Fertility Delay and Childlessness Among College Graduates: What Can We Learn from Variation by Field of Study?[*]

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ABSTRACT. College graduates are increasingly distinct in their family formation behaviors. Compared to women with less education, they are much more likely to postpone childbearing until marriage. They start their families later and have higher levels of childlessness and fewer children overall. There has been growing interest in the divergence of family patterns by education, but little work has focused on variation within the later and lower fertility pattern characteristic of U.S. college graduates. We use the Survey of Income and Program Participation (SIPP) to investigate how differences within the college-going population are shaped by characteristics of undergraduate field of study. Building on recent European research, and in an effort to better understand the mechanisms linking education and family formation, we explore how earnings profiles, work hours, gender composition, and (in planned extensions) family attitudes at the level of fields relate to the fertility timing and childlessness of U.S. college graduates.

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College graduates are increasingly distinct in their family formation behaviors. Women of all education levels have postponed marriage, but only college-educated women have delayed childbirth to the same extent. Thus women with the highest levels of education tend to have their first births later and much more often in marriage than their less educated counterparts (Ellwood and Jencks 2004; Rindfuss, Morgan, and Offutt 1996). By the end of their reproductive years, college graduates have higher rates of childlessness and fewer children overall (Musick et al. 2009). There has been growing interest in the divergence of family patterns by education, but little work has focused on variation within the later and lower fertility pattern characteristic of U.S. college graduates. Increasing college enrollments among women (Buchmann and DiPrete 2006) underscore the importance of better understanding variation in the effects of college on family life.

Undergraduate field of study is one critical dimension on which we might expect variation in fertility patterns among college graduates. Fields of study lead to career trajectories that differ in their economic rewards, time demands, and norms around the importance of work and family. Research has begun to explore this potential source of heterogeneity in the European context (Hoem, Neyer, and Andersson 2006a, 2006b; Lappegård 2002; Lappegård and Rønsen 2005; Martín-García and Baizán 2006; Neyer and Hoem 2008; Van Bavel 2010), but to our knowledge, there has been no investigation of links between field of study and fertility in the United States. European studies find that fertility is indeed highly structured by field of study. For example, subsequent childbearing is as at least as closely associated with field of study as level of education in Norway (Lappegård 2002; Lappegård and Rønsen 2005), Spain (Martín-García and Baizán 2006), and Sweden (Hoem, Neyer, and Andersson 2006a, 2006b).

In our paper, we build on recent European research in an effort to better understand the mechanisms linking education and family formation in the United States. The expansion of women's educational achievement and labor force participation in the U.S. and Europe have unfolded in very different labor market and policy contexts, with less dispersion in labor market outcomes for women, more generous family leave policies, and more highly subsidized child care in Europe as compared to the United States (Mandel and Semyonov 2006; Waldfogel 2001). Nonetheless, despite the lack of policy supports, the U.S. has maintained relatively high fertility rates, even among college graduates (Morgan 2003). We use the 2001 and 2004 Survey of Income and Program Participation (SIPP) to investigate how differences within the college-going population are shaped by characteristics of undergraduate field of study. We explore how earnings profiles, work hours, gender composition, and (in planned extensions) family attitudes at the level of fields relate to the fertility timing and childlessness of U.S. college graduates.

Prior Research

A handful of studies have explored the association between field of study and fertility in Europe. Hoem et al. (2006a, 2006b), analyzing data from Sweden, find that both permanent childlessness and the number of children ever born differ more by field of study than education level. In particular, women studying in the health care and teaching fields have lower rates of childlessness and higher overall fertility compared to women studying in other fields. Similar patterns, i.e., earlier and higher overall fertility among women in fields related to the care of individuals, are reported for Austria (Neyer and Hoem 2008), Norway (Lappegård 2002; Lappegård and Rønsen 2005), and Spain (Martín-García and Baizán 2006). Austria, however, stands out as having stronger fertility differentials by education level than field, whereas field emerges elsewhere as equally or more important than education level.

Van Bavel (2009) expands on the link between field of study and fertility, examining *how* field of study is related to fertility postponement across 21 European countries. Using multilevel logistic regression with women cross-classified by country and field of study, he explores the relationship between having a child and field-level characteristics. He finds earlier transitions to motherhood among women obtaining degrees in fields characterized by flatter wage profiles, higher shares female, and more traditional attitudes towards gendered roles in the family.

