How College Shapes Union Formation Processes[*]

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Abstract. Recent work by Brand and colleagues demonstrates variation in the effects of education on economic returns to schooling (Brand and Xie Forthcoming) and fertility (Brand and Davis 2009). College has a greater (positive) effect on economic outcomes and a more deterring effect on fertility among those least likely to attend and complete their degrees, i.e., among those with the fewest socioeconomic advantages. We extend recent lines of inquiry into differential college effects and ask how they apply to union formation. We find that college effects are strongest in encouraging marriage and discouraging cohabitation among socially advantaged men and women with the highest propensity to attend college (cohabitation differences statistically significant for men only). These results question an "affordability" model of marriage positing the largest effects of college where the economic gains are greatest. The implications of our results for the changing meaning of marriage and cohabitation are discussed.

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Historically, chances of never marrying in the U.S. were greater among women with high levels of education. In more recent years, however, education has become increasingly associated with a greater likelihood of getting (and staying) married (Goldstein and Kenney 2001). This educational crossover signals important changes in the meaning of marriage – and it coincides with growing social class differences in an array of other family patterns (McLanahan 2004). Education differences in union formation are a critical piece of understanding the nature and meaning of these broader cleavages in family experiences. At the same time, the continued expansion of educational attainment among women (Buchmann and DiPrete 2006) make it all the more critical to understand the mechanisms linking education and family life. This paper examines the effects of college attendance and completion on the chances of cohabitation and marriage, looking in particular at whether effects vary by an individual's propensity to go to college.

Average Effects of Education on Union Formation

The relationship between marriage and education has changed in recent decades. While divorce and single parenthood have long been more common among less educated women, Goldstein and Kenney (2001) show that from 1960 to 1980, fewer college-educated women ages 45-54 had ever married, as compared to their less educated peers. For more recent cohorts, college attendance delays marriage, but increases proportions ever marrying (Thornton, Axinn, and Teachman 2001; Xie et al. 2003). Sweeney (2002) argues that the changing association between women's characteristics and marriage is evidence of the "shifting economic foundations of marriage."

This change speaks to competing theories of marriage. Becker (1981) posits that the gains to marriage derive from "trade," with women specializing in home production and men in

market work. Women's economic independence erodes the gains to trade and makes marriage less desirable for women and men. By contrast, Oppenheimer (1988; 1994) argues that marriage formation depends on its affordability, and that women's economic prospects are increasingly important to building the total wealth of the marriage and facilitating marital formation. According to Oppenheimer, marriage is strengthened not by specialization, but by labor redundancy and collaboration between spouses. While both models predict that men's economic prospects promote marriage, their predictions with respect to women's prospects differ. That is, Becker's model predicts a negative relationship between women's economic prospects and marriage, while Oppenheimer's model predicts a positive relationship – and greater symmetry over time in the effects of men's and women's economic circumstances on marriage.

The reversal in the relationship between women's education and marriage supports Oppenheimer's notion of a new marriage bargain based on the expectation of women's and men's financial contributions. Her "affordability" model is also supported by work showing the (growing) importance of women's wages in marriage (Sweeney 2002; Xie et al. 2003). At the same time, men's economic prospects have not declined in importance, and men's economic circumstances remain more important to marriage formation than women's (Sweeney 2002; Smock, Manning and Porter 2005).

While education increases marriage, it decreases cohabitation (Kennedy and Bumpass 2005). The negative relationship between education and cohabitation suggests that less educated men and women are more likely to substitute cohabitation for marriage, at least until their financial circumstances improve and they can "afford" to marry (Thornton et al. 1995; Smock et al. 2005). Furstenberg argues that marriage has become a "luxury" good, and cohabitation, the "budget" way to start a family (Furstenberg 1996). Again, the (negative) relationship between

education and cohabitation may hold particularly true for men, for whom the expectations of financial support in marriage continue to be stronger (Smock and Manning 1997; Carlson, McLanahan, and England 2004).

