Columbia Business School
Center on Japanese Economy and Business

CENTER ON JAPANESE ECONOMY AND BUSINESS

日本経済経営研究所

Working Paper Series

April 2016, No. 346

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This paper is available online at www.gsb.columbia.edu/cjeb/research

COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK

Education and Marriage Decisions of Japanese Women and the Role of the Equal Employment Opportunity Act

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March 27, 2016

Abstract

Prompted by concordant upward trends in both the university advancement rate and the unmarried rate for Japanese women, this paper investigates whether the Equal Employment Opportunity Act (EEOA), which was passed in 1985, affected women's marriage decisions either directly or via their decisions to pursue university education. To this end, we estimate a model that treats education and marriage decisions as jointly determined using longitudinal data for Japanese women. We find strong support for the proposition that the passage of the EEOA increased the deterrent effect of university education on marriage, but only inconclusive evidence that the Act increased the proportion of women with a university education.

JEL classification: J12, J24, I21, K31

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1 Introduction

The striking decline in Japanese birth rates over past thirty years has prompted national concern, with fertility rates well below the population replacement rate (Faruqee and Mühleisen, 2001; Japan Ministry of Health, Labour and Welfare, 2015).[1] The resulting shrinking population means that in the future, the country's old-age dependency ratio will increase as the large postwar baby boom and baby boom echo cohorts are supported by subsequent, smaller cohorts.[2] Coincident with this decline in birth rates have been a decline in marriage rates (Sakamoto and Kitamura, 2007) and a rise in the mean age of first marriage (Japan Ministry of Health, Labour and Welfare, 2015), both of which are linked directly by fertility researchers to the decline in birth rates.[3] Over the same period, with the passage of the Equal Employment Opportunity Act (EEOA) in 1985 and subsequent supporting legislation, career opportunities available to women have expanded, especially for women with a university education.

The goal of this paper is to investigate the possible role the passage of the Equal Employment Opportunity Act in explaining the delay and decline in women's marriage, both directly and through the link of higher education. Existing literature has documented the increased proportion of women who get a university education over this period and suggested that the EEOA may have played a role in this increase (Edwards and Pasquale, 2003; Abe, 2011). At the same time, the large economic and demographic literature on the determinants of women's marriage propensity and timing underscores the role of educational attainment in marriage decisions, with university-educated women more likely than others to delay marriage (e.g. Raymo, 2003). To our knowledge, only one paper (Abe, 2011) addresses the possibility that the passage of the EEOA could be a factor in women's marriage decisions, but that paper does not explicitly test this proposition. In our paper, we address this void by investigating whether the EEOA affected women's marriage decisions either directly or via their decisions to pursue university education. Our model treats education

[1] The total fertility rate reached its lowest point, at 1.26, in 2005 and though it has risen in 2014 to 1.42, it is still well below the population replacement rate (Japan Ministry of Health, Labour and Welfare, 2015).

[2] The ratio of those aged 65 and above to the working-age population (aged 20-64 years) is estimated to rise from 27% in 2000 to 47% in 2025, higher than estimated for other low-birth-rate counties like France and Italy (Faruqee and Mühleisen, 2001, Table 1).

[3] As many researchers have noted (e.g. Hashimoto and Kondo, 2012), because the average number of children borne by a married couple has stayed relatively constant since the 1970 and the percent of births that take place outside of marriage is very small (less than 2% in 2003), it is the decline in the marriage rate of women that accounts for the overall declines in fertility. See also Narayan and Peng (2007). For a general review of models of marriage and childbirth, see Ermisch (2003) and Brien and Sheran (2003).

and marriage decisions as jointly determined—something that has not been done in previous research on Japanese women—and is estimated using data from the Japanese Panel Survey on Consumers (JPSC).

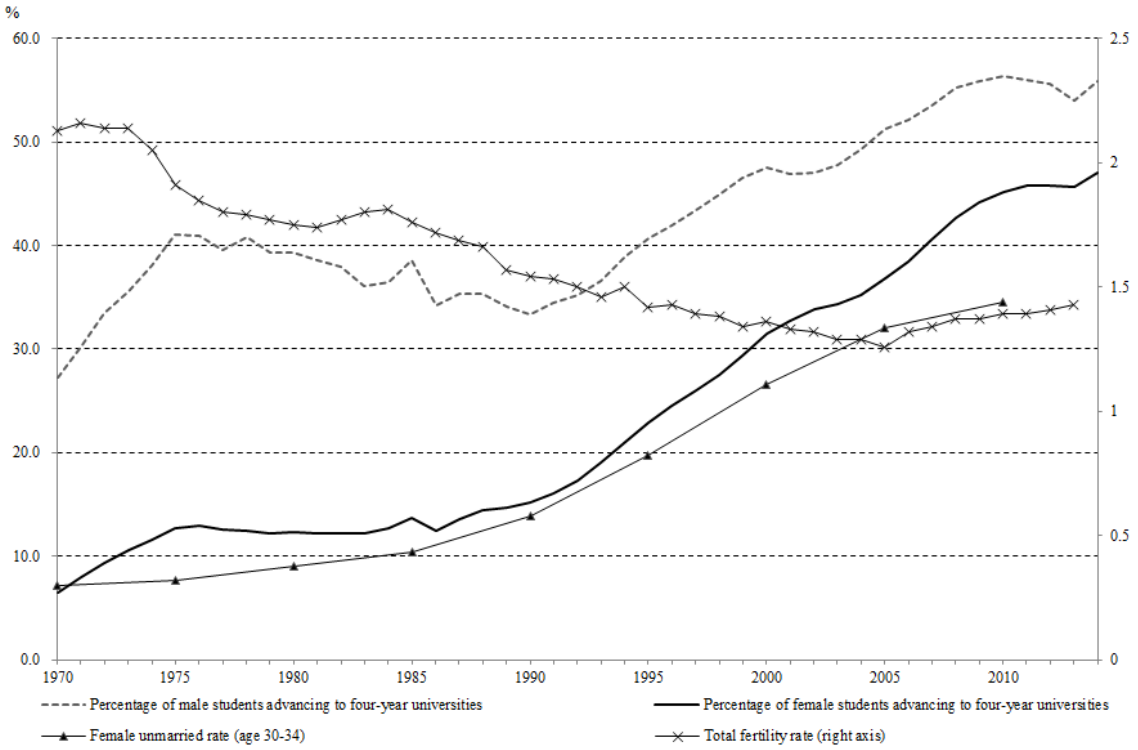
Focusing on the likelihood that women marry by age 32, our research provides strong support for the proposition that the passage of the EEOA played a role in the delay and decline of marriage. Specifically, even when we take explicit account of the effect of unmeasured personal attributes on education and marriage decisions, we find that the deterrent effect of university education on marriage more than doubles for post-EEOA cohorts of women as compared to pre-EEOA cohorts. University-educated women in post-EEOA cohorts are 16 to 19 percentage points less likely than their less educated contemporaries to be married by age 32, whereas for pre-EEOA cohorts the corresponding decline is at most 8 percentage points. On the other hand, we find that the decision to obtain a university education is primarily determined by a young woman's ability and a host of family background characteristics, with the EEOA having an ambiguous and at best small impact. Overall, our findings indicate that for those seeking to understand the declines over the past 30 years in marriage and fertility in Japan, it is important to take into account the role played by the EEOA.

Our paper is organized as follows. In Section 2 we briefly describe the Equal Employment Act and review selected recent research on the relationships among education, marriage, and the EEOA. In Section 3 we sketch out a model of joint decision making with regard to education and marriage. Section 4 describes the JPSC data, followed by Sections 5 and 6, which provide estimates of our model using a recursive bivariate probit statistical methodology. Section 7 summarizes our conclusions.

2 Background and Related Research

The trends that prompt our research and that of many others are illustrated in Figure 1. Shown in this figure are data from 1970 to 2013 for the total fertility rate, the percent of women aged 30-34 not married, the percent of female high school graduates who advance to university, and, for comparison, the percent of male high school graduates who advance to university. Throughout this period there has been a dramatic decline in the total fertility rate which, while increasing slightly since its nadir in 2005, still remains well below the replacement rate. At the same time, the percent of women aged 30-34 who remain unmarried

Figure 1: Four-year University Advancement Rate, Unmarried Rate and Fertility Rate



Source: *Basic School Survey* (Ministry of Education, Culture, Sports, Science and Technology), *Vital Statistics* (Ministry of Health, Labour and Welfare), *Population Census* (Ministry of Internal Affairs and Communications)

has steadily increased, from under 10% in 1970 to almost 35% in 2010.[4] Roughly parallel with this rise in the proportion unmarried is the increase in young women's advancement rate to university, growing from under 10% in 1970 to over 45% in 2010. It is noticeable that the slopes of both of the latter two growth curves become steeper after 1985, the year in which the EEOA was enacted by the Japanese legislature. The advancement rate to university of young men also increased over the entire period, though less uniformly than that of women, but the difference between the advancement rates of men and women shrinks noticeably after 1985.

