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ABSTRACT

Using a panel of 159 institutions over ten years, we investigate the role model effect of women faculty and quantitative requirements on the female proportion of undergraduate economics majors. We find no evidence that female faculty attract female students. Calculus, however, does matter. A one semester calculus requirement is associated with more female majors at institutions offering business degrees and liberal arts colleges. A second semester calculus requirement deters women from majoring in economics at Ph.D. granting universities, but is associated with more female majors at liberal arts colleges. Econometrics requirements are unrelated to the gender gap in economics majors.

1. INTRODUCTION

The proportion of women undergraduate economics majors has hovered between 30 and 35 percent for several decades (Siegfried 2017). Studies of the economics major demonstrate that gender is the most consistent, significant predictor of students' decisions to study economics at the undergraduate level.[i] Researchers have posited a number of hypotheses for female underrepresentation in economics. In the current study, we investigate whether the gender composition of economics department faculty and quantitative major requirements have a significant impact on the proportion of bachelor's degrees in economics awarded to women. We find no evidence of a positive role model effect of female faculty in attracting female undergraduate majors. On the other hand, we find that quantitative major requirements (specifically calculus) do influence the percentage of undergraduate economics degrees awarded to women but not always in the expected direction. At institutions offering an undergraduate business degree and liberal arts institutions, requiring first semester calculus is associated with more female economics majors. Requiring second semester calculus is associated with more female economics majors at liberal arts institutions, but fewer at Ph.D. granting institutions.

2. BACKGROUND

A limited number of empirical studies investigate reasons for female underrepresentation in the economics major. Some address the same explanations we investigate here: gender composition of economics department faculty (i.e., role model effect) and quantitative major requirements.

ROLE MODELS

One explanation posited for the relatively low proportion of females in economics is the lack of same-sex role models in the discipline. Existing studies draw data from a range of sources and provide mixed findings.

Single institution studies focusing on economics provide researchers an opportunity to analyze students' decisions to major in economics as it relates to the gender of their principles instructor. In studies conducted at Harvard University and Brock University, Dynan and Rouse (1997) and Robb and Robb (1999), respectively found that having a female instructor in introductory economics contributed virtually nothing toward explaining a student's decision to major in economics. Fournier and Sass (2000) discovered that having a female principles instructor increased the likelihood of taking additional economics courses at Florida State (by seven percent) for both men and women.

Other studies of the female role model effect in economics draw data from multiple institutions. With data from three institutions across a range of disciplines, including economics, Canes and Rosen (1995) found that the percentage of female faculty at the time students were making their decision to major (an average over the first two years) had no observable impact on their major decision. In their survey of two Southern liberal arts institutions, Smith and Zenker (2014) found no differential effect by gender of having had a female instructor for economics on a student's likelihood of majoring in the discipline. Bettinger and Long (2005) identified the proportion of courses a first year student took with a female faculty member in a particular subject at 14 Ohio universities and found that having a female instructor decreased the probability of majoring in economics. Using a cross section of 195 institutions, Ricks (2007) found a positive relationship

between the proportion of females on the economics faculty and the proportion of economics majors who are female. Additional support for the role model hypothesis comes from a survey of students (Jenson and Owen 2001) taking introductory economics at 34 liberal arts colleges where female students taking principles from a female professor reported greater interest in taking another economics course. However, they showed no greater inclination to major in economics.

Still other studies investigate the role model hypothesis more generally. Across all majors at Colgate University, Rask and Bailey (2002) found that female (male) students who had a female introductory course instructor were more (less) likely to major in that discipline. However, because their analysis aggregates across all majors at Colgate, one cannot necessarily generalize these results to a single major (e.g., economics). In another study using data across all majors at a selective liberal arts institution, Griffith (2014) found no evidence of a direct female role model effect on taking subsequent courses or majoring, although her work identified a possible indirect effect, namely that female students earn higher grades in courses taken from female faculty. Finally, in a study of STEM majors, Griffith (2010) found that even though persistence of females in undergraduate STEM majors was insensitive to rates of female faculty, they were more likely to persist the higher the percentage of female graduate students in their discipline.

