Women's Human Capital and Their Family Formation in Japan: Who Puts Off and Gives Up Childbearing?

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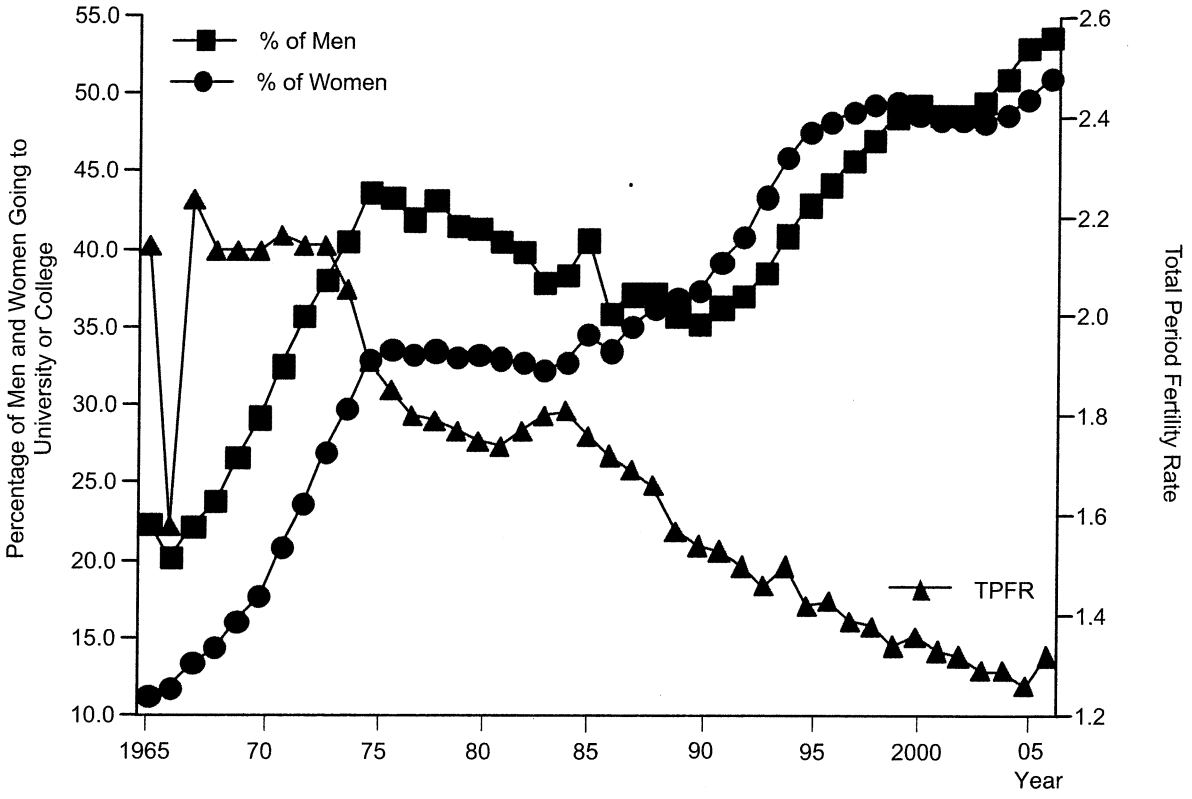
This article examines the influence of women's educational attainment on the probability and timing of having a first and a second child in Japan. To this end, we applied split population survival analysis to data from the 1998 National Family Research Survey (NFRJ98). The results of this study show that women's higher educational attainment extended the length of the interval between marriage and a first childbirth, but did not affect the probability of remaining childless. Similarly, highly-educated women tend to lengthen the period between a first and a second childbirth, but the probability of bearing a second child does not differ substantially among women's educational levels. In this regard, an increase in women's human capital in Japan does not lead to giving up, but postponing childbearing. The results of the present study also find that a rise in age at marriage significantly increases the probability of remaining childless and extends the length of the interval between marriage and a first birth, which indicates that getting married and having children are tightly interlocked in Japan. Furthermore, women's strong commitment to employment increases the probability of remaining childless and postpones the timing of a first birth after marriage, but such effects are not seen in their second childbearing behavior.

Keywords: women's education, childbirth, timing of fertility, quantum of fertility, split survival analysis

Introduction

Undoubtedly Japan, like other developed countries, has undergone great changes in women's socio-economic situation over the past four decades. While only 17.7% of women who graduated from high school went to 4-year university or 2-year junior college in 1970, the figure reached fully 52.5% in 2007, almost equivalent to their male counterpart (Ministry of Education, Culture, Sports, Science and Technology 2008). As a consequence, a growing number of women have joined the labour force. Indeed the percentage of female university graduates gaining employment upon graduation rose from 59.9% in 1970 to 72.3% in 2007, although the percentage has been slightly fluctuating over the past years due to the economic stagnation. Since these changes have gone hand in hand with a decline in the total period fertility rate (see Figure 1), it has been pointed out that an increase in women's enrolment rate in tertiary education and the eventual enhancement of their economic independence are related to the recent

Figure 1: Total Period Fertility Rate and Percentages of Men and Women Going to 4-year University or 2-Year College in Japan, 1965-2006.



Sources:
Ministry of Health, Labour and Welfare (various years), *Japanese Vital Statistics*.
Ministry of Education, Culture, Sports, Science and Technology (various years), *The Digest of Educational Statistics*.

change in Japanese fertility patterns (Ogawa & Retherford 1993; Retherford, Ogawa, & Sakamoto 1996). Nonetheless, the ways in which women's educational attainment affects their fertility behaviour in Japan has not been sufficiently investigated so far.

Hence, the primary goal of this paper is to investigate the effect of women's educational attainment on fertility behaviour in Japan. More specifically, we will examine whether the level of women's education affects either the quantum or the tempo, or both of their first and second childbearing after marriage. In the rest of this paper, we will first consider the relation between women's educational attainment and fertility behaviour. Subsequently, data and methods employed in this study will be presented. Finally, we will show the results of our analysis and discuss the impact of women's education on their first and second births.

