Heterogeneous Fertility Behavior among Highly Educated Women in Japan:

The Effect of Educational Assortative Mating on First and Second Childbirth Using Diagonal Reference Model *

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Abstract

Prior studies have argued that changes in nuptial behavior are the main contributors to the decline in fertility in Japan and educational gradients in fertility are negligible. Recently, however, changes in marital fertility have also contributed to the decline in fertility. While the influence of women's educational attainment on fertility has only been paid attention, since fertility involves two partners and so it is also possible focus on the influence of the male partner's social status. Moreover, not only can each partner's socioeconomic status, but also their combining as a couple (assortative mating), influence fertility. In spite of theoretical significance to examine the relationship between educational assortative mating and fertility, scholars face a methodological problem in examining an interaction of two variables. In this study, applying diagonal reference model to event history analysis, I estimate the effect of educational assortative mating on having first and second childbirth in Japan. A series of analysis reveals that homogamy couples of the high educated are less likely to have their second child than other types of educational coupling.

Keywords: fertility, educational assortative mating, Japan

1. Introduction

Prior studies have argued that changes in nuptial behavior are the main contributors to the decline in fertility in Japan (Iwasawa 2002). Some scholars, for example, have suggested that educational gradients in fertility are negligible, after controlling for demographic factors such as age at marriage (Fukuda 2005; Shirahase 2000; Youm and Yamaguchi 2016).

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Recently, however, changes in marital fertility have also contributed to the decline in fertility (Hiroshima 2001; Kaneko 2004). In particular, the effects of women's education (Rindfuss et al. 1996), or labor force participation (Brewster and Rindfuss 2000), on fertility have been examined. For this reason, an analysis of fertility differentials, depending on social status, is worth examining in Japan, which is known as one of the lowest low-fertility countries (with a total fertility rate of 1.45 in 2015).

Consequently, for this study, I examined the role women's education plays in fertility outcomes in Japan. Theories of New Home Economics predict that women's improved access to higher education and the labor market accompanies an increasing number of highly-educated women, who have a larger opportunity cost when balancing a combination of family and work (Tsuya and Mason 1995). Therefore, women's higher education is expected to be associated with lower fertility. On the other hand, the relationship between women's education and earning potential is 'loose' in East Asian societies, including Japan, because the gender division of labor, both in public and private spheres, has been persistent (Brinton and Lee, 2001: 134). Rather, in Japan, highly-educated women's non-participation in the labor market could be justified through investing in their children's education, based on the accumulated human capital (Yu 2009: 113), where the role of a mother's education has often been emphasized (Hirao 2001).

As stated, the assumptions made by scholars concerning women's education seem to be confused. In some studies, women's higher education is associated with low fertility because of its linkage to larger opportunity costs, while other studies assume this is merely conjecture in the case of Japan. This theoretical discrepancy among scholars partly stems from the difficulty in assessing women's human capital, or gauging their preference for a work/family balance, directly based on their educational attainment. To solve this methodological problem, in this study, I propose that the heterogeneity of women's education could be identified through focusing on their partner's status. Theories of mate selection argue that the role of preference matters in the formation of spouse-paring patterns (Kalmijn 1998); while marrying a highly-educated man is partly a result of the woman's preference for hypergamy, among those who expect a husband to fulfill an earning role in the household, their preference for marrying a lower-educated man is associated with the woman's lower expectations of the husband's earning potential. Thus, looking at the spouse's status, and a combination of the wife's and husband's status, could contribute to understanding highly-educated women's different

pathways to fertility outcomes.

In this study, I tested a series of hypotheses to predict the fertility of highly-educated women in Japan, using a Social Stratification and Mobility (SSM) dataset. This paper is divided into five sections. In the second and third sections, I review past studies on the relationship between education and fertility, and explain three possible hypotheses regarding the impact of the patterns of the wife's and husband's educational attainment, i.e., educational assortative mating on childbearing. The fourth section presents the methods and data used. The results are reported in the fifth section. The discussion, future developments, and conclusions are presented in the final section.

2. Literature review

2.1 Women's economic independence and the decline in fertility

In most developed countries, the total fertility rate (TFR) has declined to below the replacement level. Theories on the relationship between socioeconomic status and fertility have emphasized women's better access to higher education, and the increase in their earning potential. One hypothesis, proposed by Becker (1973) and other scholars in studies of New Home Economics, emphasizes the role of specialization by gender, and women's economic independence through completing higher education. In Becker's (1973) theory, male candidates in the marriage market were seeking women to fulfill a housekeeping role, while women were seeking a male partner with earning potential (Becker 1991).

In this situation, gender-specific roles are important in the decision to form a relationship, rather than staying single, because men and women together have more to gain through marriage, involving a relative advantage in the household for women, and the same in the labor market for men. In hypothesizing a marital formation as such, scholars in New Home Economics have predicted that women's improved access to higher education and the labor market accompanies an increasing number of highly-educated women for whom there is a larger opportunity cost in balancing a combination of family and work (Tsuya and Mason 1995). Therefore, this hypothesis predicts that highly-educated women marry less, and are less likely to have children.

2.2 The intensive role of women on children's education in Japan

The hypothesis that there is a strong link between women's better access to higher education and their increased earning potential might be mere conjectural. In particular,

as Brinton and Lee (2001) argued, women's better access to higher education is loosely associated with labor force participation in Japan. Rather, mothers are strongly expected to play the role of good teachers at home, so as to produce highly-educated children (Brinton 1993; Hirao 2001; Tsuya and Choe 2004), and thus investing in the child's education in this way could "justify highly educated women's inability to utilize their human capital in the workplace" (Wu 2009: 113).

