**Exploring the effects of spousal education and employment on female age at first birth using international census microdata**

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## Abstract

Although shifts in fertility levels have taken place in both the United States and Europe, remarkable differences exist between the United States' above-replacement fertility rates (2.1 in 2005) and the lowest-low rates of nations such as Greece (1.33 in 2005). These fertility declines may in part be attributed to tempo distortions caused by rising ages at first birth. Most studies of reproduction decisions focus exclusively on women's social and economic characteristics, disregarding spousal or partner characteristics that also affect the timing of a woman's first birth. This may be due, in part, to the lack of large-scale datasets that allow researchers to link women's and spouse's characteristics. In this study we show how the Integrated Public Use Microdata Series – International (IPUMS-I) data can be used to examine the simultaneous effects of male and female education, nativity and labor force involvement on women's age at first birth in Greece and the U.S. Data are drawn from the 2001 Greek National Population Housing Census and the 2004-2005 United State American Community Survey. Results indicate that in the U.S., the most important predictors of age at first birth are marital status and education while in Greece the most important predictors are education and employment. In the Greek models that include spousal characteristics, education is the most important male characteristic but the addition of spousal data did not significantly change the strength or effect of any of the women's characteristics on age at first birth. Thus, it appears that spousal characteristics do not modify women's childbearing behaviors. In contrast, spousal education in the U.S. has the most significant impact on age at first birth and also significantly modifies the importance of women's characteristics on age at first birth; decreasing the effect of women's education and nativity.

## Introduction

Although shifts in both fertility timing and total fertility levels have taken place in the United States and Europe, remarkable divergence exists between the United States' above-replacement fertility rates (2.1 in 2005 (U.S. Census Bureau 2000)) and the lowest-low rates of nations such as Spain, the Czech Republic and Greece (1.35, 1.28 and 1.33 respectively in 2005 (EuroStat 2007)). The fertility declines that many nations have experienced over the last two or three decades may in part be attributed to tempo distortions caused by rising ages at first birth. In 2000 the average American woman having her first child was almost 25 years old, up from 21.4 years in 1970. Postponement of fertility initiation in Greece has been similarly rapid, rising from an average of 25.95 in 1992 to 28.03 in 2000. Such increases in women's age at first birth are significant because the timing of initiation of reproduction both influences the total number of children she will eventually have and can affect (and be affected by) her social and economic circumstances (Rindfuss et al. 1980; Rindfuss et al. 1983; Brewster et al. 2000).

Several studies have explored the relationship between early and subsequent births and found that the age of first birth has a strong effect on the pace of fertility and completed fertility rates (Bumpass et al. 1978; Millman et al. 1980). Various factors are implicated in the delay of childbearing: rising age at marriage; changing roles of women in society; women's increasing education levels which delays entry into the marriage market and provides them with better employment opportunities; women's increasing importance to the labor force; and the sexual revolution that accompanied the mass adoption of highly efficient contraception (Rindfuss et al. 1980; Lesthaeghe 1983; Preston 1986; van de Kaa 1987; Blossfeld 1995). Many of these factors operate at the level of the individual. Thus, a woman's decision to begin childbearing is likely to be influenced by life circumstances such as education, employment situation, income and marital status.

Most studies of reproduction decisions focus exclusively on women's social and economic characteristics, disregarding spousal or partner characteristics that also affect the timing of a woman's first birth. Those studies that do consider links between spousal characteristics and fertility initiation make use of small surveys to explore links between father's educational status and fertility (Liefbroer et al. 1999; Symeonidou 2000; Dribe et al. 2006), the socio-economic characteristics or fertility intentions of the father (Sorenson 1989; Thomson et al. 1998), or analyze fertility solely from the male perspective without linking male characteristics back to mothers (Coleman 2000; Greene et al. 2000). A recent analysis of the 1989 and 1999 Greek fertility surveys examined the effect of number of socio-economic and behavioral factors on fertility, including male characteristics, but did not link married (or unmarried) couples to look at the simultaneous effects of men's and women's characteristics on fertility and childbearing behaviors (Symeonidou 2000).

Part of the difficulty in studying the effects of spousal characteristics on fertility is the lack of large-scale datasets that collect information on fertility *and* allow a woman's characteristics to be linked to those of her spouse. For example, research by Kravdal and Rindfuss (2007) uses Norway's nationwide population registers to explore male and female completed fertility in light of educational status, going further than solely examining first birth patterns, but do not link mothers and fathers in fertility relationships. The recent effort by the Minnesota Population Center to collect and integrate census microdata from countries around the world through the Integrated Public Use Microdata Series – International (IPUMS-I) provides easy access to individual-level census data and the opportunity to link records for people living in the same household. For this study we use these census microdata to examine variation in the effects of male versus female education, nativity and labor force involvement on women's age at

first birth.  Currently, Greece and the United States are the only developed countries included in the IPUMS data system that collect census data on fertility.  We felt these counties would make an interesting comparison because both have similar social policies related to child-care arrangements and paid parental leave and yet the U.S. fertility rate is significantly higher than that of Greece.  In this study, we explore socio-economic characteristics of women and their spouses that influence timing of first birth and how these vary between the two countries.