QUANTITATIVE REQUIREMENTS

According to the quantitative requirements hypothesis, women have either lower mathematical aptitude, preparation, confidence, or interest than men, and are thereby discouraged from studying economics (Dynan and Rouse 1997).

While some studies document the quantitative course requirements across economics departments (Siegfried and Bidani 1992; Johnson, Perry and Perkus 2012; Siegfried and Walstad 2014)[ii] or the extent to which economics and business majors must pass quantitative courses (Bosshardt and Watts 2008), only Ricks (2007) directly tests the hypothesis that differential quantitative requirements impact the sex ratio of majors. Using departmental requirements for calculus and statistics she gathered for a cross-section of 195 institutions in 2002, Ricks found no evidence that quantitative requirements can predict the male/female mix of economics majors.

Quantitative requirements may not only differ across institutions, but may also change over time at a single institution. For example, Margo and Siegfried (1996) suggest that departments may adjust major requirements in response to changing demand for the economics major – tightening (loosening) requirements in periods of increasing (decreasing) demand and greater (less) resource scarcity. As such, panel studies provide the opportunity to observe changes in degree requirements over time and institutions.

COMPETING MAJORS

Students select a major from a menu of options. Thus, it is also important to control for competition from alternative majors. Existing empirical studies investigate two alternatives to economics: business and biology.

One often suggested substitute for majoring in economics is the business major. Using detailed information from 546 economics departments, Siegfried and Wilkinson (1982) examined the

proportion of an institution's student body that majors in economics. They found that, ceteris paribus, the existence of a directly competing business major reduced the number of economics bachelor's degrees awarded by more than the entire average-size economics program. Exploring the same question, Willis and Pieper (1996) identified the relationship between the number of business and economics majors across institutions in 1987. They too found a negative relationship between whether schools offer a business degree and the number of economics majors.[iii] However, more recent evidence (Stock, 2017) fails to support the idea that undergraduates view business as a substitute for economics.

Salemi and Eubanks (1996) posited the "discouraged business major" hypothesis, whereby students screened out from a business degree choose to study economics as a second best alternative. Using individual student data from the University of North Carolina at Chapel Hill, they estimated that 69 percent of economics majors were discouraged business students; namely, students that failed to meet the academic standards required to transfer into business after their sophomore year. More recently, Asarta and Butters (2012) confirmed the discouraged business major phenomenon. However, they found that while a small number of students are best described this way, other highly qualified business school students are actually attracted to economics.

General findings regarding substitution between economics and business may differ by gender. Women constitute a larger proportion of bachelor's degrees awarded in economics at private, economics Ph.D. granting universities and selective liberal arts colleges (Siegfried, 2017); both categories that only rarely offer a bachelor's degree in business. Women constitute a larger share

of business than of economics majors, 46 percent vs. 33 percent (Webcasper 2017). If undergraduates view a business degree as a good substitute for an economics degree, then, institutions offering business degrees may see relatively more women enticed from economics, consequently decreasing the share of women pursuing economics.

Using National Center for Education Statistics Population Survey (NCSE) data for 1975-2003, Kasper (2008) found that among ten majors, the number of students majoring in business and in biology are the strongest predictors of the number of economics majors at an institution. While Kasper found that an increase in the number of business majors has a positive impact on the number of economics majors, the magnitude of the effect is small relative to the large negative impact of biology majors that he uncovers. The number of students in life sciences (including biology), education, and other social sciences such as anthropology and sociology correlate with a smaller share of students majoring in economics (Stock 2017). If these disciplines attract relatively more women than economics, the female to male ratio in economics will be lower.

DATA LIMITATIONS OF EXISTING STUDIES

A lack of reliable, national, comprehensive data has limited empirical studies addressing the importance of role models, academic requirements, and majors on offer in affecting undergraduate students' major decisions.[iv] Many existing studies have been limited to data drawn predominantly from a single institution, a sample of liberal arts institution(s), or both. Other studies use aggregated measures (such as "social sciences"), limiting specific interpretation to the economics major. Further, studies that use a larger sample of institutions fail to capture important department level characteristics such as the sex ratio of faculty in the

department, or curriculum requirements. Our current study overcomes these limitations by using a panel of 10 years of institutional data (such as sex ratios for total degrees conferred and degrees in other disciplines) supplemented with departmental characteristics (sex ratio of economics department faculty, quantitative course requirements) across a large number of institutions. The use of panel data allows us to estimate role model and quantitative requirement effects from variation both within and among institutions.