Empirical literature supports the association between women's education and their involvement in their children's education. Both the father's and mother's education contribute to their financial investment in their child's private education, and in their attitudes to childrearing (Shirahase 2011, 2012). Also, women's participation in the labor force is negatively associated with children's enrollment in after-school 'cramming schools' (*juku*) (Hirao 2007), and women's educational attainment is positively associated with the mother's involvement in their child's education (Holloway et al. 2008), and their participation in preschool (Yamamoto et al. 2006) and afterschool (Tsuya and Choe 2004) programs. In Japan, the expected higher expenditure on education is often cited as the gap between the desirable and projected number of children (National Institute of Population and Social Security Research 2012). A theory of quantity and quality of children (Yamaguchi 2009) hypothesizes that the highly educated are more likely to emphasize the quality aspect of their children, and restrict quantity.

2.3 Educational assortative mating and its relation to fertility

The decline in TFR rate in the developed nations has an aspect as being a process of reducing the differential fertility among the social classes. While in the past, scholars have examined the relationship between social mobility and differential fertility (Berent 1952; Duncan 1966), the influence of women's educational attainment on fertility has only been paid attention in recent years, possibly because of the relative improvement in women's access to higher education.

Fertility involves two partners, however, so we can also focus on the influence of the male partner's social status (Corjin et al. 1996). For women, if marriage acts as an opportunity for social mobility, it is decisive to consider the influence on fertility of not only the woman's, but also the male's educational attainment (Huinink 1995). Moreover, not only can each partner's socioeconomic status, but also their combining as a couple (assortative mating), influence fertility (Dribe and Stanfors 2010). In the economic

model of division of labor, male candidates in the marriage market seek women who will take up a housekeeping role, and women seek male partners with earning potential to support the home (Becker 1991). Therefore, it can be predicted that the fertility of a hypergamous couple (where the status of the female is lower than that of the man) is higher than in other types of couples. Alternatively, since homogamous couples are predicted to have similar values, and are less likely to divorce (Tzeng 1992), the fertility of homogamous couples is potentially higher than for heterogamous couples.

Predicting a similar result through a different mechanism, scholars in demography have paid more attention to the increase in hypogamous couples in recent years. Due to women's better access to higher education over the decades, more women than men are involved in higher education in most of the developed nations (DiPrete and Buchmann 2013; Esteve et al. 2016; van Bavel 2012). Esteve et al. (2016) determined that the proportion of female college graduates aged 25 to 29 years was higher than for males in 139 countries in 2010. While female hypergamy was the normative type of union in the past, this structural change in higher education has decreased the proportion of hypergamous couples (Esteve et al. 2016).

Because of changes in the assortative mating trend, hypogamous couples, who were considered to be non-normative, have declined relatively due to its disadvantages (e.g., the high risk of divorce) in the United States (Schwartz and Han 2014). In European countries, on the other hand, the number of female breadwinners has increased, and hypogamous couples are predicted to divide labor differently between the wives and husbands. Based on the increase in the number of hypogamous couples in developed nations, the consequences of educational hypogamy has been intensively examined.

Nomes and van Bavel (2016) hypothesized that an increase in educational hypogamy in Belgium has contributed to a decline in fertility over several decades. They provided three causal mechanisms to hypothesize that hypogamic unions are negatively associated with fertility. First, the opportunity cost of childbearing could be considerably high in households where women out-earn their husbands. Secondly, there are differentials in marital timing between lower- and higher-educated people. Consequently, women in hypogamic unions tend to postpone their fertility behaviors. Third, women's preferences concerning the number of children they will have might be associated with expected spousal pairings; women who want to have more children might need to rely on the husband's earning potential, while highly-educated women who do not want to have children may selectively choose partners whose status is lower than theirs. Therefore,

women in hypogamic unions are assumed to have fewer children compared to women in other types of assortative mating.

2.4 Methodological challenges estimating the effects of assortative mating

In spite of the efforts of previous studies to accumulate knowledge concerning how education, and its relations, affect fertility, a methodological problem occurs in examining a combination of (more than) two variables (i.e., an interaction effect). Eeckhaut et al. (2013) divided standard approaches to the interaction effects of a couple's education levels into two groups. One is the absolute difference approach, which treats educational coupling as a continuous difference in years of schooling between wives and husbands. The other is the categorical difference approach. As its names suggests, the approach categorizes couples' educational patterns into several types, usually homogamy, hypergamy, and hypogamy.

Both approaches have advantages and disadvantages. The former is useful in terms of using fewer degrees of freedom, and an easier interpretation of the coefficients, while it is often criticized for ignoring the qualitative differences for each education level. The latter focuses on the categorical aspects of educational attainment, but it sometimes omits the main effects of educational attainment. Even when including the wife's and husband's educational attainment, in addition to the combination variables, it is difficult to interpret what the coefficients mean.

An alternative approach—the diagonal reference model—was proposed by Sobel (1981). The method is characterized as measuring the effects of educational coupling from a weighted average of two diagonal cells. While Sobel (1981) used this model to estimate the effects of mobility on fertility, this model is also applicable to the case of assortative mating. In spite of the theoretical significance of examining the relationship between educational assortative mating and fertility, this innovative method has not been applied in prior studies. Therefore, this study compares different approaches to measuring the effects of educational assortative mating.

