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Institutional Ethos, Peers and Individual Outcomes

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Abstract

In this paper we present estimates of roommate and institution based peer effects. Using data from the College & Beyond survey, the Freshman survey, and phonebook data that allows us to identify college roommates – we estimate models of students' political persuasion and intellectual engagement. The evidence suggests that a student's roommate's political sentiments have some impact on their own political views later in life. We also implement a cluster based analysis that attempts to answer the question: how would a student's outcomes have changed if they'd attended a very different school? Our findings suggest that student outcomes are, indeed, sensitive to the school they attend. Similar students attending schools that have a decidedly different "ethos" differ in important ways post-college. Institutional peer effects seem to have a powerful effect on student outcomes.

I. Introduction

The existence and nature of peer effects are fundamental to understanding an array of crucial issues central to the economics of education. A variety of policies affecting both higher and lower education entail a redistribution of students. Affirmative action, school choice, or busing, for example, all redistribute students across schools. Ability tracking redistributes students within a school. Such policies serve to alter the peer attributes of a school or a classroom. These changes, in turn, may impact individual students. If students are sensitive to the peer environment of the school or the classroom, then such redistributions can affect both individual and aggregate outcomes.

Peer effects play an additional role in higher education. In a series of papers, Gordon Winston (c.f. Winston, 1997) demonstrates that a central feature of American higher education is that students routinely pay a net price significantly below the cost of their education[1]. The resulting subsidies are both ubiquitous and sizeable (c.f. Winston, 1999). Winston suggests that such subsidies serve, in part, to enhance the pool of applicants to a school, attracting students who embody attributes an institution deems valuable. Student quality, in this model, is seen as an important input in the production of education. Schools try to attract high quality students, in part, because it is believed they confer positive educational externalities on other students. The model assumes that students "advance farther" academically when in the presence of academically strong students – just as elite athletes or musicians, for example, "advance farther" in the company of other strong athletes or musicians.

[1] In a for-profit world, this would mean losing money on every unit produced.

Estimating peer effects is difficult. First, we must decide on the appropriate set of educational outcomes believed to be sensitive to peer attributes. Second, we must specify the relevant peer attributes. Third, and perhaps most difficult, we must contend with the fact that *selection bias* is rampant in the estimation of peer effects. In a laboratory setting, we might randomly assign a set of subjects to different peer environments and gauge any resulting effects.[2] In the world of non-experimentally derived observations, however, we must recognize that people choose their peers. And, if people tend to associate with others with similar traits (many of which are likely to be unobservable to the researcher), then it is exceedingly difficult to determine whether we are observing peer effects or simply observing similar people behaving similarly.

Empirical estimates of peer effects go back at least as far as the prominent Coleman Report of 1966. The Coleman Report not only concluded that peer effects existed and were significant in shaping educational attainment – with students being seriously advantaged or disadvantaged depending on the quality of their fellow-classmates – but it asserted, too, that those effects were non-linear – that the weak student benefited more from association with strong classmates than those strong students lost in associating with weaker classmates in studies of primary and secondary education[3].

Subsequent work on peer effects in higher education has focused on the selection issue and has attempted to implement quasi-experimental strategies wherein students are, in effect, randomly assigned environments of differing peer quality. One fruitful line of work has utilized the random assignment of first year college roommates. Such a strategy allows the comparison of high, medium, and low ability students (typically

[2] For an interesting strategy to estimate peers in an experimental context, see Goethals (2001).
[3] (Coleman, Campbell et al. 1966).

measured by SAT scores) with high, medium, or low ability roommates. For example, weak students roomed with weak students might be compared to weak students roomed with strong students. Differences in, say, the students' grade point average might then credibly be attributed to the different peer environments (i.e. the strength or weakness of their roommate). Studies of this sort were initially done by researchers at Dartmouth College and Williams College (see Sacerdote, 2001 and Zimmerman, 2002). These papers found evidence both for the existence and the non-linearity of peer effects (though the evidence on any non-linearities is less consistent). Another paper (Stinebrickner and Stinebrickner, 2002) noted that the first two studies were based on extremely high ability students and replicated the analysis using data from Berea College. At Berea, there was no evidence that roommate's ACT scores impacted their roommate's grades. There was, however, evidence that their socioeconomic background did matter. A recent paper using data from Vanderbilt University (Gleason and Siegfried, 2003) finds evidence of academic peer effects while studies at the University of Maryland (Foster, 2002) and an unnamed university (Kremer and Levy, 2003) do not. One possible explanation for these differences lies in the possibility of non-linearities in the effects. Dartmouth, Williams and Vanderbilt, for example, are extremely selective institutions and have very high average SAT scores. At these schools, weaker students showed no evidence of peer effects. To put it somewhat differently, the academic performance of weaker students did not seem to be sensitive to the peer quality of their roommates. The University of Maryland or Berea College, however, are less academically selective and so the sample data from those schools may more closely resemble the weaker subsample of students at

Dartmouth, Williams, or Vanderbilt. This may explain the different findings inasmuch as no peer effects were found amongst weaker students at Williams or Vanderbilt.