## Background
*Education and Labor Force Participation*

It is well documented that women with advanced education have lower completed fertility rates.  The U.S. Census Bureau reports that women with less than a high school education have approximately 2.5 children during their lifetime while women with a university degree have on average 1.7 children (Dye 2005).  The time required to complete higher education extends well into a woman's peak childbearing years; thus the more education a woman desires, the later the start of childbearing.  Studies have consistently found that women with higher levels of education have later patterns of childbearing (Bloom et al. 1984; Rindfuss et al. 1996; Mathews et al. 1997; Santow et al. 2001; Dye 2005).  The Greek Fertility Survey found that among women age 25-29, 71% of women with primary education had their first birth at the age of 24, while only 44% of women with secondary education and to 5% of women with higher education had their first child by that age (Symeonidou 2000).  Education acts through many different mechanisms, which are intimately linked with labor force participation, to delay childbearing.  For instance, women face difficulties in combining student and parenting roles and may prefer to postpone childbearing in order to achieve educational goals (Blossfeld 1995; Rindfuss et al. 1996; Santow et al. 2001).  An early first birth may also stop the educational process entirely (Rindfuss et al. 1980).

Women with low levels of educational attainment are more likely to hold jobs where the pay is low and there is little opportunity for career advancement.  Such jobs may conflict less with childbearing because temporary exits from the labor force will not greatly affect earnings and the economic costs of salary loss are less (Morgan et al. 2002).  As societal norms have changed and women are more accepted in upper-level jobs, women with high levels of education have increasingly taken jobs with higher wages, a steeper age-income profile, and opportunities for occupational advancement up well-structured career ladders. Childbearing and parenting must compete with these more attractive non-familial opportunities and may be delayed in order to accommodate desires for job advancement (Desai et al. 1991; Klerman et al. 1999 ; Brewster et al. 2000; Morgan et al. 2002).  In Greece, similar to the United States, state support for children is low, maternity and parental leaves are unpaid and have stringent eligibility restrictions.  Greek women with one or two children, according to Symeonidou (2000), tend to remain in their jobs as leaving and then re-entering the labor force is difficult.

*Marital Status*

Traditional Malthusian views of fertility and population growth attribute increases in age at first birth to the postponement of marriage along with abstinence outside of marital unions.  However, the reality of the situation is quite different.  Over the past 20 years, a variety of living arrangements other than marriage have emerged, ranging from prolonged single living, to premarital cohabitation, parenthood within cohabitation and single sex household formation (Lesthaeghe et al. 2006).  In the process, age at first marriage increased as did non-marital fertility as parents continued to cohabitate (Dye 2005).  At the same time, contraceptive

technology allowed women to control their fertility and avoid births of higher parities occurring at older ages. This, in conjunction with the postponement of childbearing due to more pressing competing goals such as prolonging education, achieving more stable income positions, increased consumerism associated with self-expressive orientations, realizing a more fulfilling partnership, etc., have all acted to increase the age at first birth and lower total fertility rates (Lesthaeghe et al. 2006).

Data from the United States Census' Current Population Survey show that first-birth rates were highest among never-married cohabiting women, followed by women living with their husband (42 births and 32 births per 1,000 women, respectively) (Dye 2005). The first-birth rate for never-married women without a cohabiting partner was significantly lower - 17 births per 1,000 women. At the same time, women who were currently or had ever been married were more likely to have had children than if they had never been married, regardless of their current cohabitation status (Dye 2005). Despite the increase in non-marital childbearing, out-of wedlock births still only make up about one-third of total U.S. births. In contrast, although non-marital births in Greece have risen significantly since the 1960s, they still are only ~5% of the current total (EuroStat 2007). Consideration of in-couple social and economic factors are thus important to consider, given that the overwhelming majority of births in both Greece and the United States take place within marriage.

*Nativity*

While racial/ethnic differences, usually serving as proxies for inequalities in socioeconomic factors, in fertility have received widespread attention in the United States (Presser 1971; Bean et al. 1978; St. John 1982; Dye 2005), fertility outcome differences also exist between native and non-native members of similar racial/ethnic groups. Immigrants typically sustain the fertility rates of their home countries and have fewer negative birth outcomes (i.e. low birth weight or infant mortality) than their native counterparts (Hummer et al. 1999; Storesletten 2000). The United States and Greece are both attractive countries for immigrants, given their relatively strong and stable economies and high standards of living. While nativity statistics are estimates only, due to the sensitive legal implications of international migration, over ten percent of the United States' 300 million residents and close to seven percent of Greece's 11 million residents are non-native born.

**Table 1: Summary of U.S. and Greek demographic indicators**

| Variable | United States | Greece |
|---|---|---|
| Average female age at first marriage | 21.4 in 1964[1] | 24.7 in 1965[7] |
| | 25.8 in 2002[2] | 28.2 in 2005[7] |
| Female university graduates | 49% in 2003[3] | 61.5% in 2005[7] |
| Female labor force participation (25-54 year olds, 2005) | 75.3%[5] | 58.5%[7] |
| Births out-of-wedlock (2005) | 35.7%[5] | 5.1%[7] |
| Foreign-born residents | 10.4% in 2000[6] | 6.9% in 2007[7] |

[1](Clarke 1995); [2](Sutton et al. 2004); [3](Kannankutty 2005); [4](Mosisa et al. 2006); [5](NCHS 2005); [6](U.S. Census Bureau 2000); [7](EuroStat 2007)

