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The gender difference of peer influence in higher education

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ABSTRACT

Investigations of the existence of residential peer effects in higher education has shown mixed results. Using data from a Chinese college, we find no evidence of robust residential peer effects. Using the same data we find evidence that females respond to peer influences, whereas males do not, consistent with social psychology theories that females are more influenced by peers.

1. Introduction

It is conventional wisdom that friends and peers have a large influence on an individual student's educational outcome. Nevertheless, there are two formidable empirical obstacles to credibly estimating that influence. First of all, it is difficult for a researcher to correctly identify the peer groups. The other problem is that students often select those with whom they associate. To address these two difficulties, the literature focuses upon freshman roommates (or floormates/hallmates), groups which are not only well defined but also conditionally randomly assigned in some colleges[Duncan, Boisjoly, Kremer, Levy, & Eccles (2005, 2006); Foster, 2006; Sacerdote, 2001; Siegfried & Gleason, 2006; Stinebrickner & Stinebrickner, 2006; Zimmerman, 2003].

Foster (2006) concludes that there is little evidence of robust residential peer effects. Existing evidence of differences by gender is not only weak but "sometimes in the opposite direction also". Foster (2006) further concludes that "researchers have likewise not been able to reconcile them [gender differences] with meaningful theory". To her best knowledge there is no theory, in economics or otherwise, that empiricists can cite to explain the potential gender differences.

This paper makes two contributions to the literature on residential peer effects in higher education. (1) Using data from a Chinese college, where roommates have strong interactions, we find no evidence of robust peer effects. (2) Using the same data we find evidence that females respond to peer influences whereas males do not, consistent with social psychology theories that females are more influenceable, especially by their friends and close peers.

Residential peer influence in higher education has so far been explored exclusively in the context of the U.S., where a student's randomly assigned freshman roommate might not represent a peer of "potential influence" [Stinebrickner & Stinebrickner, 2006]. Instead of exploring other measures of peer groups [Marmaros & Sacerdote, 2004],[1] we propose

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[1] Marmaros and Sacerdote (2004) use students' email histories to identify more precise peer groups. The estimated peer effects indeed double or triple, but there exists serious selection bias.

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a simple and effective alternative strategy. The key idea is to find a college in which the randomly assigned roommates are *also* peers of strong influence.

Such a college can be found in China, where college roommates have strong interactions (see Section 3 for details). Using data from a Chinese college, we find no evidence of robust peer effects on academic or other social outcomes. The peer influence, however, is stronger for women. Female academic outcomes (GPA, both cumulative and by year) are responsive to peer's academic influence (measured with average/maximum/minimum roommate College Entrance Test (CET) ranking). While weak females benefit from their strong female peers, we find no evidence that strong females are harmed by such a relationship. The most important social outcome in Chinese colleges is membership in the ruling Chinese Communist Party (CCP). We observe that only female roommates have correlated outcomes of political affiliations. We also observe that neither males nor females respond to peer pressure on the work-study choice upon graduation. Our conclusion consistently holds for various model specifications.

Such gender difference is compatible with the social psychology theories that females are more influenceable, especially by their friends and close peers. This literature has a long tradition in social psychology [Minton & Schneider, 1980]. For example, researches show that women tend to be more compliant [e.g., Minton, Kagan, & Levine, 1971], and appear more likely to conform with majority opinions [Eagly, 1978; Maccoby & Jacklin]. Cross and Madson (1997) propose that one basic and sweeping gender difference is that women have interdependent self-schemas, whereas men have mainly independent ones. Baumeister and Kristin (1997) instead argue that females are oriented toward dyadic close relationships, whereas males are oriented toward a larger group.

The rest of the paper is organized as follows. Section 2 describes the data. Section 3 performs random assignment checks. Section 4 contains our main results. Section 5 concludes.

2. Data description

Our data come from the student database of an elite college in a coastal Chinese province. Pre-treatment characteristics include the national college entrance test (CET) score (the only score used for college admission), college major (chosen in high school), home province, and family background (such as place of residence and parents' political affiliations). Outcomes include GPA, membership in the Communist Party, and the graduate's choice between work and graduate school. The data used are for the graduating class of 2005. There are 2134 students in this year. Table 1 contains summary statistics for this sample.

