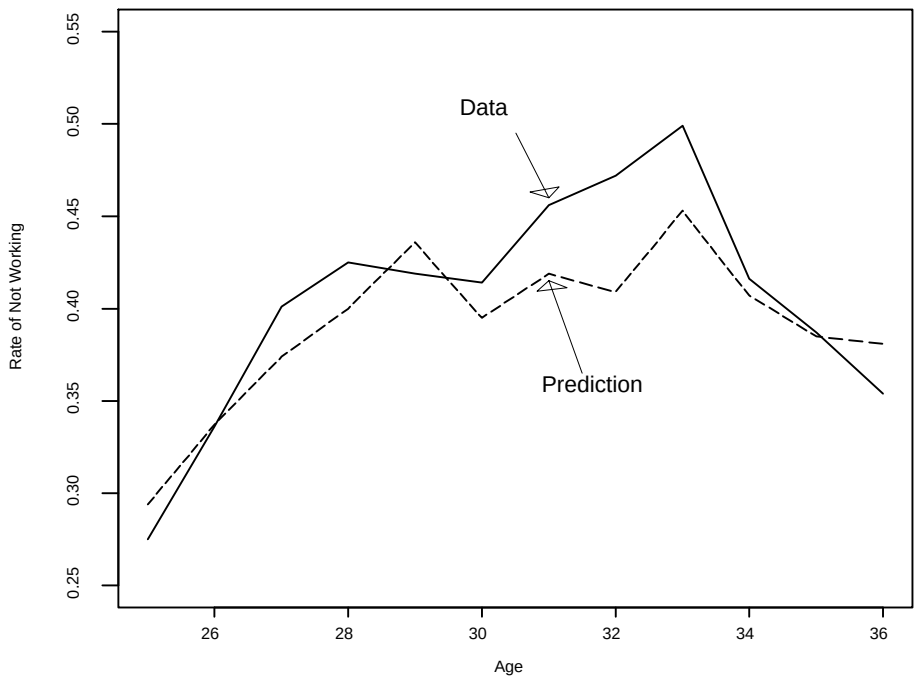

Figure 4: Predicted and Actual Rates of Not Working

their early thirties who are often with young children, the predicted and actual rates of not working do not seem to correspond as much as marriage rates and number of children. One explanation for this is that e¤ects of job status are not perfectly independent of family structure. In other words, the costs and bene…ts of raising children might di¤er according to job status, e.g., working mothers may have to spend money on nursery fees or sacri…ce their leisure time more than housewives. Therefore, in the utility function, explanatory variables related to job status and children are crossed in the next section's estimation.

4.2 E¤ects of Children and Job Status

The results of crossing the variables of job status and the number of children are presented in Table 4. The di¤erence between new estimates and predicted values from the estimates in case (3) from Table 3 for the purpose of comparison; a positive (negative) di¤erence means that an estimate of the alternative speci…cation is higher (lower) than the previous estimates. It should be noted that

marginal utility gains and losses from the second or third child do not include utility gains from market work that are already included among those gained from the …rst child. According to this comparison, estimates with crossed variables are higher in case of market work without children, the …rst child of housewives, and the second child of mothers working full-time; the estimates are lower for the second child of housewives than the previous estimates.

Table 5 summarizes utility gains and losses from family formation when the woman remains at the same job. Working mothers lose utility from the …rst child, but gain utility from the second child more than do housewives. With any number of children, working mothers gain utility less than do housewives. Also, the total value of being married and having two children is nearly zero for housewives, or even negative for working mothers in the panel sample, even without considering spontaneous costs of -5.3 or -5.7 in total for infants ages 0-2.

In comparing the two samples, it is of note that utility gains and losses from any number of children for any job status are smaller with the panel sample in 1993-95 than with the extended sample from the early 1980s. If the di¤erence between the two sample arises from social changes, this result corresponds with the recent reduction in the marriage rate and number of children. Family formation potentially indicates smaller utility gains or even losses, particularly for women who do not wish to interrupt their careers. On the other hand, recent policies to support working mothers might help to reduce the cost of raising a …rst child.

Table 6 presents an additional estimation result with the variables of job status and age of the youngest child crossed. Housewives with infants gain more utility in the estimation than in the previous estimation without crossed variables, whereas working women without infants gain more utility and working mothers with newborns lose more utility than in the previous one. In a comparison of the two samples, the estimated utility losses from newborns are smaller in the panel sample than in the extended sample. This result again indicates that the social environment has improved for working mothers raising infants.

