Major Themes in Economics

Volume 15 Article 3

Spring 2013

Education and Fertility: The Effect of Field of Study on Women's Fertility Decisions

Emily Scholtes
University of Northern Iowa

Education and Fertility: The Effect of Field of Study on Women's Fertility Decisions

Emily Scholtes

ABSTRACT. This study aims to identify the relationship between field of study and women's fertility among U.S. college graduates. Using data from the 2010 American Community Survey, this study provides the first Poisson regression analysis to compare the number of children women have with women's undergraduate fields of study. Of the 37 fields of study that are examined, I find 22 fields are statistically significant, suggesting that field of study is a significant factor in how many children a woman decides to have.

I. Introduction

In 1960, only 37.9 percent of female high school graduates enrolled in college (National Center for Educational Statistics 1999). By 2011, the percentage more than doubled to approximately 72.3 (Bureau of Labor Statistics 2012). Since the 1970s, women have moved into educational majors and occupations rarely before pursued by women. Women's relatively recent transition into higher education has played a key role in women's fertility decisions. Although extensive research has investigated the relationship between education level and fertility, the question of if and how a woman's undergraduate major may be related to the number of children she decides to have remains unanswered.

Since 2007, America's fertility rate has been falling. In June 2012, the U.S. fertility rate dropped to its lowest level since 1920. Lower fertility rates lead to lower population projections. More importantly, lower fertility rates lead to a high proportion of elderly, retired citizens in the future. A higher proportion of retired population relative to the total population puts more burden on the working age population to support the elderly. Understanding the determinants of women's fertility decisions is important for understanding the current fertility rate and making accurate future population and fertility-rate forecasts. (The Economist 2012, 31)

In this study, I use the 2010 American Community Survey to perform a Poisson regression to investigate the relationship between the number of children a U.S. female college graduate has and her undergraduate major, which will be referred to as field of study. I find a woman's field

of study to be a significant determinant; over half of the fields of study tested were statistically significant in determining the number of children a woman decides to have.

II. Why Field of Study Might Matter

Fertility theory evaluates women's opportunity costs in order to explain differences in women's fertility decisions. According to neoclassical theory, as the opportunity cost of a child increases, the demand for a child decreases. A woman's field of study may provide indications of the opportunity costs she faces when deciding to have children.

Women of different fields of study face different expected starting wages and wage trajectories. Economic theory says higher wages present higher opportunity costs for leaving the labor market. According to the National Association of Colleges and Employers Salary Survey, 2011 graduates with a humanities or social sciences degree had an average salary of $35,503, while graduates with an engineering degree had an average salary of $61,872 (NACE 2012, 3). Thus, one would predict that all else equal a woman who studied engineering will have fewer children on average than a woman who studied humanities or social sciences. In general, women who expect to make a lot of money may decide to postpone motherhood, have fewer children, or have higher rates of childlessness when compared to women who make relatively less money.

Certain fields of study also lead to occupations that have more family-friendly institutional accommodations, such as work schedule flexibility and lower motherhood penalties. Teachers, for example, seem to have family-friendly institutional accommodations, because their daily schedules match their school-attending children's schedule. Teachers usually have the summers off so they can spend more time with their children and spend less money on childcare.

Besides work schedule flexibility, fields of study lead to occupations that have different motherhood penalties. The motherhood penalty is the penalty a woman experiences when she leaves the labor force to have children. Upon reentering the labor force, mothers may experience more difficulty finding a job and may be offered less pay than their motherless peers. A high motherhood penalty may deter a woman from leaving the labor market to have children. Lower motherhood penalties are associated with family-friendly institutional accommodations, which make the combination of work and motherhood easier. Economic theory suggests

that more family-friendly institutional accommodations could lead a woman to decide to have children earlier in life and to have more children.

Job stability can also affect a woman's fertility decisions. Fields of study that lead to occupations with high unemployment rates and low job stability can have a negative effect on a woman's fertility decisions. Women who face low job stability may fear leaving the job market to have children, because they may be unable to find a job after having children (Adsera 2004, 26-27). Currently, majors with the highest unemployment rates include United States history (15.1% unemployment), miscellaneous fine arts (16.2%), architecture (10.6%), general social sciences (8.2%), and philosophy and religious studies (7.2%) (CBS News 2011). All else equal, fields of study that lead to occupations with high unemployment and low job stability may lead to lower fertility overall.

Also, fields of study that promote traditional family role attitudes, such as education, lead to lower levels of childlessness and an earlier transition to motherhood (Michelmore and Musick 2012, 25). Using these factors, one can begin to hypothesize what particular fields of study may lead to more children or fewer children.

III. Literature Review

Previous literature cites a woman's education level as a key factor in her decision to have children. Women with college degrees often delay childbearing (Rindfuss, Morgan, and Offutt 1996, 284-287). Yang and Morgan found that uneducated women had on average 2.0-2.4 children, while educated women had on average 1.6-1.8 children (Yang and Morgan 2003, 274). As a woman's education level increases, she tends to have children later in life and tends to have fewer children overall.