The CET raw scores are not directly comparable across different provinces because the exam has substantial provincial variations. We instead use the CET percentile within each province. For example, the student with the lowest (or highest) score among those taking the same CET in a given province has CET percentile 0 (or 1). From now on, when we refer to CET score or ranking we always mean this comparable percentile index.

Table 1
Summary statistics

Variable	Mean	Standard Deviation	*N*
Female	0.625	0.484	2057
Host province	0.403	0.491	2134
Father communist	0.388	0.487	2134
Mother communist	0.19	0.393	2134
Parent communist	0.443	0.497	2134
From city	0.877	0.328	1899
CET ranking	0.5	0.296	1791
GPA	2.979	0.496	2106
Freshman GPA	2.887	0.485	2070
Sophomore GPA	2.866	0.59	2077
Junior GPA	3.125	0.603	2045
Senior GPA	3.066	0.549	2053
Communist upon graduation	0.155	0.362	2016
Continue study	0.145	0.352	2134

We have no dorm information for 7.78% of the sample. For those we do have information about, the majority lived in 4-student rooms (91.87%), with a minority of 6.55% living in 3-student rooms. Very few lived in 2-student or single rooms. Males and females always live in separate buildings. Students of the same gender are further assigned in blocks of majors. So students' floor neighbors are usually from the same major. For this reasons we do not study floor neighborhood effects.

3. Room assignment process

In a typical Chinese college like the one we study, 4 students are assigned to share a small room for 4 years. The assignment is made before students enter the college. Parents and students play no role in the assignment process. Changing rooms is highly discouraged. Dorms are the centers of voluntary social interactions. This is not a choice of the students. The government still maintains a tight control of the curriculum and other campus life. All students entering college with the same major[2] are imposed a roughly common course schedule for the rest of the four years. In many colleges they are even restricted to use only one designated classroom. Student union, campus media, and many other associations are controlled by the government.

The Housing Office has the sole authority to allocate rooms. It has no information about students' academic performance and other social habits. To nurture national identity in educated Chinese people, the only official policy of dorm allocation in almost all national universities and colleges is to ensure roommates come from as many different provinces as possible. This principle of regional diversity was well respected in allocating students in our data (results omitted). The exception has to be made for students from the host province where this college is located. Since about 40% of the students are from this province, it is inevitable that some rooms have to accommodate more than two students from the host province.

This section checks whether roommates' background characteristics (other than home provinces) were significantly correlated as a result of such assignment. Even

[2] Major choice is made in high school. Changing major is rare because of the government policy.

though an explicit random device was not employed, selection bias is unlikely to arise here. The formal analysis shows that, for our purpose, a subset of the students (to be explained below) can be categorized as having exogenously assigned roommates conditional upon gender and major.

The assignment problem for the Housing Office is mapping listed room vacancies from a student list. The student list the Office has is a Microsoft Excel file, first ordered by gender, then by major, then by home province, and finally by student ID number. The mapping is conducted manually by a group of junior officers under the supervision of a senior officer. They cut one or several student records from the student list Excel file and paste it to the vacancy list Excel file. Each junior officer is usually responsible for filling an entire dorm building.

We observe that students from the host province are sometimes assigned as pairs whose student ID numbers are next to each other. This makes room assignment nonrandom for these students because the last two digits of the ID number are related to one's CET score. For any two students from the same province who have taken the same CET, the one who gets the higher score always gets a lower ID number. We know that sometimes two or more students from the host province need to be assigned to the same room as there are too many of them. When this arises, it is convenient for the officer to cut a set of students next to each other on the student list Excel file and paste them as a bundle to the vacancy list Excel file. This procedure causes positive CET score correlation between roommates from the host province.[3] Students from all other provinces do not have this problem since they rarely have roommates from their own province.

Strong students from different provinces are not likely to be roomed together, even if the housing officers might do so inadvertently, perhaps because they all appear ahead of other students from the same province. If we have few provinces and a relatively large and balanced number of students from each province, a student's position within his/her province might be psychologically prominent. But for a given major, the number of provinces (on average about 15) is far larger than the number of students from each province (typically only one or two for each sex). Matching strong students with strong roommates from different provinces is not a straightforward thing to do in this complex situation.