3. Current study and hypothesis

How does educational assortative mating influence fertility in Japan? This is worth examining because a focus on household combination, in addition to the wife's and husband's educational attainment, could contribute to the understanding of the

heterogeneous effects of women's higher education on fertility, and whether marrying a highly-educated man or not is partly associated with women's preferences concerning subsequent life trajectories. In terms of the motivation behind this study, marrying a highly-educated man indicates a woman's relative preference towards relying on the husband's earning potential. Since marrying a highly-educated man, often with relatively stable employment, and a higher income, decreases the women's labor force participation (Shirahase 2007), women are more likely to invest in their children's education than those highly-educated women who married a lesser-educated man. Therefore, I propose a series of hypotheses to test the relationship between educational assortative mating among highly-educated women and their fertility outcomes.

On the one hand, if we follow the argument of Nomes and van Bavel (2016), which examined the impact of educational assortative mating on childbirth in Belgium, women in a hypogamous couple are more likely to be the out-earner in the household than are women in other types of educational assortative mating (*Hypothesis 1a)*. Also, regardless of the order of childbirth (first and second birth) hypogamous couples are less likely to have children (*Hypothesis 1b)*.

On the other hand, if we focus on the cultural expectation towards women, and the theory concerning the price to women of childbearing, homogamous men and women who are both highly-educated are more likely to invest in their children's education, while educationally hypogamous couples are less likely to spend on their children's education (*Hypothesis 2a)*. Also, homogamous men and women who are both highly-educated are less likely to have a second child, while the likelihood of having a first child does not depend on educational assortative mating (*Hypothesis 2b*).

4. Data and methods

The data used in this study is from a series of the SSM surveys from 1985 to 2015 (see http://www.l.u-tokyo.ac.jp/2015SSM-PJ/ for details). This cross-sectional survey consists of a multistage, nationally-representative, and randomly-sampled, population in Japan. This data was chosen because it captures detailed retrospective family and occupational histories, and covers a wide range of individuals, which allows an examination of the long-term relationship between education and fertility.

I use different samples to test each hypothesis. First, the SSM surveys from 1985, 1995, 2005, and 2015 were used in examining the relationship between educational assortaitive mating and wife's income share. Second, the SSM survey of 2005 and 2015

were used to examine whether an expenditure on children's education differs by educational assortative mating. Questions about educational spending started to be asked from the SSM 2005. Third, the SSM from 2015 was used to test the main question in this study: the relationship between educational assortative mating and childbearing. I use only the SSM 2015 for testing the last question because this survey asked questions pertaining to not only current marriage, but also respondents' first marriage, if they were divorced, widowed, or remarried. Therefore, this study was able to examine, and focus on, the first marriage and its fertility.

The main independent variables are the wife's educational attainment, husband's educational attainment, and their combination. Educational attainment is categorized into four groups (i.e., junior highschool, highschool, junior college, and university and higher). Therefore, the compound variables of a couple's educational attainments provide 15 (16-1) coefficients to the maximum. As for types of educational assortative mating, in addition to the hypergamy or hypogamy of the couples, I divided homogamous couples into two types: homogamy of the highly-educated (wives and husbands are either both junior college graduates, or university graduates) and homogamy of the lesser-educated (wives and husbands are either both highschool graduates, or junior highschool graduates).

In examining the effects of educational assortative mating on childbearing, I created a person-year database of female respondents, which starts from the year of the first marriage to estimate the first birth, and the year of the first birth to estimate the second birth. In addition to the null model that includes variables of educational assortative mating, I also present the results of a full model that controlled covariates such as age at marriage, marital cohort, age at first birth (only for the second birth sample), respondent's employment status (t-1), and whether the respondent is divorced or not (t-1).

The equation of diagonal reference model is as follows. In this model, dependent variable Y_{ijk} is defined as a weighted parameter of distance from average value of μ_{ii} and μ_{jj}, which are located as diagonal cells of each educational attainment. It is possible to add covariates (x_{ijk}) to this model.

$$Y_{ijk} = p\mu_{ii} + (1-p)\mu_{jj} + \Sigma_k \beta_k x_{ijk} + \varepsilon_{ijk}$$

Distribution of the variables used in this study are shown in Table 1 and 2. In

Table 1, I present the distribution of variables used in the first and second analysis (wife's income share and expenditure on education) and in Table 2, I present the distribution of variables used in the third analysis (childbearing).

Table 1. Descriptive statistics (wife's income share and educational expenditure)

Name	N	Mean	SD	Min	Max
Homogamy (low)	4853	0.42	0.49	0	1
Homogamy (high)	4853	0.11	0.31	0	1
Hypergamy	4853	0.3	0.46	0	1
Hypogamy	4853	0.18	0.38	0	1
Female spouse earning share (>50%)	4853	0.04	0.2	0	1
Monthly financial expenditure on children's education	1074	20709.96	21839.4	0	110000
1985	4853	0.17	0.38	0	1
1995	4853	0.27	0.44	0	1
2005	4853	0.25	0.44	0	1
2015	4853	0.31	0.46	0	1
Age	4853	44.09	9.61	20	60
Non-employed dummy (spouse)	4853	0.05	0.21	0	1
Number of child	4853	1.96	0.86	0	3
Childless	4853	0.09	0.28	0	1
Youngest child aged 0-3	4853	0.16	0.37	0	1
Youngest child aged 4 and over	4853	0.75	0.43	0	1
Respondent's income (million)	4853	1.3	1.69	0	20
Spouse's income (million)	4853	5.28	3.32	0	50