There has also been some experimental work done to estimate peer effects. Goethals (2001) constructed teams of three undergraduates at Williams College who spent forty minutes reading and discussing carefully selected *New York Times* articles then wrote about and discussed what they had learned. The ability level of each student was controlled for, and the quantity and quality of the discussions and writings were quantified by trained coders. The findings were striking, with groups composed of students with homogeneous ability levels, whether strong or weak, outperforming groups with mixed ability.

In this paper, we try to broaden the existing literature in two ways. First, we'll expand the set of individual outcomes and peer characteristics being considered. Second, we'll try to develop a measure of institutional peer effects; a measure of the "ethos" of different institutions and the impact it has on students. We use data from the Andrew W. Mellon Foundation's *College and Beyond* (C&B) survey. First, we utilize roommate level data from two of the schools in the survey. These schools were selected because they use a quasi-random approach to assigning roommates. This allows us to implement a quasi-experimental research strategy whereby we contrast the outcomes of similar students who were assigned different peer environments. The richness of the data allows us to extend the current literature by considering outcomes other than grades and peer environments other than roommate's SAT scores. Second, we address a somewhat broader context for peer effects by asking the following question: how would a student's outcomes have changed if he'd attended a very different school? This is a more difficult

question and entails an analysis that provides a way of measuring a schools peer "ethos." Based on that measure, we can group (thirteen) schools in the C&B data that have a similar "ethos." Finally, we can contrast the outcomes of students who have characteristics that match well with their school's ethos with students whose characteristics do not.

The paper is organized as follows. In the next section, we describe the roommate based approach to measuring peer effects. Section III provides estimates from this approach. Section IV describes the clustering approach to characterizing the institutional ethos or peer environment. Section V provides findings associated with this approach. Section VI concludes.

II. Estimating Peer Effects using Roommates Characteristics

Estimates of SAT-based peer effects generally relate the grades of students in their first and later semesters to their own SAT scores and to the SAT scores of their first year roommate. More formally, regression models are specified as:

$$(1) \qquad GPA_{ic} = \alpha + \gamma_c + \beta_1 SAT_i + \beta_2 SAT_i^{RM} + \beta_3 X_i + \varepsilon_{ic}$$

where *GPA* is the student's Grade Point Average measured in the first year and also cumulatively to graduation, *SAT* is the student's own SAT score (sometimes entered separately for math and verbal scores and also sometimes entered nonlinearly), SAT^{RM} is the student's roommate's SAT score (sometimes entered separately for math and verbal

scores and also sometimes entered nonlinearly), and *X* is a vector of other characteristics (such as race, gender) of the student.[4] If students are randomly assigned their roommate(s), then the estimated peer effect (β_2) will be unbiased. More generally, the estimate will be unbiased if it is plausible that $\text{cov}(SAT^{RM}, \varepsilon_{ic}) = 0$.

To broaden the analysis of roommate based peer effects, we estimate more general models of the form:

$$O_{ic} = \alpha + \gamma_c + \beta_1 X_i + \beta_2 CB_i^{RM} + \varepsilon_{ic}$$

where *O* can be any outcome of interest and *CB* can be any characteristic or behavior of the roommate that is of interest. In the models that follow, *O* is always binary. Hence, we estimate these models using a probit estimator.

