
Volume 40, Issue 1, January 2011
ISSN 0049-089X
ELSEVIER
Social Science
RESEARCH
A Journal of Social Science Methodology and Quantitative Research
Available online at www.sciencedirect.com
ScienceDirect

Social Science Research 40 (2011) 107–119

Contents lists available at ScienceDirect

Social Science Research

journal homepage: www.elsevier.com/locate/ssresearch

The female advantage in college academic achievements and horizontal sex segregation

Sigal Alon [a,*], Dafna Gelbgiser [b]

[a] Department of Sociology and Anthropology, Tel Aviv University, Ramat Aviv, Tel Aviv 69978, Israel
[b] Department of Sociology, Cornell University, Ithaca, NY 14853-7601, USA

ARTICLE INFO

Article history:
Received 29 September 2009
Available online 19 June 2010

Keywords:
Gender
Higher education: the female advantage
Horizontal sex segregation
Academic achievements

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.

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

* Corresponding author. Fax: +972 3 6409215.
E-mail address: salon1@post.tau.ac.il (S. Alon).

0049-089X/$ - see front matter © 2010 Elsevier Inc. All rights reserved.
doi:10.1016/j.ssresearch.2010.06.007

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 socioeconomically 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).[1] 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

[1] 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).

opt out of the more demanding male-dominated fields. Conversely, only the most dedicated women choose male-dominated fields, leaving plenty of talented and ambitious women in the female-dominated fields (Correll, 2001; Ayalon, 2003). This suggests a negative selection for males into female-dominated fields, while females are likely to be more equally distributed across fields in terms of ability and background. Moreover, the selection into majors is based less on measurable academic achievements in high school and more on *unobserved* characteristics (like ambition, self-image, conformity, insecurity, career plans, educational expectations, family plans, etc.).

Because of these forces, sex segregation by major persists and continues to be an important structural contour of gender inequality in higher education, despite the greater presence of females in higher education (Jacobs, 1996; Turner and Bowen, 1999). Since males and females are likely to choose different majors, they are subject to different academic and social environments that may differentially shape their college experiences and academic achievements.

3. Major-specific arrangements, sex segregation and the female advantage

College majors differ in several structural arrangements that facilitate academic success and degree attainment. Majors vary in their academic demands and standards, such as admission requirements, scholastic intensity levels, grading policies and norms. In addition, there are differences between majors in terms of class size, culture, level of student integration, availability of study groups, accessibility of faculty, and social climate. Consequently, these major-specific characteristics shape students' experiences, achievements and persistence through graduation (Des Jardins et al., 2002; Leppel, 2001; Hearn and Olzak, 1981; Sabot and Wakeman-Linn, 1991). In particular, students who initially enter undergraduate science, technology, engineering, or mathematics programs have substantially lower degree completion rates than their same-race peers who enter other academic disciplines (HERI, 2010).

Thus, horizontal sex segregation situates male and female students in different learning and social environments. Consider, for example, differences in curricular openness: while male-dominated fields, like engineering, computer, physical and mathematical sciences, tend to have a large number of compulsory and "barrier courses" in their curriculum—which sets hurdles for students' achievements and persistence—female-dominated fields, like the humanities and social sciences and vocational fields, allow greater freedom in course selection (Xie and Shauman, 2003; Suresh, 2006; Hearn and Olzak, 1981). Thus, male students are more likely to enroll in fields in which the bottleneck is tighter, grades are lower and graduation chances resultingly lower, while women have a greater likelihood of enrolling in majors in which grades are higher, the social climate is more supportive and course selection less constrained.

In this study, we consider whether part of female overachievement stems from the lenient academic demands and the more supportive social environment of the majors they are likely to choose. We argue that the dissimilarity between female and male students in the distribution of majors partly accounts for the female advantage in academic performance. We employ a straightforward analytical strategy to trace the female advantage back to gendered selection of majors. First we model gender differences in the "choice" of different gender settings. Second, we examine whether and how the gender composition of fields shapes male and female students' academic performance in college. We build on these foundations to explore the main question of this study: how much of the female advantage in college academic achievements, which remains after netting out the effect of social and academic background, is explained by fields of study? To that end, we gauge a major-adjusted gender gap in cumulative college grades and graduation likelihood by running a major-fixed-effect model. Since the explanatory power of these structural arrangements stems from sex segregation by field of study, we ask the counterfactual question: how much of the female advantage would be trimmed if horizontal sex integration by field of study were achieved? We simulate two integration scenarios: in the first male students are assigned the female distribution of majors, in the second female students are assigned the male distribution of majors. The relative effectiveness of these scenarios depends on whether both sexes benefit equally from the learning and social environment of female-dominated majors.

4. Data and variables

4.1. Data and sample

Given that the female advantage is generated after matriculation in college (Buchmann and DiPrete, 2006), our study focuses on the academic outcomes of *enrolled* postsecondary students. The Beginning Postsecondary Students (BPS) data contain individual records collected from a nationally representative sample of all first-time beginning students in postsecondary education and contain detailed information on undergraduates' academic career. We use the 1996 BPS cohort (BPS: 1996) with the second follow-up in 2001 (BPS: 1996/2001), approximately 6 years after they first entered postsecondary education. We limit the analyses to 6449 students who enrolled at any 4-year institution in the fall of the 1995–1996 academic year, of which 3646 were female.[2] All analyses are weighted to allow generalization to all students attending 4-year institutions in 1995.

[2] About 3694 students were deleted from the analytical sample because they were not attending a 4-year institution and 1717 were deleted due to missing graduation information. One hundred and twenty-six were deleted from the analyses because their major when last enrolled was missing or undeclared.