Table 2. Descriptive statistics (childbirth risk)

	1st birth	2nd birth		1st birth	2nd birth
Event occurred	20.11	18.02	Marital cohort		
Duration at risk			1954-1975	28.42	50.31
1 year	22.52	21.43	1976-1994	41.78	42.14
2 year	20.65	18.89	1996-2015	29.80	7.55
3 year	13.72	12.05	Divorced (t-1)	3.76	4.04
4 year	7.53	7.02	Respondent's emp. status (t-1)		
5-6 year	8.45	8.07	Standard	39.45	21.67
7-9 year	7.61	7.78	Non-standard	14.63	11.51
10-32 year	19.52	24.76	Self-employed	45.93	66.82
Respondent's educ. attainment			Age at 1st birth		
Junior high school	10.58	17.10	16-22		15.06
High school	44.50	51.29	23-25		33.39
Junior/two year colleges	28.83	22.20	26-28		32.82
University and more	16.10	9.42	29-31		12.88
Spouse's educ. attainment			32-34		4.18
Junior high school	12.45	19.35	35-49		1.66
High school	38.08	41.87	Homogamy (high)	17.41	12.23
Junior/two year colleges	13.14	9.97	Homogamy (low)	29.60	38.33
University and more	36.33	28.81	Hypergamy	34.19	32.03
Age at marriage			Hypogamy	18.80	17.41
16-22	21.82	33.42			
23-25	35.18	41.06			
26-28	23.86	19.29			
29-31	11.13	4.68			
32-34	4.42	1.32			
35-49	3.59	0.23	N (spell/case)	13661/3077	9880/2117

5. Results

5.1 The relationship between educational hypogamy and wife's income share

Prior studies have assumed that educational assortative mating is associated with a couple's balance of power. Specifically, among couples in which women are more educated than their husbands, it is more likely that these women out-earn their husbands, and so have a relative advantage in decision-making processes in the household. The relationship between women's educational hypogamy and their relative advantage in earnings has not been tested in the Japanese context, however. A particularly important aspect of women's labor in Japan is that Japanese women tend to quit work after marriage or childbearing, regardless of their educational attainment, which is a proxy for accumulated human capital (Brinton and Lee 2001). It is also likely that there is a heterogeneity among highly-educated women, in terms of their labor force participation depending on whether their spouse is also highly educated or not.

Therefore, to test this conjecture concerning such relationships, I examined whether (highly-educated) wives that tended to out-earn their husbands were associated with their partner's status (whether the husbands were also highly educated or not). After excluding cases with missing data on variables used in this analysis, I ultimately used 4853 cases in the SSM surveys (married women aged 20 to 60 years at the time of the interview).

The definition of a female out-earning couple is as follows. The SSM surveys measured annual income between respondents and their spouses separately, but it is measured by binned scale. Therefore, about 5% (254/4853) of couples were categorized as equal-breadwinner. To distinguish equal-breadwinner couples from female out-earning couples, this study defines female out-earning couples as couples in which the wife earns more than 50% of the husband and wife's joint income.

Table 3 presents the result of regression. I included control variables (i.e., survey year dummies, age, age of the youngest child, and spouse's non-employed dummy). Compared with the homogamy of the highly educated, hypogamy, in which the wife's education is higher than that of the husband, is more likely to be a female out-earning couple, and the relationship is statistically significant at the 5% level. In contrast, homogamy of the lesser educated, and female hypergamy couples, are slightly more likely to be female out-earning, but this is not statistically significant. These results suggest that women in a hypogamy couple particularly tend to out-earn their husbands,

and the spouse's educational attainment matters, not only the wife's educational attainment, in determining whether the household tends to be female out-earning.

Table 3. Determinants of wife's income share and expenditure on children's education

	Income share (>50%)		Educational expenditure	
Homogamy (low)	0.280	(0.310)	-1.170**	(0.398)
Hypergamy	0.148	(0.318)	-0.400	(0.383)
Hypogamy	0.775*	(0.315)	-0.719†	(0.415)
1995	-0.546*	(0.279)		
2005	0.239	(0.242)		
2015	0.445†	(0.238)	0.292	(0.251)
Age	0.016	(0.011)	1.255***	(0.192)
Childless	0.272	(0.263)		
Youngest child aged 0-3	-0.077	(0.299)		
Non-employed dummy (spouse)	2.260***	(0.202)		
Number of child			0.025	(0.177)
Age † Age			-0.016***	(0.002)
Respondent's income/10000			0.142*	(0.070)
Spouse's income/10000			0.152***	(0.042)
Constant	-4.631***	(0.585)	-17.006***	(4.036)
Observations	4853		1074	
AIC	1483.575		5968.146	
R squared			0.090	

Standard errors in parentheses
† p<0.1 * p<0.05 ** p<0.01 *** p<0.001

That said, this regression does not include the wife's and husband's specific educational attainments as independent variables. Therefore, I examined the relationship using a DRM model in Table 4. This model includes the wife's and husband's educational attainments as average values of μ_{ii} and μ_{jj}, which are located as diagonal cells. This model also supports that educational hypogamy is positively related to female out-earning at the 5% level, and the positive effect of educational hypogamy on female out-earning is slightly higher in the DRM model than in the normal logistic regression model.