Although a woman's education level correlates negatively with how many children she decides to have, little research has investigated the relationship between a woman's field of study and her fertility decisions. In 2005, Lappegard and Ronsen found that Norwegian women who were educated in healthcare, education, and upper social sciences, such as psychology and sociology, had the highest first-birth rates, while women in humanities and lower social science, such as journalists, had the lowest first-birth rate (Lappegard and Ronsen 2005, 43-44). Hoem, Neyer, and Andersson discovered similar results among Swedish women. They found

that women educated in teaching and healthcare had the lowest permanent childlessness levels compared to any other field of study (Hoem, Neyer, and Andersson 2006, 347). Similarly, Martin-Garcia and Baizan found that women in Spain who studied in an area of caring for individuals, such as education or healthcare, had a higher likelihood of having children compared to other women (Martin-Garcia and Baizan 2006, 265).

In 2010, Van Bavel looked into how different aspects of field of study may be related to women's decision to postpone motherhood. When studying female college graduates from 24 European counties, Van Bavel found that women with higher starting wages and steeper earnings profiles tended to postpone childbirth (Van Bavel 2010, 452-453). Different fields of study have different views on family formation and women may be influenced by these views during their education. Van Bavel found that women who graduated in fields of study that had stereotypical attitudes toward gendered family roles and fields of study that were more female dominated were less likely to postpone motherhood (Van Bavel 2010, 452).

Recently, a few studies have looked into the relationship between field of study of U.S. college graduates and fertility decisions. In 2008, Goldin and Katz focused on fertility differences among Harvard graduates. They found that certain occupations seemed better suited for combining work and family. Goldin and Katz found that earnings penalties for taking time off work varied by occupation and degree status. The smallest earnings penalty was for physicians and other medical professionals, followed by those who had a JD or a PhD. Those with an MBA experienced the highest earnings penalty (Goldin and Katz 2008, 368). As expected, physicians had more children on average when compared to those who received their doctorate (Goldin and Katz 2008, 369).

In 2012, Michelmore and Musick performed the first analysis of fertility differences among U.S. college-educated women by undergraduate field of study. Their article looked at fertility delay and childlessness as well as the factors that link fertility and field of study: expected starting wage, expected wage trajectories, expected job stability, institutional factors, and traditional family attitudes. Michelmore and Musick found a nine percentage point difference in levels of childlessness across different fields of study (Michelmore and Musick 2012, 25). Women who studied health or education had the lowest level of

childlessness, while women who studied in arts and social sciences had the highest level of childlessness (Michelmore and Musick 2012, 17). Michelmore and Musick also found that expected wage trajectories, motherhood penalties, traditional family attitudes, and the male-female composition of the occupational field were significant factors in a woman's decision to delay motherhood and to be childless (Michelmore and Musick 2012, 22).

IV. Method and Data

Unlike most recent research, I will not focus on childlessness or delay in motherhood, but rather on the total number of children a woman decides to have. Thus, the dependent variable is the number of children a woman has (NCHILD). The estimated model is a Poisson regression model. Because the dependent variable is a count variable, which means it is bounded, it is inappropriate to use an ordinary least squares regression. A bounded dependent variable violates the standard distributional assumption for linear regression. (See Wooldridge 2012 for more detail.) The Poisson regression is formulated as follows:

$$\text{Log}_e(\text{NCHILD}) = \alpha + \beta_1 X_{INDIVIDUAL} + \beta_2 X_{FIELD\ OF\ STUDY}$$

where α is a constant, $X_{INDIVIDUAL}$ is a vector of individual characteristics (age, race, education level, etc.), and $X_{FIELDOFSTUDY}$ is an independent variable for the woman's field of study.

Data were collected from the 2010 American Community Survey. The American Community Survey is an ongoing survey that provides annual data. The data extracted includes only women who have completed four years of college in order to examine the relationship between a woman's field of study and her decision to have children.

Because the creators of the American Community Survey define number of children as the number of children residing with the mother, I restrict the data to include women ages 22 to 40. By restricting the range of the observations to 18 years, the model will be able to capture the number of children residing with the mother, assuming most children do not leave the household until they are 18 years old. The model will include an AGE variable as women in the dataset may not be finished having children. Because older women will have had more time and

opportunity to have children, I expect AGE to have a positive relationship with NCHILD.

RENTAL is a binary variable taking the value of one if the woman rents, zero otherwise. Research shows that fertility tends to increase with homeownership. (Krishnan 1988) Although people can own apartments, I still believe apartment ownership would also have a positive effect on fertility, because apartment ownership may be a sign of financial stability and perhaps the desire to settle down. Thus, I expect RENTAL to have a negative relationship with the number of children a woman has.

HEALTHCOV is a binary variable taking the value of one if the woman has any healthcare coverage, zero otherwise. Access to healthcare and contraception has shown to decrease fertility, especially in developing countries (Modrek and Ghobadi 2011, 141-144). I hypothesize, however, that in developed countries, such as the United States, women who have health coverage have a lower cost of having children because some medical bills may be covered by their healthcare coverage. Also, if a woman has family healthcare coverage, her children's medical bills may also be subsidized, reducing the cost of raising a child. Therefore, I hypothesize that HEALTHCOV will be positively related to NCHILD.