III. Estimating Peer Effects using Roommates Characteristics: Results

The C&B data used in this study were created and made available to us by the Andrew W. Mellon foundation. The C&B data contain both institutional and survey data for over 90,000 students enrolled in thirty-four selective colleges and universities in the United States for the entering classes of 1951, 1976, and 1989. This study uses data from two of the schools in the C&B population for the entering class of 1989. Institutional data in the C&B provide information on the students' grades, major, race, gender, etc. Survey data contain information on a variety of post-graduate values and experiences. This survey was conducted in 1995-6. These data were combined with housing

[4] An appealing alternative strategy would be to include the roommate's GPA in the regression. Such a variable might better measure actual rather than potential performance. The problem with including such a

information extracted from college phonebooks to form a unique data set that allowed us to identify college roommates. The two schools selected were chosen because a) they house their first year students together, b) the assignment mechanism of students to housing units (as indicated by their housing descriptions on the World Wide Web and conversations with their housing offices) seems roughly random, and c) the needed variables were available. It was necessary to use schools that choose to group first-year students together because the C&B data does not provide information on other classes. If, for example, a school allowed first and second year students to live together, we would have no information on the second year students. Further, it is necessary for the allocation to be approximately random since selection bias becomes possible when students are allowed to choose their roommates or if the housing office groups students in such a way that under or over performers are more likely to be housed together. In this case, the requirement that the error term be uncorrelated with the explanatory variables would be violated. In an earlier study of Williams freshmen by one of the authors (Zimmerman, 2002), it was possible to utilize data from the housing application forms to conduct some relatively simple analyses to check whether the assumption of random assignment was plausible. The schools in this sample employed a similar protocol to that used by Williams in using housing forms indicating sleep preferences, smoking behavior, etc. in assigning students to rooms/roommates – though the underlying housing form data was not obtained.[5]

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variable is that it is simultaneously determined within the roommate context. Using such a measure would introduce simultaneous equation bias.

[5] See a revision of my earlier paper (Zimmerman, 2001) for a mathematical model that illustrates the possibility of bias in the estimated peer effects flowing from the use of housing forms in assigning students to rooms. It is worth noting that neither Zimmerman (1999) nor Sacerdote (2001) found evidence suggesting that protocols used in assigning students to roommates created a bias. The schools used in this analysis were selected because they employ similar housing assignment protocols.

Data from the Freshman survey were also appended to the C&B and phonebook data. Freshman survey data provides information on an array of student characteristics, behaviors, and viewpoints. It provides, for example, information on political viewpoints and career values expressed by a student *prior* to attending college. Thus, these variables would not, themselves, be the result of college influences.

The key outcome variables used in this analysis are measures of economic and social liberalism, along with a measure capturing students' emphasis on intellectual versus career values. These will constitute the dependent variables in the models that follow.[6] We also form measures of students' political viewpoints and emphasis on intellectual or career values using Freshman survey data. These viewpoints were formed before the student entered college and are used as explanatory variables (along with gender, race/ethnicity, major, SAT scores) in our models. Thus, we ask: holding constant individuals' political persuasions (or intellectual/career focus) when they entered college, what was the effect on a student's political viewpoint (or career/career focus) of having a more politically liberal (or more academically inclined) roommate?

To form the outcome measures of economic and political conservatism, we utilized the following question found in the C&B survey: "Thinking about your views concerning economic and social issues, where would you place yourself on the scale below?"

	Very Conservative				Very Liberal
Economic Issues…	1	2	3	4	5
Social Issues…	1	2	3	4	5

Higher scores on this scale indicate greater economic or social liberalism. The survey was conducted in 1995-6 – so the answers pertain to students' post-college political position. We estimate probit models where we define students as "Conservative" if they coded their response 1 or 2 and as "Liberal" if they coded their response as 4 or 5.

Prior (pre-college) political viewpoints were formed in two different ways. First, we used a variable from the freshman survey where students were asked to characterize their political views as "far right," "conservative," "middle of the road," "liberal" or "far left." Alternatively, we used a principal components analysis to form a single "political viewpoint" variable from a number of questions in the Freshman Survey. Students, for example, were asked whether they disagree or agree (strongly or somewhat) with various statements. For instance, they were asked whether they thought the "government [was] not controlling pollution," or there was "too much concern for the rights of criminals" or that the government should "prohibit homosexual relations." The resulting variable was continuous ranging from 1 (conservative) to 5 (liberal). The variable used in the analysis coded the resulting political sentiments principal components variable as dummy variables with scores in the bottom 15% being coded as "conservative", in the top 15% as "liberal", and "moderate" otherwise.