These concordant trends suggest the following set of hypotheses, which we investigate in this paper: (1) The passage of the EEOA, by expanding career opportunities of university educated women, increased the proportion of qualified women who follow this educational path; (2) The expanded career opportunities associated with university education influence

[4] Young women's mean age at first marriage has also been increasing over this period, from 24.2 in 1970, to 28.8 in 2010, to 29.3 in 2013 (Japan Ministry of Health, Labour and Welfare, 2015).

women's marriage decisions, leading them to delay or decline marriage; (3) The passage of the EEOA (and subsequent supporting legislation), which changed the legal and cultural landscape to make a career path more socially and economically attractive to women, increased the "deterrent" effect of university education on marriage.

To explore these hypotheses, we develop and estimate a multivariate model of the relationship between Japanese women's education and marriage decisions and the role of the EEOA in these decisions.[5] While no other studies directly address this set of hypotheses, a number of papers that examine some of the relevant relationships inform our research. They are reviewed in the sub-sections below.[6]

2.1 The 1985 Equal Employment Opportunity Act and Subsequent Supporting Legislation

The Equal Employment Opportunity Act (EEOA) was enacted in 1985 and went into effect in April 1986. Prior to 1985, the primary Japanese legislation that treated women's position in the labor market was the 1947 Labor Standards Law, which prohibited gender-based wage discrimination. Japan, as a signatory of the 1980 United Nations Convention Concerning the Elimination of All Forms of Discrimination Against Women, sought to expand its legislation with regard to women in the labor market in order to meet the commitments in this Convention. The 1985 EEOA was the result: it prohibited gender discrimination with respect to vocational training, fringe benefits, dismissal, and mandatory retirement by reason of marriage, pregnancy or childbirth. The Act also stated that firms have a "duty to endeavor" to equalize opportunity with regard to recruitment, hiring, job assignment and promotion, though there were no prohibitions in these important areas. The Japanese government provided administrative guidance to firms to help them meet this duty, but there was no private right to legal action with regard to these areas of unequal treatment.[7] Even with these drawbacks, however, the EEOA of 1985 was enthusiastically welcomed by Japanese women

[5] Models like the one we use in this paper owe a great debt to the seminal work of Gary Becker on human capital, marriage, and the economics of the family (see, for example, Becker (1976, 1993)).

[6] The next subsection relies heavily on Araki (1998), which provides a good review (in English) of the 1985 EEOA as well as the 1997 legislation (which went into effect in 1999) that substantially strengthen the original law. Yamada (2013) also summarizes these two laws and provides a description of the subsequent law, which further expands on the original EEOA. In earlier literature the EEOA was referred to as the Equal Employment Opportunity Law, or EEOL, as opposed to the Equal Employment Opportunity Act, but EEOA is a more apt translation of the Japanese title for this law. With regard to legislation covering leaves for child and elder care, Japan Ministry of Health, Labour and Welfare (2010) is a good reference.

[7] Government oversight in the form of "administrative guidance" is much more effective in the Japanese context than it would be in an American context; indeed, some argue that it is a "means more effective than criminal or civil sanctions in the Japanese social context" (Araki, 1998, p.5).

as epoch-making legislation. Especially for university-educated women, it was expected to expand labor market opportunities, making "career" positions more available to them in an era when most women had been required by their employers to leave their jobs upon marriage or childbirth regardless of their educational levels.

In order to strengthen the 1985 Act, the Japanese legislature revised it two times, in 1997 and 2003. The Amendment to EEOA of 1997 prohibited discrimination in hiring and promotion, and the Amendment of 2003 prohibited discrimination against males. The Amendment of 2003 also included a prohibition of implicit discrimination. This proscription was introduced in response to the fact that after the original EEOA went into effect, many larger firms adopted a dual-career path system to steer women away from traditional career position (Hamaguchi, 2011). Other important legislation related to the EEOA is the 1991 Child Care and Family Care Leave Act, which was strengthened in 1995 and 1999. It mandates that employers give parental leave to any mother whose child is under the age of one.

2.2 The EEOA/Labor Market Link

The hypotheses we explore are based on the proposition that the EEOA expanded career opportunities for university-educated women. Three recent papers, Abe (2010, 2011, 2013), investigate this proposition by looking at effects of the EEOA on women's earnings and employment.

Abe (2010) examines the impact of the EEOA on the gender wage gap using cohort data from the Basic Survey of Wage Structure at five-year intervals from 1975 to 2005. Focusing on full-time workers only, she shows that while the overall female/male full-time wage gap decreased over this period, this decrease was mainly attributable to an increase in the educational attainment of the full-time female labor force; for university-educated women, the female-to-male wage gap narrowed very little for post-EEOA cohorts.

The gender wage gap within educational categories may not have been much affected by the EEOA, but what about women's employment? The relationship between the EEOA and women's labor force behavior over the life cycle is the focus of Abe (2011). Using data from the Japanese Employment Status Survey (ESS, Shugyo Kozo Kihon Chosa) from 1998 to 2007, this paper examines how the EEOA affected women's full- and part-time employment patterns both by marital status and by level of educational attainment. Using a methodology that compares cohorts of women who entered the labor market after the EEOA went into effect with earlier, pre-EEOA, cohorts, Abe finds that the employment

rate in full-time positions increased post-EEOA only for university graduates. Taking the analysis further, Abe decomposed changes in full-time employment of this group by marital status since unmarried women typically have higher employment rates than married women. She finds that the full-time employment rate did not increase for either married or unmarried university-educated women, but rather that the *proportion* of these highly educated women who remained unmarried had increased.

Abe (2013) explores the possibility that the EEOA may have had different impacts across the various Japanese regions and concludes that such differences do exist: the post-EEOA increase in employment rates of university-educated women documented in her earlier research was most evident in the Tokyo area, most likely because that is where there is the greatest availability of managerial positions.

Taken together, these three studies suggest that the benefits to Japanese women of the career opportunities enabled by the EEOA were to be obtained mainly by investing in university education and working (especially in Tokyo) a full-time rather than part-time schedule, the latter which was facilitated by delaying or declining marriage. Abe's findings are based on a model that does not allow for the explicit possibility that marriage rates and educational attainment are themselves affected by the EEOA, but she recognizes these links in her conclusion: "Since the enactment of the EEOA, more women with university education have married late or stayed unmarried" (Abe, 2011, p.52).

2.3 Higher Education and the EEOA

The role of the EEOA law in young women's decisions with regard to post-high-school education is addressed in Edwards and Pasquale (2003). Using micro-data from the first wave of the Japanese Panel Survey on Consumers (JPSC), Edwards and Pasquale's analysis holds constant family background, demographic factors, and economic conditions in estimating the effect of the passage of the EEOA on the higher education decisions of young Japanese women. Their model does a good job of explaining higher education decisions, but the results with regard to the effect of the EEOA are not robust, in part because only two cohorts in the survey had made educational decisions after the passage of the law. Nonetheless, their research provides suggestive evidence that the passage of the law was associated with an increased propensity of young women to choose university education over junior college.

2.4 Marriage

There is an extensive economic and demographic literature on women's marriage rates in Japan, much of it focusing on explaining the secular declines illustrated in Figure 1. To our knowledge, none of this literature explicitly addresses the possible role of the EEOA in contributing to this decline, but a variety of other explanations have been explored. Some studies focus on the role of labor market conditions, including unemployment rates of men, women, or both (e.g. Higuchi, 2001; Miyoshi, 2014; Hashimoto and Kondo, 2012). Other studies focus on the role of the women's own earnings and income (e.g. Higuchi, 2001; Sakai, 2009). Still others focus on the increasing levels of women's educational attainment and the resulting reduced relative availability of potential spouses with the requisite level of education, dubbed the "marriage mismatch" hypothesis (e.g. Raymo, 2003; Raymo and Iwasawa, 2005). Other studies target increased income or other transfers (housing, for example) from parents to daughters as a potential explanation—dubbed the "parasite single" hypothesis (Sakamoto and Kitamura, 2007).

These studies examine different hypotheses and use different data sets, but they have one common feature: all find that a woman's educational attainment is an important correlate of whether and when she marries. Specifically, all of these studies report that women with a university education are more likely to delay marriage.[8] With regard to the question of whether this delay translates into a lower overall likelihood that university-educated women marry, the studies are not definitive. Results differ depending on the set of explanatory variables held constant in the analyses: for example, Raymo (2003) estimates a set of alternative models which yield contrasting results on this point.

Other factors that have been found to be statistically significant in one or more of these various studies are: the woman's age; measures that represent various aspects of the labor market for both men and women, including the woman's own income; measures that represent socioeconomic characteristics of her parents, including their income, health, and work status; measures that reflect income or other transfers from her parents, including housing; characteristics of the woman's natal family; demographic measures that reflect the availability of potential spouses; and the region in which she lives and its rural/urban characteristics.

[8] Even though university-educated women delay marriage while in school, they catch up to some extent later—the difference in mean age at marriage between university graduates and high school graduates is substantially less than four years (see Shirahase, 2000, especially Table 1).

3 A Model of Joint Education and Marriage Decisions

Pulling together the findings cited above, we see that the EEOA is likely to have positively affected the probability that women attend university; that university-educated women are more likely than other women to be employed in full-time positions and to delay marriage; and that a woman's decision to marry is empirically related to her level of education, her family background, her earnings and income, and labor market conditions at the time of her graduation and thereafter. The papers on marriage referenced above do not incorporate the possibility that marriage and education are jointly determined; nor do they consider the possibility that the EEOA might be related to marriage decisions. The model described below incorporates these innovations.

