The positive influence of female college students on their male peers

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A R T I C L E   I N F O

A B S T R A C T

Female college students improve the academic outcomes of their male peers. Using within-college across-cohort variation in freshman enrollment at US colleges, a one standard deviation increase in the proportion of females in a freshman cohort is associated with a half percentage point increase in graduation rates for males in that cohort, while there is no effect for females. Effects are more evident in colleges where student interactions are likely more intense – colleges with higher shares of students living on campus, in college housing, and without cars – suggesting that effects operate through changes in the college learning environment.

1. Introduction

The nature and intensity of interactions across genders on college campuses continues to change both inside and outside the college classroom. The proportion of females enrolled in institutions of higher education levelled off in the 2000s after increasing through much of the twentieth century. In the US, females are now more likely than males to enroll in four-year colleges. Furthermore, females are also more likely to choose college majors that were considered the domain of males in the past, although there are still marked gender differences in course-taking behavior (Dickson, 2000). Outside of the class environment, universities have responded to evolving student preferences by increasing the number of mixed gender residences, and some universities have even begun to allow opposite gender roommates (Gordon, 2010). This paper takes a step towards understanding some of the implications of these changes by estimating the effect of freshman cohort gender composition on college graduation rates.

I exploit within-college across-cohort variation in freshman composition to show that there are statistically and economically significant cohort gender peer effects on graduation rates at public four-year colleges in the US. A ten percentage point increase in the share of female freshman students increases the subsequent graduation rate of male students in that cohort by about two percentage points, while there is no effect on female graduation rates. Effects are concentrated in colleges where students are more likely to interact outside the classroom: colleges with higher shares of students living on campus, in college housing, and without cars. This suggests that college peer gender composition affects student behavior through the college environment.

A secondary analysis using individual level administrative data from a small subset of institutions supports the above findings. For male students, both accumulated total credit hours and the probability of graduation are positively correlated with the share of female students in their freshman cohorts. These effects are evident when controlling for individual college admission scores. This indicates that they are not driven by changes in ability composition that may be correlated with cohort female shares, specifically more able females being admitted and enrolled at the expense of less able males. In addition, there is no convincing evidence that gender composition effects operate inside the college classroom as there is no correlation between course gender composition and course achievement. This lends further support to college peer effects operating through a general college environment mechanism rather than in the classroom.

There is clear potential for college students to be affected by the gender composition of their peers, especially given the existing evidence on peer gender composition effects in other school settings. When students leave their homes to attend college, they not only take classes with their peers, but are likely to reside with them, too. This increases the opportunities for freshman peers to exert influence on each other. At the same time, college classes are likely to be larger and less interactive than classes in elementary and high schools, reducing the possibility of students in the same cohort affecting each other's academic achievement. The overall extent to which cohort composition matters in college is therefore an empirical question.

College gender peer effects on academic achievement could operate through compositional or behavioral channels. A change in the graduation rate caused by a change in the proportion of female

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students may come about because the change in gender composition simply reflects a change in the ability composition of the cohort. For example, consider a marginally admitted male student being replaced by a female student in a particular freshman cohort. This increases the female share of that cohort. If the marginally admitted male student was less likely to graduate than other admitted males in the cohort, the removal of that male student from the male subsample would increase the male graduation rate, and we would observe a positive correlation between the cohort female share and cohort male graduation rate. This would be a purely compositional effect and not necessarily reflect any actual peer influence.

Alternatively, college peers may affect incentives and actions. Behavioral mechanisms are broadly grouped into effects operating inside and outside the college classroom. Inside the classroom, gender composition could affect the learning environment through changes in student participation and class atmosphere. For example, females may promote class engagement if they are generally more focused than their male peers. Lavy and Schlosser (2011) find that gender peer effects at the school level operate through mechanisms such as classroom disruption and student-teacher relationships that would broadly fall into this class.

Outside the classroom, peer gender composition may affect students' study efforts, attitudes towards class, and socializing behavior. For example, if females are more academically oriented than males, a higher proportion of female students in a cohort may increase the general importance given to studies by students in that cohort. Alternatively, it is also possible that female students mitigate excessive college partying and drinking. Kremer and Levy (2008) find negative spillovers from alcohol consumption among male college roommates, and Eisenberg et al. (2014) provide evidence of peer effects in binge drinking at college. College peer gender composition may affect the propensity to engage in risky behaviors of this type, which may affect academic achievement.