To measure career and intellectual values we utilized a measure developed by Katchadourian and Boli in their book Cream of the Crop: The Impact of Elite Education in the Decade After College (1994), which presents a longitudinal study of the Stanford class of 1984. Part of their methodology involves rating students on two scales – intellectualism and careerism – and dividing the students into 4 groups. The variables

[6] See Winston and Zimmerman (2003) for estimates on academic peer effects (i.e. GPA) using these data and one additional school.

used for grouping the students were taken from the Freshman Survey and were based on the reasons students gave for attending college and also on the aspects of a job they consider important in their long-term career choice. For example, students could indicate the importance of various reasons for attending college such as: "to get a better job" or "to make more money." Alternatively, they might emphasize "to learn more about things" or "to become a more cultured person." They might indicate that their career choice is heavily influenced by "high anticipated earnings" or "rapid career advancement." These variables were combined into measures of intellectualism and careerism using a principal components analysis. The resulting characteristics were scored on a 100 point scale. Students were then divided into four groups based on their median scores on these two variables. We've characterized the groups as follows. "Strivers" scored above the median on both intellectualism and careerism; "intellectuals" scored above the median in intellectualism but below on careerism; "unconnected" students scored below the median on both intellectualism and careerism; and "careerists" scored below the median on intellectualism but above on careerism. We created similar scales for these groups from the College & Beyond survey responses. We can then use these measures to see whether a roommate's intellectualism, careerism, and other traits had an effect on students' later intellectualism and careerism, etc.

Table 2 reports the probit parameter estimates (derivatives) for the economic political viewpoints models. The first and second column show the estimates using the freshman survey measures of political orientation. Here we see that one's own pre-college political views have a strong predictive effect on students' post-college political views. Being "far right", for example, is associated with a .624 percentage point increase

in the odds that an individual is conservative post-graduation compared with a student who was on the "far left" of the political spectrum when they entered college. The roommate variables have no significant effect when the outcome is "liberal" (see the first column in Table 2). Estimates in column two, however, suggest that a student (post-college) is (holding their own pre-college views constant) less likely to be politically conservative if their roommate is politically moderate or liberal than if they are "far left" – the omitted category. Roommate parameter estimates based on the principal components definitions of political orientation are found in the third and fourth columns. Roommate's political persuasion is not significant in either of these models.

Table 3 reports the probit parameter estimates for the social political viewpoints models. Again, an individual's pre-college political orientation has a strong effect on their later political persuasion. Roommate effects do not have a significant effect on whether an individual considers herself "liberal" post college. They do, however, affect whether a person reports being socially "conservative." Here we see that individuals whose roommates are either "middle of the road" or "liberal" are less likely to be conservative than individuals whose roommates considered themselves "far left" – the omitted category. Roommate parameter estimates based on the principal components definitions of political orientation are found in the third and fourth columns. Roommate's political persuasion is not significant in either of these models.

Table 4 reports the probit parameter estimates for the "Striver," "Intellectual," "Unconnected," and "Careerist" models. The dependent variable in each case is a dummy variable indicating whether the individual is classified as a member of that particular group. Here we see two things. First, the fact that an individual had traits that

would define them as a striver, intellectual, or unconnected during the pre-college period does not strongly predict whether they would be similarly classified post-college. Thus, for example, students giving patterns of answers to Freshman survey questions that would suggest a particularly intellectual slant are not statistically significantly more likely to give answers to C&B survey questions in 1995-6 that would define them as intellectuals. The same holds true for strivers and unconnected students. Pre-college careerist sentiments do, however, predict post-college careerist sentiments. In none of these models, however, does the roommate's classification have a significant effect.

IV. Estimating Peer Effects by Clustering Schools

We now turn to estimating a broader form of peer effects. Our goal is to answer: how would a student's outcomes have changed if they'd attended a very different school? This is a somewhat different question than that addressed in the last section. There, we asked whether differences in peer environment at the roommate level had measurable effects on students' political views or their level of intellectualism versus careerism. The question we are addressing in this section is more difficult to answer and entails an analysis that provides a way of measuring a schools peer "ethos." We think of this as the schools aggregate peer environment. This is certainly a murky concept, but we think there is something to it. Most people would agree that Williams is quite different than Swarthmore or Oberlin. Yet, these institutions are similar in their selectivity, curriculum, and infrastructure. A key feature of the difference would seem to be that the median student at these schools are quite different. Some schools are more politically

progressive than others. Some have more of a party culture. Others are more intellectual. School guidebooks certainly describe schools as having different "ethos." To quote some examples from the popular Fiske Guide to Colleges:

> "Friedrich Nietzsche once wrote, "That which does not kill me makes me stronger." He might well have been talking about Swarthmore College…"
>
> At Duke "people do the work with a smile and have a beer later."
>
> "…Oberlin remains a bastion of liberal thought and a mecca for the socially and politically correct (yes, there are some Dead Heads and granola munchers…)"
>
> Vanderbilt "as a whole tends to be very conservative and 'Southern' in its views…"
>
> "Dennison's biggest problem may be in overcoming its reputation as a party school."

