GENDER PEER EFFECTS IN A PREDOMINANTLY MALE ENVIRONMENT: EVIDENCE FROM WEST POINT

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I. Introduction

There has been considerable interest in recent years in understanding how exposure to other women affects women's progress in college and in the labor market. Results are mixed, and depend upon the context and the relationships between the women. For instance, several authors find positive spillovers from having women in more senior positions in the corporate or military hierarchy (Matsa and Miller, 2011; Kurtulus and Tomaskovic-Devey, 2012; Karaca-Mandic, Maestas and Powell, 2013). Instructor gender matters in predominantly male fields. Women who have women math instructors are more apt to major in Science, Technology, Engineering and Math fields (Carrell, Page and West, 2010). Women are more likely to choose their mentor officer's branch when their mentor is a woman (Kofoed and McGovney, forthcoming).

The literature reports both positive and negative spillovers of women on their women peers, with negative effects dominating the literature in economics. Kunze and Miller (2017), using matched employer-employee on white collar workers at 4,000 Norwegian firms, find that women with more women peers are less likely to be promoted. Karaca-Mandic et al. (2013) report a similar result using data on enlisted soldiers in the US Army.

What explains the disparity in the literature? The direction of the peer spillover effects is ambiguous a priori. Ibarra et al. (2010) discuss positive effects due to the support that women provide to other women. However, there is a countervailing negative effect due to women's greater propensity to compete against other women than against men. In Gneezy et al.'s (2003) laboratory experiment, this increased competition resulted in stronger performance. Kunze and Miller point out that greater competition may result in women undermining each other in other contexts. Additionally, quotas, tokenism, and informal limits on rewards conferred on women means that a greater number of women peers can hamper women's progress in some organizations. The spillover effects, then, may vary by context

depending on the need for support and the incentives for competition (Lazear, 1989).

The context we study is West Point in the years immediately after women's admission. West Point is a four-year college that trains students (cadets) to be Army officers. The first class of women arrived, amid much controversy, in 1976. Our study period of 1977 to 1984 corresponds to the second through eighth years of women's attendance. Being a cadet at West Point at that time was a grueling experience. Many of the women were subject to particularly harsh treatment (Janda, 2002).

The company peer group exposure was intense. Cadets' barracks (dorms) were organized into 36 companies containing about 32 students per class, for a total of 128 cadets per company. In the period we study, cadets were required to take virtually all their meals at assigned company tables and engage in various other extracurricular activities with their company. There was no email and no internet, and opportunities to interact with family and non-company friends outside as well as inside the academy were very limited (Janda, 2002).

This paper builds on a literature exploiting the exogenous assignments of cadets to companies at West Point (e.g., Lyle, 2007). company. This makes it possible to avert selection bias due to choice of peer group. Our study differs from Lyle's in that it considers gender-specific peer effects and focuses on a unique period in West Point history.

We find that women cadets were 5.6 percentage points less likely than men to advance to the next year. The advancement gap, however, was smaller for women with greater exposure to women peers. According to our logit marginal effects results, adding an additional woman peer to a company increases the likelihood a female cadet will advance to the next year by 2.48 percentage points, while adding an additional male reduces the likelihood she will advance by a statistically insignificant 0.25 percentage points. Peer gender has little effect on men. As a result, substituting a female peer for a male peer reduces the gender advancement gap by 2.73 percentage points.

II. Data

Our main data sources are the 1978-1984 West Point yearbooks (*Howitzers*). Each yearbook contains 144 group pictures of cadets by class (Freshman, Sophomore, Junior and Senior) and company. From these pictures, we constructed full histories of company membership for all cadets graduating between the years 1981 and 1984, along with the histories of their companymates, by class, who did not graduate. We identified cadet gender from pictures and names. Cadets are coded as

advancing if they appeared in the subsequent class in the following year. Female and male peers are measured as the number of other women and men in the cadet's company and class – that is, they leave-out counts. This provides an unbalanced panel data set of 13,422 observations of 5,164 Freshmen, Sophomores, and Juniors over the years 1978-1984. 8.2 percent of the cadets are female, and 71.9 percent of the Freshmen eventually graduated. The probability that woman advances from one year to the next is 84.2 percent, while the probability a man advances is 89.8 percent. That is, there is a gender progression gap of 5.6 percentage points.

III. Results

Our baseline regressions reported in Table 1 are of the form:

$$(1)\ Progress_{ijct} = \alpha + \beta_F Female_i + \beta_{WP} Women_{jct} + \beta_{MP} Men_{jct} + X_{jt}\theta + \mu_c + \varepsilon_{ijct}$$

where $Progress_{ijct}$ is the continuous latent variable associated with the propensity of cadet i from in company c, to advance from class $j \in$ {Freshman, Sophomore, Junior} in year $t \in$ {1978..1983} to class $j + 1$ the following year. $Female_i$ indicates that the subject is female. $Women_{jct}$ and Men_{jct} are the number of women and men in the subject's company and class in year t (excluding the subject himself or herself). X_{jt} is a vector of controls for year and class, μ_c are company fixed effects, and ε_{ijct} is an error term.

[Insert Table 1 Here]

Our most parsimonious specification reported in Column (1) shows that the marginal effect of being a woman relative to a man is -4.73 percentage points. The $Female$ effect attenuates slightly (by about 12 percent) when we introduce the year and class controls and peer variables in Column (2), and is virtually unchanged when we then introduce the company effects in Column (3).