3. DATA

The American Economic Association administers its Universal Academic Questionnaire (UAQ) every fall to economics departments in the US. Departments are asked to provide various information including the number of undergraduate degrees awarded to men and women. In this study, we use bachelor's degree data from 2001 through 2010 as reported by 159 economics departments each year. Degrees awarded by departments in this sample average 73 degrees per department per year, of which an average of 30 percent were awarded to females. Over the decade, programs at institutions offering business degrees awarded an annual average of 71 degrees while those at institutions without business degrees awarded an average of 85 economics degrees, a statistically significantly difference, suggesting that economics may function as a substitute for a business degree at the elite private Ph.D. granting universities and selective liberal arts colleges where business degrees are seldom offered. Both institutions with and without a business degree offering awarded just under a third of their economics degrees to females (30, and 31 percent, respectively). Some institutions offering a business degree house their economics department in the business college, while at others it is located in a college of letters and science or a college of liberal arts. At some institutions an economics degree can be

earned in either the business college or the college of liberal arts. And a few institutions, mostly smaller private liberal arts colleges, offer a business degree housed in their college of letters and science.

Given the drastically different environments at liberal arts and Ph.D. granting institutions, we also analyze degree awards for these subsamples. Not surprisingly, Ph.D. granting institutions conferred about three times as many economics degrees as liberal arts institutions (on average 148 and 49, respectively). However, liberal arts institutions awarded a significantly greater percentage (31 versus 29) of their degrees to women. See Table 1 for full period and yearly summary statistics for the degrees awarded at all institutions and separated by institutions with and without business degrees, and for the subsamples of liberal arts and Ph.D. granting institutions.

We augment the UAQ data with institutional level data from the Integrated Postsecondary Education Data System (IPEDS). These data allow us to control for institution-wide student body and faculty characteristics. For each institution in our sample, we draw measures for the proportion of degrees (total, math and science, and business) awarded to females, and institutional level faculty counts separated by gender. Universities in our sample awarded 56.0 percent of all undergraduate degrees to females during the sample period. A statistically significantly higher proportion of overall undergraduate degrees were awarded to females at institutions offering business degrees (56 percent) than those without business programs (53 percent). Institutions offering business degrees also awarded a significantly larger proportion of their degrees in math and science to females (54 percent) than did institutions without business

programs (50 percent). For schools offering a business degree, less than half (44 percent) of their undergraduate business degrees were earned by women. Faculty gender distribution is about the same at all types of institutions except those that award Ph.D.s. The faculties at the latter are about 33 percent female, while for the other groups they are 37 or 39 percent. Liberal arts institutions awarded a statistically significantly greater percentage (55) of their undergraduate degrees to females in comparison to Ph.D. granting institutions (52). A significantly smaller percentage of the full-time faculty at Ph.D. granting institutions are female than at liberal arts institutions (34 and 39, respectively). Summary statistics for all data drawn from IPEDS are reported in Table 2.

In order to control for departmental faculty characteristics and quantitative degree requirements, we administered a supplemental survey to the economics departments. The survey asked departments to report full-time faculty counts (by gender) and to report math, statistics and econometrics requirements for the economics degree for each year over the same period. A total of 159 departments (of the 269 for which we have UAQ and IPEDS data) completed the supplemental survey; a response rate of just under 60 percent. Of those responding to the supplemental survey, the average economics department consisted of 15 full-time faculty with 20 percent of the members female. Departments at institutions with and without business programs were of similar size (15 and 16 members, respectively), but a significantly smaller proportion of the economics faculty at institutions offering business degrees was female (18 vs. 27 percent). Although Ph.D. granting institutions have significantly larger economics departments than those located in liberal arts schools (25 and 9 members, respectively), the latter have a significantly greater percentage of female faculty (28 vs. 15 percent).