Theoretical Background

Much interest has, in the study of fertility behaviour, focused on education and it has been interpreted to be an indicator of various attributes women possess. According to Friedlander and Silver (1967), women's educational level can serve as proxy measures for: (1) contraceptive knowledge; (2) preference for having children; (3) aspirations for career; and (4) earning capacity. Notwithstanding this versatility, in recent demographic studies, women's educational attainment is commonly accepted and utilised as an index of their earning capability in the labour market. Since investments in education raises one's earning power in the labour market through the accumulation of one's human capital, higher educational qualifications result in greater earning capacity (Becker 1975). Generally speaking, since the rearing of infant children

is a time-intensive activity and is least compatible with employment outside the home, higher educational attainment, *ceteris paribus*, leads to greater opportunity costs in bearing and raising children (Becker 1981; Cigno 1991; Cigno and Ermisch 1989). Following this line of reasoning, a woman's higher educational attainment suppresses her fertility when she holds the primary responsibility for raising children and has difficulty in accommodating employment and childrearing. A negative relation is therefore expected between female educational level and fertility, given a fixed level of child quality.

Preceding analyses using micro-data show, however, mixed empirical results regarding the relation between female educational attainment and fertility. To take an example, Santow and Bracher (2001) found in Sweden that women's educational attainment was positively linked to the probability of conceiving a first child. A similar positive relation between female education levels and the risk of having a first birth was also identified for Norwegian women in married or cohabited status (Kravdal 1994). In contrast, women's educational credentials exercised a strong negative influence on the entry into motherhood in Futhermore, they had a weak and insignificant effect on the probabilities of first births in Sweden, France, the Netherlands, and Hungary (Blossfeld 1995). Likewise, Blossfeld and Huinink (1991) discovered that female educational attainment did not affect the hazard rate of her first birth in West Germany. In addition, college-educated women had a greater risk of having a second birth than those with a vocational degree or no educational degree in West Germany (Kreyenfeld 2002). On the other hand, in Japan, the influence of women's educational qualifications on the risk of giving birth to a first child varies with time. Ermisch and Ogawa (1994) discovered with survey data in the 1990s that the higher the wife's educational attainment, the greater her age at first birth became. Nonetheless, a study using older survey data in the 1970s yielded no significant effect of a wife's education on the risk of bearing her first child (Morgan, Rindfuss, and Parnell 1984).

Turning to the analysis of a third birth, we can identify that the probability of bearing a third child was greater for women with high educational attainment than those with low attainment in Sweden (Hoem and Hoem 1989; Berinde 1999). By the same token, Ní Bhrolcháin (1993) discovered that the risk of bearing a third child was positively related to the level of women's education in Britain. A similar positive gradient for third birth intensities was observed in Norway and the United States (Kravdal 1992). In contrast, the negative relation between women's education and third births was also found in Great Britain (Wright, Ermisch, Hinde and Joshi 1988). Similarly, women's educational levels exerted a significant negative influence upon second and third birth rate in Norway, when unobserved factors were controlled (Kravdal 2001). In Austria, however, women's educational attainment exercised little impact on the probability of their giving birth to a third child, when their age at second birth was controlled (Hoem, Prskawertz, and Neyer 2001).

These inconsistent results are partly due to a difference in the property of data employed. Indeed, the above-mentioned studies use samples obtained in different regions at different times. At the same time, the findings, however, indicate that the association between women's educational attainment and their fertility behaviour is more complicated than the theory assumes. In other words, it may be argued that women make a flexible decision on their family building, taking account of their earning potential and surrounding circumstances. Ní Bhrolcháin (1983 1986 b) points out three options for women to combine employment and the bearing and rearing of children. We may term the first option 'parity strategy' and the last two options 'tempo strategy'. More specifically, the first strategy is that a woman has fewer children and completes her family formation earlier. This reduces the amount of time from when she gets out of work after her first birth to when she returns to work after her last birth. Second, she may adopt a strategy

to reduce the birth interval between her first and last birth and resume employment with a short interruption between the starting and finishing of family building. Third, she may choose to take longer birth intervals and return to the labour force between births. This inter-birth employment may alleviate a devaluation of human capital caused during the out-of-employment period. In fact, Ní Bhrolcháin (1986a, 1984) finds that British women resumed employment after their last childbearing up until the 1970s, but thereafter they extended birth intervals hand in hand with an expansion of inter-birth employment.

From a theoretical viewpoint, these three strategies serve to combine labour-force participation and the bearing and rearing of children, and to reduce economic loss brought by withdrawal from the labour market, albeit in a somewhat different degree. Thus, giving up an additional child is not merely one measure to harmonise work and family roles. Rather, the fertility strategy an individual woman adopts is, to some extent, dependent on her educational attainment and surrounding conditions. In addition, we can imagine that childbearing in the late stage of occupational career incurs a modest loss of wages to women with high educational credentials, for their increased salary enables them to use childcare facilities and services and to combine employment and childrearing more easily. In such a case, the income effect of highly educated women may result in a large family size in spite of postponed childbearing. Moreover, the interruption of employment in the early stage of career development may jeopardise the chances of promotion to a high employment status, which may motivate highly educated women to opt for postponing childbirth rather than giving it up. It is therefore likely that women's higher educational attainment has a discernible influence upon the timing of childbearing but a marginal impact upon the quantum of fertility. We do not rule out the possibility that the postponement of childbearing may result in a smaller family size, however.

In fact, proceeding studies show that the influence of female educational attainment on fertility behaviour is quite complex. For example, women with higher educational qualifications tended to postpone rather than abandon childbirth in the U. S. (Marini and Hodsdon 1981; Martine 2000; Rindfuss, Morgan, and Offutt 1996). In the European context, Liefbroer and Corijn (1999) likewise finds that higher educational attainment has only a delaying effect on first birth for Dutch and Flemish women. The evidence suggests that female educational attainment affects the quantum of, but not the tempo of, fertility. On the other hand, it is found that women's educational attainment affects both the level and timing of fertility. For instance, in England and Wales, once women of higher educational attainment had a first child, they tended to proceed more quickly and with a greater likelihood to their second birth (Rendall and Smallwood 2003). Moreover, Yamaguchi and Ferguson (1995) observes that U. S. women with higher levels of education give birth to a second and a third child at shorter intervals than those with low educational attainment, whereas the former are more likely to end up with a larger family size than the latter. In short, the influence of women's educational attainment may limited to either the number of children or the timing of childbirth, or may be exerted on both of them

Turning to the Japanese socio-economic situation, the number of Japanese women enrolled in tertiary education has, as mentioned in the previous section, increased over the past decades and thereby their earning capacity is also on their rise. For instance, the average monthly wage in 2001 was 290,800 (almost equivalent to 2,237 euro) yen for women between ages 30 and 34 if they had a university degree, but the figure fell to 208,100 yen (almost equivalent to 1,600 euro) for those with a senior high school diploma (Ministry of Health Labour and Welfare 2002). The former is 1.4 times greater than the latter. This should, ceteris paribus, have a negative impact on the level of fertility, leading to a smaller family size.