OTHERFAMINC equals total family income minus total personal income. Economic theory suggests that as other family income increases, a woman may feel fewer obligations to support the family financially. Becker, Duesenberry, and Okun found that as a husband's income increased, the number of children the family had increased as well (Becker et al. 1960, 222-223). Thus, as other family income increases, one would expect the number of children a woman has to increase. I expect OTHERFAMINC to be positively related to NCHILD.

EMPLOYED is a binary variable taking the value of one if the woman is employed at the time of the survey, zero otherwise. A woman's employment status affects fertility as a woman who works often delays childbearing and has fewer children than non-working women (Brewster and Rindfuss 2000, 277-279). The opportunity cost to have children increases if a woman is in the workplace. To have children, a woman must leave her job, at least temporarily, which will result in lost wages and the potential for motherhood penalties. I expect EMPLOYED to have a negative relationship with the number of children a woman decides to have.

The model takes into account higher education levels. As women stay

in school longer, they tend to delay motherhood and tend to have fewer children when compared to women with less education (Rindfuss, Morgan, and Offutt 1996, 282). Higher education adds to the opportunity cost of having children. The variables are denoted PROFDEG, DOCTORDEG, and MASTERDEG. If the woman has completed a professional degree, PROFDEG takes a value of one, zero otherwise. If the woman has completed a doctoral degree, DOCTORDEG takes a value of one, zero otherwise. If the woman has completed a master's degree, MASTERDEG takes a value of one, zero otherwise. I expect these three variables to be negatively related to the dependent variable, NCHILD.

The model takes race into account with a binary variable, WHITE. The variable takes a value of one if the woman is white, zero otherwise. Previous literature finds that there exist differences in first births among different races. White women tend to postpone motherhood and have fewer children than nonwhite women (Chen and Morgan 1991, 518). More recently, studies have investigated the effects of race on fertility across different education levels. In 2003, Yang and Morgan found that within each level of college attainment, there was no statistical difference between the number of children had by white women when compared to African American women (Yang and Morgan 2003, 74). For my model, I do not expect WHITE to be a determinant of fertility.

METRO is a binary variable taking the value of one if the woman lives in a metropolitan area at the time of the survey, zero otherwise. Previous research has looked at the relationship between metropolitan areas and fertility. Studies have found that higher-priced housing seems to have a negative effect on fertility (Simon and Timura 2009, 38). Presumably, costs of living and raising children are higher in metropolitan areas. I expect METRO to be negatively related to the number of children a woman decides to have.

The creators of the American Community Survey define nine regions in the United States. For my study, each region is a binary variable, taking the value of one if the woman resides in that region at the time of the survey, zero otherwise. The regional variables will account for possible regional differences in the costs of raising a family, as well as trying to capture some regional family and religious values. Women who live in regions that are relatively expensive to raise children would be expected to have fewer children when compared to women who live in relatively cheaper regions for raising children. I exclude PACIFIC from the regression to compare the regional effects. Table 1 provides variable

definitions and descriptive statistics, including the mean and standard deviation, for each variable.

TABLE 1–Variable Definitions and Descriptive Statistics

	Definitions	Mean and Standard Deviation
Dependent Variable		
NCHILD	Number of children (any age or marital status) residing with the mother, includes step-children and adopted children as well as biological children	0.88 (1.12)
Independent variables:		
RENTAL	1 if woman rents, 0 otherwise	0.32 (0.47)
AGE	Woman's age in years	31.6 (5.30)
HEALTHCOV	1 if woman has any health coverage, 0 otherwise	0.92 (0.27)
OTHERFAMINC	Calculated as total family income minus total personal income	56,672.09 (74,431.64)
PROFDEG	1 if completed a professional degree, 0 otherwise	0.05 (0.22)
DOCTORDEG	1 if completed a doctoral degree, 0 otherwise	0.02 (0.15)
MASTERDEG	1 if completed a master's degree, 0 otherwise	0.24 (0.43)
WHITE	1 if white, 0 otherwise	0.79 (0.41)
EMPLOYED	1 if employed, 0 otherwise	0.80 (0.40)
METRO	1 if woman lives in a metropolitan area, 0 otherwise	0.84 (0.37)
EASTNCENTRAL	1 if woman lives in Illinois, Indiana, Michigan, Ohio, Wisconsin; 0 otherwise	0.14 (0.35)
EASTSCENTRAL	1 if woman lives in Alabama, Kentucky, Mississippi, Tennessee; 0 otherwise	0.05 (0.21)

	Definitions	Mean and Standard Deviation
MIDATLANTIC	1 if woman lives in New Jersey, New York, Pennsylvania; 0 otherwise	0.16 (0.36)
MOUNTAIN	1 if woman lives in Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming; 0 otherwise	0.06 (0.25)
NEWENGLAND	1 if woman lives in Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont; 0 otherwise	0.06 (0.24)
PACIFIC	1 if woman lives in Alaska, California, Hawaii, Oregon, Washington; 0 otherwise	0.17 (0.37)
SATLANTIC	1 if woman lives in Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia; 0 otherwise	0.20 (0.40)
WESTNCENTRAL	1 if woman lives in Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota; 0 otherwise	0.06 (0.24)
WESTSCENTRAL	1 if woman lives in Arkansas, Louisiana, Oklahoma/Indian Territory, Texas; 0 otherwise	0.10 (0.22)

The creators of the American Community Survey define 37 fields of study. Each field of study is represented as a binary variable, taking the value of one if the woman majored in that field of study, zero otherwise. Again, in fields of study in which the potential wages and wage trajectories are higher, we would expect a negative relationship between the field of study and the number of children a woman decides to have.