4.2. Variables

4.2.1. Majors' classification and characteristics

In all analyses we use a detailed classification of 52 majors in the last year in college (data from 2001). Appendix A presents this list of majors. We characterize the academic and social environment of these majors by collapsing individual-based information by fields of study. To capture *gender composition* we characterize these majors by their percentage of females. We use another specification of the gender composition of fields by collapsing these majors into three segments: (1) Fields in which female students comprised less than 40% of the sample were classified as male-dominated fields (MDF).[3] (2) Fields with 40–60% females were classified as gender-neutral fields (GNF).[4] (3) Fields with over 60% females were classified as female-dominated fields (FDF).[5] We have constructed three additional major-based variables: *size* (total number of students), *grading norms* (average GPA), and *academic integration* (frequency of participation in study groups and contact with faculty).[6]

4.2.2. Individual-level variables

All models control for a vector of individual attributes: gender, race/ethnicity, parental education, family income, high school GPA, the number of AP courses taken in high school, whether an AP calculus course was taken, verbal and math test scores, and educational aspirations. Appendix B provides descriptive statistics for all individual- and major-based variables.

4.3. Analytical strategy

To understand the selection of students into female- or male-dominated majors, we fit several OLS models predicting the gender composition of the student's field of study. We also fit several logit regressions to the dichotomous outcome of being in a FDF. All specifications include the vector of individual-level variables. We fit these models to the entire population and for males and females separately. We then examine whether the gender composition of fields shapes students' academic performance in college, above and beyond their individual attributes. We fit several hierarchical linear and non-linear models (HLM) to the data to study students' graduation likelihood and graduates' cumulative GPA, while taking into account the variability associated with the gender composition of fields of study and the vector of individual attributes. Subsequently, in order to identify systematic differences between female- and male-dominated majors in learning environments, we assess the association between the gender composition of fields and other major-based characteristics (size, grading norms, and academic integration).

Finally, we assess how much of the female advantage in college academic achievements is explained by fields of study. We fit a logistic regression of 6-year graduation likelihood to the sample of 4-year students and fit an OLS regression of cumulative GPA to the sample of graduates. The baseline model includes an indicator for female and controls for all individual-based variables; under this specification, the female variable denotes the *net female advantage*. To capture the female advantage that is net of systematic differences between majors associated with their fields of study, we then estimated a major-fixed-effect model that fully disaggregates the field of study variable (a dummy variable for each major is included in the model), in addition to these controls; the female variable under this specification captures the *major-adjusted female advantage*. Subsequently, we run a simulation in which we test two counterfactual scenarios of sex integration. In the first, we assign female students the major distribution of males; in the second, we assign males the major distribution of females. Fitting separate major-fixed-effect models for males and females, we estimate their GPA and graduation likelihood in each scenario and then calculate the gender gap. Juxtaposing these alternative estimates of the female advantage (major-adjusted, female integration, and male integration) with the net female advantage yields several approximations of the share of the female advantage that is explained by horizontal sex segregation.

5. Results

5.1. The selection process and horizontal sex segregation

We start our investigation by portraying the selection regimes that channel female and male students into different academic and social environments. Horizontal sex segregation is evident from the results of Table 1 that presents the distributions of male and female students by segments of gender composition. Only 8.5% of female students studied in a male-dominated environment (fields with less than 40% females), compared to one in three of the male students. Males also had a higher share than females in gender-neutral fields (43% vs. 34%). About 57% of the females in the sample chose fields of study in which a majority of their classmates were females. The summary statistic suggests that females are located in majors with 63% females, on average, while male students are in majors with only 48% females – a gap of 14 percentage points.

[3] Included in this segment are fields like engineering, computer sciences, finance, and history.

[4] Prominent examples are business (management), life sciences, art and a few social science fields like economics and political science.

[5] Included in this category are health majors, education, psychology and other social science majors.

[6] Academic integration is an index indicating how often students' participated in study groups, had social contact with faculty, met with an academic advisor, or talked with faculty about academic matters outside of class.

To see if this gross gender disparity persists even after accounting for a wide array of individual attributes, we fit OLS models predicting the gender composition of the student's field of study. Table 2 reports the estimates for the entire

Table 1
The gender composition of the student's field of study in the last year in college, by sex. Students who started at any 4-year institutions in 1995, BPS database.

	All students	Males	Females
Male-dominated fields (MDF)	19.1	32.1	8.5
Gender-neutral fields (GNF)	38.2	43.2	34.1
Female-dominated fields (FDF)	42.8	24.7	57.4
% Females in field (SD)	0.56 (0.19)	0.48 (0.19)	0.63 (0.17)
N	6449	2803	3646

Table 2
OLS and logit models predicting % females in field, all students who started at any 4-year institutions in 1995, BPS database.