At the same time, however, Japanese women of higher educational attainment may choose to postpone

rather than abandon childbirth. The reasons are, first, that a preference for having children is, on the whole, strong in Japan and fertility intention varies only slightly with the women's education levels. For instance, the intended number of children was 2.2 for married women who completed their senior high school education, whereas it stood at 2.1 for those with a university degree. Furthermore, married couples remaining childless were quite few, regardless of educational levels. The childlessness percentage was 3.6% for women with a university degree or higher who had been married for 15-19 years and 3.5% for those with a senior high school diploma (National Institute of Population and Social Security Research 2004). The evidence indicates that Japanese women, regardless of their educational level, are homogeneous in the number of children they have or plan to have. This may be partly because great importance is attached to women's role as mother in Japanese society (Brinton 1988). Hence, it is likely that women's educational attainment affects the tempo of fertility, but hardly the quantum of fertility.

In the second place, women with higher levels of education in Japan, especially graduates from prestigious universities, are more likely employed by large firms (Brinton 1989 1993). Once they are hired, their entry and promotion onto a career track in a company also depends upon experiences and skills acquired on the job. In such a situation, when better-educated women withdraw from the labour market on a part-time or full-time basis for some years in an early stage of their career development, they stand to loose not only a considerable amount of wages, but also their chance of promotion to higher employment status. However, bearing and rearing children later in their careers would be less disadvantageous to their future career development. If this is the case, it seems possible that women of high educational attainment with the prospect of climbing up a career ladder will delay the onset of childbearing. In addition, inter-birth employment may also serve to maintain and update their work-related knowledge and skills and secure the promotion of their career position, whereas minimising the period between first and last births without inter-birth employment is likely to reap such benefits.

The third reason why women may choose to postpone childbirth lies in the fact that an increased income in late adult years may allow women--especially women of high educational attainment--to reconcile the conflict between employment and raising children more easily. This is due to the fact that a considerable number of pre-school children in Japan are cared for in private facilities, indicating that financial factors play an important role in gaining access to childcare services. Indeed, the percentage of pre-school children looked after in public-funded nurseries was 51.5% in 2002 and the rest of the children were cared for in private nurseries (Ministry of Health Labour and Welfare 2004b). Thus, it may be that, in Japan, the higher the woman's educational attainment, the longer her birth interval. With these points into consideration, it remains an open question whether Japanese woman's educational qualifications exercise an influence on the quantum or the timing of their fertility. In this paper, we will, first, examine whether Japanese women's educational attainment affects the probabilities of their first and second childbirth. Second we will investigate whether Japanese women's educational attainment has an impact on the timing of their first and second childbearing.

Data, Methods, and Variables

The present analysis employs data from the National Family Research Survey (NFRJ98). It was conducted by the Japanese Association of Family Sociology in 1998, and its target population was men and women between ages 28 and 77 who lived in Japan at the time of the survey. The overall response rate amounted to 66.5%, and a total of 10,500 samples

were finally collected by the stratified random sampling method. Since women who have experienced a divorce or separation through the death of a spouse differ in their fertility behaviour from women who have not undergone these events, the present study employed only first-married female respondents under the age of 65 at the time of survey. Moreover, in order to remove the influence of pregnancy-dependent marriage, respondents who had their first child within eight months of their marriage were also excluded from the analysis.

In this study, we employ the analysis which is called a 'split population survival model' or a 'mover-stayer mixture model' (Heckman, Holtz, and Walker 1985; Montgomery 1992; Schmidt and Witte 1989). The important feature of this model is that it distinguishes between the effects of covariates on event timing and on event occurrences. In our model, we assume that some fraction of the sample ultimately will never experience an event; this part is called a surviving fraction or a limiting survival probability (Miller 1981; Yamaguchi 1992). In our analysis, the effect of covariates on the limiting survival probability of events is estimated by logistic regression (Quantum Equation). At the same time, we introduce the survival probability into the accelerated failure-time hazard model and estimate the effect of covariates on the timing of events (Tempo Equation). The model used here is described as follows:

$$p = \exp(X)/[1 + \exp(X)] \quad \text{(1) Quantum Equation}$$

$$S_a = (1 - p)S_m(t;X) + p \quad \text{(2) Tempo Equation}$$

where X is a set of covariates, p is the limiting survival probability, t is the duration of time, S_m is the conditional survivor function for movers experiencing an event, and S_a is the unconditional survivor function.

We employed the log-normal and the generalised Gamma distribution as the form of the survivor function in the tempo equation and estimated parameters in our preliminary analysis. Results from this analysis showed that a model with the former distribution yielded a smaller likelihood and a greater BIC[1] (Bayesian Information Criterion) than that with the latter distribution. Since a smaller BIC means a better-fitting model (Schwarz 1978), it follows that the generalised Gamma model has a better goodness of fit than the log-normal model. Thus, the argument of the following sections is made by the results of the generalized Gamma distribution[2] model. The probability density function of the generalized Gamma distribution with shape parameter κ and scale parameter σ is expressed as follows:

$$f(t) = \frac{\gamma^{\gamma}}{\sigma t\sqrt{\gamma}\Gamma(\gamma)}\exp(z\sqrt{\gamma} - u) \quad \text{if} \quad \kappa \neq 0$$

$$f(t) = \frac{1}{\sigma t\sqrt{2\pi}}\exp(-z^2/2) \quad \text{if} \quad \kappa = 0$$

where $\gamma = |\kappa|^{-2}$, $z = sin(\kappa)\{\ln(t) - \mu\}/\sigma$, $u = \gamma\exp(|\kappa|z)$. This function is flexible in shape and includes as special cases the Weibull (κ=1), log-normal (κ=0), gamma (σ=1) and exponential (κ=1, σ=1) distribution. In short, our analytical model combines the logistic regression and the generalized Gamma regression.

In this study, we examine first and second births. The dependent variable of the tempo equation is the duration of months between marriage and a first birth (=the first birth interval) and that between a first and a second birth (=the second birth interval); the dependent variable of the quantum equation is the odds ratio of not bearing over bearing a first child

[1] The BIC statistics is defined as
BIC = -2 * log(likelihood) + 2 * log(N) * df
where N is the total sample size and df is the number of free parameters estimated.