3.1 The Japanese Context

Japanese women typically choose between two types of post-high school education—university and junior college—but it is university education that provides the background for a career.[9] Junior college curricula are typically limited and three-quarters of them "offer a single curriculum in non-vocational subjects, such as music, home economics, and English literature" (Ishida, 1998). Junior college education is likely to be better preparation for marriage than for career employment, and the financial returns from a junior college education may run predominantly through the marriage market as compared to the labor market. University education, in contrast, offers a curriculum that provides superior preparation for career employment, though it too may improve a young woman's marriage prospects.[10] The education decision we focus on, therefore, is the decision to attend or not attend university.

A distinguishing feature of Japanese higher education is that, unlike the United States where people leave and re-enter post-high school educational institutions at various points in life, education in Japan is more structured; few women are in any type of formal schooling after marriage. In addition, the path to university education is well defined, so that without proper preparation in the high school years, a Japanese student cannot expect to enter

[9] Other post-high school options are colleges of technology and specialized training colleges, which provide a wide variety of vocational and practical skills but are not typically considered to be comparable to university, though in some cases they may be comparable to junior colleges.

[10] In the context of the United States, Goldin (1992), Lefgren and McIntyre (2006), Ge (2011), and others have shown that a large part of the returns to university education is via the marriage market: by attending university, young women come in contact with highly educated young men who will have greater future earning power. For example, doing a "back-of-the-envelope" computation, Lefgren and McIntyre estimate that about half of the increase in a woman's "available income" (including income that she receives through her marriage) associated with her own higher education comes through the marriage market.

university.[11] These features provide the setting within which education decisions are made in Japan.

3.2 The Model

The model we sketch out below captures in stylized form this context and is similar in spirit to the model outlined by Lefgren and McIntyre (2006) (hereafter referred to as L&M). L&M posit a two-period model in which a woman's education decision is made in the first period and her marriage decision is made in the second period.[12] They also postulate that a woman's education does not directly affect her "draw" in the marriage market, but because higher education is associated with higher earnings, her education does affect whether or not a particular draw from the distribution of potential husbands will be acceptable to her. The higher her own level of education, the fewer the number of men acceptable to her as a potential spouse. In this model, the resulting relationship between educational attainment and marriage can be positive or negative, depending on whether a woman's higher level of education has a stronger effect on her own earnings or on her share of her husband's earnings.[13] L&M also show, as we will below, that a woman's educational choice is related to her future marriage expectations and that not taking into account this potential endogeneity can lead to biased coefficients of the education variable in a marriage equation.

While our model is inspired by L&M, it differs because we focus on tracing the effects of the EEOA on the interrelated decisions regarding education and marriage rather than on measuring the economic status of women before and after marriage. We assume that a young woman's (and her family's) decision with regard to whether or not she will get a university education is well defined by the time she is near the end of high school—at age 17 (this age corresponds to period one in L&M's model). Variables that affect this decision would include

[11] This characterization of access to university education is appropriate at the time the women in this sample were attending university, but more recently there have been changes. For example, in 1997 only 5% of private universities fell below their enrollment limits, but by 2008 the situation had changed dramatically, with 47% of private universities falling below their enrollment limits. As a result, more universities are now enrolling students with lower test scores than would have been acceptable in the past; such universities have been dubbed "free-pass" universities by the Japanese media. For a detailed discussion of recent changes in Japanese higher education see Igami (2014).

[12] L&M apply this two-period model to data for the United States, but the model is more appropriate in the context of Japan than it is for the United States, where it is not at all uncommon for people to enter and/or reenter university after marriage or after having had children.

[13] Another paper that looks at the interrelationship between education and marriage decisions in the U. S., Ge (2011), focuses on the increased financial gains from marriage obtainable by attending college (because of the better set of potential spouses from which to choose) and reports that the expected financial gains from marriage are a significant determinant of a woman's decision to attend college.

family demographic and socioeconomic characteristic, the expected costs and returns to a university education, and unmeasured ability and taste factors that reflect a young woman's desire for career employment and marriage. The marriage decision is assume to take place after her education is completed (this corresponds to period 2 in the L&M model), and is determined by the young woman's educational attainment (which, in line with L&M, will affect her financial returns to marriage), her family background, various indicators of the states of the marriage and labor markets, and unmeasured taste and culture factors that influence both her career aspirations and her judgment about the desirability of marriage.

The features described above are best captured by a recursive bivariate probit statistical model, represented mathematically below (see Greene, 2008, pp. 823-826 for a discussion of this model). For $i = 1, \ldots, N$,

$$E_i = 1\left[\alpha_e A_i + x_{e,i}{}'\beta_e + \varepsilon_{e,i} > 0\right] \tag{1}$$

$$M_i = 1\left[\gamma E_i + \alpha_m A_i + \theta(E_i \times A_i) + x_{m,i}{}'\beta_m + \varepsilon_{m,i} > 0\right], \tag{2}$$

where $1[\cdot]$ is an indicator function, and the error terms are assumed to be distributed as a bivariate normal:

$$\begin{pmatrix} \varepsilon_e \\ \varepsilon_m \end{pmatrix} \sim N\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 & \rho \\ \rho & 1 \end{bmatrix}\right).$$

In this system of equations, the dichotomous variable E_i represents whether or not a young woman i completed university,[14] and M_i represents whether or not she has been married by the age of 32.[15] The factors which affect the education decision, denoted by x_e, are similar to those in Edwards and Pasquale (2003), while the error term ε_e picks up unmeasured ability, tastes for education, taste for marriage, and taste for career employment, all as of the time the young woman is making her higher education decision. The factors that affect the marriage decision, denoted by x_m, follow closely the marriage literature cited earlier, while the random error term, ε_m, picks up various luck factors that determine a marriage match and also the young woman's unobservable taste for career employment and marriage

[14] Like L&M, we posit these relations in the form of regression equations. In an appendix, L&M sketch out how regression equations such as these could be derived, with a set of appropriate simplifying assumptions, from a utility maximization framework. Note also that the first equation in the system is similar to the estimating equation in Edwards and Pasquale (2003), which is derived from a random utility model.

[15] In this paper, since we are focusing on the marriage decision, we define our marriage variable to include anyone who at the point when we observe her had decided to become married, whether or not that marriage ended in divorce. Note that divorce is relatively rare in Japan, at about 2 per 1000 population in 2010 (Japan Ministry of Health, Labour and Welfare, 2015). In the JPSC data, approximately 1.0% of the previously married women get divorced every year.

at the time of completing her education. The variables in x_e and x_m, which have some common elements, are described in detail in the next section. The dichotomous variable A_i, appearing in both equations, indicates whether or not a young woman's education decision was made before or after the passage of the EEOA.

There are three other things to note about the econometric model. First, there is a potential correlation between the error terms in the education and marriage equations ($\rho \neq 0$) because they both include components that represent unmeasured tastes for marriage and career employment. Such a correlation implies that educational attainment is an endogenous variable in the marriage equation ($Cov[M, \varepsilon_m] \neq 0$). Indeed, including the education variable, which is the dependent variable in the first equation, in the marriage equation (2) as an explanatory variable is what distinguishes this statistical model from a non-recursive model. Greene (2008, page 823) notes, however, that in models such as this one, the endogenous nature of education variable in marriage equation "can be ignored in formulating the log-likelihood." Hence, we are able to treat the education variable E_i in marriage equation (2) as if it were exogenous, by jointly estimating equations (1) and (2) and allowing for a correlation, ρ, between the error terms .

Second, identification of the model requires some variable in the education equation (1) be excluded from the marriage equation (2). Although in theory the bivariate probit model is identified without the exclusion restrictions (Wilde, 2000), the performance of the model without the exclusion restriction tends to be poor. The exclusion restrictions help estimate the model more accurately. As shown in the next section, our model satisfies the exclusion restrictions since some explanatory variables which are included in the education equation (1) do not appear in the marriage equation (2).

Third, we include an interaction term between the education variable and the EEOA variable, as explained below, in order to see if the effect of education on marriage changes after the passage of the EEO Act.