Table 4. Determinants of wife's income share and expenditure on children's education (DRM)

	Income share (>50%)	Educational expenditure (1)	(2)	(3)	(4)
Homogamy (low)	0.738	0.528			
	(0.534)	(0.439)			
Homogamy (high)			−0.402		
			(0.603)		
Hypergamy	0.453			0.532†	
	(0.483)			(0.283)	
Hypogamy	1.055*				−0.700*
	(0.463)				(0.320)
1995	−0.498†				
	(0.282)				
2005	0.356				
	(0.254)				
2015	0.539*	0.093	0.067	0.069	0.093
	(0.263)	(0.253)	(0.253)	(0.252)	(0.253)
Age	0.012	1.174***	1.182***	1.189***	1.169***
	(0.011)	(0.192)	(0.192)	(0.191)	(0.191)
Childless	0.253				
	(0.263)				
Youngest child aged 0-3	−0.121				
	(0.301)				
Non-employed dummy (spouse)	2.244***				
	(0.203)				
μ 11 (Junior high school)	−4.513***	−17.280***	−17.593***	−17.945***	−17.178***
	(0.754)	(3.974)	(3.985)	(3.982)	(3.980)
μ 22 (High school)	−5.137***	−16.790***	−16.585***	−16.749***	−16.126***
	(0.740)	(4.007)	(4.002)	(3.975)	(3.980)
μ 33 (Junior colleges)	−4.691***	−14.757***	−15.148***	−15.677***	−14.686***
	(0.701)	(4.033)	(4.034)	(4.000)	(4.012)
μ 44 (University or more)	−4.527***	−14.828***	−14.735***	−15.240***	−14.684***
	(0.589)	(4.030)	(4.038)	(4.013)	(4.021)
Number of child		0.031	0.039	0.044	0.040
		(0.176)	(0.176)	(0.176)	(0.175)
Age × Age		−0.015***	−0.015***	−0.015***	−0.015***
		(0.002)	(0.002)	(0.002)	(0.002)
Respondent's income (million)		0.112	0.111	0.109	0.109
		(0.070)	(0.070)	(0.070)	(0.070)
Spouse's income (million)		0.133**	0.134**	0.131**	0.131**
		(0.042)	(0.042)	(0.042)	(0.042)
Observations	4853	1074	1074	1074	1074
AIC	1482.248	5954.537	5955.468	5952.771	5951.505

Standard errors in parentheses
† p<0.1 * p<0.05 ** p<0.01 *** p<0.001

5.2 Do highly educated couples spend more on their children's education?

The next research question tested in this study was the relationship between educational assortative mating and the household's expenditure on the children's education. The dependent variable used in this analysis was monthly financial expenditure on the

children's education outside of school. Since this variable does not measure educational spending for each child, I included the number of children in the statistical model. Since this variable by nature was asked to respondents who have a child, the sample in this analysis is limited to marriage women who are aged 20 to 60 years at the time of the interview and have at least one child (1074 cases).

I hypothesized that, among the highly educated, women who married a man whose educational attainment was lower than hers (i.e., educational hypogamy) were less likely to spend on their children's education than women who married a man with the same level of higher education because it is predicted that, if women are interested in raising a high-quality child, in terms of their educational attainment, it matters that she has a highly-educated man as a spouse.

Table 3 presents the result of the regression. Since the expenditure on education for children was not normally distributed, I used the logged value as a dependent variable. In addition to the main independent variables, I included a survey year dummy, age and age squared, and the respondent's and spouse's annual income. Compared to the homogamy of the highly educated, hypogamous couples are less likely to spend on their children's education, while it is the homogamy of the lesser-educated couples that are least likely to spend on their children's education. To add, the effect of hypergamy on expenditure on children's education is much the same as that of highly educated homogamous couples.

To further examine the relationship between educational assortative mating and educational expenditure, Table 4 presents the results of the DRM models. Since adding multiple dummy variables of educational assortative mating does not allow the model to converge, I included each dummy variable separately. The results show that educational hypergamy couples are more likely to spend on their children's education than other types of couples. Also, hypogamous couples are less likely to spend on their children's education, which supports the hypothesis of this study.

5.3 Educational assortative mating and fertility differential

5.3.1 Descriptive results

Results of the analysis above indicated that wives in hypogamous couples were more likely to out-earn their husbands, while the educational expenditure on their children's education outside of school was below average among educational hypogamy couples. In contrast, homogamy of the high educated couples are more likely to spend their money

on investing in their children's education.

In this section, based on the results of analysis, I examine whether educational assortative mating matters for first and second childbirth risks. On one hand, Hypothesis 1b predicts that, since educational hypogamy couples tend to be female out-earning, their childbirth risk is lower than for other couples, regardless of first and second childbearing. On the other hand, hypothesis 2b, derived from theories of quantity/quality of children, predicts that it is homogamy of the highly educated who are more likely to restrict their number of children. This does not mean, however, that these highly-educated homogamous couples are less likely to have their first child because the gist of the theory is that these couples restrict their number of children in order to invest more in the quality of the children, in terms of their education.

I first estimated the descriptive survival rates of having a first and second child, depending on the types of educational assortative mating. Since homogamous couples include both the lesser and highly educated, I separated this type of pairing into lesser- (junior high and high school) and highly- (vocational/junior colleges and university) educated groups.

Figure 1 shows the survival function of first birth among these four educational groups. Homogamy of lesser-educated couples are the most likely to have their first childbirth during the first half of the survival time, and the hypogamous couple follows. Homogamy of highly-educated couples are less likely to have their a child, but the gap in their propensity to bear a child gradually decreased and, during the second half of the survival time, the propensity of the homogamy of highly-educated couples to bear child was almost the same as in the other groups. Not surprisingly, these differentials in fertility timing occur because lesser-educated couples tend to marry earlier. Therefore, we need to examine whether educational hypogamy couples are more likely to have a child compared with other groups, by controlling the demographic covariates.