Differential College Effects by Social Advantage

Men and women least likely to complete college have the highest economic returns to schooling (Brand and Xie Forthcoming). This finding supports a model of *negative selection*, contradicting the presumed positive link between the likelihood and benefits of schooling derived from principles of comparative advantage (e.g., Becker 1964). Negative selection highlights the non-economic factors that predict college attendance among the socially advantaged, where college has become a culturally expected outcome. For these young men and women, the returns to schooling are lower than at the margin of college attendance, where college-going is not the norm and demands economic justification. Consistent with a model of negative selection, Brand and Davis (2009) find that the fertility-decreasing effects of college are greatest among disadvantaged women with a low propensity for college, which they argue is likely motivated by the high economic incentives associated with their schooling decisions.

How might the effects of college on union formation vary by one's propensity to attend college? Negative selection into college, where the greatest economic benefits of college go to those least likely to attend, combined with the idea that financial resources are critical to marriage formation, suggest that college should have the greatest positive effect on marriage among low propensity men and women. Given that men's economic circumstances remain more important than women's for marriage, we expect variation in the effect of college to be greater among men than women. Negative selection into college and the affordability model of marriage further suggest that the negative effect of education on cohabitation should be greatest

among the socially disadvantaged, who reap the greatest economic rewards from college. And again, these differences should be greater among men than women.

Analytic Strategy

Our analysis proceeds in three steps. First, we estimate the probability for two distinct treatment conditions based upon a set of observed covariates: (i) the probability a person attends college by age 19; and (ii) the probability a person completes college by age 23. The control groups consist of persons who completed at least high school by age 19 but did not attend college by age 19 for the college attendance analysis and did not complete college by age 23 for the college completion analysis. We restrict the sample to high school completers as persons without a high school degree are not "at risk" of a college education. We conduct all analyses separately for men and women.

We generate estimated propensity scores (Rosenbaum and Rubin 1983, 1984) for each individual in the sample using logit regression models of the following form:

$$P_i = p(d_i = 1 | \boldsymbol{X}) = \log \frac{di}{1-di} = (\sum_{k=0}^{K} (\beta_k \boldsymbol{X}_{ik})), \quad (1)$$

where P_i is the propensity score for the i^{th} observation ($i = 1, \ldots, n$); d_i indicates whether or not individual i attended or completed college; and $\boldsymbol{X}$ represents a vector of observed pre-college covariates. We invoke an "ignorability" or "selection on observables" assumption that conditional on a rich set of pre-treatment covariates, there are no additional confounders between college and non-college graduates.

Second, we estimate average effects of college attendance and completion on ever married and whether first union was a cohabitation or marriage using logit regression models controlling for the estimated propensity score:

$$\log \frac{mi}{1-mi} = \alpha + \delta d_i + \beta P_i, \quad (2)$$

where m_i is married for the first outcome and cohabitation for the second outcome for the i^{th} observation; d_i indicates whether or not an individual attended for the first treatment and completed college for the second treatment condition; and P_i represents the propensity for college as estimated by equation (1). The parameter δ is the average effect of college on union formation. Rosenbaum and Rubin (1983, 1984) demonstrate it is sufficient to condition on the propensity score as a function of $\boldsymbol{X}$ rather than $\boldsymbol{X}$ itself, which we do here for simplicity.

Third, we assess whether heterogeneity in the propensity for college is associated with heterogeneity in effects of college. We first group respondents into balanced propensity score strata such that average values of the propensity score and each covariate do not significantly differ between college and non-college units (p<.001). Then in level-1, we estimate propensity stratum-specific effects using a logit regression model:

$$\log \frac{mi}{1-mi} = \alpha_s + \delta_s d_i, \quad (3)$$

where the s subscript represents the propensity score stratum and all other terms are defined above. In level-2, we estimate the trend in the variation of effects using variance weighted least squares:

$$\delta_s = \gamma + \zeta S + \varepsilon, \quad (4)$$

where level-1 slopes (δ's) are regressed on propensity score rank indicated by S and ζ represents the level-2 slope.

