The timing of Childbearing differentials by Educational Level
Among Ever Married Women in South Korea

Introduction

The total fertility rate (TFR) in South Korea has declined dramatically in recent decades. It was 6.0 in 1960, however, it declined to 1.08 in 2005 (Korea National Statistical Office, 2006), which is below the replace level of 2.1. The earlier declines in TFR are mainly attributable to effective family planning policy driven by Korean government (Choe and Park 2006). However, recent declines in TFRs have not been clearly explained in previous research. One of important reasons for low fertility rate would be the fact that educational attainment has increased in three decades especially for women in South Korea where marriage rate is still high and non-marital fertility is extremely low compared to US or advanced European countries.

Women's educational attainment affects childbearing behaviors in various ways. First of all, women's increased educational attainment contributes to delaying timing of marriage, which reduces exposure of pregnancy risk. Second of all, women's increased educational attainment leads to better knowledge about birth control, which prevents unwanted childbearing. In addition, increased educational attainment also leads to higher rate of labor force participation and better financial condition which help high educated women to be in a better position compared to the past to negotiate a number of desired children with their spouse.

A large body of literature suggested that higher education is associated with fewer numbers of children in the US, however, it is not known if the relationship would also be the case in South Korea. This study attempts to explore the relationship between women's education level and childbearing behavior among married women in recent years (2001-2003) using data from 2003 National Survey of Fertility and Family Health (NSFFH). The NSFFH was conducted by Korea Institute for Health and Social Affair (KIHASA) based on nationally representative household sampling design and detailed information about reproductive behaviors and fertility records were asked among married women. This study addresses the following research questions.

Research Question 1:

What would be fertility rates relative to natural fertility? Or how much women in Korea do spacing or limiting their childbearing behaviors by educational levels?

Research Question 2:

What is the shape of baseline hazards of having a birth across age group? Can education levels be a significant predictor? If so, then are the effects of education proportional or non-proportional across age group by educational levels?

Data and Method

The data using for the statistical analysis is the *2003 National Survey of Fertility and Family Health* collected by KIHASA. The survey collected information from national probability sample of 13,867 households and 7,180 ever-married women aged 15-59 residing in the selected households from 194 sampling units. The survey includes partial histories of marriage (first marriage and current marriage), childbearing (first birth and last birth), and employment (employment before marriage, current employment) in addition to summary measures of fertility such as total number of pregnancies, live birth by sex, and living children by sex. Details on pregnancies during two and half years before survey were collected but full fertility record was not collected (Kim, 2004). Missing values are handled via listwise deletion and the analytic sample size is determined to 7,006. Also note that we converted person-period data into person-year data to launch the analysis in Part 2, discrete-time hazard model.

In attempts to accomplish two research questions posed earlier, we present two independently designed but potentially integrated parts of study.[1] Part one is designed to show the patterns of educational differentials over the marital duration with reference to natural fertility rate. In part two, we test educational effects on fertility behaviors (whether having a birth during past 2.5 years) across age groups.

Table1: Descriptive Statistic of Variables (N=7006)

Variables	Mean	St. Dev.
Age (19-50)	38.53	6.64
Birth (0-1)	0.13	0.33
Education (0-16)	11.83	2.88

Part one: Rodriguez's Model (Originated from Page Model)

This model has two parameters that describe the fertility behavior: alpha (spacing component)-- indicating average union duration; beta (limiting component)-- referring any attempt of limiting behaviors, which plays great role in increasing/decreasing the duration of union.

[1] This study is still in a progress so much has to be added/modified.

Statistical Expression of Rodriguez Model : A Loglinear Poisson Regression:

$$Log(B\_i) = \alpha + Log(Offset) + \beta * D\_i, \quad \text{whereOffset} = \text{N\_i} * \text{E\_i}$$

$$\frac{B\_i}{Offset} = \exp(\alpha + \beta * D\_i)$$

B_i: Number of children in the last 2.5 years or in the interval between marriage and the interview, if marriage occurred less than 2.5 years before

D_i: Duration of marriage (at the mid point of exposure period)

Offset: Number of expected children according to age-specific fertility rate at the mid point of the exposure period and the length of the exposure period

N_i: natural fertility rate

Results:

1. Coefficient without a predictor: alpha = -.20, beta = -.14
2. Coefficient with educational predictors (see Table 2)

Table 2: Spacing and Limiting Parameter Estimates

	Alpha	**Beta**
Educ. Less than 12 (E1)	-.53	-.16
Educ. 12 - 15 (E2)	-.10	-.22
Educ. 16 or more (E3)	-.12	-.20