Requirements for the economics degree vary, but often include calculus, statistics and/or econometrics. Because virtually all undergraduate economics programs require statistics (Siegfried and Walstad, 2014; and indeed this is true for our sample as well), for the purposes of this research, we focus on the calculus and econometrics requirements. Of the 159 departments reporting calculus requirements, 67 percent required a single calculus course (i.e. a first course in differential or single variable calculus) while only 11 percent required two or more calculus courses. Twenty-two percent of economics departments did not require their majors to take any calculus.[v] Departments at institutions offering business programs were significantly less likely to require at least one course in calculus vis-a-vis those departments at institutions without business programs (75 vs. 91 percent) or two calculus courses (11 vs. 16 percent). Slightly over 80 percent of programs at either selective liberal arts or Ph.D. granting institutions required some calculus, although Ph.D. granting institutions were significantly more likely to require a second course in calculus (20 vs. 8 percent). Forty-three percent of the sample reported that econometrics was a requirement-for an economics degree. A significantly greater percentage of institutions without business degrees have such a requirement (76 vs. 36 percent); significantly fewer programs at Ph.D. granting institutions required econometrics as compared to those at selective liberal arts institutions (43 vs. 60 percent). See Table 3 for summary statistics on department specific measures.

4. METHODOLOGY AND RESULTS

Our data span 2001-2010 for 159 economics departments at a range of public and private institutions. We estimate the percentage of economics bachelor's degrees awarded to females at

these institutions as a function of the percentage of all degrees at the institution awarded to females, the extent of the presence of female role models in economics relative to the rest of the institution, economics degree quantitative requirements, and other university characteristics. Differences in the impact of female faculty presence and curriculum requirements can be identified cross-sectionally across institutions. The nature of our data, however, also allow us to identify the nature of these relationships within institutions when specific institutions make changes in their curriculum during the ten year period of the data, or change the composition of their faculty so that the percentage female varies over time at specific colleges and universities. Of our 159 sample colleges and universities, 3 percent changed their calculus requirements during the decade and 8 percent changed their econometrics requirement. Thus most, but not all of the effect of quantitative requirements is identified cross-sectionally. Eight percent of the institutions maintained the exact same ratio of female to total faculty over the period, leaving 92 percent reflecting a change. Thus, our test for gender role models is identified both cross-sectionally and by differences over time within institutions.

We estimate the impact of university and department characteristics on the percentages of bachelor's degrees in economics awarded to females at institution i in year t using our panel data:

$$\%\ \text{Economics Degrees to Females}_{it} = \alpha + \boldsymbol{X}_{it}\boldsymbol{\beta} + u_{it} \qquad (4.1)$$

where $\boldsymbol{X}_{it}$ is a vector of university and department characteristics, and includes a time trend.

Tables 4 and 5 report estimates for institutions with and without business programs, respectively, and tables 6 and 7 report estimates for liberal arts colleges and economics Ph.D. degree granting

universities, respectively.[vi] The potentially most important factor influencing the percentage of economics degrees awarded to females is the percentage of students at the institution that is female, and so we begin by controlling for the institution-wide percent of the total number of bachelor's degrees awarded to females. We get the expected result for institutions that do not have a business program on campus and for economics Ph.D. granting institutions and liberal arts colleges, but surprisingly the fraction of the overall degrees awarded to females does not seem to matter for the propensity of women to major in economics at universities that host a business program.[vii] In light of the pattern of results across types of colleges and universities, this case would appear to be centered primarily at regional (non-Ph.D. producing) state universities.

Second, consider the impact of the presence of female faculty on female students' decisions to major in economics. We model this possibility in two ways: the direct effect of female role models in economics on the decision of undergraduate women to major in economics, and, secondly, the *relative* prevalence of women faculty in economics compared to their prevalence in all departments at their institution, as Ricks (2007) found to be important. The first functional form is reported in column (1) of tables 4-7, and the second in column (2) of the same tables. (Both variables are lagged by two years to be consistent with the time when students typically choose their major). The results indicate virtually no positive role model effect of female faculty, as none of the relevant variables in either of the specifications obtains a statistically significant positive coefficient relating it to the proportion of bachelor's economics degrees that go to women.[viii]

