

Additional Analysis for "Gender Differences in the Choice of Major: The Importance of Female Role Models"

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Female instructors can inspire high-school and undergraduate students to pursue a STEM career ([Carrell et al., 2010](#); [Paredes, 2014](#)). In this document I will explore whether female professors served as a catalyst for the role models to inspire students to major in economics. The idea is that students who were exposed to the role model visit and had a female teacher would have greater engagement with the economics major.

Do female professors enhance the effects of the external role models intervention?

To explore this question, I used the paper's equation (2) and added triple interaction between a the professor's gender, the treated classes, and if the class was taught in 2016 for each student i :

$$Y_i = \beta_0 + \beta_1 dt_i + \beta_2 dT_i + \beta_3 dFP_i + \beta_4 dt_i \times dT_i + \beta_5 dt_i \times dFP_i + \beta_6 dT_i \times dFP_i + \beta_7 dt_i \times dT_i \times dFP_i + \delta X_i + \varepsilon_i \quad (1)$$

The variable dt_i is a dummy equal to one if the class was taught in 2016 and zero if it was taught in 2015, dT_i is a dummy equal to one if it is a treated class and zero otherwise, dFP_i is a dummy equal to one if the professor was female and zero if it was male,

X_i is a vector of controls accounting for the accumulated GPA of the student, the grade obtained in the principle class, if the size of the class was small and other demographic characteristics of the student.

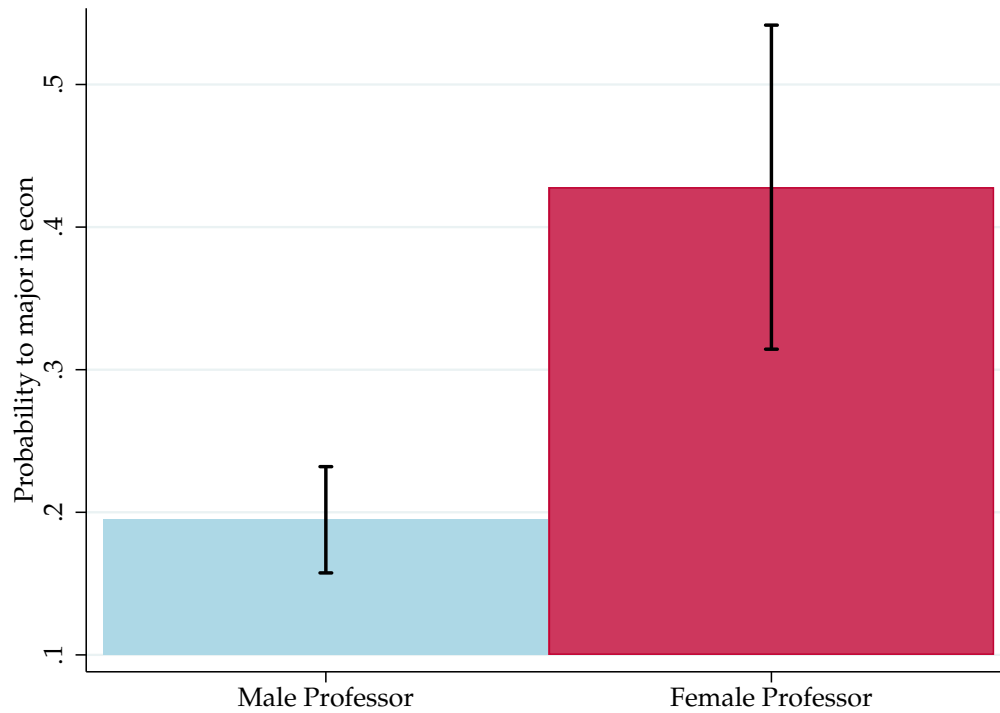
Although the intervention was random, there is no guarantee that female professors are exogenous to the model. In other words, I cannot infer that female professors have a direct impact on economic mayor engagements of the classroom using my specification.

I am interested in the coefficient β_7 that can tell me whether there is a significant difference of the economics major engagement between students on treated classes in 2016 that had a female professor versus the treated classes in 2016 that had a male professor. Closely following the paper's method, I then estimated the linear model 1 for female and male students by OLS, clustered the standard errors by class and used wild bootstrapping to account for small clusters.