[2] The values of log-likelihood and BIC for are as follows:

	log-likelihood	BIC
Model 1-1		
log-normal	-6215.0	12615.9
generalized Gamma	-5996.9	12183.1
Model 2-1		
log-normal	-6208.8	12631.6
generalized Gamma	-6065.3	12365.9

(=the first birth probability), and not bearing over bearing a second child (=the second birth probability).

A noteworthy point is that a good estimator of the split population survival model is obtained for an ample number of observations arriving around the end of the normal risk period (Yamaguchi 1992). In the analysis of fertility behaviour, it may be the case that recently married women have not yet reached the end of the risk period of bearing their first child. Similarly, some proportion of women who recently gave birth to their first child may still be at the risk of bearing their second child. We assumed that the risk period of childbearing approaches its end beyond a point in time after marriage. In the present study, we excluded women who had been married for less than 60 months at the time of the survey for the analysis of a first birth, and women who had not spent less than 60 months after their first childbearing for the analysis of a second birth. Accordingly, the final sample size amounted to 1699 for the analysis of a first birth and 1572 for that of a second birth.

It should be borne in mind that women who have a first child may be a selected group. Admittedly, women who remain childless may differ from those who have at least one child in the attribute and preference of having children. If so, this 'selection effect' will produce biased estimators in the analysis of a second birth. This possibility cannot be ruled out, but we are not concerned here with adjusting the possible bias by constructing a hypothetical population in which all women would give birth to their first child. Instead, what the present study attempts to examine is the relation between a second birth and the educational levels of women who had already given birth to their first child.

The present analysis included five time-independent covariates in our model. First, we employed wives' educational attainment as a covariate of her earning potential. In the present analysis, a woman's level of education was divided into four groups: (1) junior high school; (2) senior high school; (3) 2-year junior college; and (4) 4-year university or higher. Since educational attainment is an indicator of the level of human capital, a higher educational qualification should lead to a greater earning capacity. A drawback of the educational data in the NFRJ98 is that respondents' educational level was measured at the time of the survey. If respondents attained their highest level of education some time after childbirth, an estimated parameter will less accurately reflect the influence of the independent variable on the dependent variable. Nonetheless, women with such an educational career are rare in Japan and the proportion of married women attending full-time or part-time education stood at less than 1% in the 30-39 age group (Statistics Bureau 2002). Thus, we can reasonably conclude that post-birth schooling brings little bias to our parameter estimation. As has been previously argued, the relation between women's education and fertility behaviour is complicated from a theoretical point of view. Therefore, we cannot hypothesise the effect of female educational attainment on a first and a second birth *a priori*.

Second, our model includes a covariate signifying patterns of women's participation in the labour market. Although women's educational attainment is a crucial factor in their fertility behaviour, its influence appears to depend on the extent to which they are committed to labour-force participation. For instance, if a woman with a higher level of education quits her job after marriage and never returns to the labour market, her fertility behaviour will hardly be affected by her earning potential. In contrast, educational levels will bear a strong impact upon women's fertility behaviour if they continue to work after bearing children. In order to control such influence, our models included a covariate in relation to wives' commitment to their employment. In the examination of a first birth, we classified women into three groups according to their employment history, and used these groups as categorical variables. The first group was composed of women who continued to work after marriage, while the second comprised those who quit their jobs after

marriage. Women who had not worked before marriage belonged to the third group. In the analysis of a second birth, women's employment patterns were classified into three categories. The first category consisted of women who continued to work after marriage and never quit their jobs after a first childbearing, whereas the second was comprised of those who worked after marriage but resigned from their jobs due to a first childbirth. Women who had not worked before marriage or quit their jobs after marriage fell into the third group.

Besides the above-mentioned covariates, demographic and background factors are thought to exercise an influence on a first and a second childbearing pattern. In order to control the influence, our model included as a background covariate women's natal residential type, which was classified into two categories: urban and rural. This classification was made according to a respondent's own answer about her residential type where she lived longest until her graduation from primary school. As for the demographic covariates, the marriage cohort was included in our model. In addition, the analysis of a firth and a second birth employed women's marriage age minus 15 and the square of their marriage age minus 25 as control variables. Moreover, in the analysis of a second birth, the interval between marriage and first birth was also included in our model as a categorical control covariate.

Description of Data

Table 1 summarizes the distribution of respondents across the categories of each covariate and provides an overview of the quantum and the tempo of first and second births. Although some features are seen from the table, it is sufficient to note here that the relation between female educational qualifications and fertility patterns differs with regard to the quantum and tempo of fertility. More specifically, as for the tempo aspect, the university or higher category revealed a greater median interval between marriage and first birth than the remaining categories, but this gradient is less distinct for the median month of a second birth interval. With regard to the level of fertility, the percentage gap between the educational categories was not saliently different regarding a second child and a first child. This complicated relation between women's education and their fertility patterns naturally leads us to the detailed investigation of the effects of women's educational attainment on their first and second birth behaviour. In the following section, we will present the results of our multivariate analyses.

Results of Split Population Survival Analysis

(1) First Birth

Table 2 displays the results of our analysis regarding a first birth. As might be expected, women's educational attainment had a significant effect on the timing of first birth after marriage. Compared with women in the 'Junior High School' category, the interval between marriage and first birth was significantly 4.5% longer for those in the 'University' category, although no significant effect was identified across the remaining categories (Model 1-1). On the contrary, all educational categories did not show a significant effect in the quantum equation, which means that the level of women's earning capability does not affect the probability of remaining childless. Taking these findings together, we can argue that Japanese women with greater educational attainment postpone their entry into motherhood, but do not abandon it. In other words, women's human capital affects when to have a first child after marriage, but hardly influences whether to have a first child.