	% Female in major				FDF vs. GNF/MDF				FDF vs. MDF			
Model	1 All	2 All	3 Males	4 Females	5 All	6 All	7 Males	8 Females	9 All	10 All	11 Males	12 Females
Demographic and social background												
Female	0.136**				1.378**				2.119**			
	(0.006)				(0.070)				(0.101)			
Race (White omitted):												
Black	−0.008	0.002	0.013	−0.023*	0.140	0.216+	0.591**	−0.129	−0.198	−0.125	0.247	−0.800**
	(0.011)	(0.011)	(0.020)	(0.011)	(0.119)	(0.112)	(0.199)	(0.139)	(0.181)	(0.159)	(0.241)	(0.239)
Hispanic	−0.009	−0.006	0.014	−0.029*	0.042	0.069	0.331+	−0.175	0.247	0.238	0.447*	−0.114
	(0.010)	(0.010)	(0.016)	(0.012)	(0.117)	(0.110)	(0.181)	(0.147)	(0.177)	(0.162)	(0.216)	(0.281)
Asian	−0.039**	−0.035**	−0.019	−0.057**	−0.442**	−0.366*	−0.088	−0.623**	−0.312	−0.357+	−0.286	−0.296
	(0.011)	(0.012)	(0.018)	(0.015)	(0.157)	(0.145)	(0.235)	(0.196)	(0.215)	(0.198)	(0.271)	(0.381)
Other	−0.036	−0.055	−0.060	−0.001	−0.372	−0.533	−1.989+	0.464	−0.939*	−0.693	−2.014+	−0.363
	(0.037)	(0.039)	(0.054)	(0.048)	(0.331)	(0.393)	(1.068)	(0.519)	(0.415)	(0.470)	(1.136)	(0.624)
Family income	0.000	−0.000	0.000	−0.000	−0.000	−0.000	−0.001	−0.000	−0.001	−0.001	−0.000	−0.002+
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Parental education (HS or less omitted):												
Some PSE	−0.014	−0.010	−0.042**	0.006	−0.078	−0.031	−0.331+	0.077	−0.302*	−0.205	−0.551**	0.039
	(0.009)	(0.010)	(0.016)	(0.010)	(0.102)	(0.098)	(0.179)	(0.125)	(0.152)	(0.139)	(0.209)	(0.220)
BA	−0.004	−0.008	−0.018	0.010	0.006	−0.037	−0.120	0.096	0.022	−0.051	−0.165	0.337
	(0.008)	(0.008)	(0.012)	(0.010)	(0.095)	(0.090)	(0.151)	(0.121)	(0.143)	(0.128)	(0.178)	(0.224)
More than BA	0.006	0.002	−0.004	0.015	0.073	0.028	−0.151	0.245+	0.209	0.151	−0.086	0.724**
	(0.008)	(0.009)	(0.013)	(0.010)	(0.101)	(0.097)	(0.168)	(0.128)	(0.154)	(0.139)	(0.201)	(0.242)
Academic background												
HS GPA	0.000	0.014**	0.002	−0.001	−0.015	0.121**	0.030	−0.046	0.018	0.215**	0.038	−0.049
	(0.004)	(0.004)	(0.006)	(0.004)	(0.044)	(0.041)	(0.071)	(0.057)	(0.065)	(0.059)	(0.084)	(0.108)
# of AP courses in HS	−0.001	0.001	0.002	−0.002	−0.034	−0.010	0.025	−0.059	−0.011	0.019	0.047	−0.065
	(0.003)	(0.003)	(0.005)	(0.004)	(0.040)	(0.036)	(0.069)	(0.045)	(0.059)	(0.045)	(0.076)	(0.073)
AP calculus in HS	−0.034**	−0.034**	−0.049**	−0.024	−0.410**	−0.376**	−0.665*	−0.289+	−0.617**	−0.524**	−0.822**	−0.387
	(0.012)	(0.012)	(0.018)	(0.015)	(0.145)	(0.138)	(0.264)	(0.168)	(0.204)	(0.164)	(0.283)	(0.262)
Verbal SAT score (in pct scale)	0.005	0.013**	0.010+	0.001	0.091*	0.161**	0.147*	0.059	0.126*	0.220**	0.171*	0.053
	(0.003)	(0.003)	(0.005)	(0.004)	(0.040)	(0.038)	(0.065)	(0.050)	(0.061)	(0.055)	(0.077)	(0.098)
Math SAT score (in pct scale)	−0.022**	−0.038**	−0.019**	−0.025**	−0.218**	−0.354**	−0.165*	−0.263**	−0.358**	−0.574**	−0.282**	−0.493**
	(0.003)	(0.003)	(0.005)	(0.004)	(0.040)	(0.038)	(0.064)	(0.051)	(0.061)	(0.055)	(0.075)	(0.101)
Educational aspirations: BA	0.019+	0.017	0.025	0.012	0.138	0.101	0.165	0.106	0.280+	0.185	0.202	0.391
	(0.010)	(0.011)	(0.016)	(0.013)	(0.113)	(0.112)	(0.196)	(0.146)	(0.165)	(0.150)	(0.220)	(0.261)
Constant	0.561**	0.602**	0.515**	0.740**	−0.391	0.008	−1.127*	1.505**	0.775+	1.377**	0.179	4.149**
	(0.024)	(0.026)	(0.038)	(0.031)	(0.286)	(0.269)	(0.468)	(0.373)	(0.441)	(0.390)	(0.538)	(0.781)
Observations	6449	6449	2803	3646	6447	6447	2802	3645	4027	4027	1610	2417
R-squared	0.17	0.05	0.03	0.05	0.10	0.03	0.03	0.03	0.21	0.06	0.04	0.07

Robust standard errors in parentheses.
* Significant at 5%.
** Significant at 1%.
\+ Significant at 10%.

population and by sex. The results from the first model that controls for the student's gender and the vector of individual-based variables demonstrate that female college students are more likely than their male counterparts to choose majors with a larger share of females, even when their socioeconomic and demographic background, high school achievements, math preparation, test scores and educational aspirations are taken into account. Specifically, being female is associated with a 14% increase in the share of females in class, everything else equal, making the adjusted gap the size of the gross gap. Moreover, this model explains about 17% of the variance in the outcome, whereas the second model, which does not control for gender, accounts for only 5% of variance.

We also fit two logit regressions to the dichotomous outcome of being in a FDF (vs. all other fields and vs. MDF). The results show that female students' odds of being in a FDF, compared to MDF, are eight times higher than their male counterparts', everything else equal.[7] Once again, the following statistics tell the story succinctly: about 6% of the variance in the destination major (FDF vs. MDF) is explained by all variables but gender (Model 10), while 21% is accounted for when the gender variable is included (Model 9), an increase of 15 percentage points in the explained variance. In accordance with the literature on the subject, these findings demonstrate that gender is a key determinant of major choice.

These findings indicate that females' greater propensity to choose female-dominated majors is mostly unexplained by their characteristics. This conclusion is supported by the female-only specification: most variables are insignificant, including those one would assume shape the selection regime, such as academic achievements.[8] While females are more equally distributed than males across majors in terms of the array of characteristics we observed for males there are indications of a negative selection into FDF on several academic and social backgrounds (see the male-specific models). Taking an AP calculus course in high school and the level of parental education are negatively associated with the percentage of females in the field. We will consider the implications of these selection patterns for the interpretation of our results.