4 Data and Variables

The data used to estimate our model come from a unique micro-level panel survey entitled the Japanese Panel Survey of Consumers (JPSC), a nationwide longitudinal survey of young Japanese women and their husbands sponsored by the Institute for Research on Household Economics (Kakei Keizai Kenkyujo) in Japan. These data are especially suitable for our study because they provide a rich set of information about women's family background, education, and marriage. The first wave (Wave A) of this survey was conducted in 1993 and

Figure 2: The Number of the JPSC Respondents by Age in Each Year

Year	Age																									Total
	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	
1993	151	161	145	115	144	125	143	132	122	106	156																1,500
1994		145	146	136	108	136	115	138	124	117	101	149															1,415
1995			134	139	127	100	133	109	130	119	109	96	145														1,341
1996				132	128	122	98	126	107	128	107	105	93	143													1,289
1997	125	131	127	117	126	121	121	96	121	103	128	103	103	92	135												1,749
1998		110	121	107	97	118	121	114	91	112	95	122	98	97	91	134											1,628
1999			104	110	104	88	107	114	107	88	109	88	117	95	93	88	125										1,537
2000				99	103	99	82	108	109	105	85	106	88	112	91	91	84	119									1,481
2001					94	97	93	80	105	106	102	82	97	84	108	89	86	83	115								1,421
2002						88	88	91	76	100	102	101	82	92	83	105	87	84	82	112							1,373
2003	127	135	152	140	139	143	81	82	88	72	94	97	97	81	87	77	99	85	81	76	106						2,139
2004		106	113	134	119	124	128	77	79	85	71	90	94	95	76	85	70	95	82	79	76	102					1,980
2005			94	107	126	111	119	117	75	72	78	67	84	90	93	71	84	68	92	78	75	70	99				1,870
2006				87	99	116	98	113	108	73	65	75	65	82	85	88	69	82	68	91	75	72	69	94			1,774
2007					82	94	107	94	109	102	70	63	73	65	82	85	87	70	80	64	84	72	67	66	90		1,706
2008						76	90	100	90	105	99	66	63	70	61	82	84	83	67	81	64	80	72	64	63	88	1,648

WAVE A:
WAVE B:
WAVE C:

Post-EEOL cohorts are in dotted box.

included 1500 randomly selected women aged 24-34 in that year.[16] Subsequent waves (B and C) were added to the sample in 1997 and 2003: Wave B included 500 women aged between 24 and 27 years in 1997; and Wave C included 836 women aged between 24 and 29 years in 2003. As of 2008, there remained 1648 respondents aged between 29 and 49 in the JPSC.

The structure of the data set is illustrated in Figure 2. Each row in the figure corresponds to a year and shows the number of women of each age for whom data are reported for that year. For example, in 1993, the first survey year of Wave A, there were 151 women aged 24, 161 aged 25, and so on, for a total of 1500 women aged 24 to 34 in that year. In the following year, 1994, the women have aged one year and there is some attrition, so that there are no women aged 24, 145 aged 25 (6 women from that age-cohort had dropped out of the survey over the year), 146 aged 26, and so on, for a total of 1415 women aged 25 to 35 in that year (total attrition was 85). Things continue in a similar fashion in 1995 and 1996. Wave B begins in 1997, with a new group of 24 to 27 year-old women added to the survey, and Wave C begins in 2003, with an additional group of women aged 24 to 29 added in that year. The potential number of women for whom we would have family background and education information—both of which come from the questionnaire administered in the initial survey

[16] The survey originally contacted 3,623 randomly selected women in this age group, of whom 1500 were ultimately selected to be in the first wave of the panel. Demographic characteristics of these participants were comparable to those of the same age group in the Population Census (Higuchi, 2001).

year for each wave—is 2836. Because of missing observations for some of these variables, our actual sample consists of 2598 women.

Looking at Figure 2 in a slightly different way, one can see that each column shows the number of observations available for women of a specified age but at different points in calendar time. For example, if one wanted to study women at age 32, there would be 122 of them observed in 1993, 124 observed in 1994, and so on, for a total of 1641 women in the sample who responded to the survey at age 32. Also indicated in this figure is whether women of a particular age in a particular year are members of the pre-EEOA cohort or the post-EEOA cohort. The pre-EEOA cohort is defined to be women aged 18 or older in 1985, the year that the EEO Act was passed; women in this cohort appear in the figure above the dotted diagonal. The post-EEOA cohort of women is defined to be those who were aged 17 or younger in 1985; women in this cohort appear below the dotted diagonal.

Our choice of marriage variable—whether a woman is or has been married by age 32—requires some explanation. Ideally, we would observe marital status at an older age because not all women who plan to marry will in fact be married by age 32. However, given the construction of the sample and sample attrition, the later the age at which we observe marital status, the fewer observations will be available. Further, if we choose to observe marital status at a later age, the balance between the pre-EEOA and post-EEOA samples is reduced. Thus, our choice is a pragmatic one: by observing women at age 32, we will capture a large proportion of marriages while still having a large enough sample size to address our main hypotheses.[17]

Among our working sample of 2598, there are 2157 women for whom marital status at age 32 can be determined. The difference between these two numbers is attributable primarily to: (1) women who remained in the survey through 2008 but had not yet reached age 32 and had not yet married; and (2) women who had dropped out of the sample before age 32 and had not married prior to dropping out. The main differences between the subsample for which marital status is known and the full sample are: the women in the subsample are more likely to be from pre-EEOA cohorts (the proportions are .579 versus .518) and less likely to have a university education (the proportions ares .151 versus .169).

The variables used in our estimation are defined in Table 1. The variables that do not come from the JPSC are measured at the level of the prefecture[18] in which the young woman

[17] The mean age at first marriage for women in Japan over the time period covered in our data ranged from 25.9 (in 1990) to 28.8 (in 2010) (Japan Ministry of Health, Labour and Welfare, 2015).

[18] Prefectures in Japan are geographic units that are similar to states in the United States. One variable in Table 1 is measured at the national level: the University/H.S. First Wage Ratio.

Table 1: List of Variables

Variable Name	Time Point of Measurement	Variable Description
Marital Status[a] (M)	Age of thirty-two	Ever married, 1; never married, 0.
Completed Education[a] (E)	Initial survey year[f]	University and above, 1; junior college and below, 0.
EEOA[a] (A)	—	Those who were 17 or younger in 1985 (the year EEO Act was passed), 1; otherwise, 0
Trend (Cohort trend)[a]	—	Those who were born in 1959 (the oldest respondents) were coded at 1, and so on up to those where were born in 1979 (the youngest respondents), who were coded at 21.
Parent's Income[a]	Initial survey year[f]	Parent's Annual Income in the previous year
High Income Class		above 10 million, 1; otherwise, 0.
Middle Income Class		between 2.5 million and 10 million yen, 1; otherwise, 0.
Low Income Class		(Reference) below 2.5 million yen, 1; otherwise, 0.
Mother's Education[a]	Initial survey year[f]	University, 1; otherwise, 0.
Father's Education[a]	Initial survey year[f]	University, 1; otherwise, 0.
Private High School[a]	Initial survey year[f]	Attended private high school, 1; otherwise, 0.
Homemaker[a]	Initial survey year[f]	During daughter's childhood (birth to age 20), mother was never employed for pay, 1; mother was at some point employed for pay, 0.
Number of Siblings[a]	Initial survey year[f]	Number of siblings
Having Brother(s)[a]	Initial survey year[f]	Has one or more brothers, 1; otherwise, 0.
Juku 2[a]	Initial survey year[f]	attended juku in the late years of elementary school, 1; otherwise, 0.
Juku 3[a]	Initial survey year[f]	attended juku when in junior high school, 1; otherwise, 0.
Juku 4[a]	Initial survey year[f]	attended juku when in high school, 1; otherwise, 0.
City Size[a]	Initial survey year[f]	Size of cities of residence
Large City		14 major Japanese cities, 1; otherwise, 0.
Medium City		cities other than "Large city," 1; otherwise, 0.
Other		"Town, villages, or overseas" 1; otherwise, 0.
Number of Professors[b,h]	Age of seventeen	Number of Professors per high school graduate
Spouse Availability[b,h]	Age of seventeen	For the respondents who did not have a university degree: the ratio of (two-year senior) male high school graduates to female high school graduates who did not go to university. For the respondents who have a university degree: the ratio of (two-year senior) male high school graduates who went to university to female high school graduates who went to university.
Vacancy/Application$_{ED}$[c,h]	Age of seventeen	Ratio of job offers to job seekers
Vacancy/Application$_{MA}$[c,h]	Age at which education is completed[g]	Ratio of job offers to job seekers
Univ./HS First Wage Ratio[d]	Age of seventeen	Ratio of University graduate's first wage to high school graduate's first wage for males (national average)
Rent[e,h]	Age at which education is completed[g]	Real rent per tatami mat, in thousands of yen (a tatami mat is approximately 1.7 square meters).

[a] Source: JPSC
[b] Source: Basic School Survey (Ministry of Education, Culture, Sports, Science and Technology)
[c] Source: Job/Employment Placement Services Statistics (Ministry of Health, Labour and Welfare)
[d] Source: Basic Survey on Wage Structure (Ministry of Health, Labour and Welfare)
[e] Source: Housing and Land Survey of Japan (Statistics Bureau, Ministry of Internal Affairs and Communications)
[f] We use the first three waves of the JPSC. The initial survey year is 1993 for Wave A, 1997 for Wave B, 2003 for Wave C, and 2008 for Wave D.
[g] The age at which education is completed is assumed to be 18 for high school graduates, 21 for junior college or vocational school graduates, and 23 for university graduates.
[h] A not-JPSC variable which is aggregated at prefecture level.

resided as of age 17.

The variables in x_e are similar to those in Edwards and Pasquale (2003) and include: characteristics of the woman's family background (parents' educational attainment, family income, whether the young woman attended private high school, her number of siblings, whether she has any brothers, and whether her mother was primarily a homemaker); proxy measures of her academic ability (attendance at juku ("cram school") in elementary (Juku 2), junior high (Juku 3), and high school (Juku 4)); proxy measures for the availability and opportunity costs of university education in her area as measured at her age 17 (the ratio of professors to high school graduates and the vacancy/application ratio); a proxy for the expected returns to university education (the ratio for males of the national average starting wage for university graduates relative to that of high school graduates); and a dummy variable indicating whether the EEOA was in effect when she was 17 years old, the age at which we assume her final decision with regard to university education is made. As discussed earlier, the latter variable is included because the EEOA aimed to increase women's access to career employment (and the resulting higher lifetime earnings), and university education is the traditional route to this type of employment.