Data and Measures

We use panel data from the 1979 National Longitudinal Survey of Youth (NLSY79), a nationally representative sample of 12,686 respondents who were 14-21 years old when they

were first interviewed in 1979. Respondents were interviewed annually through 1994 and continue to be interviewed on a biennial basis. We rely on data through 2006, when sample members are in the forties.

Our sample is restricted to men and women who were 14-17 at the baseline survey in 1979 and who had completed at least the 12th grade as of 1990. These sample restrictions are set to ensure that all variables used to predict college are measured pre-college, and to compare college goers to women who completed at least a high school education. Our final samples include 1670 men and 1823 women (and vary somewhat depending on the treatment, i.e., college attendance or completion, and outcome, i.e., marriage or cohabitation).

We examine whether the respondent ever married by last interview and whether the respondent's first union was a cohabitation or marriage. The NLSY79 collects detailed information on marriage, but data on cohabitation are limited. In particular, prior to 1990, we know only whether the respondent's current union is a marriage or cohabitation. (After 1990, information is filled in regarding dates of premarital cohabitation with the respondent's current spouse; starting in 1994, questions are also asked about dates of cohabitation with the current partner. These are not of use to us, as too much information remains missing for key, young adult years.) We use the measure of union type at interview to estimate whether the respondent's first union was a cohabitation or marriage. This indicator misses any cohabitation spell that does not span an interview, and thus misses some share of short-term cohabitations. And while problematic given that cohabitations tend to move quickly to marriage or dissolution, interviews were just one year apart in the key young adult years of the 1980s and early 1990s. In future work, we will consider the implications of misclassifying a potentially non-negligible share of first unions started in cohabitation as marital unions.

We examine a rich set of pre-college covariates that have been linked to education and occupational attainment. Measures of family background include mother's and father's education, parents' income, whether the respondent grew up with both biological parents, number of siblings, whether the respondent was born in the U.S., rural and southern residence, and religious affiliation. Indicators of ability and academics include results of an achievement test (the ASVAB), which was administered to respondents in 1980, and a dummy for whether the student was enrolled in a college-preparatory curriculum in high school. Parental encouragement measures the level of encouragement from parents to attend college, and friends' plans indicates the highest level of schooling a respondent reported in 1979 that his or her friends planned to obtain. Finally, we control for race and prior marital history.

Preliminary Results

We first estimate propensity scores for men and women in the sample using probit regressions predicting the odds of attending relative to not attending college and the odds of completing relative to not completing college. We control for the set of pre-college covariates described above. Results support the literature on the determinants of college attainment and are shown in Table 1. For men and women, blacks and Hispanics are less likely to complete college, but not to attend college, net of other covariates. Ability, college track classes, parents' encouragement, and friends' plans all predict timely college attendance and completion. Women and men who marry early are significantly less likely to attend and complete college.

-- Table 1 about here --

We next estimate the effects of timely college attendance and completion on marriage and cohabitation, controlling for the propensity score estimated above and assuming treatment effect homogeneity (i.e., assuming that college effects do not vary by one's likelihood of college

achievement). Results of logistic regression models of whether the respondent ever married and whether the respondent's first union was a cohabitation or marriage are shown in Table 2. Accounting for the propensity to attend college, college attendance does not significantly affect ever marrying or cohabitation among men or women. Consistent with the importance of men's economic resources for marriage formation, men's college completion has a positive, statistically significant effect on ever marrying, increasing the odds of marriage by about 1.7 times (exp[.521]) or 70%. And supporting the idea that those who have the economic resources and can "afford" to marry choose it over cohabitation, men's college completion has a negative, statistically significant effect on cohabitation (vs. marriage as a first union), decreasing the odds of cohabitation by .4 times (exp[-.846]) or nearly 60%. While the effects for women appear to work in the same direction, only the negative effect of college completion on cohabitation is statistically significant (reducing the odds of cohabitation by over 50%). Results reported below suggest that these average effects conceal an underlying systematic distribution of college effects.