5.2. The structural arrangements that shape students' college academic performance

Horizontal sex segregation is germane to the female advantage only if the gender composition of majors shapes students' grades and graduation likelihood. To assess this issue, we fit several HLMs predicting students' graduation likelihood and graduates' GPA while taking into account the variability associated with the gender composition of fields of study (the specification includes an indicator for the percentage of females in the field and its square term) and the vector of individual attributes. These HLM models were fitted to the entire population and for males and females separately. Based on the best fitting sex-specific HLM models we calculated the predicted graduation probabilities and GPA for the average male and female as a function of the gender composition of fields and the results are presented in Fig. 1a and 1b (Appendix C reports the point estimates for the gender composition variable).[9]

The results show that the percentage of females in majors structures students' achievements in college, above and beyond the influences of individual attributes. Netting out the effects of individual attributes on the graduation outcome, the higher the share of females among the major's student body, the higher the student's graduation likelihood. Yet, above a certain share of females in the field there is a decline in graduation likelihood (see Fig. 1a). This indicates that gender-neutral fields (between 40% and 60% females) are most conducive to their students' graduation likelihood. Female students' graduation likelihood is more sensitive to the gender context than males'. In terms of students' grades the results in Fig. 1b suggest that both males and females benefit from studying in a female environment, all individual traits equal. For females the effect is monotonic for any increase in female presence, while for men the effect is visible only above 40% females in the major. That the gender composition is positively associated with male students' grades indicates that at least part of the female-dominated majors' advantage is universalistic, as both sexes benefit from the lenient grading norms in FDF.

Plausibly, the positive effect of the gender composition variable on students' academic performance captures a supportive social climate and a distinct culture in female-dominated fields – important factors conducive to the academic performance of females in particular. Yet, the results suggest that it may also capture systematic differences in learning environments between female- and male-dominated majors that universally affect both sexes. We explore the association between the gender composition and several major-based variables: size (total number of students), grading norms (average GPA), and academic integration (frequency of participation in study groups and contact with faculty). This is not a comprehensive list of all the theoretically relevant between-major variations, but it does capture several key aspects of learning environments.

Examining the correlation between the percentage of females in the various fields and these factors (Table 3) reveals that that the highest correlation is found between the percentage of females in the major and its mean GPA (.54). This correlation indicates that female students choose majors with higher grading norms (as even male students' grades are sensitive to the share of females in the fields (see Fig. 1b)). The gender composition is also correlated with academic integration and size.[10] The table also presents differences between FDF, GNF and MDF on these characteristics. GNF are the largest majors, followed by

---

[7] Exponentiation of the logit coefficients: exp(2.119) = 8.32.

[8] There are interesting racial and ethnic differences, as white women are more likely than others to choose female-dominated majors (see also Maple and Stage, 1991; Chavous et al., 2004 for similar trends).

[9] Predicted graduation probabilities in Fig. 1a are calculated based on Model 4 for males and Model 6 for females in Panel A (Appendix C). Predicted GPA in Fig. 1b are calculated based on Model 4 for males and Model 5 for females in Panel B.

[10] The level of academic integration is correlated with both GPA (.32) and the size of the major (.33).

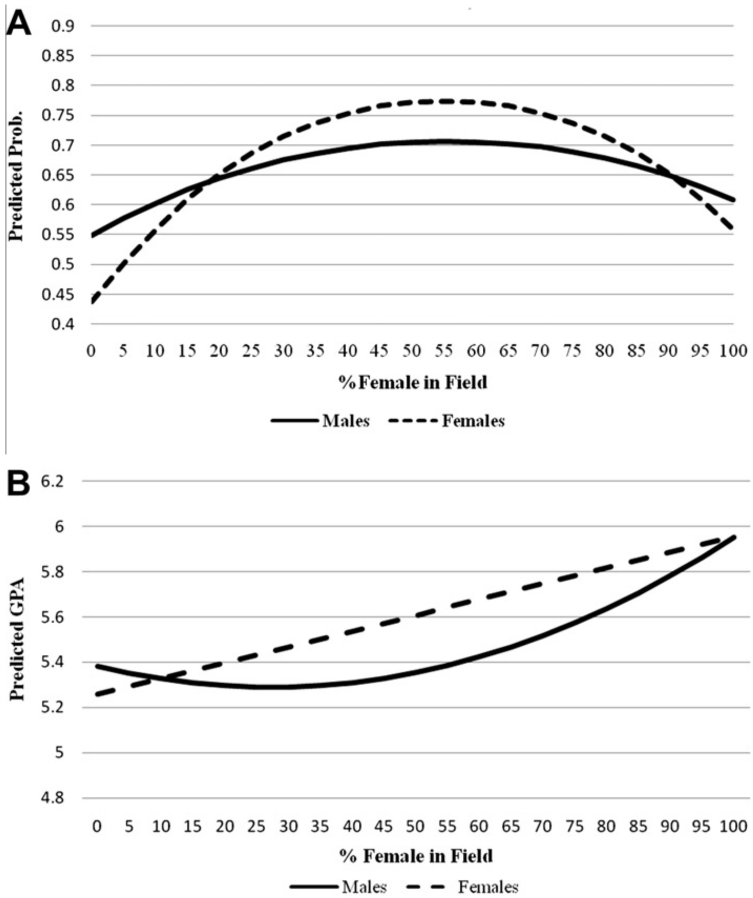

Fig. 1. (a) Predicted graduation probabilities for average male and female, by% females in field. (b) Predicted GPA for average male and female graduate, by% females in fields. Note: these graphs are based on an HLMs predicting students' graduation likelihood and graduates' GPA.

Table 3
The association between the gender composition of majors and other characteristics. Students who started at any 4-year institutions in 1995, BPS database.