In the case of the marriage equation, the explanatory variables x_m represent factors suggested by the economic and demographic literature surveyed in the previous section. Educational attainment has been found to be an important variable in marriage decisions in almost all of the literature that we surveyed and falls directly out of the L&M utility maximization model described above; our education dummy variable indicates whether or not the young woman completed university. Family background variables like parents' income, family structure (number of siblings and whether there is a male sibling), and whether the woman's mother was a full-time homemaker are also commonly used. To represent the state of the labor market around the time that the young woman completes her education a variety of proxies have been used (see Higuchi, 2001; Hashimoto and Kondo, 2012; Sakamoto and Kitamura, 2007). We use the prefecture vacancy/application ratio at the age she completes her schooling to proxy the strength of the labor market she faces post-schooling.[19] A higher vacancy/application ratio indicates a stronger job market, which may be positively or negatively related to the probability of marriage.[20] In addition, following Abe (2013), we include

[19] The age at which a woman's education is completed is assumed to be 18 for a high school graduate, 21 for a junior college or vocational school graduate, and 23 for a university graduate.

[20] Miyoshi (2014) and others, noting that a strong labor market affects both a woman's expected earning power and the earning power of a potential spouse, refers to the positive relationship the "self-reliance effect" and the negative relationship the "good catch effect."

two city size variables to proxy the state of the labor market for university-educated women.

To capture the state of the marriage market we use several variables. The availability of potential spouses with a level of education equal to that of the woman's (found to be an important factor by Raymo and Iwasawa, 2005) is computed for each birth cohort for each prefecture as follows: for women who did not have a university degree, we use the ratio of the number of (two years older) male high school graduates (with or without a university education) to female high school graduates (without a university education); for women who had a university degree, we use the ratio of the number of (two years older) male university graduates to female university graduates.[21] We expect this variable to be positively related to the woman's probability of marriage. The cost of setting up a household is proxied by rent per tatami mat (in constant yen) in the woman's prefecture as of the year she completes her education. The search costs associated with finding a mate and also varying cultural norms regarding marriage are proxied by the two city size variables mentioned above (Sakai, 2009).

To explore the potential impact of the EEOA, we include in the marriage equation the EEOA dummy variable as defined above as well as an EEOA/education interaction term. This interaction term, which enables us to estimate separate education coefficients for pre- and post-EEOA cohorts, permits us to test the hypothesis that the passage of the EEOA increased the "deterrent" effect of university education on marriage.

In addition to these variables we include in both the education and marriage equations a set of dummy variables that indicate the geographic district in which the woman lived when she was aged 17 (Japan is divided into ten such districts).[22] These are included to hold constant any district-specific unmeasured taste, economic, or cultural factors that may affect education or marriage decisions. Finally, in some specifications, we include a linear time trend variable. Descriptive statistics for all variables are shown in Table 2. The final two columns of the table indicate whether the variable appears in the education equation, the marriage equation, or both. The variables in the education equation (1) but not in the marriage equation (2), that is, "Yes" to the first of these two columns but "No" to the

[21] We construct our proxy measure for spouse availability using men two years older than the women because the average age difference between spouses over the period of our study ranged from 2.9 years in 1987, to 2.6 in 1992, to 2.4 in 1997, to 1.7 in 2002, to 1.7 in 2005 (see National Institute of Population and Social Security Research, 2005).

[22] It is possible that women will not be living in the same district at the time they make their marriage decision as when they were age 17, but the JPSC data do not permit us to identify the district in which each woman lives subsequent to age 17. The ten districts (called *Chiho* in Japanese) are *Hokkaido, Tohoku, Minami-Kanto, Kita-Kanto&Koshin, Hokuriku, Tokai, Kinki, Chugoku, Shikoku* and *Kyushu*.

Table 2: Summary Statistics

Variables	Mean	Std. Dev.	Min	Max	Educ. Eq.	Marr. Eq.
Marriage	0.8401	0.3666	0	1	No	Yes
Completed Education	0.1690	0.3748	0	1	Yes	Yes
EEOA	0.5789	0.4938	0	1	Yes	Yes
Large City	0.2587	0.4380	0	1	No	Yes
Middle City	0.5712	0.4950	0	1	No	Yes
Rent	2.2323	0.9384	0.97	4.78	No	Yes
Spouse availability	1.4686	0.4620	0.44	2.78	No	Yes
Vacancy/application$_{MA}$	0.8464	0.4338	0.12	2.68	No	Yes
Middle Income Class	0.5350	0.4989	0	1	Yes	Yes
High Income Class	0.1613	0.3679	0	1	Yes	Yes
Mother's Education	0.0400	0.1961	0	1	Yes	No
Father's Education	0.1790	0.3834	0	1	Yes	No
Private High	0.3045	0.4603	0	1	Yes	No
Homemaker	0.3299	0.4703	0	1	Yes	Yes
Number of Siblings	2.4707	0.9144	1	12	Yes	Yes
Having Brother(s)	0.5804	0.4936	0	1	Yes	Yes
Juku 2	0.3714	0.4833	0	1	Yes	No
Juku 3	0.5889	0.4921	0	1	Yes	No
Juku 4	0.1821	0.3860	0	1	Yes	No
Number of Professors	224.7074	93.9015	12	767	Yes	No
Vacancy/application$_{ED}$	0.8751	0.4390	0.09	2.68	Yes	No
Univ./HS first wage ratio	1.2361	0.0365	1.15	1.42	Yes	No
Number of obs.	2598					

second, serve as the exclusion restrictions in our estimation.

5 Results

Table 3 presents maximum likelihood estimates of our model. In discussing these estimates, we concentrate on the sign and significance of the coefficients and on comparing the two specifications. We do not discuss the magnitude of the probit coefficients because they are not readily interpretable. To evaluate magnitudes requires the estimation of partial effects, which appear in Table 4.

Note that the education equation is estimated using our entire sample of 2598 observations, while the marriage equation uses the 2157 observations for which marriage data are reported. That is, the observations without marriage information contribute to the likelihood function of education only. The main difference between these two samples is that those who do not report marital status are more likely to be from recent cohorts and more likely to be university graduates. Sakamoto (2006) finds that attrition in JPSC causes biases

Table 3: Estimation Results: Bivariate Probit Model of Completed Education and Marital Status

	Panel A Base Model			Panel B Counterfactual Model– Trend Included		
	Coef.		(S.E.[a])	Coef.		(S.E.[a])
Education Equation[b]						
EEOA	0.1561	**	(0.0792)	-0.0012		(0.1301)
Trend				0.0154		(0.0104)
Middle Income	0.2157	***	(0.0791)	0.2171	***	(0.0791)
High Income	0.4885	***	(0.0985)	0.4874	***	(0.0984)
Mother Education	0.8781	***	(0.1472)	0.8710	***	(0.1475)
Father Education	0.7274	***	(0.0800)	0.7225	***	(0.0802)
Private High	-0.1451	**	(0.0721)	-0.1459	**	(0.0721)
Homemaker	0.1493	**	(0.0697)	0.1571	**	(0.0700)
Number of Siblings	-0.1254	***	(0.0453)	-0.1257	***	(0.0453)
Having Brother(s)	-0.0973		(0.0722)	-0.0961		(0.0722)
Juku 2	-0.0627		(0.0702)	-0.0636		(0.0702)
Juku 3	-0.1992	***	(0.0728)	-0.2109	***	(0.0728)
Juku 4	0.7476	***	(0.0787)	0.7510	***	(0.0786)
Number of Professors	-0.0003		(0.0004)	-0.0002		(0.0004)
Vacancy/Application$_{ED}$	-0.1596		(0.0998)	-0.1433		(0.0999)
Univ./HS First Wage Ratio	0.3796		(1.2423)	0.1828		(1.2485)
constant	-1.8857		(1.5602)	-1.7440		(1.5649)
Marriage Equation[b]						
Completed Education	-0.3238		(0.2808)	-0.2760		(0.2860)
EEOA	0.0802		(0.1004)	0.1678		(0.1456)
Education × EEOA	-0.3556	*	(0.1898)	-0.3376	*	(0.1917)
Trend				-0.0117		(0.0129)
Middle Income Class	-0.0130		(0.0773)	-0.0111		(0.0773)
High Income Class	-0.0495		(0.1163)	-0.0507		(0.1159)
Homemaker	-0.0806		(0.0728)	-0.0846		(0.0729)
Number of Siblings	0.1662	***	(0.0470)	0.1668	***	(0.0471)
Having Brother(s)	-0.1430	**	(0.0727)	-0.1443	**	(0.0728)
Large City	-0.2177	*	(0.1148)	-0.2206	*	(0.1146)
Middle City	-0.1770	*	(0.1005)	-0.1769	*	(0.1004)
Rent	-0.1782	**	(0.0803)	-0.1662	**	(0.0816)
Spouse Availability	-0.1354		(0.1462)	-0.0728		(0.1674)
Vacancy/Application$_{MA}$	-0.3272	***	(0.1005)	-0.3348	***	(0.1011)
constant	1.4021	***	(0.2849)	1.3793	***	(0.2891)
ρ	0.0078		(0.1318)	0.0074		(0.1306)
N of obs.	2,598			2,598		
Log Likelihood	-1840.5758			-1839.1309		

[a] White (1982)-type robust standard errors. *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

[b] Both education and marriage equations also contain the district dummy variables.

in the estimation of the marriage decision function. Especially, he finds that the effect of the first job is likely to be underestimated in the marriage equation. It is unclear, however, whether or how these missing observations for the marriage equation would lead to biased estimates of our model. A potential selection bias is one of limitations in our study.