If the field of study leads to more stable careers, women may choose to have more children, because women are less concerned with losing their jobs or finding a job upon reentering the workforce. Also, if the field of study leads to family-friendly institutional accommodations, women may choose to have more children, because it is easier to combine work and motherhood.

In using this field of study variable, one must assume that if the woman works, she will work in the field in which she studied. Without this assumption, one cannot predict the connection between field of study and future job expectations and job environments. One weakness this dataset has is that it does not account for women who may not use their education to attain a job in their field of study. For example, if a woman's field of study was history, but she went on to teach history, then the model would place her into the HISTORY field of study. Her expected starting wage, wage trajectory, and job stability, however, may be more similar to that of a woman in the EDUCATION field of study.

A second concern with the dataset and model is that some of the women in this dataset are double majors. The model, however, will only take into account the major that the woman denoted as her primary major. Although I acknowledge these issues, I hypothesize that these instances are limited and should not affect the validity or accuracy of the results. Table 2 provides definitions for the 37 fields of study and the mean for each field of study variable. I exclude BUSINESS from the regression to compare the field of study effects.

TABLE 2–Fields of Study Variable Definitions and Descriptive Statistics

	Definitions of Fields of Study	**Mean**
AGRICULTURE	1 if field of study was agriculture, 0 otherwise	0.009
ARCHITECTURE	1 if field of study was architecture, 0 otherwise	0.005
CIVSTUDIES	1 if field of study was area, ethnic, and civilization studies; 0 otherwise	0.005
LIFESCI	1 if field of study was biology and life sciences, 0 otherwise	0.059
BUSINESS	1 if field of study was business, 0 otherwise	0.178
COMMTECH	1 if field of study was communication technologies, 0 otherwise	0.001
COMM	1 if field of study was communication, 0 otherwise	0.056
COMPSCI	1 if field of study was computer and information sciences, 0 otherwise	0.017

	Definitions of Fields of Study	Mean
CONSTRUCT	1 if field of study was construction, 0 otherwise	0.0003
COSMECULIN	1 if field of study was cosmetology services and culinary arts, 0 otherwise	0.0008
CRIMJUST	1 if field of study was criminal justice and fire protection, 0 otherwise	0.017
EDUCATION	1 if field of study was education administration and teaching, 0 otherwise	0.140
ELECTECH	1 if field of study was electrical and mechanic repairs and technology, 0 otherwise	0.0001
ENGINEER	1 if field of study was engineering, 0 otherwise	0.027
ENGINEERTECH	1 if field of study was engineering technologies, 0 otherwise	0.002
ENGLISH	1 if field of study was English language, literature, and composition, 0 otherwise	0.039
ENVIRONMENT	1 if field of study was environment and natural resources, 0 otherwise	0.006
FAMCONSCI	1 if field of study was family and consumer sciences, 0 otherwise	0.014
FINEARTS	1 if field of study was fine arts, 0 otherwise	0.050
HISTORY	1 if field of study was history, 0 otherwise	0.016
GENERAL	1 if field of study was interdisciplinary and multi-disciplinary studies, 0 otherwise	0.011
LAW	1 if field of study was law, 0 otherwise	0.002
HUMANITIES	1 if field of study was liberal arts and humanities, 0 otherwise	0.015
LIBSCI	1 if field of study was library science, 0 otherwise	0.0003
FOREIGNLANG	1 if field of study was linguistics and foreign languages, 0 otherwise	0.014
MATHSTAT	1 if field of study was mathematics and statistics, 0 otherwise	0.010
HEALTH	1 if field of study was medical and health sciences and services, 0 otherwise	0.094
MILITARY	1 if field of study was military technologies, 0 otherwise	0.00002
BIOTECH	1 if field of study was nuclear, industrial radiology, and biological technologies, 0 otherwise	0.0004
PHILREL	1 if field of study was philosophy and religious studies, 0 otherwise	0.005
RECLEISURE	1 if field of study was physical fitness, parks, recreation, and leisure; 0 otherwise	0.012
PHYSICALSCI	1 if field of study was physical sciences, 0 otherwise	0.022
PSYCHOLOGY	1 if field of study was psychology, 0 otherwise	0.078

	Definitions of Fields of Study	Mean
SOCIAL WORK	1 if field of study was public affairs, policy, and social work; 0 otherwise	0.019
SOCIALSCI	1 if field of study was social sciences, 0 otherwise	0.073
THEOLOGYREL	1 if field of study was theology and religous vocations, 0 otherwise	0.006
TRANSPSCI	1 if field of study was transportation sciences and technologies, 0 otherwise	0.0006

The study excludes women who reported any negative income variable, such as family income, total personal income, spouse's income, or salary income. Finally, the study also excludes any observations that were missing information. The final model includes 125,703 observations.