We perform thorough "random" assignment checks for our data. Regression (1)–(3) in Table 2 shows that, if student *i* is not from the host province, conditional on student *i*'s gender and major, there is no relationship between *i*'s CET ranking and the average/maximum/minimum CET ranking of *i*'s roommates. This is also true for non-host-province male and female subsamples (not shown here). For students from the host province, regression (4)–(6) in Table 2 shows that there are significant positive correlations between these variables, confirming our discovery

Table 2
Random checks w.r.t CET ranking (dependent variable: CET)

	Non-host Province			Host province			All		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Roommates CET mean	−0.033 (0.051)			0.236 (0.047)***			0.056 (0.036)		
Roommates CET max		0.013 (0.043)			0.173 (0.044)***			0.036 (0.032)	
Roommates CET min			−0.034 (0.042)			0.158 (0.033)***			0.059 (0.027)**
Observations	938	916	938	781	750	782	1719	1666	1720
R^2	0.342	0.339	0.343	0.514	0.507	0.512	0.363	0.361	0.364

Note: Other control variables are gender and major dummies. Significance level: 10%*, 5%**, 1%***.

[3] The housing officers did not do this consciously. In my interview with them they did not seem to know the relationship between CET and ID number. They also have no access to CET data.

Table 3
Random checks w.r.t covariates other than CET ranking for the whole sample

	Father CCP (1)	Mother CCP (2)	City (3)	CET (4)
Roommates F. CCP	0.007 (0.036)			0.002 (0.008)
Roommates M. CCP		−0.028 (0.049)		−0.00008 (0.009)
Roommates city residence			0.015 (0.061)	−0.002 (0.010)
Observations	1967	1967	1753	1594
R^2	0.065	0.051	0.087	0.369

Note: Other control variables are gender and major dummies. Significance level: 10%*, 5%**, 1%***.

that students of similar CET scores from the host province are often assigned as pairs. Regression (7)–(9) in Table 2 shows the correlations for the entire sample.

Except for the specific procedural problem mentioned above, the overall dorm assignment can be taken as conditionally random. Regression (1)–(3) in Table 3 shows that conditional on student *i*'s gender and major, there is no relationship between *i*'s background characteristics (parents' political affiliation and place of residence before college) and the background characteristics of *i*'s roommate. In the OLS regression (4), we regress own academic CET ranking on all three roommate aggregate background covariates. No correlation is detected. The same results hold if we run the above regressions using only the non-host-province subsample.

4. Empirical results

We study academic achievements in the first subsection, and study the other outcomes in the second subsection.

4.1. Academic achievements

We adopt the baseline regression [e.g., Foster, 2006] for studying peer effects.

$$A_i = \beta_0 + \beta_1 P_i + \beta_2 \boldsymbol{X}_i + \epsilon_i \quad (1)$$

where A_i measures student *i*'s college GPA (similar results hold for yearly GPA, results omitted), P_i measures student *i*'s peer influence using average/maximum/minimum CET ranking, and ϵ_i is the error term. $\boldsymbol{X}_i$ is a vector of control variables which include own CET, dummies on gender, major, home provinces, and the interactions of gender and major dummies. The interactions of gender and major dummies need to be controlled because the major choice is made in high school and there is a large gender difference (results omitted).

For all our measures of peer influence (average/maximum/minimum peer CET), β_1 is never significant at 10% level (details not shown). This is robust to various model specifications (e.g., adding or removing own CET). So there is no strong evidence of peer influence. This is consistent with the findings in the literature. There is, however, a strong gender difference, which we discuss in detail below.

We first focus upon the average peer influence (the first 3 rows in Table 4). Regression (1)–(2) in Table 4 only uses non-host-province female data. Regression (1) shows that roommates' average CET ranking has a significant impact on a student's college GPA. The causal influence of roommates' average CET ranking is about 60% as strong as that of own CET ranking (S.D. adjusted). The magnitude is quite large. Regression (2) in Table 4 shows that whether we control student's own CET ranking is not important for this result.