We follow on the work of Van Bavel, exploring how field of study relates to fertility delay and childlessness in the United States, focusing in particular on three potential mechanisms. First, fields of study may influence fertility through differences in the economic rewards of typical career trajectories that follow from them. According to the cost of time view, fields leading to higher paying jobs make time out of the labor market for childbearing and childrearing more costly. The higher opportunity cost associated with higher earnings results in later and ultimately lower fertility (Becker 1981; Hotz, Klerman and Willis 1997). Second, fields of study may affect fertility through differences in the demands of typical jobs associated with them. Long hours, inflexible work conditions, and a lack of autonomy may discourage the transition to motherhood or higher-order births (Glass and Estes 1997). Third, fields may serve a socializing function, influencing individual attitudes about gendered family and work roles. Women are strongly overrepresented in the caring professions (BLS 2009), and fields leading to these jobs may strengthen a woman's family orientation.

Of course any association between field of study and motherhood could result, as well, from preexisting characteristics selecting women into fields. For example, women may select fields based on their perception of how easy it is to balance work and family obligations in the jobs they train them for. Or family-oriented women may select into fields that lead to jobs in the

caring professions (Folbre 2010; Fortin 2007). Both causal and selection processes are likely at work in linking field of study and fertility. But unlike attitudes and orientations – or occupation and work status – field of study does not change as a consequence of childbirth (and thus is not caused by our outcome). It is determined relatively early in the life course and remains fixed after graduation.

We investigate time to first birth and childlessness in the United States using discrete-time hazard analysis and data from the 2001 and 2004 SIPP, large, nationally representative samples with detailed questions about education, employment, income, and fertility. These data allow us to look at fertility patterns by detailed field of study and to generate field-level indicators of potential mechanisms linking fields to fertility. Our field-level characteristics include starting salary and wage trajectory, frequency of overwork, and gender composition. In planned revisions, we will merge in field-level measures of gendered family roles and work-family orientations from the 1979 National Longitudinal Survey of Youth.

Data Methods

Survey of Income and Program Participation

The SIPP 2001 and 2004 are multi-part U.S. surveys conducted over 36 and 48 months, respectively. The 2001 survey interviews 36,700 households and is a representative sample of U.S. households, while the 2004 survey contains 46,500 households. Households are interviewed every four months regarding information about household composition over the past four months. The primary purpose of the SIPP is to gather information about various sources of income for all individuals residing in the household, but there are also several specific modules that collect information on topics like fertility, marriage, educational attainment, and specific attributes of education programs. We use the topical module 2 for the primary analysis, which

asks individuals about fertility and marital histories, as well as detailed information about schooling. In-person interviews are conducted with all individuals in the household over the age of 15.

Our main sample includes female respondents born between 1960-1979 (ages 20-45) who completed a Bachelors' degree by age 25 and were childless at degree completion. We create a retrospective panel starting at age 21 or year of degree completion and ending at first birth or the last year of the survey, whichever comes first. This yields a total of 7,146 women, pooled over the 2001 and 2004 SIPP surveys. Our sample restrictions, namely remaining childless until timely college completion, limits to some extent the generalizability of our results, but ensures that college field of study is temporally prior to the transition to first birth.

Measures

Field of study. The SIPP collects information on the highest degree obtained, the year that degree was obtained, and the field of study in which the individual specialized. There are 18 different categories of major field of study for individuals completing a Bachelors' degree, ranging from architecture to engineering to business and management. We use these specific fields in our final models, but we show various descriptive statistics by grouping detailed fields into just 7 broader categories, following Van Bavel (2009) as a guide.

Characteristics of field of study. We generate field-level characteristics by aggregating data on working-age college graduates (ages 21-60) in the 2001 and 2004 SIPP. We construct two measures tapping earning trajectories: the mean starting salary and the mean salary 10 years after graduation. We construct an indicator of work demands, measured by the proportion in each field working over time (45 hours or more per week). And we generate an indicator of gender composition, measured by the proportion of men in each field. These field-level

characteristics are shown in **Table 1**. In subsequent revisions, we will merge in data from the 1979 National Longitudinal Survey of Youth (NLSY79) on gendered roles in the family and work-family orientations. The NLSY79 has attitudinal measures and data on college field of study, but samples are much smaller, making it difficult to examine fertility patterns, even across broad fields of study. Merging field-level characteristics from this source, however, combines the richness of this detailed survey with the large samples of the SIPP.