V. Results

Table 3 gives the Poisson regression results. Column 2 provides the coefficients; however, for the Poisson regression model, it is more appropriate to examine the marginal effects of the variable as provided in Column 5, titled Marginal Effect. The pseudo R^2 is 0.1793 and is a goodness-of-fit measure for the model.

TABLE 3–Poisson Regression Results

	Coefficient	Std. Error	Z score	p-value	Marginal Effect
RENTAL***	-0.3598	0.0084	-42.77	0.000	-0.224
AGE***	0.1177	0.0007	173.43	0.000	0.078
HEALTHCOV***	0.2348	0.0139	16.89	0.000	0.141
OTHERFAMINC***	1.30e-06	3.45e-08	37.72	0.000	8.58e-07
PROFDEG***	-0.1097	0.0142	-7.74	0.000	-0.069
DOCTORDEG***	-0.1990	0.0211	-9.43	0.000	-0.120
MASTERDEG***	-0.0728	0.0072	-10.12	0.000	-0.047
WHITE	0.0020	0.0081	0.24	0.809	0.001
EMPLOYED***	-0.4230	0.0070	-60.02	0.000	-0.320
METRO***	-0.2188	0.0076	-28.22	0.000	-0.156
EASTNCENTRAL***	0.1752	0.0113	15.48	0.000	0.123
EASTSCENTAL***	0.1581	0.0153	10.34	0.000	0.112
MIDATLANTIC**	0.0260	0.0115	2.26	0.024	0.017

	Coefficient	Std. Error	Z score	p-value	Marginal Effect
MOUNTAIN***	0.2086	0.0138	15.12	0.000	0.151
NEWENGLAND***	-0.0541	0.0155	-3.48	0.001	-0.035
SATLANTIC***	0.0591	0.0106	5.56	0.000	0.040
WESTNCENTRAL***	0.2731	0.0138	19.76	0.000	0.204
WESTSCENTRAL***	0.1820	0.0122	14.97	0.000	0.129
AGRICULTURE	-0.0138	0.0337	-0.41	0.683	-0.009
ARCHITECTURE***	-0.3300	0.0527	-6.26	0.000	-0.186
CIVSTUDIES***	-0.2222	0.0529	-4.20	0.000	-0.132
LIFESCI***	-0.0609	0.0159	-3.84	0.000	-0.039
COMMTECH***	-0.3865	0.1135	-3.41	0.001	-0.212
COMM***	-0.1775	0.0161	-11.03	0.000	-0.108
COMPSCI**	0.0492	0.0234	2.1	0.036	0.033
CONSTRUCT***	0.4622	0.1327	3.48	0.000	0.388
COSMECULIN	0.0499	0.1243	0.40	0.688	0.034
CRIMJUST***	0.1391	0.0242	5.75	0.000	0.098
EDUCATION***	0.2132	0.0100	21.24	0.000	0.152
ELECTECH	-0.3657	0.3537	-1.03	0.301	-0.202
ENGINEER***	-0.0640	0.0207	-3.08	0.002	-0.041
ENGINEERTECH	-0.0312	0.0650	-0.48	0.631	-0.020
ENGLISH***	-0.1372	0.0177	-7.75	0.000	-0.085
ENVIRONMENT***	-0.2015	0.0467	-4.32	0.000	-0.121
FAMCONSCI***	0.1757	0.0240	7.33	0.000	0.126
FINEARTS***	-0.3112	0.0182	-17.07	0.000	-0.179
HISTORY***	-0.1099	0.0271	-4.06	0.000	-0.069
GENERAL	0.0372	0.0300	1.24	0.216	0.025
LAW	0.0162	0.0613	0.26	0.792	0.011
HUMANITIES***	0.0793	0.0246	3.23	0.001	0.054
LIBSCI	0.0039	0.1624	0.02	0.981	0.003
FOREIGNLANG***	-0.1141	0.0286	-3.99	0.000	-0.071
MATHSTAT	0.0402	0.0297	1.35	0.176	0.027
HEALTH***	0.1972	0.0113	17.46	0.000	0.141
MILITARY	-0.5815	1.0001	-0.58	0.561	-0.291
BIOTECH	-0.0066	0.1545	-0.04	0.966	-0.004
PHILREL***	0.2085	0.0525	-3.97	0.000	-0.124
RECLEISURE	0.0410	0.0308	1.33	0.183	0.028
PHYSICALSCI	-0.0310	0.0227	-1.37	0.171	-0.020

	Coefficient	Std. Error	Z score	p-value	Marginal Effect
PSYCHOLOGY	-0.0200	0.0135	-1.48	0.138	-0.013
SOCIALWORK***	0.1475	0.0211	6.97	0.000	0.105
SOCIALSCI***	-0.0962	0.0141	-6.84	0.000	-0.061
THEOLOGYREL***	0.2651	0.0537	4.93	0.000	0.200
TRANSPSCI	-0.2126	0.1315	-1.62	0.106	-0.126
***significant at the 1 percent level **significant at the 5 percent level N = 125,703 Pseudo R^2 = 0.1793					

As expected, AGE, HEALTHCOV, OTHERFAMINC were statistically significant and positively related to the number of children a woman decides to have. On average, as a woman's age increased by a year, the number of children she had increased by approximately 0.08. A woman who had any form of health coverage had, on average, 0.14 more children than a woman who had no form of health coverage. On average, for an increase in other family income of $100,000, the woman had 0.08 more children.