## Data and Methods
*Data Sources*

The data used for this analysis were extracted from the Integrated Public Use Microdata Series - International (IPUMS-I) and the Integrated Public Use Microdata Series – USA (IPUMS-USA) (Ruggles et al. 2004; Minnesota Population Center 2007).  The advantage of using microdata is that they contain all the information for each individual included in a population register, survey, census or other data collection instrument.  Thus, instead of a table giving a count of how many people in a given locality in a given year shared one characteristic, "census microdata give *all* the responses of individual persons and households transcribed from the census manuscripts.  A census microdata sample allows researchers to know, simultaneously, all the personal characteristics of every individual in the sample" (Hall et al. 2000).  In addition, many datasets link records for people living in the same household, allowing simultaneous analysis of the characteristics of the individual and the people with whom that person resides.  This allows researchers examine the influence of spousal characteristics (as well as a woman's characteristics) on age and first birth.  The IPUMS program also converts census microdata for multiple countries into a consistent format in order to ease comparisons across time and across nations, without loss of information.  At this time, the IPUMS provides census microdata for twenty-six countries and the United States.  IPUMS data are deidentified, so as to preserve confidentiality.

Data from Greece were collected during the 2001 National Population Housing Census administered by the National Statistical Service.  The Census is taken every 10 years, includes the entire population of the country, and provides data on demographic, social, economic and housing characteristics of the Greek population.  The 2001 microdata includes a 10% sample of the full census for a total of 1,028,899 records.  The 2001 National Population and Housing Census obtained data on the number of children ever born to a woman and the year of last birth. These two variables were used to obtain a sample of the number of women with a "first birth" in the year prior to the census.

Data for the United States were collected during the 2001-2003 American Community Survey (ACS).  The ACS is a yearly nationwide survey that collects data on demographic, social, economic, and housing characteristics of the U.S. population.  In 2001, the ACS collected data from 1.2 million U.S. households.  ACS data are also available through the IPUMS microdata system.  The ACS survey obtained data on the number of own children residing with an individual, the age of each woman's eldest child as well as whether or not a woman had given birth to any children in the prior year.  These three variables were used to subset the dataset and obtain a sample of the number of women with a "first birth" in the prior year.  It is possible that some women were incorrectly included in the sample.  Such inclusions would be limited to women with a prior birth who gave birth to a child in the last year and neither child resides in the household.  We feel this would be an extremely small group.

Both the Greek and U.S. microdata are cross-sectional in nature and do not obtain a complete birth and pregnancy history.  This means that we cannot examine questions of birth spacing or completed fertility.  However, the timing of first births is important because postponement of childbearing until later ages often leads to a lower overall completed fertility rate because of a shortened timeframe during which childbearing occurs.

*Study Sample*

The analysis is limited to women age 16 to 44 (e.g. women of childbearing age) who gave birth to their first child in the prior year.  Sixteen was chosen as the bottom age limit

because the ACS only collects employment data for individuals age 16 and over.  Women older than 44 years were excluded in order to minimize the possibility of including women with additional children in the sample.  The final sample sizes used in this analysis was 18,290 for the United States and 5,207 for Greece.  Figure 1 presents the distribution of the samples by age at first birth.  In the United States, the sample was slightly younger; one-quarter of women were between the ages of 25 and 29 compared to 36 percent of women in the Greek Sample.

**Figure 1: Proportion of study sample categorized by age at first birth: United States and Greece**
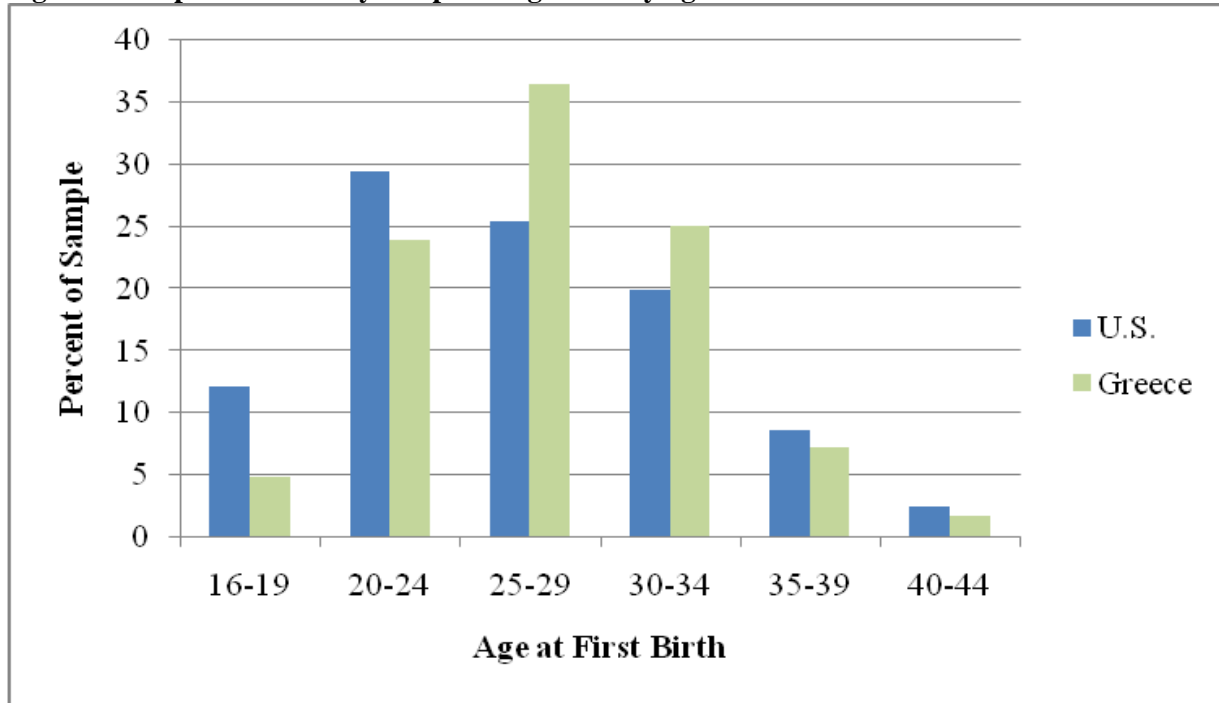