These results indicate two key points. First, if women are systematically placed in better, or poorer performing companies, the estimated effect of $Female$ may reflect company-level effects rather than an effect of gender per se. The Column (3) results suggest that this is not the case and supports the assertion that the placement of women into companies is as good as random with respect to cadet skill. In an additional robustness check find that the number of Freshmen women a company is assigned is unrelated to the performance of women in that company the previous year, further supporting that assignment of women is unrelated to company environment.

Second, while overall there is no apparent effect of the number of female or male peers, the differential between the two coefficients is significant albeit small (-.031 percentage points). Peer gender matters. However, these estimates are for all cadets and do not distinguish effects of peers on male and female subjects.

We allow the effects of male and female peers to differ by subject gender by estimating logit models of the form:

$$(2)\ Progress_{ijct} = \alpha + \beta_F Female_i + \beta_{WP} Women_{jct} + \beta_{MP} Men_{jct} + \beta_{FW} Female_i * Women_{jct} + \beta_{FM} Female_i * Men_{jct} + X_{jt}\theta + \mu_c + \varepsilon_{ijct}$$

Marginal effects are reported in Table 2 in the form of a 3 x 3 difference-in-difference style table. The rows refer to the gender of the peer and the columns refer to the gender of the subject.

[Insert Table 2 Here]

The estimated effect marginal effect of .0248 in the first row of Column 1 means that adding an additional woman peer, holding the number of men constant, increases the likelihood a woman will advance by 2.48 percentage points. Adding an additional man, holding the number of women constant, reduces the likelihood a woman will advance by 0.25 percentage points, but the effect is insignificant. The differential is reported in the third row. Women who gain a new peer are 2.73 percentage points more likely to advance if that new peer is a woman rather than a man.

The results in Column (2) correspond to the effects of peer gender on male subjects. The estimates and associated standard errors are very small for all three elements of that column. This suggests that peer gender has no effect on male cadets' advancement.

The effects of peers on the gender advancement gap are measured as the difference in the effect of the peers on women minus the effect on men and reported in Column (3). An additional female peer increases the likelihood a female cadet will progress relative to a male cadet by 2.36 percentage points, while an additional male peer reduces this advancement gap by 0.38 percentage points. If a new cadet is added, that cadet will reduce the gender advancement gap by 2.74 percentage points more if that new cadet is a female relative to a male.

IV. Conclusion

We find that exposure to women peers helped women cadets advance in the years immediately following women's first admission to West Point. How do we reconcile

these results with a literature reporting negative spillovers of women peers on other women?

One possibility is methodology. Our peer groups are exogenously assigned. Kunze and Miller (2017) use matched employer-employee data with detailed sets of controls and rank, plant, and time fixed effects. It may be there is still negative selection of women into women-dominated cells even at the within these fine cells. Karaca-Mandic et al. (2013), however, use data from a military context where peer group assignment is induced by a process that is arguably random.

We believe the difference relates to context. Our study period is virtually the earliest years of women's attendance at West Point. Women were so rare that there was little if any scope for quotas or tokenism. A new Superintendent in 1977 sought to help women succeed, although there was resistance among some faculty and cadets. Many women graduates and former cadets of the period describe a brutal environment where women were subject to particularly harsh treatment. The intense interaction within the company peer group created an unusual need for support among the women (Janda, 2002). On net, the support effect outweighed the competition effect.

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TABLE 1: EFFECTS OF CADET GENDER AND PEER BY GENDERS ON THE LIKELIHOOD OF ADVANCING
LOGIT MARGINAL EFFECTS (STANDARD ERRORS IN PARENTHESES)

	(1)	(2)	(3)
Female	-0.0473***	-0.0395***	-0.0396***
	(0.0085)	(0.0087)	(0.0087)
Female Peers		-0.0019	-0.0017
		(0.0015)	(0.0015)
Male Peers		0.0012	0.0012
		(0.0010)	(0.0010)
Sophomore		0.0408***	0.0405***
		(0.0092)	(0.0093)
Junior		0.1073***	0.1068***
		(0.0093)	(0.0095)
Year		0.0045*	0.0047**
		(0.0024)	(0.0023)
Company FE	N	N	Y
Female Peers - Male Peers		-.0031**	-.0029**
		(.0013)	(.0013)
N Observations	13,422	13,422	
N Cadets	5,164	5,164	

Source: Author calculations. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

TABLE 2: GENDER SPECIFIC EFFECTS OF PEERS ON THE LIKELIHOOD OF ADVANCING
LOGIT MARGINAL EFFECTS (STANDARD ERRORS IN PARENTHESES)

Effect of Peer on…	(1) Female Cadet	(2) Male Cadet	(3) (1) – (2) Fem – Male Cadet
Female Peer	0.0248**	0.0012	0.0236**
	(0.0100)	(0.0035)	(0.0106)
Male Peer	-0.0025	0.0013	-0.0038***
	(0.0015)	(0.0010)	(0.0013)
Female – Male	0.0273***	-0.0001	0.0274**
	(0.0100)	(0.0035)	(0.0107)

Notes: Controls for year, class, and company included. *Source:* Author calculations. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.