The indicators that one semester of calculus, two semesters of calculus, and econometrics are required to graduate with a major in economics are also included with a two-year lag to represent their status when students made the decision whether to major in economics. Our hypotheses, based on the stereotypical view that women are more likely to avoid quantitative requirements, are that each of these indicators of a more quantitative curriculum will obtain a negative coefficient. In this case, we obtain the expected results for just one of the requirements at just one type of institution—a second semester of calculus requirement at universities that grant Ph.D.s in economics. The estimated coefficients suggest that departments meeting these criteria would be expected to have five percentage points fewer women among their graduating classes. Instead, we find considerably more evidence counter to our hypothesis. At institutions offering business degrees and liberal arts institutions, we find that requiring first semester calculus is associated with a higher percentage of economics degrees awarded to females – ten and six percentage points, respectively. Further, liberal arts institutions requiring a second semester of calculus enjoy an additional six percentage point increase in female economics major graduates. While calculus requirements appear to impact female major rates, there seems to be no effect of requiring econometrics, which is now the situation at almost half of the departments offering an undergraduate degree in economics in the United States (and over 40 percent in our sample) (Siegfried and Walstad, 2014).

Finally, we control for economics departments that face aggressive competition for female students with strong quantitative skills by including the proportion of mathematics and biological and physical sciences degrees awarded by each institution to women (again lagged two years), but find no statistically significant results.

5. CONCLUSION

This study uses a relatively rich data set (as compare to previous investigations) including 10 years of department level data to evaluate the degree to which female faculty role models and quantitative requirements influence the sex ratio of economics majors, controlling for other institutional characteristics. We find no evidence of a female faculty role effect inducing more women to choose economic as their major. We do find some impact of higher quantitative requirements, but not necessarily in the expected direction. Counter to expectations, requiring first semester calculus is associated with a higher percentage of female economics majors at institutions offering undergraduate business degrees and at liberal arts institutions. Liberal arts institutions where a second semester of calculus is also required for the economics major experience additional gains in female majors. Only at Ph.D. granting institutions does requiring second semester calculus deter women from choosing to major in economics.

We believe that there are several conclusions to draw from this study. First, the influence of female role models in economics education is far from settled. Evidence in the literature is mixed, including the full range of possible outcomes – positive, negative, no effect. Additional study is required. Second, while direct empirical investigation into the quantitative requirements hypothesis is limited (Ricks, 2007 and the present study), no substantial support has been found. In fact, we find some evidence that stronger requirements are associated with higher rates of female economics majors. Yet, many mistakenly believe that quantitative requirements deter females from studying economics. We would encourage departments to set their major requirements to best prepare their graduates for the realities of the job market, as opposed to any

other possible consideration. Third, our understanding of competing and complementary majors is still evolving. Additional study to identify which majors serve as substitutes and complements for economics will help us better understand the demand for our product. Finally, given that our analysis explained less than twenty percent of the variation in female major rates, there are likely other additional factors contributing to the low rates of female undergraduate majors in economics. Investigation into other potentially important factors is warranted.

On the last point, Claudia Goldin has suggested (in a recent personal conversation with one of the authors) that women may be more sensitive to signals they receive about their prospects in economics.[ix] Using data from a large private research university, Goldin discovered that women who received high grades in introductory economics courses tended to continue their study of economics, while women who received low grades in introductory economics sought their fortunes in other disciplines. However, a different pattern emerged for men. Both men who received high grades and men who received low grades in introductory economics continued to pursue a major in economics at approximately similar rates suggesting that those men collecting warning signals in terms of their introductory economics course grades remain oblivious to the risks of majoring in economics.[x] The gender difference in response to introductory grade signals is just one potential type of differential response to information. Women and men may differentially respond to the information the discipline distributes regarding areas of study within economics (e.g., research topics) or potential career options. We believe differential responses to information are a promising area for investigation to help us better understand (and possibly address) the low rates of female economics majors.

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ENDNOTES

[i] Women are less likely to study economics at all levels – principles, intermediate, major (Emerson, McGoldrick, and Mumford 2012).

[ii] In 2013 about three-quarters of economics departments required calculus and just under half required an econometrics course (beyond the basic economic statistics course, required virtually everywhere.) (Siegfried and Walstad 2014)

[iii] Willis and Pieper (1996) control for the number of undergraduate degrees conferred, admittance selectivity, institutional type (public, private), whether the institution offered a graduate degree (MA or PhD), and whether the institution offered a business, business economics, or other combined economics major.