-- Table 2 about here --

Tables 3a and 3b report our main results based on the hierarchical linear model of heterogeneous effects of college on union formation. Effects are examined across balanced propensity score strata, within which the average propensity score and the means of each covariate used to estimate propensity scores do not significantly differ between treated (college) and control (non-college) units. For college attendance, men and women are distributed across 6 strata; for college completion, they are distributed across 5. There is overlap within each stratum, i.e., there are both college and non-college educated respondents within each stratum,

with the college educated respondents increasing in number with the propensity score, and the non-college educated decreasing in number.

-- Tables 3a and 3b about here --

Marriage results are similar for both sexes and treatment conditions (i.e., college attendance and completion): the level-2 slope is positive and statistically significant, indicating that college exerts more positive effects on marriage as the propensity to go to college increases. For example, the level-2 slope from the college attendance model for men indicates a significant increase in the marriage-enhancing effect of college, on the order of .32 for every one-unit change in propensity score rank. Level-1 estimates range from a nonsignificant 20% decline in the odds of marriage for men attending college with the lowest propensity to attend college (stratum 1), to a significant 70% decline in the odds of marriage (stratum 2), to a significant increase of 1.74 times the odds among the men with the highest propensity to attend college (stratum 6).

Cohabitation results are not as strong, but they are suggestive. Level-2 slopes are consistently negative (for both sexes and treatment conditions), but only in the case of men and college completion are they statistically significant. Here, the deterring effect of college on cohabitation is greater for men with a high propensity to attend college: the effect of college completion on cohabitation becomes more negative, on the order of -.4 for each change in propensity score rank. Level-1 estimates range from a nonsignificant increase in the odds of cohabitation of 2 times (stratum 1), to a significant decline in the odds of cohabitation of 65% (stratum 2), to a significant decline of nearly 75% in the odds of cohabitation for men with a high propensity to complete college (stratum 5).

Preliminary Discussion and Next Steps

Our results are inconsistent with the hypothesized importance of financial resources to marriage formation, or the affordability model described above. We expected that the positive effects of college on marriage would be strongest among those with the greatest economic payoff, i.e., the least advantaged men and women with the lowest propensity for college. Our data show instead that the positive effects of college on marriage and the negative effects on cohabitation are concentrated among those with the highest propensity for college.

We suggest (preliminarily) two alternative explanations consistent with these findings. The first posits that although disadvantaged men and women stand to gain most economically from college, they may also experience the greatest degree of social distance from their college-going peers. They may be mismatched on the marriage market, aspiring to marry within their education group but having little in common with their peers at school. This social distance/mismatch may translate into lower marriage rates. The second posits that the economic motivations of the low propensity college goers may obscure family-related goals. These largely first-generation college goers may act more like earlier cohorts, choosing careers over family (Goldin 2004). This explanation may be more plausible for the women than for the men, whose good economic prospects have always been seen as facilitating family formation.

We aim to further develop these ideas, including with additional analyses to flesh out the differential effects of college by the propensity for college. For example, we will explore differences in educational homogamy by college achievement and propensity for college that speak to the marriage market position of college graduates from less advantaged social backgrounds. Further, we plan to examine marriage and cohabitation in an event history framework, making clear the distinction between the timing and incidence of marriage and

cohabitation. Finally, addressing unresolved debates about the gendered nature of family change, we will systematically test differences between men and women in the effects of college on union formation.