- MathCad Simulation

$D\_i := 0, 1 .. 40$ 'D_i'is the marriage duration

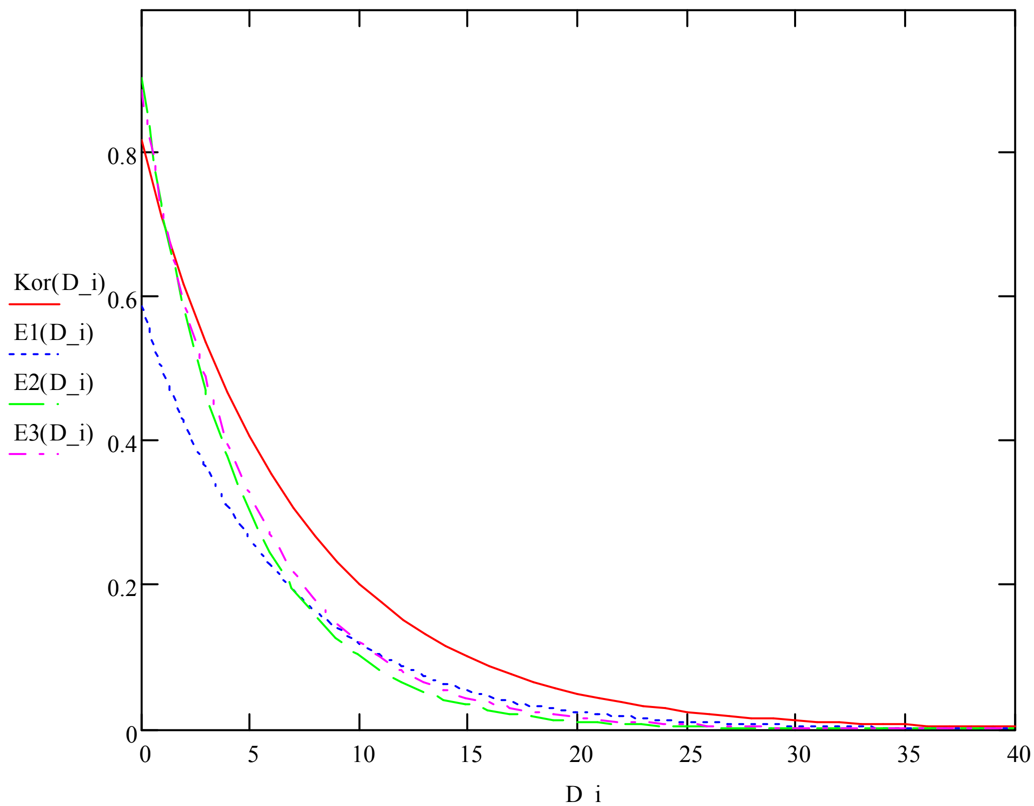
$Kor(D\_i) := \exp(-.20 - .14D\_i)$ Without any predictor: General Model

$E1(D\_i) := \exp(-.53 - .16D\_i)$ Less than 12 yrs edu.

$E2(D\_i) := \exp(-.10 - .22D\_i)$ 12 through 15 yrs edu.

$E3(D\_i) := \exp(-.12 - .20D\_i)$ 16 or more yrs edu.

Figure 1: Fertility rate relative to Natural Fertility Over the Marriage Duration



In general, the magnitude of rate declines as marital duration progresses. However, all four lines also indicate that relative fertility rates of the first several years of marriage are quite high. That is, the Y axis of Kor(D_i)/E2/E3 are all above 0.8 which indicates that, at least in the beginning stage of marriage, the childbearing behaviors are almost (80%) of natural fertility. As expected the rate declined exponentially, but we also can find the different patterns educational attainment. It is hard to distinguish lines of E1 and E2 since their moving routes are almost identical, but by looking at closely, we can discern that E3 is slightly moving over the E2 and the gap also very slightly diverged as duration increases. However, the path of E1 from the E2 and E3 are quite different. Those who have less education (E1) do not rush to have babies compares to the higher educated groups (E2 and E3). It is shown that less educated group maintained the lower fertility rate than their counterparts up to the 7-8 marriage duration years.