Female students Table 1 shows the results of the model 1 for female students. Focusing on the coefficient of interest, female professor only enhanced female students' immediate interest in the economics mayors. In the first column female professors had a significant positive correlation with female students taking an economics class the next Fall. The remaining columns report positive but insignificant correlations. This suggests that female professors enhanced the immediate interest of their female students who were exposed to the role models.

Male students While male students were not inspired by the one visit of the female role models, they might have been inspired by female professors. Table 2 reports the model 1 estimations for male students. In contrast with the female students, female professors of treated classes might have an immediate and prolonged effect on male students. Female professors might deter male students to take an econ class next Fall, showed in the first column on Table 2. In other words, students who were exposed to role models and had a female teacher were likely to take an economics class next fall compared to those treated male students that had a male professors. This seems to be consistent with the idea that

Figure 1: Male student's probability of choosing econ major by female professor



Note: the probability was estimated using a Probit model with specification 1. The black lines represent the 95% confidence intervals.

effective role models tend to be the same gender of the student.

Column 2 in Table 2 shows how male students seem to negatively respond to the intervention of the role models, controlling for the gender of the professors. In fact, the interaction between treated class and the dummy of the class taught in 2016 is both negative and significant, regardless of the professor's gender. However, those male students who were exposed to the role models and female professors were more likely to major in economics. This finding implies that male students can be inspired by female role models, but they cannot be exposed to a male role model in the classroom. Figure 1 quantifies the likelihood of majoring in economics for treated male students by their professors's gender by estimating equation 1 as a Probit model. Treated male students with a female professor are roughly 20% more likely to mayor in economic than treated male students with a male professor.

Are female professors better teachers? Male students could be inspired by female professors to pursue economics because female professors can be more caring or better teachers than their male counterparts. Table 3 attempts to test this hypothesis by looking at what drives the students' grades in the Principles class across the sample. Female professors might negatively influence the overall grade of the class, but this coefficient is statistically insignificant suggested by the insignificant coefficient. Sadly, I cannot assess whether female professors are more caring to their male students and through this channel inspiring them to major in economics.

To isolate the correlation between grades and female professors I controlled for small classes, accumulated GPA up until the Principles class and the students' intended econ major. While high achieving students prior the Principles class had better grades in the class, class size and the student's intent to major in econ had no effect on their grades.

Closing Remarks There is to be some evidence supporting that female professors could have inspired male students that interacted with the role models. Female professors could have negative short-term effect on the student's choice to immediately take an economics class next semester, but female professors positively correlated with higher male economics majors subjected to the role-model visit. I think this finding suggests that female professors can inspire male students when the students reflect on the opposite gender experiences and teachings. Overall, the economics literature has yet to understand how role models could mitigate gender disparities in STEM fields and when are they appropriate to implement.

References

- Carrell, S., M. Page, and J. West (2010, aug). Sex and Science: How Professor Gender Perpetuates the Gender Gap. *Quarterly Journal of Economics* 125(3), 1101–1144.
- Paredes, V. (2014, apr). A teacher like me or a student like me? Role model versus teacher bias effect. *Economics of Education Review* 39, 38–49.