These two estimation results imply that working women gain less utility from having children

Table 4: Job Status and Number of Children

	Panel Sample			Extended Sample		
	estimate	(s.e.)	di¤erence	estimate	(s.e.)	di¤erence
No job, …rst child	0.477	(0.208)*	0.529	-0.027	(0.133)	0.366
No job, second child	0.611	(0.196)**	-0.245	1.255	(0.139)**	-0.313
No job, third child	0.081	(0.222)	0.028	0.283	(0.118)*	0.106
Full-time, no child	1.342	(0.073)**	0.295	1.329	(0.027)**	0.166
Full-time, …rst child	1.068	(0.246)**	0.074	0.310	(0.168)	-0.460
Full-time, second child	1.063	(0.260)**	0.207	2.332	(0.188)**	0.764
Full-time, third child	-0.012	(0.267)	-0.065	-0.103	(0.146)	-0.280
Part-time, no child	1.243	(0.093)**	0.404	0.823	(0.044)**	0.224
Part-time, …rst child	1.009	(0.214)**	0.222	-0.088	(0.149)	-0.295
Part-time, second child	0.912	(0.207)**	0.056	2.019	(0.159)**	0.451
Part-time, third child	0.057	(0.219)	0.004	0.299	(0.125)*	0.122
Youngest child aged 0	-5.964	(0.811)**	-0.059	-9.259	(0.467)**	-0.196
Youngest child aged 1	1.928	(1.000)	0.131	5.872	(0.509)**	0.417
Youngest child aged 2	-1.708	(0.671)*	-0.055	-1.900	(0.469)**	-0.019
Marriage	-1.086	(0.032)**	-0.033	-1.019	(0.011)**	0.000
Probability of …nding a full-time job	0.178	(0.016)**	0.004	0.157	(0.008)**	-0.002
Log-Likelihood	-2816.6			-13297.1		
Restr. log-L	-4011.8			-19589.2		
Sample number	2,705			12,797		

Reference group: not working, no children.
Asymptotic standard errors are in parentheses.
** (*) indicates statistically signi…cant at the the 1% (5%) level.

Table 5: Utility Gains and Losses from Family Formation by Job Status

Sample	Job status	First child	Second child	Third child	Two children	Three children	Married with two children
Panel sample	Not working	+0.477	+0.611	+0.081	+1.088	+1.169	+0.002
	Full-time	¡0:274	+1.063	¡0:012	+0.789	+0.777	¡0:297
	Part-time	¡0:234	+0.912	+0.057	+0.678	+0.735	¡0:408
Extended sample	No job	¡0:027	+1.255	+0.283	+1.228	+1.511	+0.264
	Full-time	¡1:019	+2.332	¡0:103	+1.313	+1.210	+0.294
	Part-time	¡0:911	+2.019	+0.299	+1.108	+1.407	+0.089

Gains and losses are calculated from estimates in Table 4.

Table 6: Job Status and Young Children

	Panel Sample			Extended Sample		
	estimate	(s.e.)	di¤erence	estimate	(s.e.)	di¤erence
First child	-0.104	(0.177)	-0.052	-0.307	(0.112)**	0.086
Second child	0.838	(0.181)**	-0.018	1.505	(0.115)**	-0.063
Third child	0.054	(0.198)	0.001	0.195	(0.099)*	0.019
Not working, child aged 0	-5.403	(0.839)**	0.503	-8.161	(0.474)**	0.902
Not working, child aged 1	2.512	(1.019)*	0.715	5.678	(0.508)**	0.223
Not working, child aged 2	-1.052	(0.713)	0.600	-1.650	(0.481)**	0.231
Full-time, child aged 0	-5.461	(1.008)**	-0.602	-9.170	(0.557)**	-1.270
Full-time, child aged 1	2.968	(1.118)**	0.124	6.547	(0.597)**	-0.070
Full-time, child aged 2	-0.366	(0.800)	0.240	0.437	(0.533)	1.156
Full-time, no young children	1.211	(0.060)**	0.164	1.399	(0.028)**	0.237
Part-time, child aged 0	-5.920	(0.887)**	-0.853	-9.889	(0.509)**	-1.426
Part-time, child aged 1	2.522	(1.012)*	-0.115	5.658	(0.509)**	-0.396
Part-time, child aged 2	-0.774	(0.694)	0.039	-1.325	(0.463)**	-0.043
Part-time, no young children	1.063	(0.065)**	0.224	0.993	(0.038)**	0.394
Marriage	-1.053	(0.030)**	-0.000	-1.020	(0.010)**	-0.001
Probability to …nd full-time job	0.176	(0.016)**	0.002	0.153	(0.008)**	-0.006
Log-likelihood	-2795.0			-13183.7		
Restr. log-L	-4011.8			-19589.2		
Sample number	2,705			12,797		