Controls. The SIPP collects limited background characteristics. We control for race/ethnicity with indicators for Black and Hispanic. To account for period effects, we include a dummy for year in which the individual obtained her Bachelors' degree. In subsequent analyses, we will examine the sensitivity of our results to including information about marital history and advanced degree holding. Marriage is central to the family formation behaviors of college graduates, but it is also endogenous to fertility. Likewise, further schooling is likely a cause and effect of first birth timing.

Hazard models

We model the timing of first birth using discrete-time logistic regression. The hazard is a function of age, modeled as a cubic polynomial. We include controls at the individual level for and race/ethnicity and time period. Our key predictors are field-level characteristics. The discrete-time hazard framework can be used to assess how covariates affect the intensity of first birth. By manipulating model-based age-specific probabilities of first birth, it can also be used to estimate proportions childlessness. In planned revisions, we will incorporate a multi-level approach, adding a random effect at the level of field to allow for the effects of field-level characteristics to vary by field of study.

Preliminary Results

Our analyses focus on variation in the fertility patterns of college-educated women by field of study. In an effort to put variation *among* college graduates in the context of variation *across* education levels, however, we start by showing how fertility varies by education level, including women across the education distribution. **Table 2** shows childlessness, age at first birth, and total number of children for women ages 35-45, most of whom have completed their childbearing (for this reason, we rely here on an older sample than our main analytic sample). Compared to women with the least education, college-educated women have much higher childlessness (9 vs. 28%), older age at birth (21 vs. 29), and fewer children (1.5 vs. 2.7).

Table 3 presents data on our main analytic sample: women born between 1960-1979 (ages 20-45) who completed a Bachelors' degree by age 25 and were childless at degree completion. It shows the estimated percent childless by broad and detailed field of study categories. Childlessness is calculated by accumulating age-specific first birth probabilities derived from descriptive, discrete-time hazard models run separately by field of study. This method accounts for censoring, i.e., for the fact that many women in this age group will not yet have made the transition to motherhood. Across the broad categories, and consistent with patterns reported in Europe (e.g., Hoem et al. 2006a), childlessness is lowest among women from the fields of education (18.5%) and health (18.5%). **Figure 1** plots the age-specific birth probabilities from the field-specific models (without accumulating them over ages) to show timing differences in the transition to motherhood by broad field of study categories. Consistent with low levels of childlessness reported in Table 2, women in the education and health fields make the earliest transitions to first birth.

Table 4 reports results of discrete-time logistic regression models of first birth, pooled over field of study. Individual-level controls are included for race/ethnicity and period. Characteristics of specific fields of study (i.e., of the 18 as opposed to 7 categories) are included as field-level contextual variables. Mean field-level starting salary has a positive, statistically significant coefficient, indicating that higher starting salaries are associated with earlier transitions to motherhood. Although this is contrary to notions of economic opportunity cost, the negative sign on wage growth (or mean wage 10 years after graduation) is in accord with the idea that women with steep wage growth face higher costs of childbearing and thus are likelier to delay family formation. We expected that long hours would deter fertility, but the share of workers with hours averaging 45 or more per week is associated with *earlier* transitions to motherhood. Finally, as expected, as the percent male in the field delays transitions to first birth.

Next Steps

Preliminary results suggest that, first, education differences by field may be narrower in the U.S. than in Sweden, Norway, and Spain. This would be consistent with greater inequality in the U.S. by education in terms of earnings and – increasingly – family patterns (McLanahan 2004). Second, the mechanisms linking field of study to fertility may differ, in particular, with earnings playing a weaker role in shaping U.S. fertility patterns (see Musick et al. 2009).

In subsequent revisions, we will further develop and elaborate our models linking field of study, fertility timing, and childlessness. Broadly, we aim to better understand the mechanisms linking education and family formation in the United States. By comparing our results to recent studies focusing on the European context, we also hope to shed light on institutional factors that potentially shape childbearing decisions. With these broad goals in mind, we will build on our preliminary analyses in the following ways: 1) use data from the 1979 National Longitudinal

Survey of Youth to generate field-level indicators of attitudes about gendered family roles and work-family orientations; 2) run our models including a random effect of field of study, allowing the effects of field-level characteristics to vary across fields; 3) flesh out the implications of our models by generating model-based estimates of childlessness, varying values on key field-level characteristics; and 4) test the sensitivity of our results to including indicators of an individual's marriage history and advanced degree holding.