The dependent variable used in this analysis is age at first birth, coded as a continuous variable.  Several different model specifications were examined, but inclusion of the following variables yielded the best model fit: marital status, education, employment, hours worked per week and nativity.  These variables were partially chosen because comparable variables were available for both the United States and Greece. The measurement of these variables, their means and standard deviations can be found in Table 2.  The average age at first birth was 26.4 years in the U.S. sample and 27.5 years in the Greek sample.  Only 60% of the U.S. sample was married, compared to 97.5% of the Greek sample.  Over 50% of the U.S. sample had a University degree, compared to 25% of the Greek sample.  Women worked an average of 26.8 hours per week in the U.S., compare to 15.5 hours in Greece.  Finally, only 17% of the U.S. sample is foreign-born, compared to 22% of the Greek sample.

*Methods*
Data were analyzed using ordinary least squares regression techniques using the PROC GLM procedure in SAS 9.1 software.  Interaction terms were examined further using the LSMEANS command to look at the difference in mean age between each level of the interacted variables.  Uninformative variables were dropped in order to enhance interpretation of the final model, multiple interactions were tested, and models were constructed with and without spousal variables to determine which spouse characteristics may indirectly influence women's

childbearing decisions.  Initially, error terms were heteroscedastic, so robust standard errors were calculated to adjust for this.  The final models are summarized in Table 3 and 4 with parameter estimates, robust standard errors and significance.

**Table 2: Measurement of variables in the age-at-first-birth model**

| Variable Label | Variable Name | Unit | Coding description | United States | | | Greece | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | % | Mean | SD | % | Mean | SD |
| *Respondent's Characteristics* | | | | *n = 18,290* | | | *n = 5,207* | | |
| Age | Age at first birth | Years | | - | 26.4 | 6.1 | - | 27.5 | 5.2 |
| Hrswork | Usual number of hours worked per week | Hours | | - | 26.8 | 18.0 | - | 15.5 | 20.0 |
| Marital | Marital status | Dummy variable | 1=married, 0=never married, divorced, separated | 59.9 | | | 97.5 | | |
| Educate | Whether the respondent has a university degree | Dummy variable | 1=university degree, 0=no university degree | 55.9 | | | 25.1 | | |
| Employmt | Whether the respondent is employed | Dummy variable | 1=employed, 0=not in the labor force or unemployed | 52.9 | | | 45.5 | | |
| Nativity | Whether the respondent was born in the U.S./Greece | Dummy variable | 1=native, 0=foreign-born | 83.2 | | | 78.1 | | |
| *Spouse's Characteristics* | | | | *n = 10,137* | | | *n = 4,906* | | |
| Sage | Spouses age | Years | | - | 31.1 | 6.6 | | 32.1 | 5.7 |
| Shrswork | Usual number of hours worked per week | Hours | | - | 43.8 | 12.5 | | 41.3 | 17.6 |
| Seducate | Whether the spouse has a university degree | Dummy variable | 1=university degree, 0=no university degree | 38.7 | | | 20.1 | | |
| Semploymt | Whether the spouse is employed | Dummy variable | 1=employed, 0=not in the labor force or unemployed | 94.2 | | | 87.8 | | |

## Results

Tables 3 and 4 show the results of the multivariate regressions.  Models 1 and 4 include only respondent (or maternal) characteristics for both married and unmarried women in the sample (i.e., the full sample) while models 2 and 5 show characteristics for the subset of women who are married.  Models 3 and 6 include respondent and spousal characteristics for those individuals that were married.  When examining the additional effect of spousal characteristics on the timing of child bearing, we chose to compare models 2 with 3 and 5 with 6 (all of which only included married women) since marriage has such a strong effect on childbearing decisions.

There are several categorical variables in this analysis, due in part to the nature of the data used (surveys).  The reference category to which we make comparisons is non-married, unemployed, foreign-born women with less than a university education.

*United States Sample*

Table 3 shows the results for the U.S. regression models. Model 1 shows significant effects for marital status, education, employment, hours worked per week and nativity for U.S. women. All factors act to delay timing of childbearing, with the exception of nativity. Being married corresponded to a 2.6 year increase in age at first birth while having a university education corresponded to a 2.2 year increase of age at first birth. Employment had less of an effect, delaying childbearing by less than a year, while being born in the U.S. corresponded to a 2.4 year decrease in age at first birth. We also found two significant interaction effects: marital status*education and education*nativity. Being married and university-educated corresponded to an additional 1.3 year delay in childbearing while being university-educated and a native of the U.S. corresponded to an additional 0.8 year delay.