A significant and positive effect was discovered concerning the pattern of women's commitment to labour force. The continuation of labour-force participation after marriage decreased the probability of having a first child. The odds ratio of remaining childless over bearing a first child was 2.37 times

Table 1. Distributions of respondents at the various levels of fixed categorical covariates

Covariate	Number	Percentage of women having a first child	Median month of a first birth interval
First birth			
Marriage cohort:			
-1964	353	96.3	16.3
1965-74	548	96.5	14.2
1975-84	457	94.7	16.3
1985-	341	91.5	16.3
Wife's education:			
Junior high school	290	96.2	15.2
Senior high school	842	94.5	15.3
2-year junior college	444	96.2	15.2
University or higher	123	91.1	20.2
Labour Force Commitment:			
Continue after marriage	764	93.2	18.2
Quit after marriage	663	96.7	14.2
Not working before marriage	272	96.0	15.2
Natal residential type:			
Rural	744	96.2	15.2
Urban	955	94.0	16.3
Total	1699	95.0	16.2
	Number	Percentage of women having a second child	Median month of a second birth interval
Second birth			
Marriage cohort:			
-1964	338	88.2	37.6
1965-74	527	89.2	33.5
1975-84	432	87.7	32.5
1985-	275	71.5	35.5
Wife's education:			
Junior high school	277	89.9	35.5
Senior high school	781	86.7	34.6
2-year junior college	408	86.8	33.4
University or higher	106	85.9	37.6
Labour Force Commitment:			
Quit after marriage or not working before marriage	887	88.8	33.5
Job interruption by 1st childbearing	377	85.7	34.5
Never quit a job	308	84.4	38.5
Natal residential type:			
Rural	706	89.5	33.5
Urban	866	85.3	37.6
Birth interval between marriage and a first birth			
-11 months	488	90.8	33.4
12-23 month	704	90.1	33.5
24- months	380	77.4	38.5
Total:	1572	87.2	34.5

Source: Own calculation based on the National Family Research Survey.

greater for women who continued to work after marriage than for those who quit their job after marriage (Model 1-1). This factor, at the same time, delayed the timing of entry into motherhood. The interval between marriage and first birth was 1.02 times longer for women who kept on working after marriage than for those who withdrew from the labour market after marriage (Model 1-1). On the other hand, no significant differences were identified between the 'Quit after Marriage' group and the 'Not Working before Marriage' group, which indicates that pre-marital employment does not affect the probability and timing of having a first child inasmuch as women quit their job after marriage. Moreover, Model 1-3a, which excluded the 'Wife's Education' covariates, showed a smaller BIC than Model 1-2 which dropped the 'Labour Force Commitment' covariates. This indicates that the former model has a better goodness of fit than the latter. Hence, we can argue that the reconciliation between employment and childrearing plays a crucial role in the pattern of family formation in Japan. As OECE (2003) points out, it is not easy for Japanese women to continue to work after giving birth to children. Because of this difficulty, a considerable proportion of female employees quit their job owing to childbearing. Indeed, 58.1% of women who had been in employment one year prior to their first childbirth were out of employment 18 months after the childbearing (Ministry of Health Labour and Welfare 2004a). Due to this less family-friendly situation, the strong influence of women's employment on their first childbearing behaviour may be seen in our results. Furthermore, the log-likelihood ratio test did not show a significant difference between Model 1-3a having the 'Labour Force Commitment' variable in both equations and Model 1-3b including it only in its quantum equation. However, Model 1-3c with the 'Labour Force Commitment' variable only in its tempo equation was significantly different from Model 1-3a at a level of 5%. This suggests that the pattern of women's employment is more influential to the probability of than the timing of having a first birth.

Women's marriage age also exerted a significant effect on both the probability and the tempo of having a first child. The odds ratio of not having over having a first child increased hand in hand with a rise in a woman's age at marriage. Likewise the interval between marriage and first birth also extended in tandem with an increase in age at marriage. This evidence implies that the timing of a woman's entry to marriage affects whether and when she will have a child. It is pointed out that getting married is synonymous with having a child in Japan (Retherford, Ogawa and Matsukura 2001). Our findings support this tightly-connected association between marriage and procreation in Japanese society. In short, if a Japanese woman gets married later in life, she is more likely to refrain from childbearing than delay it.

The natal residential type did not exercise a significant effect on the probability and the timing of having a first child. It therefore follows that societal factors in women's childhood is not related to the patters of their family formation.

Overall, socio-economic and demographic covariates in our models seems to have a less significant effect on the quantum equation than the tempo equation of the first birth, which suggests that these factors are more influential to the timing of women bearing a first birth. As mentioned before, Japanese married women are homogeneous in their desired family size. Since our analysis dealt with only married women, our covariates may have showed a relatively weak impact on the quantum equation.

(2) Second Birth

As in the case of the first birth, women's educational attainment revealed a significant effect only on the tempo of their second birth (see Table 3). Although no significant difference was seen among the three lower educational categories, women with a university or higher degree had a 1.10 times longer interval between a first and second birth than those with a junior high school diploma (Model 2-1). This may be due to the fact the postponement of a subsequent