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Table 1. Characteristics of fields of study

	Number of Observations	Average Starting Salary	Average Salary 10 Years Post Graduation	Percent Working Over Time	Percent Male
Arts and Humanities	**3163**	**$27,422**	**$46,137**	**29.6%**	**43.2%**
Art/Architecture	704	$27,187	$44,327	26.8%	47.5%
Literature	711	$27,195	$65,476	30.6%	36.2%
Foreign Language	205	$30,095	$49,532	26.8%	28.2%
Liberal Arts	1269	$29,234	$32,331	29.5%	42.3%
Theology	274	$19,960	$45,157	36.7%	65.7%
Education	**3095**	**$29,457**	**$37,768**	**28.1%**	**24.1%**
General Studies	**4192**	**$32,529**	**$57,827**	**34.6%**	**52.4%**
Health Sciences	**1273**	**$38,074**	**$54,894**	**22.6%**	**22.4%**
Pre-Professional	**240**	**$35,774**	**$58,653**	**36.8%**	**59.1%**
Private and Public Administration	**5203**	**$33,423**	**$55,335**	**36.0%**	**58.8%**
Business	4510	$33,911	$56,714	36.7%	60.6%
Communications	693	$30,064	$49,284	31.6%	47.8%
Science and Technology	**4887**	**$40,115**	**$58,538**	**34.0%**	**72.3%**
Agriculture	283	$28,439	$35,314	43.6%	73.5%
Computers and IT	795	$41,852	$62,379	25.8%	71.3%
Engineering	1805	$49,036	$60,759	37.0%	86.7%
Mathematics	473	$44,950	$48,618	32.3%	63.5%
Natural and Biological Sciences	1531	$30,826	$57,171	33.7%	57.9%
Social Sciences	**2189**	**$26,273**	**$45,860**	**26.9%**	**37.3%**
Psychology	1073	$23,775	$46,553	24.6%	31.5%
Social Sciences	1116	$28,710	$44,707	29.1%	42.7%

Note: 2001 and 2004 SIPP. Men and women ages 21-60 completing at least a Bachelors degree as of SIPP interview. Starting salary calculated for individuals with earnings who completed their Bachelors degree in the previous year. All income in 2004 nominal dollars.

Table 2: Fertility by education level, women born 1956-70 (ages 35-45)

	<HS	HS	Some College	College[1]
Percent childless	9.4%	12.9%	16.7%	27.8%
Age at first birth	21.18	22.94	24.10	29.38
Average number of children	2.68	2.07	1.94	1.53

Note: 2001 and 2004 SIPP.

[1]: Corresponds to our analytical sample, but for the age limitation. Restricted to women who completed a Bachelors' degree by age 25 and were childless at degree completion.

Table 3. Estimated childlessness by field of study, college-educated women born 1960-1979 (ages 20-45)

Field of Study	Number of Observations	Percent Childless[1]
Arts and Humanities	**889**	**24.9%**
Art/Architecture	191	24.2%
Literature	226	26.1%
Foreign Language	65	26.0%
Liberal Arts	375	26.9%
Theology	32	9.4%
Education	**863**	**18.5%**
General Studies	**1015**	**26.9%**
Health Sciences	**429**	**18.5%**
Pre-Professional	**46**	**12.0%**
Private and Public Administration	**1242**	**22.0%**
Business	994	21.3%
Communications	248	27.3%
Science and Technology	**792**	**20.6%**
Agriculture	35	11.5%
Computers and IT	139	22.0%
Engineering	171	14.5%
Mathematics	91	25.1%
Natural and Biological Sciences	356	21.0%
Social Sciences	**674**	**26.4%**
Psychology	390	28.9%
Social Sciences	284	24.1%

Note: 2001 and 2004 SIPP. Restricted to women who completed a Bachelors' degree by age 25 and were childless at degree completion.

1: Calculated by accumulating age-specific first birth probabilities derived from hazard models run separately by field of study.