This model demonstrates that if we do not take into account of the timing of marriage, the less educated would have more time before they give birth and the more educated rush to have baby once they become union. The results seem to stress the point that the timing of marriage also matters. Approximate birth rate is 0.2 of natural fertility after 10 years of marriage and if we take into account the age at marriage, say E3, they marry late and rush to have babies but the total exposure will be shrunken which result in rapid decline of the rate as duration passes.

Part 2: A Discrete-Time Hazard Model

This model is designed to test the effect of education (E1-E3) on fertility behaviors (whether having a birth during past 2.5 years) across age group (A1-A4).

Table 3: Parameter Estimates and Asymptotic St. Errors (N = 24690)

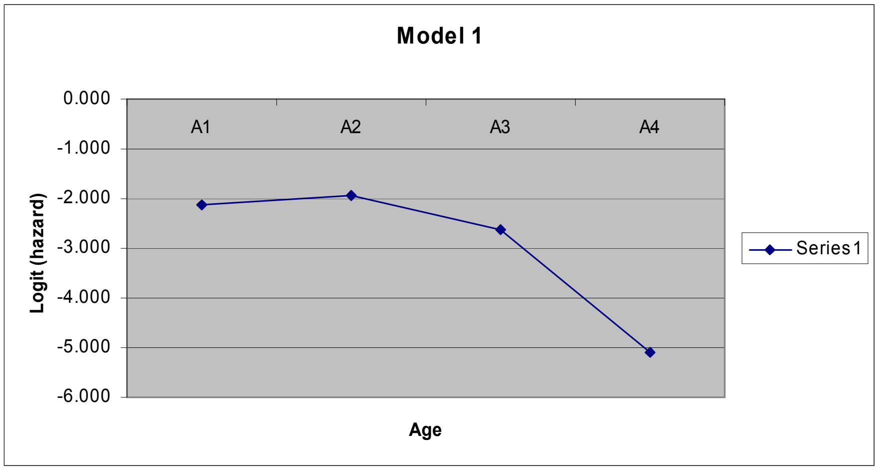
	Model 1			Model 2			Model 3		
Variables	**logit (hazard)**		**se**	**logit (hazard)**		**se**	**logit (hazard)**		**se**
Age 24 or below (A1)	-2.136	***	0.131	-2.505	***	0.198	-1.526	***	0.349
Age 25 - 29 (A2)	-1.934	***	0.055	-2.345	***	0.165	-2.862	***	0.514
Age 30 - 34 (A3)	-2.636	***	0.056	-3.051	***	0.162	-3.037	***	0.284
Age 35 or above (A4)	-5.088	***	0.101	-5.386	***	0.155	-5.533	***	0.214
Educ.Less than12(E1)				reference	--	--	reference	--	--
Educ. 12 - 15 (E2)				0.370	*	0.160	0.573	*	0.252
Educ. 16 or more (E3)				0.605	***	0.170	-0.841		0.551
E2*A1							-1.242	**	0.456
E2*A2							0.373		0.576
E2*A3							-0.293		0.386
E3*A2							1.775	*	0.764
E3*A3							1.591	*	0.628
E3*A4							1.613	*	0.633
LL	-3181.759			-3173.991			-3165.643		

***p<.001; **p<.01; *p<.05

Results

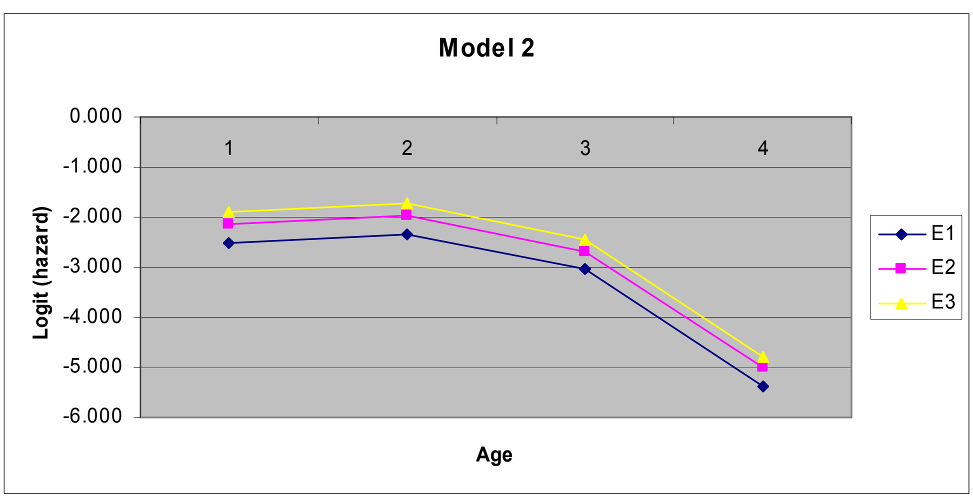
Table 3 presents the results of fitting three models to these data: a baseline model 1, an educational main effect model 2, and the general interaction between education and Age model 3. Fitted hazard functions for each-plotted on a logit scale-are presented in the figure 2. Model 1, a baseline model, is the most parsimonious and displays each logit(hazards) without introducing any predictors. Baseline is graphed in figure2-1.