We begin with the estimates in column 1, which pertain to our base model. For the university education equation, shown in the top half of the table, our results are consistent with our expectations and with Edwards and Pasquale (2003).[23] Consider first our main variable of interest, the EEOA dummy. This variable has a positive and statistically significant sign, indicating that young women who made their higher education decisions after the passage of the EEO Act were more likely than comparable women from earlier cohorts to have a university degree.

Among the other variables, characteristics of the young woman and her family are very important for predicting whether or not she has a university degree: higher family income, greater parental education, and fewer siblings are all positive and significant predictors of the probability that a young woman has a university education. Having a mother who was a full time homemaker is also positively and significantly related to a young woman's likelihood of having a university education—perhaps having one's mother available full time facilitates the young woman's study. Greater academic ability, as reflected by three juku ("cram school") variables, is also associated with a higher probability of having university degree (attending juku in elementary and/or junior high school are indicators of a lower than average level of ability, and attending juku in high school is an indicator that the young woman has a high enough level of ability to contemplate university).[24] Attending a private high school, which has a statistically significant negative sign, may also be reflecting academic ability: outside of metropolitan areas, private high schools are of lower quality than public high schools and this differences may translate to lower student academic ability.

The three variables included to capture the returns to and costs and availability of university education do not have statistically significant coefficients. These variables—the vacancy/application ratio, the professor/high school graduate ratio, and the ratio of the starting wage for male university graduates to the starting wage for male high school graduates—are all measured at the prefecture or national level and may not well represent the underlying

[23] Note that Edwards and Pasquale (2003) is not perfectly comparable with this paper because it employs three education categories (university, junior college, and all other education) and a logit econometric model.

[24] See Edwards and Pasquale (2003) for a more detailed discussion of using attendance at juku as a proxy for ability. Note that it is possible that there is reverse causality with regard to the Juku 4 variable if young women who plan to pursue a university education are more likely than others to attend juku in their high school years.

costs and returns factors faced by the young women in our sample.

Estimates of the marriage equation appear in the bottom half of Table 3. We focus first on the roles of the two variables of primary interest—the young woman's education and EEOA—and on the interaction between them. At first glance, both variables do not make a significant contribution to the marriage decision: the university education variable has a negative coefficient, as expected, but it is not statistically significant, and the EEOA variable has an unexpected positive coefficient, but is also not statistically significant. However, when we look at the coefficient of the education/EEOA interaction term, which is negative and statistically significant, a pattern emerges. For pre-EEOA cohorts, there is a negative relationship between university education and marriage by age 32, but it is not strong enough to rise to statistical significance. For post-EEOA cohorts this negative effect, represented by the sum of the education coefficient and the interaction coefficient, reaches statistical significance. To be specific, the education coefficient for pre-EEOA cohorts is a non-significant -.324, while for post-EEOA cohorts it is more than twice as large, at -.680 (-.324 + (-.356)), and a Wald test indicates that this sum is statistically significant, with the p-value of 0.0156. This result is consistent with our hypothesis that the "deterrent effect" of university education on marriage would increase after the passage of the EEOA. Interestingly, the EEOA dummy variable itself is not statistically significant, indicating that the EEOA had no added effect on marriage beyond that which operates through university education.

The role of family background variables is mixed. Higher family income is associated with a lower probability of marriage, as is having a mother who is a full-time homemaker, but these are not statistically significant relationships. In contrast, having more siblings has a significant positive relationship to the probability of marriage, while having at least one brother has a significant negative relationship with the probability of marriage. Having more siblings may reduce a young woman's responsibilities with regard to caring for aged parents, thereby making it more feasible for her to marry. Similarly, having at least one brother, holding constant the number of siblings, means that she has fewer sisters available to help care for aging parents, and therefore may be less likely to marry by age 32.

Other variables in the marriage equation are proxies for aspects of the marriage market and/or the labor market. The two city size variables—large city and medium city—reflect unmeasured aspects of both the labor market and the marriage market. The signs of both variables are negative and significant, with the coefficient of "large city" greater in absolute value than the coefficient of "medium city". This result implies that the larger the city in which a woman lives the less likely she is to have married by age 32, a result consistent

with the findings in Sakai (2009). Rental costs are also significantly related to the likelihood of marriage and in the expected direction, with higher rental costs associated with a lower probability of marriage. The other measure that proxies the state of the marriage market, spouse availability, is not statistically significant and its sign is the opposite what we expected, possibly because of the imprecision of this measure. The vacancy/application ratio, included to capture the state of the labor market, has a negative, statistically significant sign, consistent with the findings of Higuchi (2001) that women are less likely to marry when the job market is strong.

Two other findings in Table 3 should be pointed out. First, the estimated value for the coefficient of correlation between the error terms in the education and marriage equations is positive but small (.0078) and not statistically significant. This means that the potential correlation between unmeasured characteristics of the young woman that affect both education and marriage is not large enough to affect our estimates. Second, more than half of the district dummy variables (not shown) are statistically significant, indicating that it is important to include these variables to hold constant cross-sectional social and economic differences that are not fully captured by the socioeconomic variables included in the analysis.

We explore one variation in our model. A skeptic could argue that the results in column 1 with regard to the relationships among the marriage, education, and EEOA variables are simply reflecting secular trends in cultural attitudes towards the role of women in society rather than any "cause and effect" relationship among these three variables. Put differently, one could conjecture that the EEOA variable in both equations and the education and education/EEOA interaction variables in the marriage equation are simply proxies for omitted variables that capture secular changes in attitudes.[25] If this argument were true, a trend variable added to our estimating equations would be statistically significant and knock out some or all of the other variables that have monotonic trends. Even it were not valid, the potential multicollinearity among the variables with common trends has the potential to raise the standard errors of coefficient estimates, reducing their likelihood of statistical significance.

We carry out this demanding robustness test by adding a trend variable to our base specifications in column 1. This variable ("Trend") is coded at one for the oldest cohort

[25] An alternative way of casting this argument is to say that the EEOA is an endogenous variable, a result of these changing attitudes. While changing attitudes within Japan undoubtedly played a role, this is a case where exogenous forces were at work: it was widely recognized at the time the Act was under discussion that Japan felt some pressure, as a signatory of the 1980 United Nations Convention Concerning the Elimination of All Forms of Discrimination Against Women, to pass legislation that would put it into compliance with this Convention.

in our data (those born in 1959) up to 21 for the youngest cohort (born in 1979). The resulting estimates appear in column 2 of Table 3. As might be expected, the coefficient of Trend has a positive sign in the education equation and a negative sign in the marriage equation. However, in both cases the coefficients are not statistically significantly different from zero. Thus, adding this variable does not contribute significant explanatory power to our economic model. What including this collinear variable does do, however, is to sap some strength from the EEOA variable in the education equation. Specifically, the coefficient of the EEOA variable in the education equation drops to virtually zero, its standard error almost doubles, and it loses statistical significance, thereby casting doubt on the role the EEOA played in university education decisions. In contrast, in the marriage equation, including the trend variable leads to no changes in our conclusions. Notably, the coefficient of the education/EEOA interaction in the marriage equation maintains its statistically significant negative sign (though its coefficient shrinks slightly in absolute value). In sum, the result of this robustness test is to confirm our findings with regard to the role of the EEOA and education in the marriage decision, but to create skepticism about our previous finding of a significant positive effect of the EEOA on university education decisions.[26]

6 Further Results: Partial Effects

[26] We perform a second robustness test in response to a reviewer's recommendation. Recall that our specification of the cohorts to be affected by the EEOA includes young women who were age 17 or younger when the Act was passed in 1985—because post-high-school education plans would already have been made for women aged 18 or older at that time. The reviewer suggested, however, that women who were aged 18-21 in 1985 might have been able to alter their post-high-school education plans upon learning of the passage of the Act, and suggested that as a "robustness test" we also estimate a version of our model that includes these four age-cohorts in the post-EEOA group rather than in the pre-EEOA group. We conduct this test, re-computing the estimates in Table 3 using a revised definition of the EEOA dummy variable to reflect the recommended changes. Given that the four cohorts added to the post-EEOA group are less likely to have been affected by the passage of the Act, we expected the coefficients of the revised EEOA variable (denoted EEOA-rev) in the education and marriage equations to decline in absolute value and this is what we find for the most part. For example, in our base case (i.e., without the trend variable) in the education equation, the coefficient of EEOA is a statistically significant .1561, whereas for EEOA-rev, the coefficient falls to a non-significant .0886. Similarly, for the marriage equation, the coefficient of the EEOA/education interaction term is a statistically significant -.3556, whereas for the EEOA-rev/education interaction term, it is a non-significant -.1085. The one exception to this pattern is in the marriage equation, where the EEOA dummy is a non-significant .0802, but the EEOA-rev dummy is a statistically significant -.2760, implying that there is a predicted reduction in marriage probability for the post-EEOA cohorts. To summarize, the expansion in the definition of post-EEOA cohorts results in an estimated weaker effect of the EEO Act on women's choice of university education, but the finding of lower predicted marriage rates by age 32 for post-EEOA cohorts remains, though through a different mechanism.