As expected, RENTAL, EMPLOYED, and METRO were found to be statistically significant and negatively related to NCHILD. A woman who rented had on average 0.22 fewer children than a woman who did not rent. A woman who was employed had on average 0.31 fewer children than a woman who was not employed. On average, a woman who lived in a metropolitan area had 0.16 fewer children than a woman who did not.

The three higher education variables, MASTERDEG, PROFDEG, and DOCTORDEG, were found to be statistically significant and negatively related to the number of children a woman decides to have. Of the three variables, MASTERDEG had the smallest effect on the number of children a woman had. A woman with a master's degree had on average 0.05 fewer children than a woman without a master's degree. On average, a woman with a professional degree had approximately 0.07 fewer children than a woman without a professional degree. Of the three higher education variables, a doctoral degree had the largest effect on the number of children a woman had, as a woman with a doctoral degree had approximately 0.12 fewer children than a woman without a doctoral degree. These findings agree with economic intuition in that among the three levels of education, master's degrees require the least amount of time and money. Women with master's degrees may be less likely to postpone motherhood and reduce the number of children when compared

to women with doctoral degrees, because the opportunity cost is not as high when compared to women with doctoral degrees that require much more time and money.

All regions were statistically significant. NEWENGLAND was the only region with a negative coefficient, but the economic significance is minimal. A woman who lived in the New England region had on average 0.03 fewer children than a woman who lived in the Pacific region. I hypothesize that the cost of raising children may be higher in the New England region compared to the Pacific region, thus increasing the opportunity cost of raising children in the New England region.

The other seven regions had positive coefficients. The West North Central region had the largest marginal effect, showing that on average women in the West North Central region had 0.20 more children than women in the Pacific region. The Mountain, the East North Central, and the East South Central regions also had economically significant marginal effects with women having on average 0.15, 0.13, and 0.12 more children than women in the Pacific region. Besides differences in cost of living, fertility differences among regions may be caused by regional views on family formation and preferences for children.

Of the 37 fields of study, 22 were found to be statistically significant. Compared to BUSINESS, nine fields of study were positively related to NCHILD: COMPSCI, CONSTRUCT, CRIMJUST, EDUCATION, FAMCONSCI, HUMANITIES, HEALTH, SOCIALWORK, and THEOLOGYREL.

Of the nine fields of study, CONSTRUCT and THEOLOGYREL had the largest marginal effects. Women who studied CONSTRUCT had approximately 0.39 and women who studied THEOLOGYREL had approximately 0.20 more children than women who studied BUSINESS. I hypothesize that women who studied THEOLOGYREL may have strong religious values that may promote family values and lead to more children.

EDUCATION, HEALTH, and FAMCONSCI also had economically significant marginal effects on the number of children a woman decided to have, with women having approximately 0.15, 0.14, and 0.13 more children than women who studied BUSINESS. The results for EDUCATION and HEALTH are consistent with previous European studies and the study done by Michelmore and Musick.

The other three fields of study that were positively related to NCHILD, COMPSCI, CRIMJUST, and HUMANITIES, had marginal

effects of 0.10 or lower. Previous research suggests that HUMANITIES majors tend to postpone motherhood and have higher levels of childlessness. Differences in the definition of HUMANITIES, however, may help to explain this discrepancy.

The remaining 13 statistically significant fields of study were negatively related to NCHILD: ARCHITECTURE, CIVSTUDIES, LIFESCI, COMMTECH, COMM, ENGINEER, ENGLISH, ENVIRONMENT, FINEARTS, HISTORY, FOREIGNLANG, PHILREL, and SOCIALSCI.

Of the 13 fields of study, COMMTECH and ARCHITECTURE had the largest marginal effects. On average, women who studied COMMTECH had approximately 0.21 fewer children than women who studied BUSINESS and women who studied ARCHITECTURE had approximately 0.19 fewer children than women who studied BUSINESS.

FINEARTS, CIVSTUDIES, PHILREL, ENVIRONMENT, and COMM also had economically significant marginal effects on the number of children a woman decided to have children; respectively, women had 0.18, 0.13, 0.12, 0.12, and 0.11 fewer children on average compared to women who studied BUSINESS. The remaining six fields of study, LIFESCI, ENGINEER, ENGLISH, HISTORY, FOREIGNLANG, and SOCIALSCI had marginal effects of 0.10 or lower.

VI. Discussion of Field of Study Results

Table 4 provides unemployment and earnings data from the American Community Survey from 2009-2010 as published by the Georgetown University Center on Education and the Workforce. Table 4 provides a reference to compare the Poisson regression results with statistics regarding two field of study characteristics: job stability and potential earnings. Although both sources use the American Community Survey, there are some discrepancies among the field of study definitions. These discrepancies limit the explanatory power of this comparison. Some statistics for fields of study, such as ENVIRONMENT and FOREIGNLANG, were omitted in order to avoid misrepresentation of the data.