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Table 1. Propensity Score Probit Regression Models Predicting College Attendance/Completion

	Men		Women	
Variables	College Att.	College Comp.	College Att.	College Comp.
Black	-0.014	-0.662 ***	-0.145	-0.792 ***
	(0.110)	(0.177)	(0.096)	(0.166)
Hispanic	-0.047	-0.550 **	-0.095	-0.465 **
	(0.138)	(0.166)	(0.122)	(0.154)
Mother's edu.	0.039 *	0.041	0.045 *	0.033
	(0.019)	(0.022)	(0.018)	(0.022)
Father's edu.	0.012	0.018	0.015	0.035 *
	(0.016)	(0.018)	(0.014)	(0.016)
Parents' inc. (1979 $1,000s)	1.050 **	1.211 **	-0.247	0.333
	(0.380)	(0.421)	(0.360)	(0.424)
Intact family	0.008	0.171	0.022	0.212 *
	(0.095)	(0.112)	(0.084)	(0.107)
Num. of siblings	-0.028	-0.009	-0.040 *	-0.029
	(0.020)	(0.024)	(0.017)	(0.021)
U.S. born	-0.196	---	0.097	---
	(0.186)		(0.165)	
Rural res.	0.018	-0.029	-0.063	-0.104
	(0.099)	(0.115)	(0.089)	(0.108)
Southern res.	0.121	0.009	0.201 **	0.054
	(0.088)	(0.118)	(0.077)	(0.112)
Black * Southern	---	0.286	---	0.487 *
		(0.235)		(0.213)
Catholic	-0.042	0.015	0.072	-0.204
	(0.096)	(0.105)	(0.087)	(0.105)
Jewish	0.351	-0.061	0.888 *	0.528
	(0.391)	(0.395)	(0.377)	(0.411)
Mental ability	0.690 ***	0.490 ***	0.636 ***	1.004 ***
	(0.068)	(0.114)	(0.069)	(0.132)
Mental ability^2	---	0.184 *	---	-0.111
		(0.075)		(0.115)
College track	0.422 ***	0.415 ***	0.339 ***	0.261 **
	(0.083)	(0.093)	(0.077)	(0.092)
Parents' enc.	0.377 ***	0.462 ***	0.293 **	0.234 *
	(0.102)	(0.123)	(0.093)	(0.119)
Friends' plans	0.077 ***	0.111 ***	0.087 ***	0.099 ***
	(0.020)	(0.023)	(0.018)	(0.023)
Married by age 18	-1.062 *	-0.762	-1.278 ***	---
	(0.487)	(0.702)	(0.269)	
Married by age 22	---	-0.805 ***	---	-0.684 ***
		(0.145)		(0.105)
Constant	-3.234 ***	-4.283 ***	-2.979 ***	-3.404 ***
	(0.384)	(0.411)	(0.361)	(0.413)
N	1670	1610	1823	1643
LR χ^2	454.400	512.070	450.120	522.710
P > χ2	0.000	0.000	0.000	0.000

Notes: Numbers in parentheses are standard errors. Covariates for the college attendance versus completion models differ according to which variables were necessary to balanced propensity score strata.

* p <. 05 ** p < .01 *** p < .001 (two-tailed tests)

Table 2. Homogenous Effects of College Attendance and Completion on Union Formation

	Men				Women			
	College Attendance		College Completion		College Attendance		College Completion	
Logit Regression Models	Ever Married	First Union: Cohab./ Married	Ever Married	First Union: Cohab./ Married	Ever Married	First Union: Cohab./ Married	Ever Married	First Union: Cohab./ Married
College Attendance	-0.078	-0.189	---	---	0.069	-0.241	---	---
	(0.154)	(0.160)			(0.160)	(0.141)		
College Completion	---	---	0.521 **	-0.846 ***	---	---	0.383	-0.772 ***
			(0.191)	(0.195)			(0.211)	(0.186)
Propensity Score	0.261	-0.128	-0.722 *	0.813 *	0.093	0.823 **	-0.008	1.360 ***
	(0.305)	(0.308)	(0.315)	(0.321)	(0.332)	(0.287)	(0.356)	(0.310)
Constant	1.078 ***	-0.613 ***	1.218 ***	-0.691 ***	1.544 ***	-0.981 ***	1.456 ***	-0.811 ***
	(0.085)	(0.085)	(0.078)	(0.076)	(0.102)	(0.089)	(0.085)	(0.075)
N	1670	1396	1610	1358	1823	1613	1643	1444
LR χ^2	0.750	2.930	8.430	20.170	0.490	8.300	4.990	23.270
P > χ2	0.688	0.231	0.015	0.000	0.781	0.016	0.082	0.000