Reference group: not working, no young children.
Asymptotic standard errors are in parentheses.
** (*) indicates statistically signi…cant at the the 1% (5%) level.

than housewives and that working women lose more utility than do housewives when taking care of a newborn. This obstacle is likely to discourage some single women working full-time from getting married and having children, whereas others may resign from full-time work in order to form a family.

4.3 E¤ects by Education

The proposed empirical model has not included unobserved heterogeneity, but the joint decision problem of marriage, childbearing, and labor force participation could vary according to individual preferences; this decision might be particularly in‡uenced by education. Besides, (potential) earnings di¤er across educational levels, as mentioned earlier. Thus, the behavior of women could vary among di¤erent educational levels[20].

[20] Rust and Phelan (1997) argues that it is di¢cult to relax the IID assumption with maintaining computational tractability, and that the analysis requires "more careful attention to the economic rather than the statistical speci…cation". This paper tries to reduce the heterogeneity problem by spliting the sample according to educational levels.

Table 7: Estimation Result by Education

	Panel Sample			Extended Sample		
	High school	Junior coll.	University	High school	Junior coll.	University
Full-time	1.164 **	1.011 **	1.197 **	1.204 **	1.184 **	1.322 **
	(0.054)	(0.068)	(0.118)	(0.022)	(0.022)	(0.055)
Part-time	0.801 **	0.833 **	1.073 **	0.552 **	0.613 **	0.855 **
	(0.053)	(0.068)	(0.140)	(0.034)	(0.031)	(0.080)
First child	0.035	-0.020	-0.348	-0.343	-0.480 **	-0.493
	(0.253)	(0.271)	(0.781)	(0.177)	(0.178)	(0.400)
Second child	1.005 **	0.412	1.329	1.876 **	1.248 **	1.161 **
	(0.256)	(0.283)	(0.733)	(0.185)	(0.187)	(0.357)
Third child	0.044	0.023	0.361	0.312 *	-0.065	0.164
	(0.257)	(0.354)	(0.991)	(0.141)	(0.137)	(0.407)
Youngest child	-5.946 **	-4.947 **	-7.441 **	-9.947 **	-7.680 **	-8.503 **
at age 0	(1.128)	(1.461)	(2.409)	(0.671)	(0.787)	(1.555)
Youngest child	2.078	1.276	0.758	5.431 **	5.866 **	4.309 **
at age 1	(1.341)	(1.818)	(3.693)	(0.694)	(0.813)	(1.665)
Youngest child	-2.478 **	-0.942	1.100	-1.883 **	-2.362 **	0.661
at age 2	(0.960)	(1.028)	(2.675)	(0.636)	(0.748)	(1.461)
Marriage	-1.086 **	-1.041 **	-1.114 **	-1.017 **	-1.041 **	-1.075 **
	(0.036)	(0.045)	(0.058)	(0.011)	(0.015)	(0.024)
Probability of …nding	0.135 **	0.197 **	0.281 **	0.115 **	0.188 **	0.268 **
a full-time job	(0.018)	(0.026)	(0.052)	(0.009)	(0.012)	(0.029)
Log-Likelihood	-1378.8	-1185.0	-360.2	-6927.5	-5560.2	-1465.9
Restr. log-l	-1675.6	-1649.1	-515.8	-8573.2	-8289.0	-2111.1
Sample number	1,280	1,093	332	6,176	5,273	1,346

Asymptotic standard errors are in parentheses.
** (*) indicates statistically signi…cant at the the 1% (5%) level.

Table 7 presents the estimation result using the original speci…cation of the utility function, and includes (potential) earnings by education and gender. It is assumed that the education levels of wife and husband are identical because the majority of university (high school)-educated wives are married to husbands who are educated to the same degree.