Our goal here is to provide a plausible way of grouping schools that are most similar in terms of the interests and values of their student body. That is, the groups we create should be comprised of students that are similar in some basic ways. We might imagine moving students between these schools and having them feel right at home. We can then consider students who are "outliers" in the sense that they have interests and values that are very different than those of the median student at the school they attend. They might be regarded as, for example, "Princeton students" at Oberlin or "Williams students" at Swarthmore. Thus, we might contrast the outcomes of students who have characteristics that match well with their school's ethos with students whose characteristics do not. That is our basic strategy.

When attempting to categorize institutions of higher education, studies typically rely upon either relatively simple binary measures or preexisting taxonomies in order to

classify them. Thus, numerous studies divide institutions along lines of private versus public control, religious versus secular nature, and so forth. Research also often relies upon systems like the Carnegie classifications that group all institutions according to their type, for example, "Doctoral/Research Universities – Intensive" or "Baccalaureate Colleges – Liberal Arts". Studies occasionally use a discrete variable like selectivity, but generally use that variable to create several different groups (e.g. "high selectivity", "low selectivity"). These methods were undesirable for our study, however, because although these distinctions may have some correlation with or even indirect effect on institutional environments, they are nonetheless very different from peer effects and running regressions using these divisions would only determine the overall effect of, for example, public versus private control. Instead, we used nine discrete variables – from a group of thirteen C&B schools – derived from a survey of entering freshmen, all of which describe the respondent's interests in some way.[7] By creating clusters of institutions based upon the characteristics of students at those institutions, it is possible to classify institutions solely from student traits, and therefore, since institutional dummy variables are included in the regressions, any differences in outcomes should result only from peer effects and not from any other differences between institutions.

To determine whether students could be said to be "mismatched" with the other students at their institution, we first had to derive traits with which they could be compared to their classmates. The Astin freshmen survey contained numerous questions indicating respondents' activities during high school, views on various issues,

[7] The schools used were Kenyon College, Stanford University, Wesleyan University, Wellesley College, Princeton University, University of North Carolina, Miami University (Ohio), Oberlin College, Bryn Mawr College, Pennsylvania State University, University of Pennsylvania, Vanderbilt University, and Williams College. These schools had all of the variables needed to conduct the analyses.

background experiences, and other relevant factors from which traits could be derived. Therefore, particular questions from the survey were taken and used to construct nine traits, all scaled equally for a range of 0-1, for each individual student. These included:

1. Religiosity – A measure of how religious a student was (e.g. "Frequency of attending church services").
2. Community Service and Political Activism – A measure of how involved with community service and political activism a student had been in high school and importance placed on them (e.g. "Frequency of performing volunteer work last year").
3. Athleticism – A measure of how involved with athletics and exercise a student had been in high school (e.g. "Hours per week in last year of high school spent on exercising and sports").
4. Partying – A measure of how involved in partying and related activities a student had been in high school (e.g. "Frequency of drinking beer in last year").
5. Cultural and Intellectual Interest – A measure of how interested in cultural and intellectual pursuits a student was (e.g. "in going to college, how important was 'to make me a more cultivated person'").
6. Artistic and Literary Interest – A measure of how much importance students placed on these interests and their self-ratings on artistic and literary ability (e.g. "Importance of creating artistic work").
7. Drive – A measure of students' self-ratings on competitiveness, drive to achieve, and leadership ability (e.g. self rating on drive to achieve).
8. Popularity – A measure of how much time students spent socializing in high school and their self-ratings on a variety of popularity-related traits (e.g. self rating on popularity).
9. Politics – A measure of where on a one-dimensional spectrum a student fell derived from many questions about their views on specific issues and one question about their general political views. A higher score means further to the right (e.g. agreement with "abortion should be legalized").