	Correlation w/ % Female	MDF		GNF		FDF		Gap (FDF − MDF)	*t*-Test[a]
		Mean	SD	Mean	SD	Mean	SD		
Major's size	0.1525*	129.49	75.57	248.59	177.10	189.86	101.86	60.37	18.6948*
Academic integration in major (standardized)	0.1677*	−0.32	1.06	0.26	0.99	−0.02	0.91	0.30	8.6146*
Mean GPA in major	0.5408*	5.22	0.18	5.38	0.19	5.46	0.18	0.24	36.4097*
N									

[a] Independent means comparison test (F-M).
* p < 0.01.

FDF (about 60 additional students in an FDF class than in an MDF, on average). GNF also provide better academic integration in terms of availability of study groups and contact with faculty outside class. The academic integration in FDF, where most females study, is lower than in GNF, but significantly higher than in MDF. Additional HLM analyses (results not shown) reveal that both the size of the major and its level of academic integration increase the chances of college completion, especially among male students.

Female students may have superior cognitive and non-cognitive skills—they have great learning habits, they are self disciplined, and they are less predisposed to behavioral problems—but as the foregoing results suggest, most of them, by choosing female-dominated fields, face unique social and academic environments in college, which vary from the learning settings experienced by their male counterparts. With these insights in mind, we now consider the extent to which these gender differences in structural arrangements play a role in the creation of the female advantage in academic performance.

5.3. The female advantage in graduation likelihood and GPA

Our objective is to assess what share of the net female advantage in college grades and degree completion, i.e., net of socioeconomic and academic factors, is accounted for by horizontal sex segregation. We fit several logistic regressions of 6-year graduation likelihood to the sample of 4-year students and OLS regressions of cumulative GPA for graduates. We report the predicted graduation probabilities and the linear prediction of grades that were produced post-estimation for males and females, while setting all other variables to their mean. The results in Table 4 regarding college completion (Panel A, column 1) capture the *net female advantage*. Net of socioeconomic background and cognitive skills, the female advantage in 6-year graduation likelihood is about 9 percentage points (67.1 vs. 58.2). Netting out the major-specific effects (a major fixed-effect model, column 2) trims 8% from the net female advantage in degree completion (from 9 to 8.3 percentage points).

These estimates of the female advantage are calculated for the entire population and assume that the effects of learning environments on academic performance are equivalent for males and females. However, the results in Fig. 1 clearly demonstrate that the effect of gender composition on males' and females' graduation likelihood is asymmetrical: female students benefit from a feminine learning environment much more than their male classmates, everything else equal. To take into account this variation, we re-estimate the female advantage by simulating two integration scenarios. In the first, we assign male students the female distribution of majors (so that both male and female students have the female distribution). In the second, we assign female students the male distribution of majors (so that both groups have the male distribution). The simulations are based on major-fixed-effect sex-specific models and the predicted probabilities are calculated with the opposite sex distribution of majors, while all the individual-level variables are set to their same sex-specific mean.

The results in Table 4 (column 3) show that if both male and female students had the female distribution of majors, the female advantage would be 7.3 percentage points, a decline of 18% from the net advantage. However, if both groups had the male distribution of majors, the female advantage would shrink to around 5 percentage points (column 4). This is a reduction of about 45% from the net female advantage. Given the asymmetrical effect of female-dominated environments on males' and females' graduation likelihood, it is not surprising that assigning females to male-dominated fields yields a more substantial narrowing of the female advantage than does transferring males to female-dominated fields. Female students thrive in a feminine learning and social environment, and if moved to male-dominated majors they are deprived of this advantage and suffer a decline in their chances of graduation (their graduation rate drops from 67.3 to 64.7, a decline of 4%). Conversely, males benefit much less from feminine social and academic environments, thus when assigned to female-dominated fields their graduation likelihood is unaffected. This exercise demonstrates that the answer to the question—how much of the female advantage in graduation likelihood would be trimmed if horizontal sex integration in field of study were achieved—depends on the contours of integration. The estimate ranges between 18% and 45%.

Repeating the same analytical strategy, we assess the contribution of horizontal sex segregation to the female advantage in cumulative GPA among those who have graduated from college. The results are reported in Panel B of Table 4. Among college graduates, the net female advantage in grades is 0.30 points (on a 1–7 scale). After major-fixed effects are netted

Table 4
Predicted 6-year graduation rates and college GPA by actual and counterfactual distributions of majors. Students who started at any 4-year institutions in 1995, BPS database.

	Combined models		Sex-specific major-FE models	
	Net gap	Major adjusted gap	Counterfactual distribution	
			Females distribution	Males distribution
	1	2	3	4
Panel A: 6-year graduation				
All students				
Male	58.2	59.0	60.0	59.8
Female	67.1	67.3	67.3	64.7
Gender gap	8.99	8.26	7.35	4.95
% of net gap explained		8%	18%	45%
Panel B: 6-year cumulative GPA				
Graduates only				
Male	5.39	5.44	5.48	5.39
Female	5.68	5.64	5.68	5.56
Gender gap	0.30	0.20	0.19	0.17
% of net gap explained		32%	34%	43%

Note: The models controls for race/ethnicity, HS GPA, parental education, family income, # of AP courses, AP calculus courses, math SAT score, verbal SAT score, educational aspiration (BA).

out, the female advantage drops to 0.20 points. Thus, major-specific grading norms and learning environment account for 32% of the female advantage in college GPA. We expect that both integration scenarios will yield a reduction in the female advantage in GPA, with a more substantial cut under the second scenario (assigning female students the male distribution of majors). This is because the HLM results indicate that the gender composition of fields influences *both* male and female students' grades, although females benefit more from being in a female-dominated major (see Fig. 1b). The results corroborate this prediction. If both male and female students had the female distribution of majors, the female advantage would be .19 points, a decline of 34% from the net advantage. Yet, if both groups had the male distribution of majors, the female advantage would shrink to 17 points, trimming 43% of the net female advantage. As is the case with graduation likelihood, female students flourish in a feminine context, and when this advantage is taken from them they experience a decline in their grades (from 5.68 to 5.56, a drop of 2%).