Of the nine fields of study that were positively related to the number of children a woman decides to have, five had lower unemployment rates for recent college graduates than recent business college graduates. Of the 13 fields of study that were negatively related to number of children a

woman decides to have, ten had higher unemployment rates for recent college graduates than recent business graduates. Thus, the regression results appear to be consistent with economic theory. Women with fields of study that lead to relatively low unemployment may choose to have more children because of high job stability. Women with fields of study that lead to relatively high unemployment rates may choose to have fewer children because of low job stability and fear that mothers will not be able to return to the workforce after having children.

TABLE 4–Unemployment Rates and Average Earnings by Experience Level and Field of Study

	UNEMPLOYMENT RATES		AVERAGE EARNINGS	
Field of Study (Field of Study Variable Title)	Recent College Graduate	Experienced College Graduate	Recent College Graduate	Experienced College Graduate
Architecture (ARCHITECTURE)	13.9	9.2	36,000	64,000
Area Ethnic and Civilization Studies (CIVSTUDIES)	10.1	5.5	35,000	50,000
Biology (LIFESCI)	7.7	4.6	31,000	56,000
Business (BUSINESS)	7.4	4.4	39,000	84,000
Communication Technologies (COMMTECH)	-	8.5	-	55,000
Communications (COMM)	7.4	6.3	34,000	57,000
Computer Science (COMPSCI)	7.8	5.6	50,000	81,000
Construction Services (CONSTRUCT)	-	5.2	-	76,000
Criminal Justice and Fire Protection (CRIMJUST)	7.6	4.1	34,000	55,000
Education (EDUCATION)	5.4	1.9	33,000	56,000
Engineering (ENGINEER)	7.5	3.4	55,000	100,000
English language and literature (ENGLISH)	9.2	6.2	32,000	52,000

	UNEMPLOYMENT RATES		AVERAGE EARNINGS	
Family and Consumer Sciences (FAMCONSCI)	4.3	4.2	30,000	43,000
Fine arts (FINEARTS)	12.6	7.3	30,000	45,000
History (HISTORY)	10.2	5.8	32,000	54,000
Pre-Law and Legal studies (LAW)	-	7.4	-	49,000
Liberal Arts (HUMANITIES)	9.2	6.2	30,000	50,000
Mathematics (MATHSTAT)	6.1	5.1	40,000	71,000
Health (HEALTH)	5.4	1.9	43,000	81,000
Philosophy and Religious Studies (PHILREL)	10.8	6.8	30,000	48,000
Physical Fitness, Parks Recreation (RECLEISURE)	8.3	4.5	30,000	50,000
Psychology (PSYCHOLOGY)	7.6	6.0	30,000	48,000
Social Work (SOCIAL WORK)	6.6	5.8	30,000	40,000
Social Science (SOCIALSCI)	8.9	4.1	37,000	85,000
Theology and Religious Vocations (THEOLOGYREL)	-	3.9	-	40,000
Transportation Sciences and Technologies (TRANSPSCI)	-	4.0	-	71,000

ACS 2009-2010, pooled sample. Recent college graduates are 22-26 years of age, experienced workers are 30-54 years of age. Percent unemployed are computed based on total employed and unemployed. Earnings based on full-time, full-year workers. Published in "Hard Times, College Majors, Unemployment and Earnings: Not All College Degrees Are Created Equal." by Georgetown University Center on Education and the Workforce.

Women in some fields of study, such as COMPSCI and HUMANITIES, face higher unemployment rates when compared to women who studied BUSINESS, but women who studied COMPSCI and HUMANITIES had more children on average than women who studied BUSINESS. These results suggest that there are other field of study

characteristics, such as institutional accommodations, which may also influence how many children a woman decides to have.

Of the nine fields of study that were positively related to the number of children a woman decides to have, all nine had lower average earnings for recent college graduates than recent business college graduates. Of the 13 fields of study that were negatively related to number of children a woman decides to have, two had higher average earnings for recent college graduates than recent business graduates. Following economic theory, one expects women with relatively high opportunity costs to have fewer children on average. Thus, the regression results appear to be consistent with economic theory.

Women who studied HEALTH, however, had higher average earnings for recent college graduates than recent business college graduates, but had more children on average than women who studied BUSINESS. Although experienced business college graduates made more on average than experienced health college graduates, these results provide additional evidence that there may be other field of study characteristics that may influence how many children a woman decides to have.

VII. Conclusion

While several studies have investigated the relationship among a woman's field of study, childlessness, and delayed motherhood in Europe, only one previous study has investigated this relationship in the U.S. My study examined the relationship between the number of children a U.S. female college graduate has and her field of study. After collecting data from the 2010 American Community Survey, I used a Poisson regression and found that over half of the fields of study were statistically significant. I believe this provides strong evidence that field of study is a significant determinant of the number of children a woman decides to have. Although it is difficult to generalize the results of 22 fields of studies, patterns do emerge within the results. For example, women who study in areas that lead to low job stability, such as architecture and fine arts, tend to have fewer children than women who face higher job stability. Women who studied in areas that lead to high earnings, such as engineering and social science, tend to have fewer children on average than women who face lower earnings. Further research is needed to investigate how the different aspects of fields of study and the jobs these fields lead to relate to how many children a woman decides to have.