My paper is related to a few strands of the existing peer effects literature. We know that peer gender affects educational outcomes in kindergarten (Whitmore, 2005), elementary school (Hoxby, 2000), middle school (Hu, 2015; Lee et al., 2014; Lu and Anderson, 2015) and high school (Lavy and Schlosser, 2011; Jackson, 2012; Hill, 2015). The subset of this literature investigating the effects of variation in cohort gender composition in mixed gender school environments typically finds that school performance is positively associated with the proportion of female students in the cohort. The effect found in this paper for male college students goes in the same direction. Importantly, however, school peer gender composition effects are typically considered to be stronger inside the classroom (Burke and Sass, 2013), while evidence presented in this paper indicates that college peer gender composition effects operate outside the classroom.

Outside of K–12 education, the potential for college peers to influence outcomes has been explored in a variety of settings, such as roommates (Sacerdote, 2001; Zimmerman, 2003; Stinebrickner and Stinebrickner, 2006; Jain and Kapoor, 2015), air force academy squadrons (Carrell et al., 2009), and residences (Garlick, 2014). There is some evidence that college peer effects differ by gender. Fischer (2016) finds that class ability composition affects the likelihood that females choose and complete degrees in STEM, while Ficano (2012) and Griffith and Rask (2014) find that males are more susceptible to ability peer effects than females. In a more directly related study, Feld and Zölitz (2016b) finds that the gender composition of randomly assigned teaching sections at a university in the Netherlands affects achievement and major choice, although a related study by Oosterbeek and van Ewijk (2014) does not find evidence of substantial peer gender composition effects in randomly assigned college study groups. My paper differs from these by looking at the effects of the gender composition of larger freshman cohorts and considering an arguably more representative sample consisting of the majority of public four-year colleges in the US.

The paper is organized as follows. The empirical strategy, data and estimation results using the aggregate data are presented in Sections 2–4, respectively, while the discussion and analysis using the individual student data forms Section 5.

2. Empirical strategy

I investigate the effect of college freshman cohort gender composition on students' academic outcomes by estimating the following reduced form equation:

$$y_{ct} = \alpha_c + \beta_t + \gamma_c t + \pi P_{ct} + \varepsilon_{ct} \tag{1}$$

y_{ct} is the gender-specific aggregate graduation rate for the cohort of freshman students in college c in year t, α_c is a college fixed effect, β_t is a cohort or year fixed effect, and $\gamma_c t$ is a college-specific time trend (which is included in some specifications and is either linear or quadratic). P_{ct} is the proportion of female students in the freshman cohort in college c in year t. The parameter π measures the relationship between the share of female freshman students in the college cohort and the aggregate graduation rate for male or female freshman students in that college cohort. In order for π to have a causal interpretation, the unobserved component of the cohort graduation rate must be uncorrelated with the cohort female share.

College fixed effects capture the endogenous sorting of students into colleges. This controls for colleges that consistently have higher shares of female students and higher or lower graduation rates, for example. There may also be unobserved time-varying factors that are correlated with both changes in the proportion of female students and aggregate graduation rates. In particular, a potential upward trend in the female share of college students due to a widening female-male achievement gap combined with a potential upward trend in college graduation rates due to grade inflation or higher administrative costs associated with student failure would generate a positive estimate of the parameter π, but would not indicate a causal relationship. The cohort fixed effects and college-specific time trends control confounding factors of this type. Identification therefore relies on college-specific deviations in cohort female shares and cohort graduation rates from their long-term trends.

Essentially, we are comparing the graduation rates of cohorts at the same college who are exposed to different cohort female shares by purely idiosyncratic factors. Sources of variation may include (1) fluctuations in the gender composition of applicants caused by either natural variation in the gender composition of the local college-going population or the college preferences of applying students, (2) changes in the gender composition of admitted students, and, (3) idiosyncratic shocks to the college preferences of admitted students in terms of if and where they choose where to enroll. I show in the data section that these factors generate a sufficient amount of variation in female shares across cohorts within colleges for the identification strategy to work.

Angrist (2014) shows that models that rely solely on chance variation in peer groups may be complicated by bias from weak instruments. Feld and Zölitz (2016a) consider precisely how classical measurement error impacts the estimation of compositional peer effects in these contexts, ultimately showing that estimates will only be attenuated by measurement error when assignment to peer groups is random. Although assignment to freshman cohort groups is not random, measurement error is likely to be a much smaller concern in my study given we are considering a fixed, well-measured peer characteristic – gender – rather than peer traits such as ability or smoking that are harder to measure.

The primary specification above considers gender peer effects at the college cohort level using aggregate data. The majority of college students primarily interact with other students who entered college in the same year that they did. Freshman students in college are likely to live, attend classes and socialize with other students in their cohorts. The preferences and actions of students in all three settings are likely to