Table 2. Results of first birth analysis

Covariate	Model 1-1		Model 1-2		Model 1-3a		Model 1-3b		Model 1-3c	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
<Tempo equation>										
Marriage Cohort:										
(-1964)										
1965-74	-0.021	0.018	-0.019	0.018	-0.020	0.018	-0.018	0.018	-0.020	0.018
1975-84	-0.015	0.019	-0.013	0.018	-0.016	0.019	-0.014	0.019	-0.016	0.019
1985-	-0.030	0.022	-0.026	0.021	-0.030	0.021	-0.024	0.021	-0.030	0.021
Wife's Education:										
(Junior High School)										
Senior High School	-0.005	0.018	-0.005	0.018						
2-year Junior College	0.026	0.020	0.028	0.020						
University or Higher	0.045#	0.030	0.049#	0.029						
Natal Residential Type:										
(Rural)										
Urban	-0.007	0.013	-0.006	0.013	-0.005	0.013	-0.003	0.013	-0.005	0.013
Marriage Age-15	-0.011***	0.003	-0.010***	0.003	-0.009***	0.003	-0.009***	0.003	-0.009***	0.003
Marriage Age-25	0.001#	0.000	0.001#	0.000	0.001#	0.000	0.001#	0.000	0.001#	0.000
***Marriage Age-25**										
Labour Force Commitment:										
Continue after marriage	0.024*	0.014			0.029**	0.014			0.029**	0.014
(Quit after marriage)										
Not working before marriage	0.005	0.019			0.002	0.019			0.002	0.019
Constant	2.442***	0.034	2.443***	0.032	2.437***	0.033	2.438***	0.032	2.436***	0.033
Sigma	1.278***	0.019	1.283***	0.019	1.283***	0.019	1.281***	0.018	1.283***	0.019
Kappa	-2.758***	0.219	-2.801***	0.216	-2.712***	0.209	-2.744***	0.205	-2.721***	0.210
<Quantum equation>										
Marriage Cohort:										
(-1964)										
1965-74	-0.365	0.427	-0.370	0.424	-0.311	0.418	-0.310	0.418	-0.340	0.417
1975-84	-0.296	0.448	-0.243	0.440	-0.277	0.440	-0.276	0.441	-0.253	0.436
1985-	-0.438	0.534	-0.309	0.512	-0.514	0.525	-0.521	0.527	-0.412	0.503
Wife's Education:										
(Junior High School)										
Senior High School	0.605	0.470	0.576	0.481						
2-year Junior College	-0.169	0.581	-0.179	0.588						
University or Higher	0.592	0.621	0.696	0.622						
Natal Residential Type:										
(Rural)										
Urban	0.401	0.312	0.400	0.316	0.452	0.308	0.451	0.309	0.433	0.312
Marriage Age-15	0.142**	0.063	0.141**	0.063	0.146**	0.063	0.146**	0.063	0.150**	0.064
Marriage Age-25	0.007	0.005	0.007	0.005	0.006	0.005	0.006	0.005	0.006	0.005
***Marriage Age-25**										
Labour Force Commitment:										
Continue after marriage	0.865**	0.363			0.863**	0.359	0.879**	0.362	0.150**	0.064
(Quit after marriage)										
Not working before marriage	0.455	0.475			0.502	0.468	0.512	0.471	0.006	0.005
Constant	-5.603***	0.762	-5.104***	0.716	-5.335***	0.688	-5.342***	0.690	-4.864***	0.644
Log likelihood	-5996.88		-5999.80		-6000.37		-6002.72		-6003.67	
BIC	12183.13		12163.24		12149.49		12139.32		12141.22	
df	26		22		20		18		18	
N	1699		1699		1699		1699		1699	

*** Significant at the 0.01 level or better. ** Significant at the 0.05 level. * Significant at the 0.10 level.
# Significant at the 0.15 level. Parentheses are the baseline category.
Source: Own calculation based on the National Family Research Survey.

birth allows university-educated women to work between births and serve to update their job-related skills and knowledge. However, this covariate did not show a significant effect on the probability of having a second child. These results mean that mothers with a university degree do not give up on having their second child, but extend the length of time between a first and second birth.

In contrast to first birth, the patterns of women's labour force participation did not significantly affect either the probability of having a second child or the interval between a first and second birth (Model 2-1). From the results, it follows that women who already born their first child choose to have their second child, regardless of their employment patterns. As mentioned before, women at the risk of experiencing their second birth may be a selected group of the whole samples used in the present analysis. Thus, they may have a common unobserved factor such as a preference for children. Due to this, the 'Labour Force Commitment' variable may have produced no substantial impact in our results.

Demographic covariates, in contrast to first birth, had a limited impact on women's second childbearing behaviour. A rise in women's age at first birth significantly increased the probability of not having a second child, whereas it did not have a significant effect on the interval between a first and second birth. We can therefore argue that, if a woman gives birth to her first child at a relatively advanced age, she does not accelerate the tempo of bearing a subsequent child, but terminates her childbearing career at first birth. By the same token, the length of the period between marriage and first birth showed a significant effect only on the probability of having a second child. More concretely, the odds ratio of not having over having a second child was 2.01 times greater for women with a first birth interval of over 24 months, compared with those who gave birth to their first child within 24 month of marriage (Model 2-1). As shown before, women's educational attainment and their employment pattern had a bearing upon the length of the period between marriage and first birth. In addition, the length of the second birth interval is affected by that of the first birth interval in our results. Putting these findings together, we may argue that women's socio-economic factors do not have a direct influence on the probability of having a second child, but have a indirect influence on it via the length of the interval between marriage and first birth. Interestingly, women who bore their first child over 24 months after marriage significantly extend the interval between their first and second births in Model 2-2 which does not include 'Labour Force Commitment' as a covariate. However, this significant effect disappears in Model 2-1 and Model 2-3 which include the 'Labour Force Commitment' covariate. To put it another way, when controlling the influence of women's labour force participation patterns, the length of the interval between marriage and first birth does not affect the tempo of bearing a second child. This evidence suggests that the length of the interval between first and second births affects the patterns of women's employment history.

It is worth noting that marriage cohorts showed a significant effect on the second birth interval in all models of Table3. Compared with women who got married before 1964, those in recently-married cohorts tended to bear their second child at a quicker pace after their first birth. These results imply that cohort variations on the second birth interval can be insufficiently accounted for by the demographic and socio-economic covariates in our models. Hence, factors causing this acceleration should be investigated by further research.

Conclusion

The primary purpose of this article was to examine the effect of women's human capital on their family formation in Japan. More specifically, we examined the influence of women's education on the quantum