These findings need to be considered in light of the selection patterns into FDF since a fraction of the female advantage that we attribute to differences in learning environments may stem from a negative selection of males into FDF. A negative selection on *observed* characteristics, however, does not conflict with our interpretation, because our estimates do take into account the variability of these attributes and the predicted GPA and graduation probabilities are calculated for a student with the average characteristics. The issue is pertinent only if there is a negative selection on unobservable characteristics that are unrelated to observed attributes. This means, for example, that males choosing FDF are less motivated or ambitious than their counterparts in MDF, but this disparity has no bearing on their high school grades, selection of AP courses, test scores, or aspirations. Such a situation seems most unlikely: low motivation undoubtedly shapes students' educational careers prior to college by constricting choices and impeding scholastic performance. Yet we cannot completely rule out this possibility.[11]

Another way to weigh the environment vs. selection debate is to focus on the female students because for them we can rule out the selection bias explanations. They are evenly distributed across fields in terms of academic preparation, aspirations and background. Assuming a correlation between observable and unobservable characteristics, the estimates for females are less prone to selection bias than those for males. For them we see a clear impact of the learning environment on their scholastic achievements and attribute the reduction in the gender gap in graduation to the changes in contexts. Overall, a selection bias (on unobservable characteristics) is an explanation that in the current context can neither be tested nor discarded, but we think the evidence is robust enough to suggest that at least part, if not all, of the reduction in the female advantage derives from gender differences in structural arrangements.

6. Conclusions

The emergence of the female advantage in academic success in college is a fascinating and complex phenomenon rooted in numerous forces. We contribute to the vibrant literature on this topic by revealing that sex segregation by field of study is a key structural explanation for the female advantage in college academic achievements.

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, and social support—shape both females' and males' performance. The female advantage is intensified as a result of a high level of gender segregation by field of study. Females are more likely to enroll in female-dominated majors with high grades and graduation rates, namely the humanities, social sciences, and vocational fields like health and education, while male students are crowded in the math/physical sciences and engineering/computer sciences, notorious for their tightfisted grading policies and tighter bottleneck.

We find that this variation is a key factor in the creation of the female advantage in grades and graduation likelihood. 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 have been reduced by approximately 45%. This implies that the female advantage is not a temporary phenomenon – it will exist as long as female-dominated majors provide settings which are more conducive to academic performance than those of male-dominated majors.

Horizontal sex segregation by field of study continues to be an important structural contour of gender inequality in higher education, shaping male and female enrollment patterns, academic achievements and degree attainment. However, as opposed to occupational sex segregation, which curtails women's earnings potential, horizontal segregation in higher education in fact works to the advantage of women, as they are disproportionately represented in majors that deliver better outcomes. Yet it can be a double-edged sword, helpful in the short run, but harmful in the long-run, by restricting women's occupational choices, leading to careers that are less remunerative on average. The overarching question is whether women's lifelong earning trajectories are lowered by consecutive systems of horizontal sex segregation that shape their outcomes in a contradictory pattern within the higher education and labor market arenas. This implies that in order to formulate a broader comprehension of gender in stratification systems we need to stop treating higher education as a pre-market externality when considering labor market inequality.

[11] Given that a selection on the unobservable characteristics is a key underlying factor in the assignment process – a two-stage model strategy has a limited explanatory value without instrumenting for socialization. Given the link between socialization and scholastic achievements it is impossible to find a strong instrumental variable that creates discontinuity in socialization, but not in college academic achievements (to satisfy the exclusion restrictions) and to which the assignment is random (to satisfy the ignorability assumption).

Appendix A

Detailed classification of college majors, BPS data.

	Major	Percent	Freq.
1	Agriculture	1.61	104
2	Architecture	0.99	64
3	Accounting	2.87	185
4	Business – finance	2.26	146
5	Business – business/management systems	2.48	160
6	Business – management/business admin	7.34	473
7	Business – business support	1.17	75
8	Business – marketing/distribution	1.34	86
9	Journalism	0.74	48
10	Communications	3.82	246
11	Computer and information sciences	4.16	268
12	Education – early childhood	1.03	67
13	Education – elementary	4.33	279
14	Education – secondary	1.61	104
15	Education – other	2.01	130
16	Engineering – electrical	1.2	77
17	Engineering – chemical	0.57	37
18	Engineering – civil	0.93	60
19	Engineering – mechanical	1.35	87
20	Engineering – all other	1.31	84
21	Engineering technology	1.04	67
22	Foreign language: European, not Spanish	0.98	63
23	Health, allied – dental/medical tech	1.63	105
24	Health, allied – therapy & mental health	1.52	98
25	Health, allied – general & other	1.41	91
26	Health – clinical health science	1.4	90
27	Nursing	2.06	133
28	Health – all others	1.58	102
29	Vocational home economic – others	0.7	45
30	Law	0.58	37
31	Letters	3.27	211
32	Liberal studies	1.93	124
33	Biological sciences	6.41	413
34	Mathematics	1.04	67
35	Interdisciplinary – environment/biopsychology/general	2.06	133
36	Leisure studies	0.5	33
37	Philosophy	0.84	54
38	Physical sciences	1.79	115
39	Psychology	5.48	353
40	Protective services	1.78	115
41	Social work	1.42	91
42	Anthropology/archaeology	0.71	46
43	Economics	1.89	122
44	History	2.06	133
45	Sociology	2.59	167
46	Political science	2.61	168
47	Industrial arts – construction	1.59	102
48	Mechanics – all others	0.61	39
49	Arts – design	1.77	114
50	Arts – speech/drama	0.7	45
51	Arts – music	1.16	75
52	Arts – visual/performing/fine	1.77	114
	Total	100	6449

Appendix B

Descriptive statistics for students attending a 4-year institution in 1995, BPS database.