A full list of the variables used to create the nine variables is found in **Table 5.**

Once these traits had been calculated for each individual student, it became possible to determine the overall characteristics of the entering class for each institution by averaging the scores for each trait of the students at each institution. Once averages were produced, the institutions could be compared on each trait. The thirteen institutions were divided

into three clusters[8]. **Figure 1** shows a cluster tree indicating the clustered schools.[9] To cluster, we used a clustering algorithm based on the distances of each school from the others where the distance was measured based on an equal weighting of these traits.[10]

The three resulting clusters can be characterized as follows:

1. Cluster 1: "Competitors"– Notable for being the most driven, this cluster is similar to cluster two in terms of popularity and athleticism, is in between the other two clusters in terms of religiosity, artistic and literary interest, and politics, and is similar to cluster three in terms of partying, cultural and intellectual interest, and engagement in community service and political activism.
2. Cluster 2: "Non-selective"– This cluster had the highest religiosity, was the most athletic (albeit barely), was most to the right politically, was the most partying, had the lowest cultural and intellectual interest and artistic and literary interest, was the least involved in community service and political activism, and had the highest popularity. It was in between the other two clusters in terms of drive.
3. Cluster 3: "Leftist/Activist" – This cluster had the lowest religiosity, was the least athletic, had the highest cultural and intellectual interest and artistic and literary interest, was the least driven, had the lowest popularity, was the most involved in community service and political activism, and was most to the left politically.

The characteristics of the clusters are show in **Figure 2**. The average SAT scores (not shown in the figure) were 1265.4 for cluster one, 1093.5 in cluster two, and 1245.25 for cluster three.

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[8] Although different numbers of total clusters could have been used, three was the largest number that could be used without two clusters of only two schools resulting.

[9] The schools are not identified by name for confidentiality reasons.

[10] In particular, we used Ward's method of agglomerative hierarchical clustering with a squared Euclidean distance measure. Because this operates by attempting to minimize the increase in the sum of squares within clusters, it tends to create compact clusters where all members are fairly close to each other. This avoided the tendency of the single-linkage and, to a lesser extent, average-linkage methods to create chains of members with great variance between some of the members. Since we wanted to produce clusters where the members were discernibly different in certain characteristics from the members of other clusters, a method generating compact clusters was clearly preferable. Ward's method is also considered one of the two best hierarchical agglomerative techniques (Pung & Stewart, 1983). To test the robustness of this cluster analysis, three clusters were also produced using the average-linkage method, which is generally considered the other of the two best hierarchical agglomerative techniques. This resulted, however, in only a single institution out of the 13 changing clusters. Furthermore, tests were conducted using normal Euclidean distance and Minkowski distance (with r=3) instead of squared Euclidean distance. Both normal Euclidean distance and Minkowski distance yielded the same results.

Next, for each individual student, it was determined, in addition to which cluster they attended (whichever of the three clusters their institution happened to be in), which cluster *they* were *closest to* in terms of the nine student traits. This entailed finding the average absolute distance of each student, in terms of their scores for these nine traits, from each cluster of institutions. The student was said to be closest to whatever cluster had the least average distance, meaning that the students entering institutions in that cluster were, on average, more similar to that student than those of any other cluster were. There were thus nine total possible ways in which students could be placed by the three possible clusters attended and three possible clusters closest in terms of those traits. If a student attended a cluster different from the one the student was closest to, then the student is said to be "mismatched".

We can see from the following cross tabulation how students were distributed across school in terms of the cluster they attend and the cluster that has students with traits closest to their own.

Figure 1. Percentage of students

Cluster Closest to	Cluster Attended 1	2	3	Total
1	38.94	20.32	20.86	28.18
2	29.55	61.90	11.25	36.84
3	31.52	17.78	67.89	34.98
Total	100.00	100.00	100.00	100.00

We see here that of those students attending cluster 1, about 39% of them had traits that matched most closely with that cluster. However, about 30% and 32% matched more closely to clusters 2 and 3. These students would be characterized as "mismatched." Clusters two and three have higher proportions of matched students. For

cluster 2, about 62% of the students have traits that match them with this cluster. For cluster 3, almost 68% do.

We are interested in measuring the effect being mismatched has on outcomes. Thus, we can ask, for example: how does someone do if they attend cluster 3 but are really most similar to cluster 1 students? To illustrate using a simple cross-tabulation (without any controls), consider how the fraction of students in different clusters attending PhD programs varies with matching and mismatching.

Percentage working towards PhD degrees

Cluster Closest to	Cluster Attended 1	2	3	Total
1	.10	.055	.11	.092
2	.074	.031	.11	.051
3	.14	.063	.13	.12
Total	.11	.042	.13	.087

Here we see that about 10% of students who are classified as "Competitors" and who attend "Competitor schools" pursue a PhD degree. Only 5.5% of similar students who attend "Non-Selective Schools" are pursuing a PhD degree. Similarly, students with traits like those of the typical "Non-Selective School" student are much more likely to be working toward a PhD if they had attended either "Competitor" or "Leftist/Progressive" schools. Clearly, other variables (such as average SAT) could be at work here. We turn next to estimating regression models that replicate this kind of analysis but attempt to control for other variables that could induce a spurious correlation.