Table 4: Partial Effects on Education and Marriage Decisions

	Direct Effect			Indirect Effect			Total Effect		
	Est.		(S.E.[a])	Est.		(S.E.[a])	Est.		(S.E.[a])
Panel A: Base Model									
Education Decision									
EEOA	0.031	**	(0.014)						
Middle Income	0.040	***	(0.012)						
High Income	0.103	***	(0.022)						
Mother's Education	0.239	***	(0.049)						
Father's Education	0.183	***	(0.023)						
Private High	-0.028	**	(0.015)						
Homemaker	0.030	**	(0.014)						
Number of Siblings	-0.025	***	(0.010)						
Juku 3	-0.040	**	(0.017)						
Juku 4	0.186	***	(0.023)						
Marriage Decision									
Completed Education	-0.150	*	(0.084)						
pre-EEOA	-0.085		(0.087)						
pro-EEOA	-0.191	**	(0.092)						
EEOA	0.006		(0.024)	-0.005	*	(0.003)	0.001		(0.024)
Middle Income Class	-0.003		(0.017)	-0.006	*	(0.004)	-0.009		(0.017)
High Income Class	-0.012		(0.029)	-0.016	*	(0.009)	-0.028		(0.027)
Homemaker	-0.019		(0.018)	-0.005	*	(0.003)	-0.024		(0.017)
Number of Siblings	0.039	***	(0.010)	0.004		(0.003)	0.043	***	(0.010)
Having Brother(s)	-0.033	**	(0.016)	0.003		(0.003)	-0.030	*	(0.016)
Large City	-0.049	*	(0.029)						
Middle City	-0.039	*	(0.023)						
Rent	-0.042	**	(0.019)						
Vacancy/Application$_{MA}$	-0.077	***	(0.025)						
Mother's Education				-0.037	*	(0.019)			
Father's Education				-0.028	*	(0.015)			
Juku 3				0.006		(0.005)			
Juku 4				-0.029	*	(0.016)			

Table 4: Partial Effects on Education and Marriage Decisions

	Direct Effect			Indirect Effect			Total Effect		
	Est.		(S.E.[a])	Est.		(S.E.[a])	Est.		(S.E.[a])
Panel B: Counterfactual Model-Trend Included									
Education Decision									
EEOA	0.000		(0.025)						
Middle Income	0.040	***	(0.012)						
High Income	0.102	***	(0.022)						
Mother's Education	0.236	***	(0.048)						
Father's Education	0.181	***	(0.023)						
Private High	-0.028	*	(0.015)						
Homemaker	0.032	**	(0.014)						
Number of Siblings	-0.025	**	(0.010)						
Juku 3	-0.043	**	(0.017)						
Juku 4	0.187	***	(0.023)						
Marriage Decision									
Completed Education	-0.132		(0.084)						
pre-EEOA	-0.074		(0.088)						
pro-EEOA	-0.165	*	(0.092)						
EEOA	0.028		(0.037)	0.000		(0.004)	0.028		(0.037)
Middle Income Class	-0.003		(0.017)	-0.006		(0.004)	-0.008		(0.017)
High Income Class	-0.012		(0.029)	-0.014		(0.009)	-0.026		(0.027)
Homemaker	-0.020		(0.040)	-0.005		(0.003)	-0.025		(0.017)
Number of Siblings	0.039	***	(0.010)	0.004		(0.002)	0.043	***	(0.010)
Having Brother(s)	-0.034	**	(0.016)	0.003		(0.003)	-0.031	**	(0.016)
Large City	-0.050	*	(0.029)						
Middle City	-0.039	*	(0.023)						
Rent	-0.039	**	(0.019)						
Vacancy/Application$_{MA}$	-0.079	***	(0.025)						
Mother's Education				-0.032	*	(0.019)			
Father's Education				-0.025		(0.015)			
Juku 3				0.006		(0.005)			
Juku 4				-0.026		(0.016)			

[a] Bootstrap standard errors with 100 replications. *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

We have identified the statistically significant variables that influence the university education and marriage decisions of young women, but it is well known that statistical significance

does not necessarily translate into practical economic or social impact. To see which variables would be of meaningful consequence to decision making, we compute partial effects. These partial effects are shown in Table 4 and are computed as described below.

The partial effects on the education decision can be computed in the same way as those in a usual probit model since $E(E_i) = \Phi(\alpha_e A_i + x_{e,i}'\beta_e)$. Because of its recursive structure, there is no impact of $x_{m,i}$ on the education decision. Only the variables $x_{e,i}$ directly affect the education decision. For discrete variables such as A_i, we compute the partial effects using the finite-difference method: $E(E_i|x_{e,i} = 1) - E(E_i|x_{e,i} = 0)$. For continuous variables, we compute the partial effects using the calculus method: $\partial E(E_i)/\partial x_{e,i}$.

Computing partial effects in the marriage equation is more complicated. Consider first one of our main interests: the impact of the education on the marriage decision. This can be computed as

$$E(M_i|E_i = 1) - E(M_i|E_i = 0) = \Phi(\gamma + (\theta + \alpha_m)A_i + x_{m,i}'\beta_m) - \Phi(\alpha_m A_i + x_{m,i}'\beta_m), \quad (3)$$

where the expectations are conditional on the other explanatory variables as well (suppressed for brevity). In the literature, this effect is often referred to as the average treatment effect. We estimate this effect by evaluating equation (3) for each observation and then taking the average. We also estimate the partial effect of education on marriage separately before and after the EEOA. Specifically, the pre-EEOA education effect is computed by evaluating equation (3) with $A_i = 0$ for each observation. Likewise, we compute the post-EEOA education effect by assigning $A_i = 1$ for each observation.

The other explanatory variables can have direct and indirect impacts on the marriage decision, depending on whether a variable appears in the marriage equation or the education equation. Direct partial effects are the impacts on the marriage decision of the explanatory variables that appear in the marriage equation ($x_{m,i}$). The signs of the direct effect are the same as the sign of the coefficients in the marriage equation (2). Indirect partial effects are the impacts on the marriage decision of explanatory variables that appear in the education equation ($x_{e,i}$) through the education decision. Given the negative impact of the education on the marriage decision, the signs of the indirect partial effects are opposite to signs of the coefficients in the education equation. If a variable appears in both the marriage and education equations, the sum of direct and indirect partial effects is reported as a total effect.[27]

In general, we compute all of the partial effects described above by computing them for

[27] Specifically, under the assumption of the bivariate normality, the expected value of M_i (conditional on

each observation and then averaging across all observations to yield average partial effects. Standard errors are estimated using the bootstrap method with 100 replicates.

The partial effects reported in Table 4 correspond to the two specifications in Table 3: Panel A contains partial effects computed from the coefficient estimates of our base model in column 1 (trend variable excluded), while Panel B contains those computed from the counterfactual model in column 2 (trend variable included). Partial effects are shown for our main variables of interest and for those that are statistically significant in Table 3. Recall that partial effects are computed for each variable holding constant all other variables and are therefore not additive.

To get a sense of the scale of these partial effects, it is useful to keep in mind the level and changes in the prevalence of university education and marriage across the cohorts in our sample. The percent of women in our sample with a university education ranged from 11% in the earliest cohort to 25% in the final cohort, an increase of 14 percentage points. Over the same period, the percent of 32 year-olds ever married ranged from 100% in our earliest cohort to 73% in the final cohort, a decline of 27 percentage points.