Table 1: Female professor and treated effects on female student's outcomes

	Took class next Fall	Major in economics	Number of econ classes	Took another econ class
Female Professor \times Year 2016 \times Treated class	0.118 (0.041) [0.005, 0.220]	0.099 (0.322) [-0.099, 0.253]	0.353 (0.633) [-1.757, 1.375]	0.023 (0.877) [-0.481, 0.281]
Female Professor \times Year 2016	-0.020 (0.667) [-0.129, 0.142]	-0.059 (0.397) [-0.214, 0.224]	-0.256 (0.636) [-1.125, 2.052]	0.028 (0.705) [-0.126, 0.399]
Female Professor \times Treated class	0.075 (0.384) [-0.079, 0.232]	0.051 (0.310) [-0.047, 0.204]	0.419 (0.368) [-0.572, 1.738]	0.082 (0.108) [-0.018, 0.256]
Treated class \times Year 2016	0.029 (0.379) [-0.100, 0.180]	0.026 (0.593) [-0.117, 0.255]	0.323 (0.338) [-0.295, 2.332]	0.128 (0.029) [0.030, 0.480]
Female Professor	-0.008 (0.824) [-0.139, 0.044]	0.004 (0.908) [-0.173, 0.074]	-0.123 (0.736) [-1.338, 0.526]	-0.035 (0.417) [-0.186, 0.044]
Year 2016	-0.016 (0.620) [-0.144, 0.084]	0.011 (0.830) [-0.169, 0.133]	-0.012 (0.954) [-1.211, 0.652]	-0.078 (0.126) [-0.324, 0.046]
Treated class	-0.059 (0.073) [-0.226, 0.076]	-0.061 (0.067) [-0.203, 0.034]	-0.449 (0.118) [-1.944, 0.514]	-0.107 (0.026) [-0.279, -0.053]
Constant	0.009 (0.277) [-0.122, 0.351]	0.540 (0.004) [0.110, 1.028]	0.019 (0.001) [2.378, 9.292]	0.842 (0.006) [0.342, 1.354]
Controls	Yes	Yes	Yes	Yes
Observations	627	627	627	627

Note: the table reports the coefficients estimated by OLS using specification 1. Wild bootstrapping p-values are reported in parenthesis and confidence intervals in brackets.

Table 2: Female professor and treated effects on male student's outcomes

	Took class next Fall	Major in economics	Number of econ classes	Took another econ class
Female Professor \times Year 2016 \times Treated class	-0.085 (0.036) [-0.174,-0.009]	0.194 (0.067) [-0.018, 0.387]	1.870 (0.176) [-0.704, 4.132]	0.170 (0.104) [-0.046, 0.347]
Female Professor \times Year 2016	-0.044 (0.187) [-0.104, 0.041]	-0.083 (0.055) [-0.162, 0.009]	-1.151 (0.095) [-2.222, 0.250]	-0.113 (0.135) [-0.285, 0.052]
Female Professor \times Treated class	0.095 (0.466) [-0.177, 0.383]	-0.216 (0.008) [-0.345,-0.075]	-1.724 (0.015) [-2.639,-0.449]	-0.107 (0.288) [-0.273, 0.123]
Treated class \times Year 2016	0.040 (0.160) [-0.035, 0.234]	-0.155 (0.069) [-0.326, 0.010]	-1.518 (0.134) [-3.906, 0.427]	-0.156 (0.034) [-0.269,-0.031]
Female Professor	0.057 (0.640) [-0.163, 0.179]	0.141 (0.016) [0.040, 0.254]	1.197 (0.037) [0.079, 2.443]	0.128 (0.099) [-0.024, 0.234]
Year 2016	0.003 (0.896) [-0.225, 0.121]	0.081 (0.172) [-0.121, 0.365]	0.841 (0.051) [-0.004, 3.155]	0.047 (0.151) [-0.086, 0.235]
Treated class	-0.045 (0.656) [-0.525, 0.080]	0.213 (0.046) [0.012, 0.365]	1.836 (0.020) [0.419, 3.286]	0.169 (0.214) [-0.118, 0.358]
Constant	-0.022 (0.001) [0.282, 0.565]	0.737 (0.004) [0.329, 1.261]	-0.321 (0.001) [4.321,11.408]	0.857 (0.006) [0.492, 1.371]
Controls	Yes	Yes	Yes	Yes
Observations	770	770	770	770

Note: the table reports the coefficients estimated by OLS using specification 1. Wild bootstrapping p-values are reported in parenthesis and confidence intervals in brackets.

Table 3: Female professors's quality on male students

	Grade in econ principles
Female Professor	-0.175 (0.123) [-0.359, 0.087]
Small Class	0.142 (0.166) [-0.063, 0.363]
GPA	1.389 (0.000) [1.061, 1.577]
Intended econ major	0.047 (0.473) [-0.136, 0.174]
Constant	-1.531 (0.028) [-2.163,-0.249]
Observations	513

Note: the table reports the coefficients estimated by OLS using specification 1. Wild bootstrapping p-values are reported in parenthesis and confidence intervals in brackets.