V. Estimating Peer Effects by Clustering Schools: Results

Table 6 provides descriptive statistics and **Table 7** reports estimates for a set of probit models that allow for student mismatches. The dependent variables – measured in 1995-6 – are:

(1) "Overall, how satisfied have you been with the undergraduate education you received?" (ranging from 1 (very satisfied) to 5 (very dissatisfied)). We have created a binary variable equaling 1 if "very satisfied" and zero otherwise.

(2) "Imagine that you had your life to live over again and were graduating from high school. Knowing what you know now, how likely is it that you would choose the same undergraduate school?" (ranging from 1 (very likely) to 3 (not at all likely)). We have created a binary variable equaling 1 if "very likely" and zero otherwise.

(3) "Overall, how satisfied would you say you are with your life right now?" (ranging from 1 (very satisfied) to 5 (very dissatisfied)). We have created a binary variable equaling 1 if "very satisfied" and zero otherwise.

(4) "Was the employer on your first job a not-for-profit?"

(5) "Did you vote in the 1996 Presidential election?"

(6) "When thinking about a job, how important is high income to you?" (ranging from 1 (very important) to 3 (not important)). We have created a binary variable equaling 1 if "very important" and zero otherwise.

(7) "When thinking about a job, how important is "service to society to you?" (ranging from 1 (very important) to 3 (not important)). We have created a binary variable equaling 1 if "very important" and zero otherwise.

(8) The "Intellectualist" variable described in the roommate based analysis above.

(9) The "Careerist" variable described in the roommate based analysis above.

(10) An indicator variable indicating whether the individual is pursuing a PhD.

Each possible mismatch was incorporated as a dummy explanatory variable in the model. In addition, we include control variables for institution fixed effects, fixed effects for college major, gender, race/ethnicity, citizenship, and SAT scores.

The results shown in **Table7** are interesting with many of the mismatch variables being statistically significant. Competitive students (cluster 1, as described above) attending non-selective institutions (cluster 2, as described above) are less likely to be working toward a PhD. Other effects are not statistically significant. Competitive students attending leftist/elite schools indicate they'd be less likely to choose the same school if they could choose again and are generally less satisfied with life. They do, however, place less emphasis on money and more emphasis on intellectualism than do similar students who attended cluster 1 schools. Non-selective students who attend competitive schools place higher emphasis on service as an important characteristic of their job. Other coefficients are not significant. Non-selective students attending the leftist/elite schools are generally less satisfied with their education and their life. They do, however place less emphasis on income as an important job characteristic than similar students who attend a non-selective school. They also are more likely to be pursuing a

PhD. Leftist/elite students attending competitive schools are more likely to indicate that they'd attend that school again if they had the choice. They are, however, less likely to take jobs at non-profits or to have voted in '96 when compared to similar students who attended leftist/elite schools. The remaining coefficients are not significant.

VI. Conclusions

In this paper we present estimates of roommate and institution based peer effects. Using data from the College & Beyond survey, the Freshman survey, and phonebook data that allows us to identify college roommates – we estimate models of students' political persuasion and intellectual engagement. The evidence suggests that a student's roommate's political sentiments have some impact on their own political views later in life. We also implement a cluster based analysis that attempts to answer the question: how would a student's outcomes have changed if they'd attended a very different school? Our findings suggest that student outcomes are, indeed, sensitive to the school they attend. Similar students attending schools that have a decidedly different "ethos" differ in important ways post-college. Institutional peer effects seem to have a powerful effect on student outcomes.