There are some interesting di¤erences among estimates (albeit not always statistically signi…cant di¤erences). Most of the features show striking similarities across educational levels. First, estimated utility gains from of market work are the highest for university-educated women in both samples. Second, as regards children, better-educated women gain less or lose more from children than do less-educated women. Third, estimated utility losses from marriage are the highest for university-

educated women, although the di¤erence among estimates does not seem to be very large. Finally, it is of note that better-educated women …nd full-time work with a higher probability than do less-educated women; the estimated probability of …nding full-time work is 27-28% for university-educated women, 19-20% for women educated at the junior college level, and 12-14% for women educated at the high-school level. The estimated probability is slightly higher in the panel sample than in the extended sample at any educational level; it is possible that the opportunity to return to full-time work has improved slightly since the 1980s irrespective of educational levels.

In summary, it seems that university-educated women gain more utility from labor force participation and have better opportunities to …nd full-time positions after a career interruption. However, these women gain less utility from family life than less-educated women. In other words, university-educated women tend to prefer market work to family life with a husband and children comparing to less-educated women.

5 Concluding Remarks

This paper has examined the lifetime utility maximization problem of Japanese women according to a dynamic decision model. Utility gains and losses from marriage, children, and labor force participation are considered in the model. The structural estimation result suggests that women gain utility from labor force participation, and that this gain exceeds …nancial bene…ts from earnings. However, women lose utility from marriage if …nancial advantage from the husband is not considered. Estimated utility gains and losses of being married and having two children are negative for working women in the recent sample in the early 1990s, but are slightly positive in the extended sample from the 1980s.

The estimation results appear to re‡ect the recent decline in married rate as well as the decline in the total fertility rate in Japan. The utility gains from market work and the utility losses from marriage are likely to lead women to remain in the labor force and postpone marriage, particularly in their twenties, when the small di¤erence in earnings between men and women results in small …nancial gains from marriage. Besides, the limited opportunity of …nding a full-time position may lead women

to hesitate to get married and thus to have children.

These effects become more distinct for university-educated women, who benefit more from labor force participation than do less-educated women, both in the pecuniary and non-pecuniary sense. Such women appear to benefit less from family life than do less-educated women. Because an increasing number of women are seeking education at 4-year universities rather than 2-year junior colleges, it is possible that more women will delay (or avoid) marriage; thus, childbearing will be postponed (or avoided) in order for women to pursue a career.

There is room for further investigation as regards the decline in the married rate and the number of children. For example, the search process of seeking a mate has not been integrated in the model analyzed here. In the 1994 JPSC, almost 4 out of 5 women wish to get married sooner or later, but 2 out of 3 of these women had not yet found a suitable partner. Nearly half of the remaining women who did not necessarily hope for marriage agreed that only a small number of men could treat them as an equal partner. Therefore, further research on the marital search process could help to explain delayed and fewer marriages and childbirth in Japan.

Appendix: Speci…cation of transition rates

Marital status

Age Group	Divorced or Widowed Rate (%)	Married Rate (%)
20-24	3.22	-
25-29	1.56	-
30-34	0.95	-
35-39	0.72	4.31
40-44	0.70	1.87
45-49	0.80	1.17
50-	0.97	1.30

Childbirth

Age	Birth Rate (%)	
	(Married)	(Unmarried)
37	2.69	0.35
38	1.84	0.28
39	1.19	0.26
40	0.73	0.19

Return to Labor Market

Marital status	Return to	Age group			
		37-39	40-44	45-49	50-
Married	full-time	2.09%	2.10%	1.39%	0.76%
Married	part-time	13.17%	13.80%	9.73%	6.28%
Unmarried	full-time	8.37%	10.48%	6.86%	3.10%
Unmarried	part-time	10.92%	10.48%	9.14%	8.87%

The rates related to marital status and childbirth in the table are calculated from numbers of marriages, divorces, widows, and childbirth, obtained from the 1995 Vital Statistics of Japan, and population numbers by marital status are obtained from the 1995 Population Census of Japan.

The rates of return to the labor market are obtained from the 1992 Employment Status Survey of Japan. The resignation rate from full-time position is assumed to 4% if due to marriage, and 14% if due to childbirth, as calculated for female employees, resignation due to marriage and due to childcare are also from the 1992 Employment Status Survey of Japan.

All data sources are published by: Statistics Bureau, Management and Coordination Agency, Government of Japan.

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