Variable	Definition	Mean	(SD)
6-yr graduation	6-Year graduation	0.61	
Cumulative GPA	6-Year cumulative GPA in college (1–7 scale)	5.38	1.02
Female	Female	0.55	
White	White, not of Hispanic origin	0.72	
Black	Black, not of Hispanic origin	0.11	
Hispanic	Hispanic, regardless of race	0.10	
Asian	Asian or Pacific Islander	0.06	
Other race	Other	0.01	
Family income	Family income in $K of dependent students	58.11	54.14
Parents, HS	At least one parent with a HS diploma	0.25	
Parents, some college	At least one parent with some college experience	0.17	
Parents, BA	At least one parent with a BA degree	0.24	
Parents, post-BA	At least one parent with a post-BA degree	0.25	
SAT verbal	SAT verbal score	456.15	108.45
SAT math	SAT math score	501.35	118.76
HS GPA	HS cumulative GPA: BPS: 1–7	4.39	2.88
# of AP courses	# of AP courses taken in HS	0.60	1.25
AP calculus	If student took AP calculus course in HS	0.31	
Educational aspirations: BA	If student aspire to earn BA	0.90	
Major characteristics			
Academic integration	This variable indexes the overall level of academic integration the respondent experienced at the NPSAS institution during the 1995–1996 academic year. It is derived based on the average of the responses indicating how often student participated in study groups, had social contact with faculty, met with an academic advisor, or talked with faculty about academic matters outside of class (multiplied by 100). This index was generated by NCES	194.60	41.78
% female	% Female in major	0.56	0.19
Size	# of students in major	197.04	137.58
Mean GPA	Mean college cumulative grade point average		
N		6449	

Appendix C

Hierarchical linear and non-linear models predicting graduation likelihoods and GPA, individual and major's characteristics. Students who started at any 4-year institutions in 1995, BPS database.

Population	All students[a]		Males[b]		Females[b]	
Model #	1	2	3	4	5	6
Panel A: Dependant variable: 6-year graduation						
Intercept slope						
Intercept	0.897**	0.893**	0.789**	0.771**	1.019**	0.989**
% Female in major	0.056	3.410**	0.333	2.468!	0.082	5.408*
% Female in major (squared)		−3.264*		−2.218		−4.916*
Level 1 units (students)	5881	5881	2535	2535	3346	3346
Level 2 units (majors)	52	52	52	52	52	52

(*continued on next page*)

Appendix C (*continued*)

Population	All Graduates[a]		Male Graduates[b]		Female Graduates[b]	
Model #	1	2	3	4	5	6
Panel B: Dependant variable: 6-year cumulative GPA						
Intercept slope						
Intercept	5.556**	5.559**	5.424**	5.435**	5.628**	5.629**
% Female in major	0.595**	−0.241	0.515**	−0.688	0.700**	0.548
% Female in major (squared)		0.811!		1.259*		0.136
Level 1 units (students)	4073	4073	1676		2397	2397
Level 2 units (majors)	52	52	51	51	52	52

Note: As a matter of parsimony we report estimates for the gender composition variable and not for the individual attributes.

[a] Level 1 controls: gender, race/ethnicity, parental education, family income, high school GPA, # of AP courses in HS, AP calculus course, math SAT score, verbal SAT score, educational aspirations.

[b] Level 1 controls: race/ethnicity, parental education, family income, high school GPA, # of AP courses in HS, AP calculus course, math SAT score, verbal SAT score, educational aspirations.

* sig. < 0.05.

** sig. < 0.01.

! sig. < 0.1.

References

Alon, Sigal, 2007. The effect of overlapping disadvantages on the racial/ethnic graduation gap among students attending selective institutions. Social Science Research 36 (4), 1475–1499.

Ayalon, H., 2003. Women and men go to university: mathematical background and gender differences in choice of field in higher education. Sex Roles 48 (5–6), 277–290.

Bradley, Karen, 2000. The incorporation of women into higher education: paradoxical outcomes? Sociology of Education 73, 1–18.

Buchmann, Claudia, DiPrete, Thomas A., 2006. The growing female advantage in college completion: the role of parental resources and academic achievement. American Sociological Review 71, 515–541.

Charles, K.K., Luoh, M.C., 2003. Gender differences in completed schooling. Review of Economics and Statistics 85, 559–577.

Charles, Maria, Bradley, Karen, 2002. Equal but separate? A cross-national study of sex segregation in higher education. American Sociological Review 67 (4), 573–599.

Chavous, T.M., Harris, A., Rivas, D., Helaire, L., Green, L., 2004. Racial stereotypes and gender in context: African Americans at predominantly black and predominantly white colleges. Sex Roles 51 (1–2), 1–16.

Correll, Shelley J., 2001. Gender and the career choice process: the role of biased self-assessments. American Journal of Sociology 106 (6), 1691–1730.

Correll, Shelley J., 2004. Constraints into preferences: gender, status, and emerging career aspirations. American Sociological Review 69, 93–113.

Davies, Scott, Guppy, Neil, 1997. Fields of study, college selectivity, and students inequalities in higher education. Social Forces 74 (4), 1417–1438.

Des Jardins, Stephen L., Ahlburg, Dennis A., McCall, Brian P., 2002. A temporal investigation of factors related to timely degree completion. The Journal of Higher Education 73 (5), 555–581.

DiPrete, Thomas A., Buchmann, Claudia, 2006. Gender specific trends in the value of education and the emerging gender gap in college completion. Demography 43, 1–24.

Eccles, J.S., Jacobs, J.E., 1986. Social forces shape math attitudes and performance. Signs: Journal of Women in Culture and Society 11 (2).