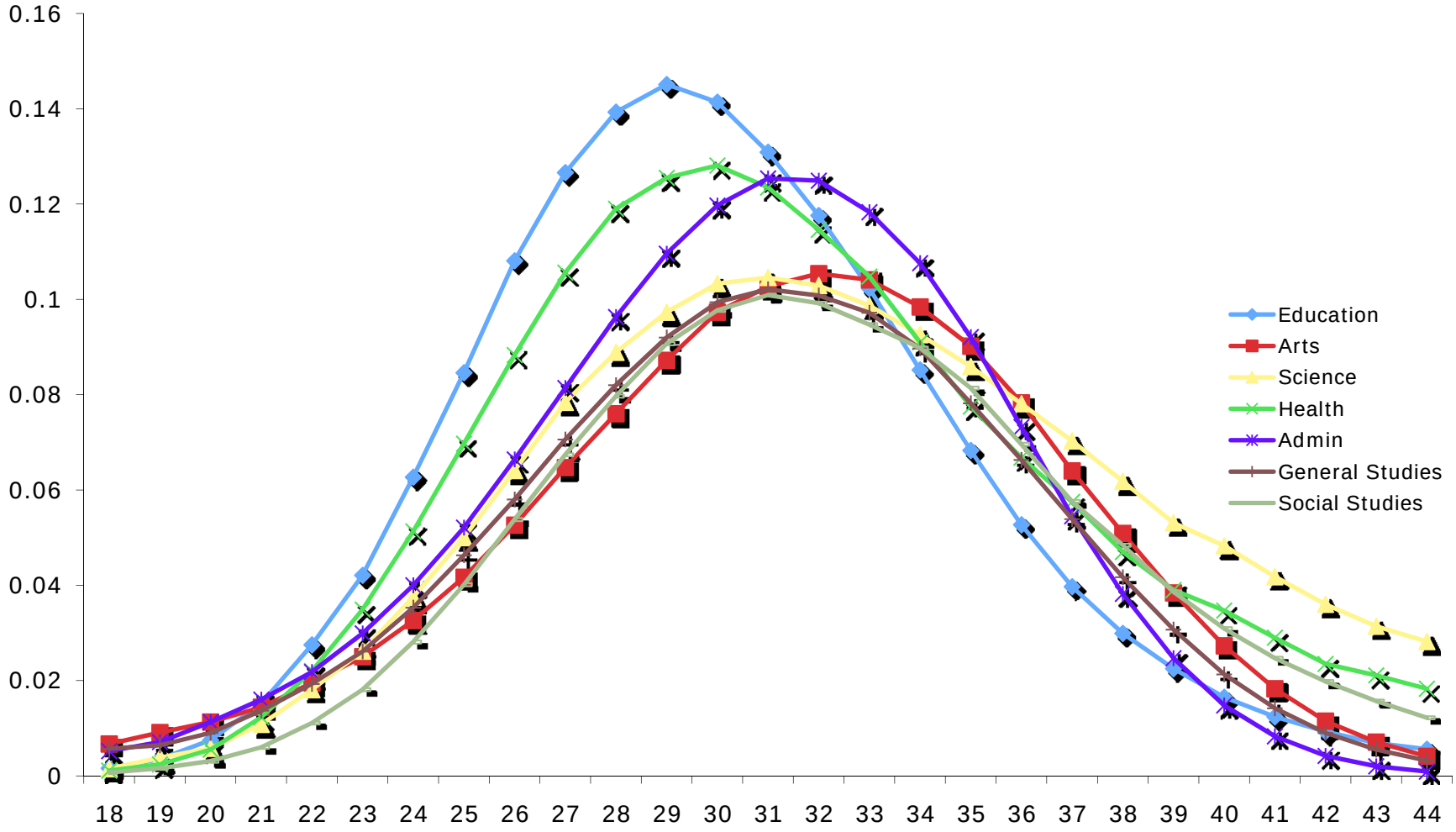
Table 4. Odds ratios from discrete-time logistic regression models of first birth, women born 1960-1979, characteristics of specific fields of study

Individual Characteristics	Odds Ratios (*SE*)	
Number of Years Since Degree	1.104	***
	0.017	
Degree Year	0.992	*
	0.004	
Race (white omitted)		
Black	0.976	
	0.081	
Hispanic	1.503	***
	0.124	
Age	8.057	***
	0.476	
Age squared	0.952	***
	0.016	
Age cubed	1.000	*
	0.000	
Specific Field of Study Characteristics		
Log of Average Starting Salary	2.498	***
	0.157	
Log of Earnings Ten Years Post-Graduation	0.993	***
	0.002	
Share working over time	1.022	***
	0.007	
Percent of men in the field	0.988	***
	0.002	

Note: 2001 and 2004 SIPP. Restricted to women who completed a Bachelors' degree by age 25 and were childless at degree completion.

* $P < 0.10$; ** $P < 0.05$; *** $P < 0.01$

Figure 1. Probability of first birth, by age and field of study



Note: 2001 and 2004 SIPP. Restricted to women who completed a Bachelors' degree by age 25 and were childless at degree completion. Age-specific first birth probabilities derived from hazard models run separately by field of study.