When we reran the model using only the subset of the sample that was married, all variables were still significant predictors of age at first birth, though coefficients changed somewhat. The effect of education became stronger and corresponded to a nearly 4 year increase in age at first birth (note that this is the average length of time it takes to get a university degree in the United States). In addition, the effect of employment increased while the effect of foreign-born status decreased. We introduced on additional interaction term to this model: education*employment. Women with a university education who were employed had children nearly a year earlier than women without these characteristics.

**Table 3: Regression Results for Age-at-First-Birth Models: United States**

| Variable | Model 1: Married and Unmarried Respondents (full sample) | | | Model 2: Married-only Respondents | | | Model 3: Married-only Respondents & Spouses | | |
|---|---|---|---|---|---|---|---|---|---|
| | *Coeff* | *RSE* | | *Coeff* | *RSE* | | *Coeff* | *RSE* | |
| Intercept | 23.25 | 0.13 | ** | 25.27 | 0.16 | ** | 24.9 | 0.30 | ** |
| Marital | 2.60 | 0.11 | ** | | | | | | |
| Educate | 2.22 | 0.20 | ** | 4.02 | 0.21 | ** | 2.14 | 0.37 | ** |
| Employmt | 0.67 | 0.09 | ** | 1.53 | 0.19 | ** | 1.58 | 0.20 | ** |
| Hrswork | 0.03 | 0.002 | ** | 0.02 | 0.003 | ** | 0.02 | 0.003 | ** |
| Nativity | -2.41 | 0.13 | ** | -1.73 | 0.18 | ** | -1.66 | 0.19 | ** |
| Marital*Educate | 1.27 | 0.17 | ** | | | | | | |
| Educate*Nativity | 0.81 | 0.19 | ** | 0.58 | 0.24 | * | 0.51 | 0.25 | ** |
| Educate*Employmt | | | | -0.87 | 0.22 | ** | -0.75 | 0.22 | * |
| | | | | | | | | | |
| seducate | | | | | | | 1.85 | 0.12 | ** |
| semploymt | | | | | | | -0.92 | 0.27 | ** |
| shrswork | | | | | | | 0.02 | 0.004 | ** |
| educate*semploymt | | | | | | | 0.88 | 0.33 | ** |
| F-statistic (df) | 1033.7 (7) | | | 335.9 (6) | | | 208.6 (10) | | |
| Adjusted $R^2$ | 0.28 | | | 0.16 | | | 0.17 | | |

** $p < 0.01$; * $p < 0.05$

For the U.S. sample, the addition of spousal characteristics changed results significantly. While female education continues to be the most significant predictor of age at first birth, the parameter estimate (2.14 years) is remarkably different from the model with only married women (4.02 years, nearly a 2 year decrease). In addition, spousal education significantly affects age at first birth, corresponding to a 1.9 year increase in age at first birth. This suggests there is an additive effect for a man's and woman's education. When both are educated, couples delay childbearing by nearly 4 years rather than 2 years if only one is university-educated. Spousal

employment was also significant, corresponding to nearly a 1 year decrease in age at first birth. There was one additional interaction term that was introduced into our analysis: woman's education*man's employment. When a woman was educated and her spouse employed, there was an additional 0.9 year increase in age at first birth. This interaction was not significant the other way (man's education* woman's employment).

*Greek Sample*

Table 4 shows the regression results for Greek women. Model 1 suggests that being married, having a university degree, being employed and a native of Greece all corresponded to a significant increase in age at first birth. Education had by far the largest effect on age at first birth, corresponding to an 8 year increase in age at first birth (educated women would be 31 at their first birth rather than 23). There was a negative interaction between marital status and education, however, and women who were married and university-educated gave birth 3.7 years earlier than those who were not, suggesting that marital status has a significant effect on decisions about child bearing even among university-educated women. Being university educated and a native of Greece also had a subtractive effect (of 1.7 years) on age at first birth. Note that while nativity was a significant predictor for both Greece and the United States, the signs were opposite. The age at first birth for native Greek women was 1.5 years later than foreign-born women.

**Table 4: Regression Results for Age-at-First-Birth Models: Greece**

| Variable | Model 4: Married and Unmarried Respondents (full sample) | | | Model 5: Married-only Respondents | | | Model 6: Married-only Respondents & Spouses | | |
|---|---|---|---|---|---|---|---|---|---|
| | *Coeff* | *RSE* | | *Coeff* | *RSE* | | *Coeff* | *RSE* | |
| Intercept | 22.82 | 0.54 | ** | 24.09 | 0.16 | ** | 23.53 | 0.35 | ** |
| Marital | 1.33 | 0.52 | * | | | | | | |
| Educate | 8.02 | 1.25 | ** | 4.60 | 0.37 | ** | 5.16 | 0.78 | ** |
| Employmt | 1.84 | 0.25 | ** | 2.93 | 0.27 | ** | 2.62 | 0.27 | ** |
| Hrswork | -0.02 | 0.006 | ** | -0.02 | 0.006 | ** | -0.01 | 0.006 | * |
| Nativity | 1.89 | 0.18 | ** | 1.93 | 0.18 | ** | 1.91 | 0.18 | ** |
| Marital*Educate | -3.68 | 1.23 | ** | | | | | | |
| Educate*Nativity | -1.72 | 0.37 | ** | -1.69 | 0.38 | ** | -1.85 | 0.39 | ** |
| Educate*Employmt | | | | -0.46 | 0.32 | | -0.35 | 0.33 | |
| | | | | | | | | | |
| seducate | | | | | | | 1.89 | 0.18 | ** |
| semploymt | | | | | | | 0.48 | 0.40 | |
| shrswork | | | | | | | 0.002 | 0.005 | |
| educate*semploymt | | | | | | | -1.20 | 0.74 | |
| F-statistic (df) | 160.8 (7) | | | 180.9 (6) | | | 115.2 (10) | | |
| Adjusted $R^2$ | 0.18 | | | 0.18 | | | 0.20 | | |