Figure 2 shows the survival functions of second childbirth among those groups. Compared with the survival function of first birth, in which more than 90% of the population experienced their first birth, the probability of couples having a second child is slightly lower. It also demonstrates that homogamy of highly-educated couples are less likely to have a second child than other couples; however, a similar problem occurs as we factor in the survival function of first birth. In this case, it is highly likely that hypergamy of highly-educated couples have their first child later than other couples. Therefore, we need to control not only the timing of marriage, but also the timing of first child birth in

estimating the propensity to have second child birth, and its differentials among the four educational groups.

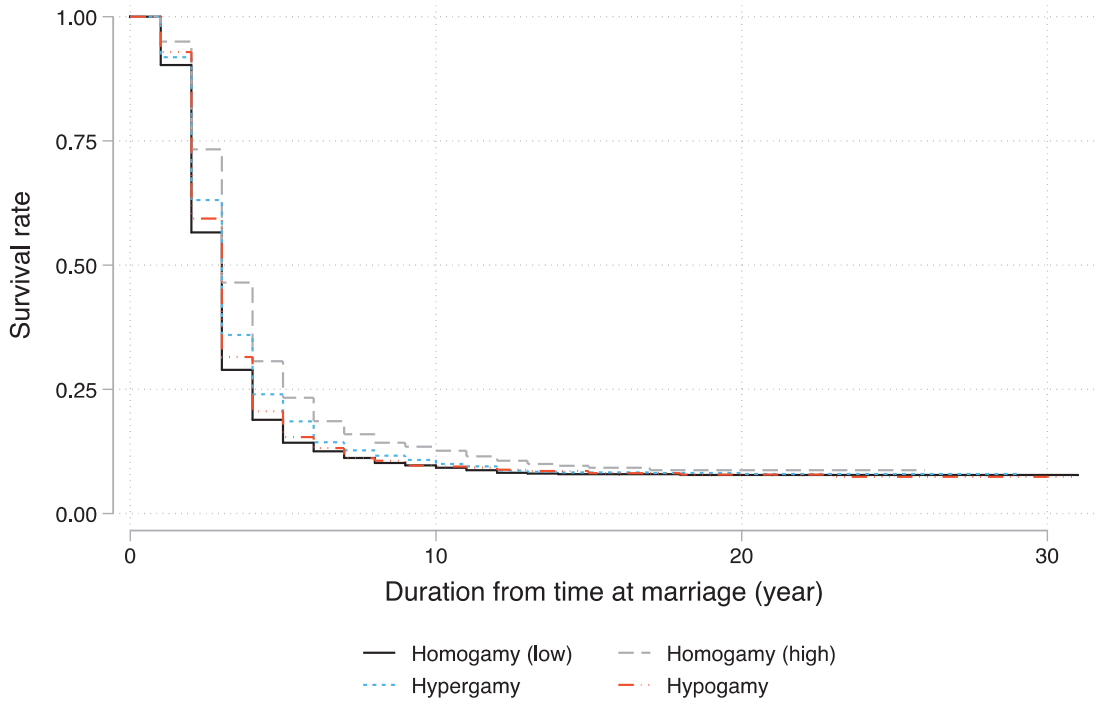

Figure 1 Survival curve of first childbearing

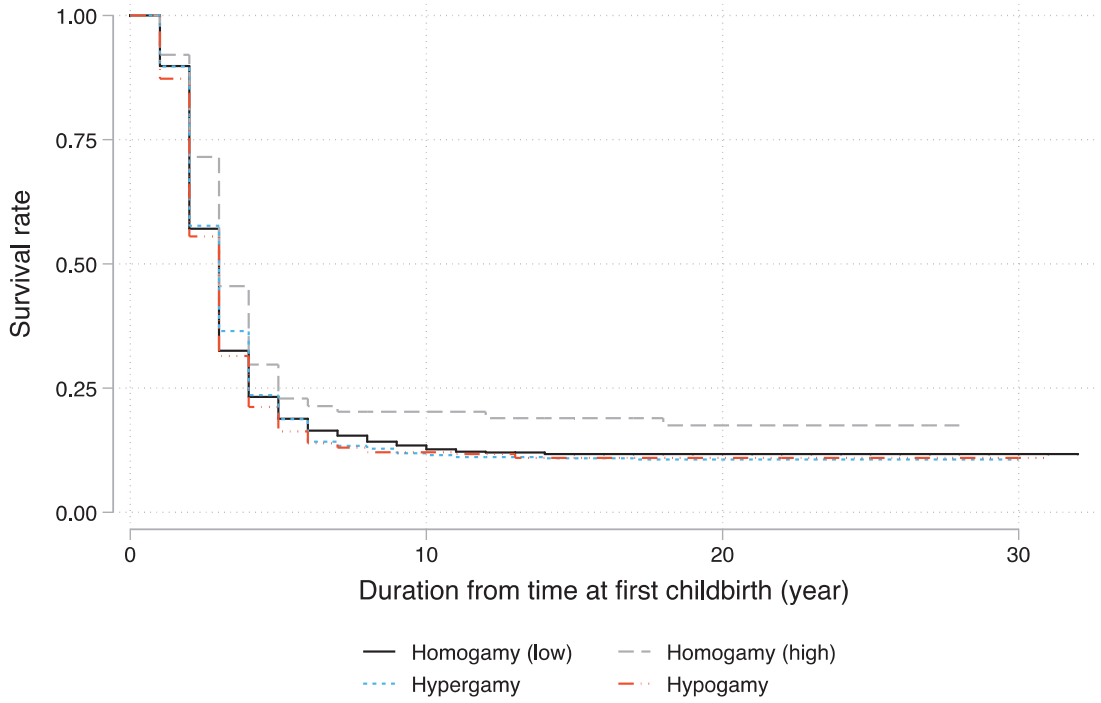

Figure 2 Survival curve of second childbearing

5.3.2 Multivariate results

Table 5 shows the results of a discrete time logistic regression, which predicts the likelihood to have first and second child. Models in this table include only combinations of the wife's and husband's educational attainments (assortative mating). While results of the null model show that, compared with homogamy of the highly educated, other types of couples are more likely to have first and second child, this relationship is partly cancelled out by including control variables, such as age at marriage or age at first birth. Model 2 for both the first and second births suggests that hypogamy couples are particularly more likely to have the child than homogamy of the highly educated.

Table 5. Determinants of first and second childbirth

	1st birth				2nd birth			
	Model 1 (Null)		Model 2 (Full)		Model 1 (Null)		Model 2 (Full)	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Duration at risk (ref: 3 year)								
1 year	-2.235***	(0.082)	-2.035***	(0.084)	-1.764***	(0.093)	-1.821***	(0.094)
2 year	-0.501***	(0.062)	-0.541***	(0.063)	-0.247**	(0.077)	-0.288***	(0.078)
4 year	-0.414***	(0.081)	-0.351***	(0.083)	-0.334***	(0.101)	-0.273**	(0.102)
5-6 year	-1.062***	(0.086)	-0.965***	(0.088)	-1.074***	(0.109)	-0.953***	(0.111)
7-9 year	-2.034***	(0.116)	-1.909***	(0.118)	-2.480***	(0.171)	-2.325***	(0.174)
10-32 year	-3.530***	(0.137)	-3.376***	(0.138)	-4.271***	(0.218)	-4.052***	(0.220)