[iv] For example, a commonly used source that documents the number of majors across disciplines, National Center for Education Statistics Population Survey (NCSE), has historically underreported the number of economics degrees awarded because it did not count the second of double majors. Siegfried and Wilkinson (1982) estimated that for 1980, "the NCES recorded only 82 percent of the economics degrees awarded." (327)

[v] While these economics degree programs did not require a calculus course, it is possible that college- or institution-wide general distribution requirements might have exposed even those students to some calculus.

[vi]In conducting our empirical analysis we conducted a Hausman test that rejected a random effects model, applied a Durbin-Watson test to ensure there was no serial correlation, and orrected standard errors for existing heteroskedasticity.

[vii] Salemi and Eubanks (1996) demonstrated that economics and business are substitute majors in the view of some students. In order to test whether characteristics of economics programs were

potentially driving female students to business (and away from economics), we estimate the same model specifications for the three relevant subsamples (excluding institutions without business programs) but with the percent female in business majors as the dependent variable. We find no evidence to suggest that the characteristics of the economics departments are driving students to major in business instead of economics.

[viii] While we find no evidence of a positive female role model effect, we do estimate a significant negative coefficient on the percent of female faculty in economics at institutions without business degrees. Nonetheless, we believe that overwhelmingly the findings suggests no evidence of a female role model effect – neither positive nor negative.

[ix] Rask and Tiefenthaler (2008), Jensen and Owen (2001), and Owen (2010) also find evidence of greater grade sensitivity on the part of females. In particular, Owen finds that receiving an A in their first economics course, significantly and materially increases the probability of females majoring in economics, but no such effect on males.

[x] The result of this pattern is relatively more men than women moving forward with the economics major, with the men more likely to constitute the bottom tail of the grade distribution in subsequent courses in the major.

Table 1. Bachelor's Degree Awards by Year, Gender, and Institution Type

	All institutions		Institutions with Business Degrees		Institutions without Business Degrees		Liberal Arts Institutions		Ph.D. Granting Institutions	
	Total	% Female	Total	% Female	Total	% Female	Total	% Female	Total	% Female
2001	57.69	33.85	54.65	33.93	72.74	33.45	40.72	33.43	118.54‡	30.69
	(90.41)	(14.60)	(94.37)	(15.51)	(67.12)	(9.08)	(22.91)	(10.46)	(134.17)	(9.92)
2002	61.96	32.39	60.26	33.16	70.30	28.61	41.69	28.13	129.84‡	32.39‡
	(97.39)	(16.61)	(102.91)	(17.77)	(64.75)	(8.17)	(25.15)	(11.09)	(144.17)	(10.54)
2003	66.56	31.42	64.16	31.07	79.09	33.22	44.00	33.44	136.92‡	27.41‡
	(102.67)	(14.94)	(106.37)	(16.05)	(81.51)	(6.63)	(25.90)	(6.53)	(148.43)	(9.59)
2004	71.61	31.80	69.08	31.98	84.25	30.88	45.48	31.15	144.68‡	30.02
	(105.55)	(12.75)	(109.58)	(13.65)	(83.26)	(6.70)	(25.53)	(9.12)	(150.31)	(8.04)

2005	72.90	28.44	70.02	27.89	87.16	31.16	48.88	30.57	145.86‡	27.29‡
	(103.13)	(12.00)	(106.33)	(12.78)	(85.96)	(6.48)	(32.23)	(7.51)	(145.45)	(8.77)
2006	73.60	29.86	70.94	30.08	86.68	28.77	48.91	29.60	145.82‡	29.23
	(101.10)	(11.60)	(103.89)	(12.18)	(86.75)	(8.30)	(30.73)	(8.27)	(141.66)	(8.41)
2007	72.51	29.28	69.51	29.41	87.40	28.64	49.31	29.24	146.70‡	27.30
	(100.83)	(12.95)	(102.74)	(13.80)	(91.20)	(7.58)	(33.02)	(9.24)	(142.14)	(8.32)
2008	76.32	27.49	73.38	26.58	91.16	32.06†	57.06	32.25	151.41‡	26.96‡
	(103.27)	(11.66)	(107.40)	(12.13)	(79.41)	(7.62)	(37.16)	(7.60)	(144.81)	(8.62)
2009	86.90	28.66	84.49	28.30	98.58	30.41	55.70	30.80	174.48‡	28.93
	(120.02)	(13.81)	(125.72)	(14.79)	(88.35)	(7.68)	(38.16)	(10.37)	(163.36)	(15.43)
2010	90.13	28.02	89.56	26.82	93.04	34.05†	53.94	32.50	181.96‡	26.22‡