Table 3. Results of Second birth analysis

Covariate	Model 2-1 Coefficient	S.E.	Model 2-2 Coefficient	S.E.	Model 2-3 Coefficient	S.E.
<Tempo equation>						
Marriage Cohort:						
(-1964)						
1965-74	-0.107***	0.034	-0.108***	0.034	-0.101**	0.033
1975-84	-0.133***	0.038	-0.136***	0.038	-0.123***	0.036
1985-	-0.077*	0.044	-0.084*	0.043	-0.070*	0.042
Wife's Education:						
(Junior High School)						
Senior High School	0.037	0.035	0.035	0.035		
2-year Junior College	0.012	0.040	0.013	0.040		
University or Higher	0.098*	0.058	0.101*	0.058		
Natal Residential Type:						
(Rural)						
Urban	0.036	0.025	0.035	0.025	0.042	0.025
Marriage Age-15	-0.004	0.005	-0.003	0.005	-0.003	0.005
Marriage Age-25	0.001	0.001	0.001	0.001	0.001	0.001
***Marriage Age-25**						
Labour Force Commitment:						
(Quit after Marriage or not Working before Marriage)						
Job Interruption by 1st Childbearing	-0.020	0.030			-0.019	0.030
Never Quit a Job	0.022	0.032			0.023	0.032
Birth Interval between Marriage and a First Birth						
-11 Months	-0.002	0.027	-0.002	0.027	-0.002	0.027
(12-23 Month)						
24- Months	0.044#	0.031	0.046#	0.031	0.043#	0.031
Constant	3.464***	0.059	3.467***	0.058	3.476***	0.056
Sigma	1.550***	0.014	1.551***	0.014	1.551***	0.014
Kappa	-0.345***	0.070	-0.344***	0.070	-0.339***	0.070
<Quantum equation>						
Marriage Cohort:						
(-1964)						
1965-74	-0.291	0.235	-0.271	0.234	-0.273	0.231
1975-84	-0.376	0.254	-0.339	0.251	-0.381	0.246
1985-	-0.250	0.295	-0.210	0.289	-0.252	0.281
Wife's Education:						
(Junior High School)						
Senior High School	0.264	0.253	0.248	0.252		
2-year Junior College	0.054	0.291	0.041	0.290		
University or Higher	-0.376	0.409	-0.349	0.407		
Natal Residential Type:						
(Rural)						
Urban	0.204	0.173	0.185	0.173	0.191	0.171
Marriage Age-15	0.164***	0.037	0.161***	0.037	0.157***	0.036
Marriage Age-25	0.007#	0.005	0.007#	0.005	0.007#	0.004
***Marriage Age-25**						
Labour Force Commitment:						
(Quit after Marriage or not Working before Marriage)						
Job Interruption by 1st Childbearing	0.130	0.204			0.132	0.203
Never Quit a Job	0.290	0.208			0.244	0.206
Birth Interval between Marriage and a First Birth						
-11 Months	0.087	0.214	0.069	0.214	0.093	0.214
(12-23 Month)						
24- Months	0.700***	0.195	0.721***	0.194	0.714***	0.194
Constant	-4.530***	0.431	-4.449***	0.425	-4.318***	0.403
Log likelihood	-6065.45		-6069.08		-6069.011	
BIC	12365.94		12329.13		12328.99	
df	32		26		26	
N	1572		1572		1572	

*** Significant at the 0.01 level or better. ** Significant at the 0.05 level.
* Significant at the 0.10 level. # Significant at the 0.15 level. Parentheses are the baseline category.
Source: Own calculation based on the National Family Research Survey.

and the timing of their first and second childbearing, using the nationwide survey data in 1998. The results of our analysis suggest, first, that women's higher educational attainment saliently affects the timing of childbearing. In concrete terms, better-educated women tend to lengthen the interval between marriage and first birth, and between first and second birth. This factor, however, influences neither the probability of remaining childless nor of not bearing a second child. In this regard, a rise in women's education attainment in Japan does not lead to giving up on having children, but to the postponement of childbearing. This is probably derived from the fact that the desired number of children hardly varies among between educational levels. Moreover, as seen in a very small percentage of childless couples, a preference for having children may be still strong in Japanese society. These factors may motivate a better-educated woman with a great human capital to postpone her childbearing in stead of abandoning it.

Second, the present study found that women's age at marriage significantly affects the patterns of their family formation. As women get married later, they have a greater probability of their remaining childless and of extending the interval between their marriage and their first birth. In addition, higher age at marriage had a reducing effect on the probability of having a second child via the interval between marriage and first birth. These findings imply that the linkage between marriage and childbearing is quite strong in Japan. In fact, the proportion of extra-marital births stood at only 1.7% of all births in 2001. This clearly shows that getting married is almost synonymous with having children. Thus, the timing of entering a married status plays a crucial role in the level and tempo of fertility. In other words, we may argue that, compared with other industrialized countries, a formal marital union is still the primary unit of reproduction in Japan.

Third, our results indicate that women's employment after marriage affects the probability and timing of having a first birth. This factor does, however, not have an impact on the probability and tempo of bearing a second child. Hence, we can argue that the influence of labour-force participation is limited to whether and when a woman enters motherhood, although we cannot rule out the possibility that the selectivity of women with a first child may have caused this connection between employment and fertility.

In addition, our findings may account for the ineffectiveness of natalist policies in Japan. As is well known, the Japanese government have been, over the past decades, implementing natalist policies such as generous parental leave and ample childcare provision. Nevertheless, the Japanese total period fertility rate (TPFR) remains low and the policies do not appear to raise the level of its fertility. As shown in the results of our study, Japanese women's human capital and employment hardly affect the probability of having children, especially having a second child. This indicates that the economic cost of bearing and rearing children have a limited effect on the level of fertility. Taking this point into consideration, it is not surprising that the Japanese policies have no sufficient natalist effect, because they mainly aim to reduce the economic cost of having children. To put it another way, it is safe to say that a different family policy is necessary to raise the Japanese TPFR up to.

Finally, as has been already argued, the present study found that better-educated women tend to lengthen the interval between their marriage and their first birth, as well as between their first and second birth. These findings may have a bearing on the formation of women's occupational career and the availability of childcare facilities. Unfortunately our data does not provide us with sufficient information on women's career profiles and their use of childcare services. Future studies will therefore be needed to investigate the influence of these factors on childbearing behaviour.

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References

Becker, G. S. 1975. *Human Capital: A Theoretical and Empirical Analysis, With Special Reference to Education (2nd ed.).* Chicago: University of Chicago Press.

Becker, G. S. 1981. *A Treaties on the Family. Cambridge*, Massachusetts: Harvard University Press.

Berinde, D. 1999. "Pathways to a Third Child in Sweden", *European Journal of Population* 15: 349-378.

Blossfeld, H. P. and Huinink J. 1991. "Human Capital Investments or Norms of Role Transition? How women's Schooling and Career Affect the Process of Family Formation", *American Journal of Sociology* 97: 143-168.

Blossfeld, H. P. 1995. "Changes in the Process of Family Formation and Women's Growing Economic Independence: A Comparison of Nine Countries", in *H. P. Blossfeld (ed.), The New Role of Women: Family Formation in Modern Societies.* Boulder: Westview, pp. 3-23.

Brinton, M. C. 1988. "The Social-Institutional Bases of Gender Stratification: Japan as an Illustrative Case", *The American Journal of Sociology* 94: 300-334.

Brinton, M. C. 1989. "Gender Stratification in Contemporary Urban Japan", *American Sociological Review* 54: 549-564.

Brinton, M. C. 1993. *Women and the Economic Miracle: Gender and Work in the Postwar Japan.* Berkeley: University of California Press.

Cigno, A. 1991. *Economics of the Family.* Oxford: Oxford University Press.

Cigno, A. and Ermisch J. 1989. "A Microeconomic Analysis of the Timing of Births", *European Economic Review* 33: 737-760.