Table 4
OLS estimations of average/strongest/weakest peer influence on GPA (dependent variable: GPA)

	Female non-host province		Male non-host province		All non-host province	
	(1)	(2)	(3)	(4)	(5)	(6)
I. Average peer influence						
CET ranking	0.281 (0.061)***		0.264 (0.090)***		0.276 (0.052)***	
Roommates CET mean	0.214 (0.081)***	0.199 (0.081)**	−0.071 (0.164)	−0.096 (0.166)	−0.086 (0.149)	−0.118 (0.153)
Female × roommates CET mean					0.281 (0.169)*	0.299 (0.174)*
II. Strongest peer's influence						
CET ranking	0.287 (0.062)***		0.270 (0.088)***		0.279 (0.052)***	
Roommates CET Max	0.137 (0.070)*	0.120 (0.071)*	−0.203 (0.131)	−0.196 (0.139)	−0.187 (0.127)	−0.179 (0.136)
Female × roommates CET Max					0.312 (0.146)**	0.286 (0.154)*
Weakest peer's influence						
CET ranking	0.273 (0.062)***		0.271 (0.092)***		0.276 (0.053)***	
Roommates CET min	0.159 (0.070)**	0.164 (0.071)**	0.047 (0.115)	0.008 (0.112)	0.046 (0.104)	−0.0005 (0.103)
Female × roommates CET min					0.095 (0.125)	0.148 (0.125)
R^2 (Average peer)	0.315	0.283	0.331	0.314	0.485	0.467
R^2 (Strongest peer)	0.313	0.28	0.351	0.333	0.482	0.463
R^2 (Weakest peer)	0.313	0.283	0.33	0.313	0.484	0.466
Observations	558	558	379	379	937	937

Note: Other control variables are dummies on gender, major, home provinces, and the interactions of gender and major dummies. Std. errors adjusted for intragroup correlation at the room level. Significance level: 10%*, 5%**, 1%***.

Table 5
Probit estimations of average peer influence on social outcomes

	CCP			Graduate school		
	Female (1)	Male (2)	All (3)	Female (4)	Male (5)	All (6)
Roommates CCP	0.203 (0.089)**	−.090 (0.140)	−.074 (0.134)			
Female × Roommates CCP			0.280 (0.160)*			
Roommates graduate school				0.028 (0.098)	−.106 (0.193)	−.146 (0.200)
Female × Roommates graduate school						0.163 (0.222)
Female			−.391 (0.365)			−.073 (0.381)
CET ranking	−.0007 (0.236)	0.319 (0.286)	0.090 (0.183)	0.047 (0.237)	0.112 (0.332)	0.121 (0.186)
GPA	1.111 (0.199)***	1.374 (0.204)***	1.198 (0.138)***	1.602 (0.262)***	1.212 (0.246)***	1.402 (0.181)***
Observations	1082	549	1656	1094	400	1715
R^2	0.133	0.199	0.145	0.221	0.189	0.231

Note: Other control variables are dummies on gender, major, home provinces, and the interactions of gender and major dummies. Std. errors adjusted for intragroup correlation at the room level. Base outcome is *Not CCP Member* and *Work*. Significance level: 10%*, 5%**, 1%***.

There is also some evidence of non-linearity (results now shown in the table). For those weak students with CET ranking smaller than 50%, the coefficient of average roommate CET ranking is 0.32, and is significant at 1% level. For strong students with CET ranking no less than 50%, this coefficient is not significant. So it is indeed socially more efficient to mix students of different abilities. Weak students tend to benefit from high ability peers, while strong students are not affected. In our result, only females enjoy this positive externality.

Regression (3)–(4) in Table 4 uses only non-host-province male data. We fail to observe significant peer effects in any of these regressions. Regression (5)–(6) in Table 4 pools all non-host-province students together and adds the interaction of *Female* and the average peer CET ranking. We can see that males do not respond to average peer influence while the females are significantly more likely to respond to such influence (at 10% level). The magnitude is comparable to the previous results.

Is it true that the weakest/strongest student exerts a disproportionate influence upon the rest of the students? These are the so called Bad Apple model and Shining Light model [Hoxby and Weingarth, 2005]. Since most of the students have 3 roommates in our data, we can provide a tentative answer to this question. The same gender difference roughly holds if we use minimum and maximum of roommates' CET rankings instead of the average (the 4th–9th rows in Table 4), though the interaction of *Female* and the minimum peer CET ranking is not statistically significant. So our results seem to favor the Shining Light model. What's more, there is some weak evidence that the strongest male roommate exerts a *negative* influence upon the rest of the students. This is compatible with a hypothesis that men are more competitive. They are depressed if they have a very strong roommate. If their roommates are weak, they tend to perform better.