** $p < 0.01$; * $p < 0.05$

Model 5 shows the results for only married women in the Greek sample. The results were somewhat different, reflecting the difference in characteristics between wed and un-wed mothers. Among married women, education was still the most important predictor of age at first birth, corresponding to a 4.6 year increase (much lower than for the full model, reflecting the influence of marital status on childbearing decisions). The effect of employment increased, corresponding to a nearly 3 year increase and the effect of nativity was similar. The interaction term educate*nativity had a similar negative influence; women who were education and native

Greek had children 1.7 years earlier.  The interaction between education and employment was not significant for Greek women.

Even after adding male characteristics to the Greece model, female education, employment, hours worked and nativity were still significant predictors of age at first birth (see model 6).  Age at first birth for university-educated women actually increased by 0.5 years (from 4.6 to 5.2) and for employed women decreased by 0.3 years (from 2.9 to 2.6).  The only male characteristic that significantly affected age at first birth was having a university degree.  The wives of university graduates experienced a nearly 2 year delay age at first birth.  Male hours worked per week and employment status were insignificant.

## Summary and Conclusions

Of all the variables considered in model 1 (United States), marital status, education and nativity have the most substantial effect on age at first birth.  In the United States, being married has a significant positive effect on age at first birth; women who are married are older when they have their first child than women who are not married.  Education also has a significant positive effect on age at first birth; women with a university degree are older at first birth than women without a college degree.  In addition, women who are both married and university-education delay childbearing even further.  Both of these findings are consistent with the literature. In model 1, the effects of nativity persist even after controlling for employment and education, which suggests that nativity may act as a proxy for background factors, such as cultural and social norms related to childbearing, which influence a woman's decision about when to begin childbearing.  We were somewhat surprised by the direction of the sign for nativity.  We hypothesized foreign born women would have a lower age at first birth than native women because the U.S. typically draws immigrants from high fertility countries (e.g. Mexico).  As we examined our data further, we found that the lowest age at first birth occurred among (native) African American and American Indian populations.  The Hispanic population, however, had a rate slightly below that of white women.

Model results were somewhat different when we only examined married women (model 2), indicating how important marital status is to childbearing decisions.  Education and employment both had a stronger effect on age at first birth while nativity had a weaker effect.  In addition, women who were both educated and employed had children earlier, suggesting that secure (and higher level) employment may allow women to have children earlier than women without secure employment or with a lower status job.

When spousal characteristics are added to the U.S. model, the results are quite different.  Model 3 indicates that the effect of a woman's education and nativity were weaker when spousal characteristics were included.  The effect of employment was similar, suggesting that married women who are employed delay childbearing regardless of whether or not their spouse is employed.  Spousal education, second only to female education status, becomes the most dominant effect modifier.  Perhaps the inclusion of spousal economic variables paints a more complete picture of family socioeconomic status, which is ultimately more important to childbearing decisions than a woman's economic situation alone.  If an American woman's spouse is university educated her age at first birth is higher than if the spouse has no university degree.  This suggests that university education women are likely to marry educated men (in our sample 83% percent of educated women married a university educated man) and the combination of both partners attending university has an additive effect on the delay in childbearing.  We found no significant interaction between a man's and woman's education, however, suggesting that the effect of education is truly additive.  The only interaction term that

was significant between spousal characteristics was a woman's education and man's employment. This suggests that if a woman is university-educated and her partner is employed, the couple may delay childbearing an additional year.

Of the variables considered in model 4 (Greece), education, employment and nativity have the most substantial effect on age at first birth. The very large coefficient for education (8 years) and the negative interaction term between marital status and education suggests that unmarried university-educated women delay childbearing far longer than university-education women who are married. Marriage plays a very important role in the initiation of childbearing. Employment also has a significant positive effect on age at first birth; women who have a job are older when they have their first child, similar to the United States' models and to observed behaviors across Western nations. Also a factor delaying age at first birth in the Greek sample is nativity status: foreign-born women give birth to their first child earlier than native-born women. The model results indicate that an increase in the hours a woman works per week leads to a small decrease in the age at first birth. While the coefficient is very small, the sign is different than that for the U.S. We speculate this might be a related to job security: women with steady employment in Greece feel they can have children earlier whereas in the U.S. steady employment may leave less time for childbearing.

When only married women were considered (model 5) the overall age at first birth (intercept) increases, suggesting married women delay child bearing longer than unmarried women. The effect of education greatly decreases, showing the importance of the *interaction* between marriage and education in the delay of childbearing. The effect of employment increases and employed women who are married delay childbearing for an additional 3 years. The interaction between education and employment was not significant.