Homogamy (low)	0.363***	(0.070)	0.130†	(0.077)	0.320***	(0.097)	0.250*	(0.103)
Hypergamy	0.215**	(0.069)	0.043	(0.072)	0.315**	(0.098)	0.189†	(0.102)
Hypogamy	0.301***	(0.077)	0.168*	(0.081)	0.392***	(0.108)	0.347**	(0.111)
Age at marriage (ref: 16-22)								
23-25			-0.096	(0.064)			0.116	(0.087)
26-28			-0.191**	(0.074)			0.218†	(0.121)
29-31			-0.454***	(0.098)			0.510**	(0.197)
32-34			-0.627***	(0.139)			0.365	(0.371)
35-49			-1.014***	(0.164)			0.390	(0.874)
Marital cohort (ref: 1954-1975)								
1976-1994			-0.016	(0.060)			0.179**	(0.064)
1995-2015			0.165*	(0.071)			-0.117	(0.110)
Divorced (t-1)			-1.611***	(0.347)			-0.329	(0.298)
Emp. status (ref: Standard)								
Non-standard			-0.477***	(0.093)			-0.342*	(0.151)
Self-employed			0.718***	(0.054)			0.508***	(0.082)
Age at first birth (ref: 16-22)								
23-25							-0.026	(0.104)
26-28							-0.147	(0.127)
29-31							-0.415**	(0.159)
32-34							-0.876***	(0.235)
35-49							-1.469***	(0.408)
Constant	-0.467***	(0.069)	-0.553***	(0.106)	-0.688***	(0.098)	-1.018***	(0.152)
Observations	13661		13661		9880		9880	
Log Likelihood	-5780.652		-5556.318		-3814.757		-3751.594	
AIC	11581.303		11152.637		7649.514		7553.188	

Standard errors in parentheses
† p<0.1 * p<0.05 ** p<0.01 *** p<0.001

These models, however, did not consider the baseline effects of each wife's and husband's educational attainments. To precisely capture the effect of a couple's

educational pattern on fertility differentials, I examined diagonal reference models in Table 6, which shows a contrasting result between the first and second childbirth. In the first birth regressions, there is no significant difference between the four types of educational assortative mating, regardless of including control variables or not. In the second birth mode, in contrast, it is the homogamy of the high educated that are least likely to have the second child, although the full model suggests that its likelihood to have the second child is not significantly different from the hypergamy couples. These results suggest that a fertility differential is observed in the second childbearing, rather than the first childbearing, and highly-educated homogamous couples are less likely to have a second child, but they are equally likely to bear the first child, compared with other types of couples.

Table 6. Determinants of first and second childbirth (DRM)