	(130.70)	(11.49)	(137.99)	(11.38)	(87.07)	(10.24)	(36.59)	(11.12)	(181.69)	(8.98)
2001	73.33	30.05	70.91	29.84	85.37†	31.11	48.76	31.09	148.44‡	28.57‡
-2010	(106.44)	(13.40)	(110.70)	(14.23)	(81.14)	(8.02)	(31.40)	(9.25)	(150.41)	(9.99)
Number of Institutions	159		133		26		37		54	

Means and standard deviations (in parenthesis) reported

†Differences between with and without business school means statistically significant at the 5% level

‡Differences between liberal arts and PhD institutions means statistically significant at the 5% level

Table 2. Institution Specific Measures by Institution Type, 2001-2010

	All institutions	Institutions with Business Degrees	Institutions without Business Degrees	Liberal Arts Institutions	Ph.D. Granting Institutions
% Degrees Awarded to Females	55.67	56.16	53.26†	54.65	52.37‡
	(5.63)	(5.82)	(3.76)	(4.40)	(5.10)
% Full-time Faculty Female, lagged 2 years	37.00	37.05	36.71	38.60	33.52‡
	(6.07)	(6.09)	(5.98)	(5.55)	(5.24)
% Math, Biological, Physical Science Degrees Awarded to Females, lagged 2 years	53.48	54.16	50.10†	52.41	52.01
	(7.55)	(7.51)	(6.78)	(8.07)	(5.88)
% Business Degrees Awarded to Females		43.75			
		(8.16)			
Observations	1,460	1,216	244	325	501
Number of Institutions	159	133	26	37	54

Means and standard deviations (in parenthesis) reported

†Differences between with and without business school means statistically significant at the 5% level

‡Differences between liberal arts and PhD institutions means statistically significant at the 5% level

Table 3. Department Specific Measures by Institution Type, 2001-2010

	All institutions	Institutions with Business Degrees	Institutions without Business Degrees	Liberal Arts Institutions	Ph.D. Granting Institutions
Number of full-time faculty in Economics Department	15.11	14.97	15.83	9.18	25.24‡
	(10.68)	(9.66)	(13.69)	(3.85)	(10.90)
% Economics Faculty Female	19.72	18.31	26.75†	27.76	14.73‡
	(13.56)	(12.81)	(14.97)	(14.27)	(8.15)
% Requiring Calculus I	0.78	0.749	0.91†	0.85	0.82
	(0.42)	(0.43)	(0.28)	(0.02)	(0.02)
% Requiring Calculus II	0.11	0.11	0.16†	0.08	0.20‡
	(0.32)	(0.31)	(0.37)	(0.02)	(0.02)
% Requiring Metrics	0.43	0.36	0.76†	0.60	0.43‡
	(0.50)	(0.48)	(0.43)	(0.49)	(0.50)
Observations	1,460	1216	244	325	501

Number of Institutions	159	133	26	37	54

Means and standard deviations (in parenthesis) reported

†Differences between with and without business school means statistically significant at the 5% level

‡Differences between liberal arts and PhD institutions means statistically significant at the 5% level

Table 4. Estimation of Percent of Economics Degrees Awarded to Females, Institutions with Business Degrees

	% Eco Degrees Female (1)	% Eco Degrees Female (2)
% Total Degrees to Females	0.30	0.30
	(0.23)	(0.23)
% Full-time Economics Faculty Female, lagged 2 years	-0.03	--
	(0.10)	
Ratio of Female Faculty, lagged 2 years	--	-19.00
		(156.21)
Calculus I Required for Economics Degree, lagged 2 years	9.58**	9.52**
	(0.99)	(0.92)
Calculus II Required for Economics Degree, lagged 2 years	-4.47	-4.48
	(6.83)	(6.826)