We begin our discussion of Table 4 with the variables that are the prime focus of this research: EEOA in the education equation and both EEOA and education in the marriage equation. In Panel A, the partial effect of EEOA on the probability of university education

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exogenous explanatory variables) can be written as

$$E(M_i) = \Phi_2(\alpha_m A_i + x_{m,i}{}'\beta_m, -\alpha_e A_i - x_{e,i}{}'\beta_e; -\rho) + \Phi_2(\gamma + (\theta + \alpha_m)A_i + x_{m,i}{}'\beta_m, \alpha_e A_i + x_{e,i}{}'\beta_e; \rho),$$

where $\Phi_2(\cdot, \cdot; \rho)$ is the cdf of the bivariate normal distribution with the coefficient of correlation ρ. For discrete variables, we compute the partial effects using the finite-difference method. We evaluate the expected value $E(M_i)$ at the relevant values of $x_{m,i}$ for the direct effect and $x_{e,i}$ for the indirect effect. For continuous variables, we compute the partial effects using the calculus method by taking partial derivatives. The direct effect on marriage decision is

$$\begin{aligned}\frac{\partial E(M_i)}{\partial x_{m,i}} = \Bigg[& \phi(\alpha_m A_i + x_{m,i}{}'\beta_m) \times \Phi\left(\frac{-\alpha_e A - x_{e,i}{}'\beta_e + \rho(\alpha_m A_i + x_m{}'\beta_m)}{\sqrt{1-\rho^2}}\right) \\ & + \phi(\gamma + (\theta + \alpha_m)A_i + x_{m,i}{}'\beta_m) \times \Phi\left(\frac{-\alpha_e A_i - x_{e,i}{}'\beta_e + \rho(\gamma + (\theta + \alpha_m)A_i + x_{m,i}{}'\beta_m)}{\sqrt{1-\rho^2}}\right)\Bigg] \times \beta_m.\end{aligned}$$

The indirect effect is

$$\begin{aligned}\frac{\partial E(M_i)}{\partial x_{e,i}} = & \phi(\alpha_e A_i + x_{e,i}{}'\beta_e) \times \left[\Phi\left(\frac{\gamma + (\theta + \alpha_m)A_i + x_{m,i}{}'\beta_m - \rho(\alpha_e A_i + x_{e,i}{}'\beta_e)}{\sqrt{1-\rho^2}}\right)\right. \\ & \left. - \Phi\left(\frac{\alpha_m A_i + x_{m,i}{}'\beta_m - \rho(\alpha_e A_i + x_{e,i}{}'\beta_e)}{\sqrt{1-\rho^2}}\right)\right] \times \beta_e.\end{aligned}$$

See Greene (1998) and Hasebe (2013) for details of partial effects in the bivariate probit model.

is a statistically significant 3 percentage points. While this is not large relative to the partial effects of family background variables, it does amount to about 20% of the total increase in the proportion of women with a university education over the time period studied. In contrast, in Panel B, which shows the results of our robustness test (i.e. trend variable included), the partial effect of EEOA falls to virtually zero. It is hard to know which is the more reliable estimate. The conservative approach is to recognize this uncertainty explicitly and conclude that the best point estimate of the partial effect is in the range of 0 to 3 percentage points. Put differently, we cannot draw an unambiguous conclusion about the importance of the EEO Act on young women's decisions with regard to university education.

In the case of the marriage equation, the partial effect of the EEOA variable is not significantly different from zero in Panel A or B. Conversely, the university education variable has a large partial effect—a negative and significant 15 percentage points in Panel A and a negative but non-significant 13 percentage points in Panel B. However, these estimated partial effects, which are in effect an average over pre-EEOA and post-EEOA cohorts, obscure a crucial finding: it is the interaction between the EEOA and education that is the real story here. The deterrent effect of university education on marriage is more than doubled after the passage of the EEOA. To be specific, prior to the EEOA, a university education is associated with an 8.5 (7.4 in Panel B) percentage point reduction in the likelihood that a young woman has married by age 32, though this partial effect is not statistically different from zero. Subsequent to the EEOA, however, the partial effect is much larger and statistically significant, yielding a 19 percentage point reduction in the probability of marriage (.17 in Panel B). Given the fact that in our sample the proportion of 32-year-olds who have married falls by 27 percentage points over the period in our study, the magnitude of this partial effect for post-EEOA cohorts is remarkable. This result clearly supports the proposition that university-educated women believe that they can best take advantage of the enhanced career options associated with the passage of the EEO Act by delaying or declining marriage.

Partial effects of the other variables in the education and marriage equations, though not the main focus of our study, are also informative. Consistent with the probit estimates in Table 3, the first thing to point out is that except for the variables discussed above, the magnitudes of partial effects are very close in Panels A and B. Therefore, we limit our discussion to the results for our base model, in Panel A.

In the case of the education equation, it is evident in Table 4 that family background variables play the strongest role in decisions regarding university education. The partial effect of mother's education is by far the largest: having a mother with a university education is

associated with an increased probability that a young woman herself completes university by 24 percentage points. Having a father with a university education is almost as powerful, associated with a 18 percentage point increased likelihood of completing university, as is attending juku in high school, which is associated with a 19 percentage point increase in the likelihood of completing university. Being in a high income category is also associated with a large partial effect, as compared to being in the lowest income category, at 10 percentage points. Other family background variables that are statistically significant have lesser partial effects ranging from 2 to 4 percentage points.

In the case of the marriage equation, both direct and indirect partial effects must be considered. Among the direct effects the single most important variable, in terms of the magnitude of the partial effect, is whether or not the young woman has a university education, as discussed in detail above. The other statistically significant direct partial effects are smaller. Women from large cities are 5 percentage points less likely to be married as compared to small cities, and the corresponding difference is 4 percentage points for middle-sized cities versus small cities. The number and gender of siblings have an impact of similar magnitude: having an additional sibling is associated with about a 4 percentage point increase in the probability of marriage, while having at least one brother is associated with a 3 percentage point decline. The partial effects of the rent and labor market variables are also comparable in magnitude: a one standard deviation increase in monthly rent (which corresponds approximately to a one thousand yen increase) is associated with about a 4 percentage point decline in the likelihood of marriage, and a one standard deviation increase in the vacancy/application ratio (which we see from Table 2 is 0.439) is associated with a decline of about 3 percentage points ($.439 \times (-0.0787)$).

Beyond these direct effects, a number of variables have significant indirect effects on marriage through their effects on education. In the case of variables that are common to both the marriage and education equations, taking into account these indirect effects does not substantially change the conclusions drawn above. That is, the combined direct and indirect effects of these variables, shown in the "total" column in Table 4, do not differ substantively from the direct effects alone, so we do not discuss them further. However in the case of several of the variables that appear only in the education equation, the indirect partial effects on marriage merit mention. Most notable is the mother's education variable: women whose mothers were themselves university graduates have a 3.7 percentage point lower probability of marriage by 32, as compared to other women. Slightly smaller statistically significant indirect partial effects are also reported for father's education and Juku 4 (though these do

not maintain statistical significance in Panel B).

7 Conclusions

Prompted by declines in Japanese birth rates and marriage rates over the past thirty years, this paper seeks to understand how women's declining propensity to marry interacts with the growth over the same period in women's propensity to attend university, and how both of these latter two trends may have been impacted by the passage in 1985 of the Japanese Equal Employment Opportunity Act (EEOA). Using data from a unique Japanese panel survey, the Japanese Panel Survey on Consumers (JPSC), we estimate a model that treats education and marriage decisions as jointly, though not simultaneously, determined. Specifically, we use a recursive bivariate probit econometric model to capture the particular context within which education and marriage decisions are made in Japan.

What are our conclusions? First, a young woman's decision with regard to university education is determined primarily by her parents' education and income, by the young woman's ability, and by her family's structure. Economic factors that reflect the costs and returns to education do not play a significant role in this analysis. The role of the EEOA is unclear: with point estimates of the partial effect ranging from 0 to 3 percentage points, our results are suggestive but inconclusive.

Second, it is clear that young women's decisions with regard to university education and marriage are closely interlinked. The single most important variable from among those we study in determining whether a woman is married by age 32 is whether or not she has a university education. Notably, this strong linkage is found only for post-EEOA cohorts. Specifically, for pre-EEOA cohorts, university-educated women are estimated to be 7 to 8 percentage points less likely to married by age 32, compared to their less-educated contemporaries, but this estimate is not statistically significant. In contrast, for post-EEOA cohorts, we see a strikingly large, statistically significant negative partial effect of university education on marriage by age 32, with point estimates from -16 to -19 percentage points. There is also an intergenerational aspect to the role of education in marriage which operates indirectly, with women whose mothers or fathers had a university education approximately 3 percentage points less likely to be married by age 32.

Third, other factors affect marriage decisions by age 32, but to a lesser extent. Marriage is less likely for women who live in large or middle-sized cities or who have a male sibling. In contrast, having additional siblings (holding their sex constant) is associated with a higher likelihood of marriage. The role of the labor market is similar to that reported by other

researchers: when the vacancy/application rate is higher, and jobs more plentiful, women are less likely to be married by age 32. Also, when the cost of setting up a marital home, as reflected by average rental costs, is higher, women are less likely to be married by that age. The passage of the EEOA does not appear to have had an important impact in of itself, but rather operates by increasing the responsiveness of the marriage decision to university education, as described above.

At the beginning of this paper, we set out three hypotheses: (1) The passage of the EEOA, by expanding career opportunities of university educated women, increased the proportion of qualified women who follow this educational path; (2) The expanded career opportunities associated with university education influence women's marriage decisions, leading them to delay or decline marriage; (3) The passage of the EEOA (and subsequent supporting legislation), which changed the legal and cultural landscape to make a career path more socially and economically attractive to women, increased the "deterrent" effect of university education on marriage. In the case of our first hypothesis, our evidence about the role of the EEOA in university-education decisions does not provide unambiguous support. It may be that some young women chose other paths not studied here, like vocational training, as avenue for taking advantage of the opportunities affording by the EEOA. In the case of the second and third hypotheses, we find that women who were university educated had a lower probability of being married by the age of thirty-two, as compared to other similar women, and that, most notably, the deterrent effect of university education is significantly greater for post-EEOA cohorts than for their predecessors. Overall, our research strongly suggests that the Japanese Equal Employment Opportunity Act and the expansion in career opportunities it made available to university-educated women was a contributory factor in the delay and decline over the past 30 years of marriage in Japan.

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