Eccles, J.S., Jacobs, J., Harold, R., 1990. Gender role stereotypes, expectancy effects, and parents' socialization of gender differences. Journal of Social Issues 46 (2), 183–201.

England, Paula, Li, Su, 2006. Desegregation stalled: the changing gender composition of college majors, 1971–2002. Gender & Society 20 (5), 657–677.

Freeman, C.E., 2004. Trends in Educational Equity of Girls & Women (NCES 2005-016). US Department of Education, National Center for Education Statistics. US Government Printing Office, Washington, DC.

Goldin, Claudia, 2006. The Quiet Revolution that Transformed Women's Employment, Education, and Family. Ely Lecture, American Economic Association Meetings, Boston, MA.

Goldin, Claudia, Katz, Lawrence F., 2000. Career and marriage in the age of the pill. American Economic Review Papers & Proceedings 90, 461–465.

Goldin, Claudia, Katz, Lawrence F., Kuziemko, Ilyana, 2006. The Homecoming of American College Women: The Reversal of the College Gender Gap. NBER Working Papers 12139, National Bureau of Economic Research Inc.

Hearn, J.C., Olzak, S., 1981. The role of college major departments in the production of sexual inequality. Sociology of Education 54, 195–205.

The Higher Education Research Institute (HERI), 2010. Degrees of Success: Bachelor's Degree Completion Rates among Initial STEM Majors. Research Brief, Higher Education Research Institute, University of California at Los Angeles.

Jacob, Brian, 2002. Where the boys aren't: non-cognitive skills, returns to school and the gender gap in higher education. Economics of Education Review 21, 589–598.

Jacobs, Jerry A., 1986. The sex segregation of fields of study: trends during the college years. Journal of Higher Education 57 (2), 134–153.

Jacobs, Jerry A., 1995. Gender and academic specialties. Sociology of Education 68, 81–98.

Jacobs, Jerry A., 1996. Gender inequality and higher education. Annual Review of Sociology 22, 153–185.

Leppel, Karen, 2001. The impact of major on college persistence among freshmen. Higher Education 41, 327–342.

Maple, Sue A., Stage, Frances K., 1991. Influences on the choice of math/science major by gender and ethnicity. American Educational Research Journal 28 (1), 37–60.

The National Center for Education Statistics (NCES), 2007. The Condition of Education: Table 42-2. US Department of Education. Institute of Education Sciences (NCES: 2007-064). US Government Printing Office, Washington, DC.

Reskin, Barbara, 1991. Labor markets as queues: a structural approach to changing occupational sex composition. In: Huber, Joan (Ed.), Micro-Macro Linkages in Sociology. Sage Publication, NY, pp. 170–186.

Reynolds, J.R., 2001. The gender gap in college expectations: myth or males falling behind? In: American Sociological Association Annual Meeting, Anaheim, CA.

Reynolds, J.R., Burge, S.W., 2008. Educational expectations and the rise in women's post-secondary attainments. Social Science Research 37 (2), 485–499.

Sabot, Richard, Wakeman-Linn, John, 1991. Grade inflation and course choice. The Journal of Economic Perspectives 5 (1), 159–170.

Sax, L.J., Harper, C.E., 2007. Origins of the gender gap: pre-college and college influences on differences between men and women. Research in Higher Education 48 (6), 669–694.

Sum, A., Fogg, N., Harrington, P., Ishwar Khatiwada, I., Palma, S., Pond, N., Paulo, Tobar P., 2003. The Growing Gender Gaps in College Enrollment and Degree Attainment in the US and their Potential Economic and Social Consequences. Center for Labor Market Studies, Northeastern University, Boston, MA. Prepared for: The Business Roundtable, Washington, DC.

Suresh, R., 2006. The relationship between barrier courses and persistence in engineering. Journal of College Student Retention 8 (2), 215–239 (The American Journal of Sociology 106 (6), 1691–1730).

Turley, Ruth N., Santos, López Martín, Ceja, Cecilia, 2007. Social origin and college opportunity expectations across cohorts. Social Science Research 36 (3), 1200–1218.

Turner, S.E., Bowen, W.G., 1999. Choice of college major: the changing (unchanging) gender gap. Industrial and Labor Relations Review 52 (2), 289–313.

US Department of Education, National Center for Education Statistics (NCES), 2003. Postsecondary Attainment, Attendance, Curriculum, and Performance: Selected Results From the NELS:88/2000 Postsecondary Education Transcript Study (PETS), 2000 (NCES 2003-394). Report prepared by Adelman, C., Daniel, B., Berkovits, I. National Center for Education Statistics, Washington, DC.

US Department of Education, National Center for Education Statistics (NCES), 2005a. 2004-05 Integrated Postsecondary Education Data System (IPEDS), Fall 2005 (Table No. 258). Full table available at <http://www.nces.ed.gov/programs/digest/d06/tables/dt06_258.asp>.

US Department of Education, National Center for Education Statistics (NCES), 2005b. Gender Differences in Participation and Completion of Undergraduate Education and How They Have Changed Over Time (NCES 2005-169). Report prepared by Peter, K., Horn, L. US Government Printing Office, Washington, DC.

Wilson, Kenneth L., Boldizar, Janet P., 1990. Gender segregation in higher education: effects of aspirations, mathematics achievement, and income. Sociology of Education 63 (1), 62–74.

Wine, Jennifer S., Heuer, Ruth E., Wheeless, Sara C., Francis, Talbric L., Franklin, Jeff W., Dudley, Kristin M., 2003. Beginning Postsecondary Students longitudinal study: 1996–2001 (BPS: 1996/2001) methodology report. Educational Statistic Quarterly 4 (3). Topic: Methodology, available at <http://www.nces.ed.gov/programs/quarterly/vol_4/4_3/7_1.asp>.

Xie, Y., Shauman, K., 2003. Women in Science: Career Processes and Outcomes. Harvard University Press, Cambridge.