Figure 2-1: Baseline



As shown in figure2-2, this model constrains the main effect of education to be identical in the each age category. Exponentiating the coefficient for E2 and E3 (exp(0.370)=1.44 and exp(0.605)=1.83, respectively), we estimate that the odds that a high school graduate group give a birth are 44% higher and that a college or more graduate group does are 83% higher, than are the odds for less than high school group. With only having a main effect, we do not allow the odds of giving a birth to differ across educational attainment. Instead, we constrain the odds to be identical in any educational levels.

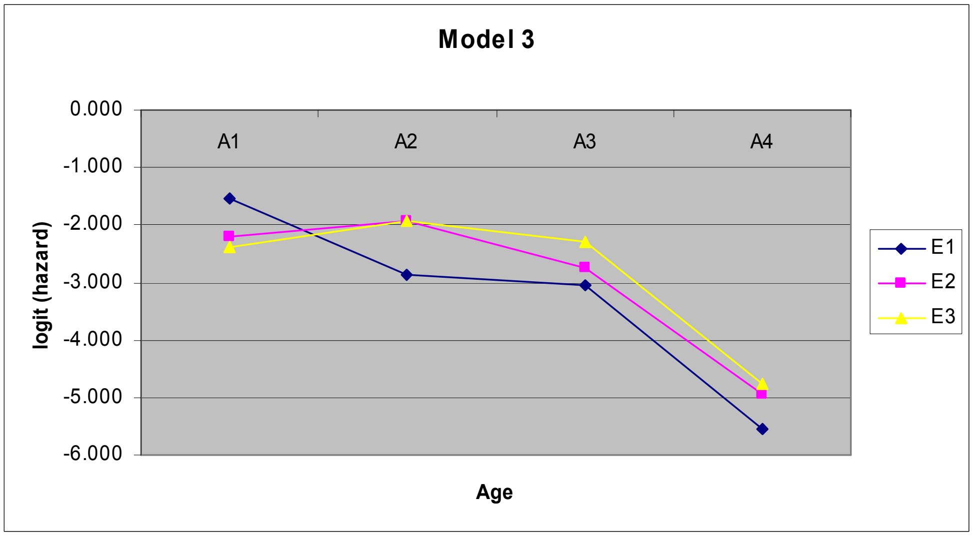
Figure 2-2: Main effect of Education level



Model 3, the general interaction with age model, allows the each educational differential to differ in each interested age category. This is the way we can test the proportional assumption of age over the educational effects. The logit(hazard) of each age category by educational level in Model 3 in Table 2, displays the time-varying effects of education. We can also see this easily in Figure2-3. Note that the estimates fluctuate over the age categories and they cross among them between A1 and A2. Now we have secured sufficient evidence to suggest a proportional assumption of effect of Education on Age.

By close looking at Figure2-2, it seems to reveal some crucial points of Korean fertility. First of all, the general comparison among lines suggests that the pattern of childbearing behaviors are somewhat similar E2 with E3 but E1 is departed from the rest That is, where the hazards of E1 is dropped rapid between A1 and A2, those of E2 and E3 are gently incremented between the intervals. This suggests that in the early 20s, practical onset of the childbearing, E1 are more productive than E2 and E3 but in the late of 20s the patterns are reversed. And since then, the more educated maintained the higher hazards than the lower educated over the remaining childbearing periods.

Figure 2-3: Interaction between Education level and Age



Conclusion

In this paper, we tried to demonstrate two things: First, fitting the discrete proportional hazard models that will show the relationship between the event of birth and age categories. Further, by introducing the educational predictor, we tested the proportional assumption of effect of education on the age categories; Second, we estimated the spacing and limiting components of Korean fertility with comparing to the natural fertility. Further, we also estimated the spacing and limiting parameter by educational differences that shows the different pattern childbearing behavior within the wedding block.

Reference

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