When we added spousal characteristics to the Greek model (model 6) spousal education was the most important male characteristic; spousal employment status and hours worked per week have no effect on Greek women's age at first birth. Maternal education and employment still have the greatest effect on age at first birth, though the addition of data on spousal education does decrease these effects slightly. Overall, women's characteristics are still highly important in determining age at first birth, even after controlling for spousal characteristics.

The differences between Greece and the United States are striking. First, the interaction between marital status and education is very different in the two countries. Marriage is quite possibly the single most important factor in determining age at first birth in the U.S. Women who are married delay child bearing, and university educated women delay childbearing even longer. Although higher-levels of education act to delay childbearing in both countries, the magnitude of the effect of education in Greece is striking, but highly mediated by marital status, which is not true in the U.S. In Greece, marriage does delay child bearing, though not by as much. Among university educated women, marriage actually modifies the effect of education, decreasing the age at first birth. Some of these differences are almost certainly due to the very low percentage of extramarital births in Greece (5%) compared to the United States (30%). In the U.S. babies born out-of-wedlock are typically born to young mothers who are not university educated.

Second, U.S. and Greek models have opposite signs for nativity: foreign-born women in the U.S. have their first child later than native-born women while the opposite is true for Greek women. We speculate that this difference in signs may be due both to differences in the fertility patterns of immigrants that enter these countries and the birth patterns of natives. While the United States attracts immigrants from high fertility countries such as Mexico, in our sample these immigrants have ages at first birth similar to native Caucasian Americans. In contrast,

African Americans generally have earlier ages at first birth, which we believe causes the positive relationship between nativity and age at first birth. While the foreign born population in Greece comes predominantly from low-fertility Albania, Bulgaria and other former Eastern-bloc countries, the fertility patterns among these groups differ. Albanians have ages at first birth similar to native-born Greek women, but they go on to have higher completed fertility. In contrast, Bulgarian women have their first child two to three years earlier than Greek women, but have lower birth parities (Verropoulou et al. 2007). It is likely this much earlier onset of childbearing experienced by Bulgarian immigrants that leads nativity to be negatively associated with age at first birth.

The effect of employment (while positive in both countries) is much stronger in Greece. There is a small effect of employment on age at first birth in the U.S., yet this is one of the most important predictors in the Greek model especially among married women. Thus, in the U.S. it appears that employment does not interfere with childbearing while it may cause a delay in childbearing in Greece (or the combination of marriage and employment somehow delays child bearing). This may reflect the fact that Greek women with one or two children tend to remain in their jobs as leaving and then re-entering the labor force is difficult (Symeonidou 2000). In the United States, non-familial childcare has become the norm for working women, rendering female employment status less important than having a husband with a job in fertility initiation. The interaction between education and employment was negative for both countries suggesting that job security in high-level jobs may allow women to have children with fewer negative repercussions to their careers.

In both the U.S. and Greek models with spousal characteristics, education is the most important male characteristic acting on age at first birth. This suggests that the time a man spends on education impacts childbearing decisions as much as the time spent on education by the woman. However, in the U.S. educated women tend to married educated men, and both men and women appear to wait to have children until they finish university. This trend does not hold true for Greek women. Thus, among Greek women the addition of spousal data does not significantly change the strength or effect of any of the women's characteristics on age at first birth. In contrast, spousal education in the U.S. has the most significant impact on age at first birth and also significantly modifies the importance of women's characteristics on age at first birth; the effect of a woman's nativity and employment are not as strong.

If increased age at first birth does indeed lead to a lower completed fertility rate, this analysis suggest that educated women will have lower fertility in both countries while married women will have lower fertility in the U.S. and Greece. The interaction between marriage and education suggests that educated women who are married may have higher fertility in Greece (but not in the U.S.). But Greek women married to a spouse with a university degree may have lower fertility, which is also true in the United States. Employed women may have lower fertility in Greece, and this effect appears to be stronger in Greece than in the U.S. In addition, American women in a marital union where the spouse is employed may have higher fertility, though higher levels of education and income appear to mitigate this effect.

## Literature Cited

Bean, F. and J. Marcum (1978). Differential Fertility and the Minority Group Status Hypothesis: An Assessment and Review. The Demography of Racial and Ethnic Groups. F. Bean and W. Frisbie. New York, Academic Press.

Bloom, D. E. and J. Trussell (1984). "What are the Determinants of Delayed Childbearing and Permanent Childlessness in the United States?" Demography **21**(4): 591-611.

Blossfeld, H. P. (1995). The New Role of Women: Family Formation in Modern Societies. Boulder, CO, Westview Press.

Brewster, K. and R. Rindfuss (2000). "Fertility and Women's Employment in Industrialized Nations." Annual Review of Sociology **26**: 271-296.

Bumpass, L., R. Rindfuss, et al. (1978). "Age and Marital Status at First Birth and the Pace of Subsequent Fertility." Demography **15**(1): 75-86.

Bureau, U. S. C. (2000). Current Population Survey.

Center, M. P. (2007). Integrated Public Use Microdata Series - International: Version 3.0. . Minneapolis, University of Minnesota.

Clarke, S. (1995). "Advance report of final marriage statistics, 1989 and 1990." Monthly vital statistics report; **43**(12): suppl.

Coleman, D. (2000). Male fertility trends in industrial countries: Theories in search of some evidence. Fertility and the male lifecycle in the era of fertility decline. C. Bledsoe, S. Lerner and J. I. Guyer. Oxford, Oxford University Press**:** 29-60.