In future research, I would like to use a less restrictive dataset. Due to the definition of number of children as given by the creators of the American Community Survey, I was forced to limit my dataset to women who were between the ages of 22 and 40 in order to reduce the risk of error within the model. I would also like to include some more variables that previous research has found to have an effect on women's decisions to have children, such as religion, family benefits, and child care costs.

Recent low levels of fertility raise concern for how the economy will fair with a higher percentage of the elderly population relative to total population. Fewer children means fewer workers in the future to help fund the demanding financial needs of retired citizens. Understanding the determinants of fertility is important to predict how fertility rates will change. A woman's field of study is one such determinant that has an effect on the number of children she decides to have and this determinant should be further investigated.

References

Adsera, Alicia. 2004. Changing fertility rates in developed countries. The impact of labor market institutions. *Journal of Population Economics* 17: 17-43.

Becker, Gary S, James S. Duesenberry, and Bernard Okun. 1960. An economic analysis of fertility. In *Demographic and economic change in developed countries*, 225-256. New York: Columbia University Press.

Brand, Jennie, E., and Dwight Davis. 2011. The Impact of College Education on Fertility: Evidence for Heterogeneous Effects. *Demography* 48: 863-887.

Brewster, Karin L., and Ronald R. Rindfuss. 2000. Fertility and Women's Employment in Industrialized Nations. *Annual Review of Sociology* 26: 271-296.

Bureau of Labor Statistics. 2012. http://www.bls.gov/news.release/hsgec.nr0.htm (accessed March 22, 2013)

Carnevale, Anthony D., Ban Cheah, and Jeff Strohl. 2012. Hard Times, College Majors, Unemployment and Earnings: Not All College Degrees Are Created Equal. *Georgetown University Center on Education and the Workforce* 1-20.

CBSNEWS. November 16, 2011. 25 college majors with the highest unemployment rates. http://www.cbsnews.com/8301-505145_162-57325132/25-college-majors-with-the-highest-unemployment-rates/ (accessed March 15, 2013).

Chen, Renbao, and S. Philip Morgan. 1991. Recent Trends in the Timing of First Births in the United States. *Demography* 28: 513-533.

The Economist. 2012. America' demographic squeeze: double bind., December, 31.

Goldin, Claudin, and Lawrence F. Katz. 2008. Transitions: Career and Family Life Cycles of the Educational Elite. *American Economic Review: Papers and Proceedings* 98(2): 363-369.

Hoem, Jan, M., Gerda Neyer, and Gunnar Andersson. 2006. Education and childlessness: The relationship between educational field, educational level, and

childlessness among Swedish women born in 1955-59. *Demographic Research* 14: 331-380.

Krishnan,V. 1988. Homeownership: its impact on fertility. *Research Discussion Paper 51*, Edmonton: The University of Alberta, Department of Sociology.

Martin-Garcia, T., and Baizan, P. 2006. The impact of the type of education and of educational enrolment on first births. *European Sociological Review* 22: 259-275.

Michelmore, Katherine, and Kelly Musick. 2012. Field of Study and Fertility Patterns Among U.S. College Graduates. *California Center for Population Research* 12:1-41.

Modrek, Sepideh and Negar Ghobadi. 2011. The Expansion of Health Houses and Fertility Outcomes in Rural Iran. *Studies in Family Planning* 42 3: 137-146.

NACE Salary Survey
http://www.naceweb.org/uploadedFiles/NACEWeb/Research/Salary_Survey/Reports/SS_January_exsummary_4web.pdf (accessed March 15, 2013)

National Center for Education Statistics. 1999. http://nces.ed.gov/programs/digest/d99/d99t187.asp (accessed March 22, 2013).

Rindfuss, Ronald R., S. Philip Morgan, and Kate Offutt. 1996. Education and the changing age pattern of American fertility: 1963-1989. *Demography* 33: 277-290.

Ruggles, Steven, J. Trent Alexander, Katie Genadek, Ronald Goeken, Matthew B. Schroeder, and Matthew Sobek. 2010. Integrated Public Use Microdata Series: Version 5.0 [Machine-readable database]. Minneapolis: University of Minnesota.

Simon, Curtis J., and Robert Tamura. 2009. Do higher rents discourage fertility? Evidence from U.S. Cities, 1940-2000. *Regional Science and Urban Economics* 39: 33-42.

Van Bavel, Jan. 2010. Choice of study discipline and the postponement of motherhood in Europe: The impact of expected earnings, gender composition, and family attitudes. *Demography* 47: 439-458.

Wooldridge, Jeffrey M. 2009. Introductory Econometrics: A Modern Approach 4ed. Mason, Ohio: South-Western Cengage Learning.

Yang, Yang, and S. Philip Morgan. 2003. How Big Are Educational and Racial Fertility Differentials in the U.S.? *Social Biology* 50: 167-187.