Ermisch, J. and Ogawa N. 1994. "Age at Motherhood in Japan", *Journal of Population Economics* 7: 393-420.

Friedlander, S. and Silver M. 1967. "A Quantitative Study of the Determinants of Fertility Behavior", Demography 4: 30-70.

Heckman, J. J., Holtz V. J., and Walker J. R. 1985. "New Evidence on the Timing and Spacing of Births", *The American Economic Review* 75: 179-184.

Hoem, B. and Hoem J. 1989. "The Impact of Women's Employment on Second and Third Birth in Modern Sweden", *Population Studies* 43: 47-67.

Hoem, J. M., Prskawertz A., and Neyer G. 2001. "Autonomy or Conservative Adjustment? The Effects of Public Policies and Educational Attainment on Third Birth in Austria, 1975-96", *Population Studies* 55: 249-261.

Kravdal, O. 1992. "The Emergence of a Positive Relation Between Education and Third Birth Rate in Norway with Supportive Evidence from the United States", *Population Studies* 46: 459-475.

Kravdal, O. 1994. "The Importance of Economic Activity, Economic Potential and Economic Resources for the Timing of First Births in Norway", *Population Studies* 48: 249-267.

Kravdal, O. 2001. "The High Fertility of College Educated Women in Norway: An Artefact of the Separate Modelling of Each Parity Transition", *Demographic Research* 5: 187-216.

Kreyenfeld, M. 2002. "Time-Squeeze, Partner Effect or Self-Selection?: An Investigation into the Positive Effect of Women's on Second Birth Risks in West Germany", *Demographic Research* 7: 15-47.

Liefbroer, A. C. and Corijn M. 1999. "Who, What, Where, and When? Specifying the Impact of Educational Attainment and Labour Force Participation on Family Formation", *European Journal of Population* 15: 45-75.

Marini, M. M. and Hodsdon P. J. 1981. "Effects of the Timing of Marriage and First Birth of the Spacing of Subsequent Births", *Demography* 18: 529-548.

Martin, S. P. 2000. "Diverging Fertility among U. S. Women Who Delay Childbearing Past Age 30", Demography 37: 523-533.

Ministry of Education, Culture, Sports, Science and Technology. 2008. *The Digest of Educational Statistics.* Tokyo: Ministry of Education, Culture, Sports, Science and Technology.

Ministry of Health, Labour and Welfare. 2002. *Basic Survey on Wage Structure 2001.* Tokyo: Rodo Horei Kyokai.

Ministry of Health, Labour and Welfare. 2004a. *The Longitudinal Survey of Millennium Born Babies.* Tokyo: Ministry of Health, Labour and Welfare.

Ministry of Health, Labour and Welfare. 2004b. *Governmental White Paper on Welfare and Labour.* Tokyo: Ministry of Health, Labour

and Welfare.

Montgomery, M. 1992. "Household Formation and Home-Ownership in France", in *J. Trussell, R. Hankinson, and J. Tilton (eds.), Demographic Applications of Event History Analysis.* Oxford: Clarendon Press, pp. 94-119.

Morgan, S. P., Rindfuss R. R., and Parnell A. 1984. "Modern Fertility Patterns: Contrasts between the United States and Japan", *Population and Development Review* 10: 19-40.

National Institute of Population and Social Security Research. 2004. *Report on the Twelfth Japanese Fertility Survey Volume I.* Tokyo: National Institute of Population and Social Security Research.

Ní Bhrolcháin, M. 1983. "Women's and Men's Life Strategies in Developed Societies", in *The International Union for the Scientific Study of Population (ed.), International Population Conference Montreal 1993* Vol.2. Liege: IUSSP, pp. 179-190.

Ní Bhrolcháin, M. 1984. "Birth Intervals and Women's Economic Activities", *Journal of Biosocial Science* 17: 31-46.

Ní Bhrolcháin, M. 1986. "The Interpretation and Role of Work-Associated Accelerated Childbearing in Post-War Britain", *European Journal of Population* 2: 135-154.

Ní Bhrolcháin, M. 1986. "Women's Paid Work and the Timing of Births: Longitudinal Evidence", *European Journal of Population* 2: 43-70.

Ní Bhrolcháin, M. 1993. "Recent Fertility Differentials in Britain", in M. Ni Bhrolchain (ed.), *New Perspectives of Fertility in Britain.* London: OPCS, pp. 95-109.

OECD. 2003. *Babies and Bosses: Reconciling Work and Family Life Volume 2: Austria, Ireland and Japan.* Paris: Organisation for Economic Co-operation and Development.

Ogawa, N. and Retherford R. D. 1993. "The Resumption of Fertility Decline in Japan: 1973-92", *Population and Development Review* 19: 703-741.

Rendall, M. S. and Steve S. 2003. "Higher Qualifications, First-Birth Timing, and Further Childbearing in England and Wales", *Population Trends* 111: 18-26.

Retherford, R., Ogawa N., and Sakamoto S. 1996. "Values and Fertility Change in Japan", *Population Studies* 50: 5-25.

Retherford, R. D., Ogawa N., and Matsukura R. 2001. "Late Marriage and Less Marriage in Japan", *Population and Development Review* 27: 65-102.

Rindfuss, R. R., Morgan S. P., and Offutt K. 1996. "Education and the Changing Age Pattern of American Fertility: 1963-1989", *Demography* 33: 277-290.

Santow, G. and Bracher M. 2001. "Deferment of the First Birth and Fluctuating Fertility in Sweden", *European Journal of Population* 17: 343-363.

Schmidt, P. and Witte A. 1989. "Predicting Criminal Recidivism Using Split Population Survival Time Models", *Journal of Econometrics* 40: 141-159.

Schwarz, G. 1978. "Estimating the Dimension of a Model", The Annals of Statistics 6: 461-464.

Statistics Bureau. 2002. 2000 *Population Census of Japan.* Tokyo: Ministry of Public Management, Home Affairs, Posts and Telecommunications.

Wright, R., Ermisch J. F., Hinde P. R. A., and Joshi H. E. 1988. "The Third Birth in Great Britain", *Journal of Biosocial Science* 20: 489-496.

Yamaguchi, K. and Ferguson L. R. 1995. "The Stopping and Spacing of Childbirths and Their Birth-History Predictors: Rational-Choice Theory and Event History Analysis", American Sociological Review 60: 272-298.

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