4.2. Other outcomes

Now we turn to study other outcomes. Since the endogenous assignment procedure only affects the CET scores, we feel comfortable with employing the whole sample for our analysis. Restricting our analysis to the non-host-province subsample produces very similar results.

Again, we find no strong evidence of peer influence on joining the Communist Party (details not shown). But there is a strong gender difference. Using only the female subsample, regression (1) in Table 5 shows that female roommates tend to make correlated decisions about whether to join the ruling Communist Party or not. Regression (2) in Table 5 uses only the male subsample. We fail to observe a similar correlation here. Regression (3) in Table 5 uses the sample of all students and adds the interaction between *Female* and the number of roommates who became CCP members while attending college. The interaction is significant at the 10% level.

A student also needs to decide whether to go to a graduate school or go directly to work upon graduation. We find no strong evidence of peer influence on this choice (details not shown). There also exists no gender difference. Regression (4)–(6) in Table 5 uses the female, male, and whole sample respectively to study this outcome. In all these results roommates' work-study choices upon graduation are not correlated. Note that in our sample, whenever females are not responding to peer influence, males never do.

5. Conclusion

In this paper we argue that Chinese college dorm allocation offers a better quasi natural experiment to study residential peer effects. We observe that only women respond to roommates' peer influence. This is compatible with the social psychology theories that females are more influenceable, especially by their friends and close peers. Our evidences also supports the view that females outperform males in higher education because they have better non-cognitive skills [Jacob, 2002].

We have separately explored average peer influence, the strongest peer's influence, and the weakest peer's influence. Though the results in general support our main hypothesis, there is some weak evidence that women and men respond differently to the strongest peer's influence. Men seem to be depressed by their strongest peer. This deserves more research in the future.

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References

Baumeister, R., & Kristin, L. S. (1997). What do men want? Gender differences and two spheres of belongingness: Comment on Cross and Madson (1997). *Psychological Bulletin*, *122*, 38–44.

Cross, S. E., & Madson, L. (1997). Models of the self: Self-construals and gender. *Psychological Bulletin*, *122*, 5–37.

Duncan, G., Boisjoly, J., Kremer, M., Levy, D., & Eccles, J. S. (2006). Empathy or antipathy? The impact of diversity. *American Economic Review*, *96*(5), 1890–1906.

Duncan, G., Boisjoly, J., Kremer, M., Levy, D., & Eccles, J. S. (2005). Peer effects in drug use and sex among college students. *Journal of Abnormal Child Psychology*, *33*(3), 375–385.

Eagly, A. H. (1978). Sex differences in influenceability. *Psychological Bulletin*, *85*, 86–116.

Foster, G. (2006). It's not your peers, and it's not our friends: Some progress toward understanding the educational peer effect mechanism. *Journal of Public Economics*, *90*, 1455–1475.

Hoxby, C. M., Weingarth, G. (2005). *Taking race out of the equation: School reassignment and the structure of peer effects.* Mimeo.

Jacob, B. A. (2002). Where the boys aren't: Non-cognitive skills, returns to school and the gender gap in higher education. *Economics of Education Review*, *21*(6), 589–598.

Maccoby, E. E., & Jacklin, C. N. (1974). *The psychology of sex differences*. Stanford: Stanford University Press.

Marmaros, D., Sacerdote, B. (2004). *How Do Friendships Form?* Mimeo.

Minton, H. L., & Schneider, F. W. (1980). *Differential psychology*. Prospect Heights, IL: Waveland Press.

Minton, C., Kagan, J., & Levine, J. A. (1971). Maternal control and obedience in the two-year-old. *Child Development*, *42*, 1873–1894.

Sacerdote, B. I. (2001). Peer effects with random assignment. *Quarterly Journal of Economics*, *116*(2), 681–704.

Siegfried, J., Gleason, M. (2006). *Academic roommate peer effects.* Mimeo.

Stinebrickner, T., & Stinebrickner, R. (2006). What can be learned about peer effects using college roommates? Evidence from new survey data and students from disadvantaged backgrounds. *Journal of Public Economics*, *90*(8–9), 1435–1454.

Zimmerman, D. J. (2003). Peer effects in academic outcomes: Evidence from a natural experiment. *Review of Economics and Statistics*, *85*(1), 9–23.