



# The female advantage in college academic achievements and horizontal sex segregation

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## ABSTRACT

This study offers a structural explanation for the female advantage in college completion rates, stressing the importance of horizontal sex segregation across fields of study in shaping educational outcomes and gender inequality. Results from a nationally representative sample of students who matriculated at 4-year institutions in 1995 reveal a high level of gender segregation by field of study. Field of study creates the immediate learning environment for the students and between-major differences in academic and social arrangements—such as different grading norms, academic intensity, size and social support—shape both female and male performance. We find that this variation is a key factor in the creation of the female advantage in grades and graduation likelihood. The simulation we conduct demonstrates that if sex integration were achieved and both groups had the male distribution of majors, the female advantage in graduation likelihood and grades, which remains after socioeconomic and academic factors are netted out, would be substantially reduced.

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## 1. Introduction

One of the most fascinating phenomena in recent decades has been the reversal of the historic male advantage in higher education. Today, a woman's chances of applying, enrolling and attaining a college degree are better than those of her male peers (Freeman, 2004; Jacobs, 1996; Buchmann and DiPrete, 2006; Jacob, 2002; Sum et al., 2003; Turley et al., 2007; Reynolds, 2001; Alon, 2007). The expansion of the higher education system in the US since the 1970s was accompanied by dramatic changes in the gender composition of both undergraduate students and bachelor degree recipients. In 2004–2005 females also comprised the majority of degree recipients (57%) (US Department of Education, 2005b). There is also a significant female advantage in college grade point average (GPA), even after controlling for family background, pre-collegiate academic achievements and institutional characteristics (Goldin et al., 2006; Buchmann and DiPrete, 2006; Sax and Harper, 2007; US Department of Education, 2003).

Several macro- and micro-level explanations have been suggested to account for the emergent female advantage in college academic achievements. Notable macro-forces include the spread of egalitarian norms; structural forces in higher education, like the system's expansion and greater openness; and economic forces, i.e., women's greater labor force participation and rising economic returns in the labor market (Goldin et al., 2006; Goldin and Katz, 2000; Goldin, 2006; DiPrete and Buchmann, 2006; Charles and Luoh, 2003; Jacob, 2002). Micro-level explanations focus on gender differences in cognitive and non-cognitive skills like academic achievements, learning habits, self-discipline, and behavioral problems (Reynolds

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and Burge, 2008; Jacob, 2002; Goldin et al., 2006). In addition, research has demonstrated gender disparities in the effect of social background on educational attainment – the female advantage is more salient among students hailing from a socio-economically disadvantaged background (Buchmann and DiPrete, 2006; Alon, 2007).

In this study, we focus on an additional explanation for the female advantage: sex segregation by field of study. Today the main axis of gender inequality in higher education in the United States, as in all industrialized countries, is horizontal sex segregation across fields of study, given parity (or even an edge) in enrollment rates (Charles and Bradley, 2002; Davies and Guppy, 1997). Since students' field of study provides the immediate academic and social context for their performance in college, gender differences in the distribution across majors can contribute to the female advantage in academic achievements. Evidence that the remaining female advantage in college completion after socioeconomic factors are netted out drops by 30% among whites and fades away altogether among non-whites, just by controlling for college major and type, underscores the merit of further pursuing this line of investigation (Buchmann and DiPrete, 2006).

Our investigation provides a comprehensive and systematic assessment of the effects of sex segregation by field of study on the female advantage in grades and graduation likelihood. First, we portray the selection regime that channels female and male students into different majors. Second, we examine whether and how much the gender composition of fields of study is associated with different learning environments, and whether these systematic differences shape students' academic performance in college. Finally, we examine the extent to which horizontal sex segregation by field of study contributes to the female advantage in college grades and degree completion. Using the Beginning Postsecondary Students (BPS) dataset, which is a nationally representative sample of about 6500 students who matriculated at any 4-year school in 1995, we find that horizontal sex segregation by field of study explains up to a half of the female advantage in college graduation and the cumulative GPA of graduates, net of individual and academic background factors.

## 2. Sex segregation by field of study

The gender composition of recent degree recipients in the US reflects the female advantage in graduation likelihood, but also clearly captures sex segregation by field of study. Although female students received 57% of the degrees conferred in 2004–2005, they are more likely than males to have graduated in the humanities, social sciences, and life sciences (US Department of Education, 2005b). Conversely, males are more likely to have earned a degree in the mathematical and physical sciences, but especially in engineering and computer science. For example, 18% of recent male graduates earned a degree in engineering and computer science, compared to only 3% of female graduates. As a result, females constitute only 20% of degree-holders in these fields (US Department of Education, 2005a).

The expansion of the higher education system in the last few decades has intensified this sex segregation in higher education by expanding and/or creating female-dominated fields (Charles and Bradley, 2002).<sup>1</sup> Cultural egalitarian norms, pushing females to pursue higher education, have only a weak positive effect in undermining horizontal sex segregation, because segregation across fields is easily reconciled with the “equal but separate” concept (Charles and Bradley, 2002). Economic factors, like the rising rate of female labor force participation, are frequently mentioned as a driving force in the emergence of the female advantage in college enrollment and graduation rates; yet, they also intensify horizontal sex segregation in higher education because of the disproportional growth of female-dominated occupations, like the health professions, and a strong trend of occupational feminization (Charles and Bradley, 2002; Reskin, 1991). Thus, notwithstanding the operation of strong macro-forces that have raised female college enrollment, sex segregation by field of study remains intact and continues to be a powerful force in structuring gender disparities in higher education (Jacobs, 1986, 1995, 1996; Bradley, 2000; Charles and Bradley, 2002; Turner and Bowen, 1999; Davies and Guppy, 1997).

In addition, micro-level factors – a powerful explanation for women's increasing presence in higher education and among bachelor's degree recipients – have been largely ineffectual in abating horizontal sex segregation across fields of study. Academic skills, which have been found to increase female enrollment rates in college and their college outcomes, seem to have a weak effect on their choice of major (Turner and Bowen, 1999; Xie and Shauman, 2003). The tendency of women to avoid mathematically oriented majors in college is generally attributed to the high-school gender gap in mathematical and science achievements. Yet, despite near gender parity in math and science achievements, female high school students are substantially less likely to aspire to major in science or engineering in college compared to male students, even after controlling for individual and familial influences (Xie and Shauman, 2003; Ayalon, 2003).

Socialization is, no doubt, an influential factor in creating gender disparities in the choice of fields of study, as it channels males and females into gender-specific majors in college (Wilson and Boldizar, 1990). Parents and educators tend to perceive girls as less qualified than boys in math-oriented fields, which are largely considered “masculine,” and these fields as less important to girls' future career paths than to boys' and incompatible with raising a family (Eccles et al., 1990; Eccles and Jacobs, 1986; Correll, 2001). Consequently, males are more likely to have a higher self-assessment of their mathematical ability than females, regardless of their actual ability, and they also face a high social penalty associated with majoring in female-dominated fields (Correll, 2001, 2004). As a result, only men who are less talented or ambitious than their peers will

<sup>1</sup> Fields such as psychology, biomedical science, visual and performing arts and other humanities fields have expanded since the 1980s, while mathematical science, engineering, and physical science shrunk (NCES, 2007). The construction of new gender-related fields (such as gender studies) has also intensified horizontal sex segregation in higher education (Jacobs, 1996; Bradley, 2000; England and Li, 2006).

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