Metrics Required for Economics Degree, lagged 2 years	-0.18	-0.16
	(1.61)	(1.62)
% Math and Science Degrees to Females	0.05	0.05
	(0.09)	(0.09)
Time trend	-2.83	-2.89
	(1.81)	(1.85)
Time trend squared	0.06	0.06
	(0.05)	(0.05)
Constant	35.28**	35.51**
	(19.88)	(20.41)
Institutional Fixed Effects	Included	Included
R^2	0.04	0.04
N	1,216	1,216

* $p<0.05$; ** $p<0.01$

Table 5. Estimation of Percent of Economics Degrees Awarded to Females, Institutions without Business Degrees

	% Eco Degrees Female	% Eco Degrees Female
	(1)	(2)
% Total Degrees to Females	1.02**	1.03**
	(0.14)	(0.14)
% Full-time Economics Faculty Female, lagged 2 years	-0.22**	--
	(0.08)	
Ratio of Female Faculty, lagged 2 years	--	-77.76
		(61.65)
Calculus I Required for Economics Degree, lagged 2 years	-1.23	-2.06
	(2.47)	(2.63)
Calculus II Required for Economics Degree, lagged 2 years	3.95	4.49
	(3.54)	(3.78)

Metrics Required for Economics Degree, lagged 2 years	3.76	3.37
	(4.86)	(5.17)
% Math and Science Degrees to Females	-0.13	-0.12
	(0.10)	(0.10)
Time trend	-4.28	-4.27
	(3.09)	(3.24)
Time trend squared	0.12	0.12
	(0.09)	(0.09)
Constant	23.98	20.80
	(28.43)	(29.81)
Institutional Fixed Effects	Included	Included
R^2	0.16	0.14
N	244	244

* $p<0.05$; ** $p<0.01$

Table 6. Estimation of Percent of Economics Degrees Awarded to Females, Liberal Arts Institutions

	% Eco Degrees Female (1)	% Eco Degrees Female (2)
% Total Degrees to Females	0.72**	0.73**
	(0.18)	(0.18)
% Full-time Economics Faculty Female, lagged 2 years	-0.03	--
	(0.10)	
Ratio of Female Faculty, lagged 2 years	--	9.06
		(63.36)
Calculus I Required for Economics Degree, lagged 2 years	5.60**	5.55**
	(2.13)	(2.18)
Calculus II Required for Economics Degree, lagged 2 years	6.22**	6.33**
	(2.34)	(2.33)

Metrics Required for Economics Degree, lagged 2 years	2.04	2.01
	(3.24)	(3.26)
% Math and Science Degrees to Females	-0.10	-0.10
	(0.06)	(0.06)
Time trend	-4.07	-4.19
	(3.05)	(3.06)
Time trend squared	0.11	0.11
	(0.09)	(0.09)
Constant	27.57	26.90
	(28.21)	(28.38)
Institutional Fixed Effects	Included	Included
R^2	0.07	0.07
N	325	325

* $p<0.05$; ** $p<0.01$

Table 7. Estimation of Percent of Economics Degrees Awarded to Females, Ph.D. Granting Institutions

	% Eco Degrees Female (1)	% Eco Degrees Female (2)
% Total Degrees to Females	0.71*	0.72*
	(0.28)	(0.28)
% Full-time Economics Faculty Female, lagged 2 years	-0.01	--
	(0.12)	
Ratio of Female Faculty, lagged 2 years	--	13.34
		(79.99)
Calculus I Required for Economics Degree, lagged 2 years	collinear	collinear
Calculus II Required for Economics Degree, lagged 2 years	-4.89**	-4.94**
	(0.78)	(0.78)

Metrics Required for Economics Degree, lagged 2 years	0.33	0.30
	(0.92)	(0.94)
% Math and Science Degrees to Females	0.01	0.01
	(0.08)	(0.08)
Time trend	-2.04	-2.02
	(1.56)	(1.55)
Time trend squared	0.05	0.05
	(0.05)	(0.04)
Constant	12.47	12.09
	(21.06)	(20.61)
Institutional Fixed Effects	Included	Included
R^2	0.05	0.05
N	501	501

* $p<0.05$; ** $p<0.01$