Desai, S. and L. J. Waite (1991). "Women's Employment During Pregnancy and after the First Birth: Occupational Characteristics and Work Commitment." American Sociological Review **56**(4): 551-566.

Dribe, M. and M. Stanfors (2006). Education, work and parenthood: The experience of young men and women in post-war Sweden. Annual Meeting of the Population Association of America. Los Angeles, CA.

Dye, J. L. (2005). Fertility of American Women: June 2004. Current Population Reports. Suitland, MD, U.S. Census Bureau.

EuroStat. (2007). "Population and Social Conditions: Data."   Retrieved Oct 12, 2007, from http://ec.europa.eu/eurostat/.

Greene, M. E. and A. E. Biddlecom (2000). "Absent and problematic men: Demographic accounts of male reproductive roles." Population and Development Review **26**: 81-115.

Hall, P., R. McCaa, et al. (2000). Introduction — International Historical Microdata: A New Resource for Research and Planning. Handbook of International Historical Microdata for Population Research. P. Hall, R. McCaa and G. Thorvaldsen. Minneapolis, The Minnesota Population Center**:** 3-10.

Hummer, R. A., M. Biegler, et al. (1999). "Race/ethnicity, Nativity, and Infant Mortality in the United States." Social Forces **77**: 1083-1118.

Kannankutty, N. (2005). College Graduates in the U.S. Workforce: A Profile. NSF Issue Brief. Arlington, VA, National Science Foundation.

Klerman, J. and A. Leibowitz (1999 ). "Job continuity among new mothers." Journal of Human Resource **29**(2): 277-303.

Kravdal, Ø. and R. R. Rindfuss (2007). Changing relationships between education and fertility – a study of women and men born 1940-64**:** Unpublished manuscript.

Lesthaeghe, R. J. (1983). "A century of demographic and cultural change in Western Europe: An exploration of underlying dimensions." Population and Development Review **9**: 411-435.

Lesthaeghe, R. J. and L. Neidert (2006). The "Second Demographic Transition" in the US: Spatial Patterns and Correlates. Population Studies Center Research Report. Ann Arbor, MI, Population Studies Center, University of Michigan.

Liefbroer, A. C. and M. Corijn (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.

Mathews, T. and S. Ventura (1997). "Birth and fertility rates by educational attainment: United States, 1994." Monthly vital statistics report 45(10): supp.

Millman, S. R. and G. E. Hendershot (1980). "Early Fertility and Lifetime Fertility. ." Family Planning Persectives 12(3): 139-149.

Morgan, S. and Y. Yang (2002). How Big are Educatinal Racial Fertility Differentials in the U.S.? Population Association of America. Atlanta, GA.

Mosisa, A. and S. Hipple (2006). "Trends in labor force participation in the United States." Monthly Labor Review Online 12(10).

NCHS. (2005). "Preliminary Births for 2004."   Retrieved 4/15/07, from http://www.cdc.gov/nchs/products/pubs/pubd/hestats/prelim_births/prelim_births04.htm.

Presser, H. (1971). "The Timing of the First Birth, Female Roles and Black Fertility." Milbank Memorial Fund Quarterly 49: 329-362.

Preston, S. H. (1986). "Changing values and falling birth rates." Population and Development Review 12 Suppl.: 176-195.

Rindfuss, R., L. Bumpass, et al. (1980). "Education and Fertility: Implications for the Roles Women Occupy." American Sociological Review 45(3): 431-447.

Rindfuss, R., S. Morgan, et al. (1996). "Education and the Changing Age Pattern of American Fertility: 1963-1989." Demography 33(3): 277-290.

Rindfuss, R. and C. St. John (1983). "Social Determinants of Age at First Birth." Journal of Marriage and the Family 45(3): 553-565.

Ruggles, S., M. Sobek, et al. (2004). Integrated Public Use Microdata Series: Version 3.0 [Machine-readable database]. Minnesota, MN: Minnesota Population Center [producer and distributor].

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

Sorenson, A. M. (1989). "Husbands' and wives' characteristics and fertility decisions: A diagonal mobility model." Demography 26: 125-135.

St. John, C. (1982). "Race Differences in Age at First Birth and the Pace of Subsequent Fertility: Implications for the Minority Group Status Hypothesis." Demography 19(3): 301-314.

Storesletten, K. (2000). Sustaining Fiscal Policy through Immigration. Journal of Political Economy. 108: 300-323.

Sutton, P. and T. Mathews (2004). "Trends in characteristics of births by State: United States, 1990, 1995, and 2000-2002." National vital statistics reports 52(19).

Symeonidou, H. (2000). "Expected and actual family size in Greece: 1983-1997." European Journal of Population 16: 335-352.

Symeonidou, H. (2000). Greek Fertility Surveys: 1983, 1987, 1999. Partnership and Fertility - A Revolution? Brussels, Belguim, Conference Organized by the Population Activities Unit of the United Nations Economic Commission for Europe.

Thomson, E. and J. M. Hoem (1998). "Couple childbearing plans and births in Sweden." Demography 35: 315-322.

van de Kaa, D. J. (1987). "Europe's Second Demographic Transition." Population Bulletin 42(1).

Verropoulou, G., C. Bagavos, et al. (2007). "Migrant and non-migrant fertility in GReece: Results based on the 2001 population census." Migrantion Letters **4**(2): 147-158.