	1st birth		2nd birth	
	Model 1 (Null)	Model 2 (Full)	Model 1 (Null)	Model 2 (Full)
	Coef. S.E.	Coef. S.E.	Coef. S.E.	Coef. S.E.
Year at risk (1 year)	−2.246 (0.082)***	−2.029 (0.084)***	−1.765 (0.093)***	−1.823 (0.094)***
Year at risk (2 year)	−0.509 (0.062)***	−0.536 (0.063)***	−0.248 (0.077)**	−0.288 (0.078)***
Year at risk (4 year)	−0.410 (0.081)***	−0.364 (0.083)***	−0.332 (0.101)***	−0.269 (0.102)**
Year at risk (5-6 year)	−1.052 (0.086)***	−0.995 (0.088)***	−1.069 (0.109)***	−0.947 (0.111)***
Year at risk (7-9 year)	−2.028 (0.116)***	−1.961 (0.118)***	−2.473 (0.171)***	−2.320 (0.174)***
Year at risk (10-32 year)	−3.534 (0.137)***	−3.489 (0.138)***	−4.261 (0.218)***	−4.060 (0.220)***
Homogamy (low)	0.030 (0.112)	−0.140 (0.130)	0.438 (0.156)**	0.333 (0.158)*
Hypergamy	−0.083 (0.099)	0.005 (0.073)	0.386 (0.145)**	0.236 (0.148)
Hypogamy	0.111 (0.092)	−0.084 (0.130)	0.439 (0.140)**	0.368 (0.142)**
μ 11 (Junior high school)	0.032 (0.129)	−0.269 (0.161)†	−0.776 (0.170)***	−1.080 (0.198)***
μ 22 (High school)	−0.175 (0.112)	−0.276 (0.145)†	−0.818 (0.158)***	−1.114 (0.188)***
μ 33 (Junior colleges)	−0.230 (0.094)*	−0.507 (0.112)***	−0.679 (0.139)***	−1.000 (0.177)***
μ 44 (University or more)	−0.565 (0.074)***	−0.531 (0.103)***	−0.693 (0.109)***	−0.991 (0.157)***
Age at marriage (23-25)		−0.065 (0.065)		0.106 (0.088)
Age at marriage (26-28)		−0.133 (0.074)†		0.222 (0.121)†
Age at marriage (29-31)		−0.371 (0.096)***		0.498 (0.196)*
Age at marriage (32-34)		−0.530 (0.136)***		0.419 (0.370)
Age at marriage (35-49)		−0.887 (0.161)***		0.469 (0.871)
Marital cohort (1976-1994)		−0.008 (0.065)		0.014 (0.070)
Marital cohort (1996-2015)		−0.092 (0.062)		0.212 (0.073)**
Non-standard		−0.462 (0.093)***		−0.339 (0.150)*
Self-employed/Non-employed		0.721 (0.054)***		0.504 (0.082)***
Divorced				−0.337 (0.298)
Age at first birth (23-25)				−0.009 (0.103)
Age at first birth (26-28)				−0.121 (0.125)
Age at first birth (29-31)				−0.377 (0.158)*
Age at first birth (32-34)				−0.856 (0.234)***
Age at first birth (35-49)				−1.475 (0.406)***
Observations	13661	13661	9880	9880
AIC	11564.468	11191.335	7652.768	7559.672

Standard errors in parentheses
† p<0.1 * p<0.05 ** p<0.01 *** p<0.001

6. Discussion

In this study, I examined the relationship between educational assortative mating and fertility outcomes in Japan. Theories on how and why women's educational attainment matters for their fertility are divided among several camps. In particular, women's increasing opportunity cost to balance family and work might not be applicable to the Japanese context. Rather, these highly-educated women find it difficult to continue in their occupational careers, but they can justify their educational attainment through raising a high-quality child, in terms of the child's educational attainment. For those highly-educated women, rather than selecting to be childless, it is more rational to limit the number of children. Therefore, while the opportunity cost hypothesis predicts that highly-educated women are less likely to have a child, the quality/quantity hypothesis predicts that these women are likely to have a first child, but less likely to have a second child.

Since the diagonal reference model is the most parsimonious and best fit model for estimating the effect of educational assortative mating on fertility differentials (Eeckhaut et al. 2013), I used this model to examine the relationship between educational assortative mating and couples' different preferences towards the earnings role, expenditure on children's education, and childbearing. The results show that homogamy of the highly-educated couples are more likely to spend on their children's education outside of school, while they are less likely to bear a second child than other types of couples, as the quality/quantity hypothesis predicted. In contrast, although it is the case that wives of educational hypogamy couples tend to out-earn their husbands, compared to wives of other educational assortative mating couples, these hypogamy couples are not less likely to bear a first and second child, compared to highly-educated homogamous couples. Therefore, the results of this analysis support the quality/quantity hypothesis.

This is an understandable result in the Japanese context. Japan is known for its poor public expenditure on education, and thus private sectors (households) play a major role in education expenditure among OECD countries. Possibly due to this structure, highly-educated couples tend to have fewer children, so as to be able to invest more in the child's education, than lesser-educated couples (Shirahase 2011, 2012). In addition, women's better access to higher education is loosely related to labor force participation. Therefore, if highly-educated women marry highly-educated spouses, their motivation to continue in their career is expected to be lower, compared to those highly-educated women who marry down (i.e., marry a lesser-educated husband). Although this reasoning

is supported from the results of regression in Tables 3 and 4, in which educational hypogamy couples are more likely to be female out-earning compared to the homogamy of the highly educated, educational hypogamy couples do not necessarily restrict their number of children.

This study leaves an implication to disentangling the decline in TFR in Japan. While the main factor to decline in TFR has been the changes of nuptiality behavior in Japan (Iwasawa 2002), the decline in marital fertility started contributing to the decline in TFR (Hiroshima 2001; Kaneko 2004). In contrast to to the Belgium case (Nomes and van Bavel 2016), the results present that hypogamy couples do not necessarily have statistically significant difference from the other type of assortative mating couples in terms of their childbirth risk, while homogamy couples of the both highly educated have lower probability to have second birth. This means that recent decline in marital fertility may be caused by highly educated homogamous couples. Future studies are needed to elucidate the detailed mechanism between female breadwinning couples and their family formation, including childbearing outcomes.

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