Notes: Numbers in parentheses are standard errors.

Propensity scores were generated by probit regression models of college attendance/completion as summarized in Table 1.

* p <.05 ** p < .01 *** p < .001 (two-tailed tests)

Table 3a. Heterogeneous Effects of College Attendance on Union Formation

	Men		Women	
	Ever Married	First Union: Cohab./ Married	Ever Married	First Union: Cohab./ Married
Level-1 Slopes *Logit Regression*				
P-Score Stratum 1: for men [0.0-.05); for women [0.0-0.1)	-0.208 (0.637)	-0.561 (0.820)	-0.722 (0.612)	0.586 (0.626)
P-Score Stratum 2: for men [0.05-0.1); for women [0.1-0.2)	-1.175 * (0.541)	-0.661 (0.817)	-0.197 (0.359)	-0.120 (0.349)
P-Score Stratum 3: for men [0.1-0.2); for women [0.2-0.3)	-0.502 (0.371)	0.260 (0.381)	-0.500 (0.321)	-0.230 (0.325)
P-Score Stratum 4: for men [0.2-0.4); for women [0.3-0.4)	-0.299 (0.280)	-0.572 † (0.307)	0.488 (0.438)	-0.332 (0.325)
P-Score Stratum 5: [0.4-0.6)	0.556 † (0.283)	-0.011 (0.291)	0.301 (0.310)	-0.288 (0.272)
P-Score Stratum 6: [0.6-1.0)	0.389 (0.433)	-0.523 (0.432)	0.607 (0.426)	-0.051 (0.348)
Level-2 Slopes *Variance Weighted Least Squares*	0.317 * (0.114)	-0.019 (0.132)	0.253 * (0.103)	-0.051 (0.095)

Table 3b. Heterogeneous Effects of College Completion on Union Formation

	Men		Women	
	Ever Married	First Union: Cohab./ Married	Ever Married	First Union: Cohab./ Married
Level-1 Slopes *Logit Regression*				
P-Score Stratum 1: [0.0-0.1)	-0.406 (0.465)	0.698 (0.478)	-0.073 (0.508)	-0.259 (0.523)
P-Score Stratum 2: [0.1-0.2)	0.188 (0.452)	-1.064 * (0.475)	-0.335 (0.439)	-0.504 (0.463)
P-Score Stratum 3: [0.2-0.4)	0.751 * (0.381)	-0.930 * (0.389)	0.584 (0.421)	-1.169 * (0.343)
P-Score Stratum 4: [0.4-0.6)	0.560 (0.373)	-1.015 * (0.373)	0.585 (0.409)	-0.770 * (0.350)
P-Score Stratum 5: [0.6-1.0)	0.877 † (0.448)	-1.350 * (0.473)	0.922 † (0.514)	-0.302 (0.463)
Level-2 Slopes *Variance Weighted Least Squares*	0.284 * (0.141)	-0.395 * (0.146)	0.301 † (0.155)	-0.022 (0.149)

Notes: Numbers in parentheses are standard errors.

Propensity scores were generated by probit regression models of college attendance/completion as summarized in Table 1. Propensity score strata were balanced such that mean values of covariates did not significantly differ between college and non-college goers. For *N*'s, see Table 2.

† p < .10 * p <. 05 (two-tailed tests)