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Figure 1: Cluster Tree

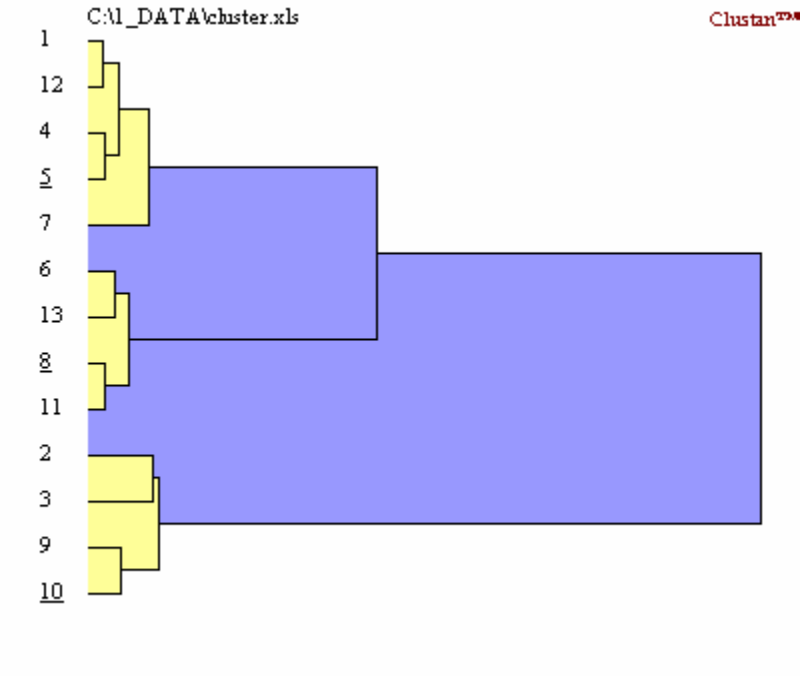

Figure 2: Characteristics of Clusters

Table 1:
Roommate Models
Descriptive Statistics

	Mean	Std. Dev.	Min.	Max.
Dependent Variables				
Economic Liberalism	3.14	1.06	1	5
Social Liberalism	3.94	.98	1	5
Intellectualism	87.8	15.4	55	113.3
Careerism	49.7	10	24.8	74.6
Explanatory Variables				
Female	.532	.4996	0	1
Black	.0658	.2406	0	1
Asian	.0837	.2773	0	1
Other	.0443	.206	0	1
Non-Citizen	.0369	.1889	0	1
SAT Verbal	657	73	400	800
SAT Math	685	70	320	800
SAT Combined	1342	123	940	1600
Political Views Scale (principal component)	3.41	.5465	1.55	4.8
Political Views (Freshman survey)				
Intellectualism	72.8	10.8	39	95.2
Careerism	61.9	12.9	28.8	93.9

Table 2:
Roommate Models: Political Views (Economic)
Derivatives from Probit Model
(Standard errors in parenthesis)

	Liberal	Conservative	Liberal	Conservative
Female	**.153**	-.069	**.172**	-.051
	(.054)	(.048)	**(.057)**	(.054)
Black	.163	-.177	.197	-.210
	(.116)	(.104)	(.120)	(.113)
Asian	.000	-.138	-.136	-.079
	(.094)	(.080)	(.098)	(.087)
Hispanic	**.346**	-.114	.168	-.048
	(.127)	(.113)	(.138)	(.130)
Other race	-.153	-.0498	-.115	-.063
	(.201)	(.180)	(.203)	(.192)
Not a Citizen of the United	-.0415	.187	-.091	.417
States	(.148)	(.132)	(.149)	(.140)
SAT Score/100	**.062**	-.034	.043	-.033
	(.024)	(.022)	(.026)	(.024)
Own views far right	**-.675**	**.624**		
	(.274)	**(.244)**		
Own views conservative	**-.528**	**.503**		
	(.174)	**(.155)**		
Own views middle of road	**-.479**	.210		
	(.163)	(.146)		
Own views liberal	-.236	.111		
	(.161)	(.144)		
Moderate (principal component)			**-.544**	**.148**
			(.104)	**(.062)**
Conservative (principal component)			**-.365**	**.464**
			(.066)	**(.098)**
Roommate far right	-.212	-.161		
	(.274)	(.246)		
Roommate conservative	-.179	-.233		
	(.164)	(.147)		
Roommate middle of road	-.076	**-.309**		
	(.155)	**(.139)**		
Roommate liberal	-.166	**-.292**		
	(.156)	**(.140)**		
Moderate roommate (principal component)			.006	-.003
			(.098)	(.060)
Conservative roommate (principal component)			.034	.0003
			(.063)	(.092)
Major and Institution Fixed Effects	YES	YES	YES	YES
Sample Size	386	391	317	321

Note: Bolded peer coefficients are significant at the 5% level.

Table 3:
Roommate Models: Political Views (Social)
Derivatives from Probit Model
(Standard errors in parenthesis)

	Liberal	Conservative	Liberal	Conservative
Female	**.138**	-.069	**.151**	-.051
	(.054)	(.048)	**(.058)**	(.054)
Black	.165	-.177	.209	-.210
	(.117)	(.104)	(.121)	(.113)
Asian	.079	-.138	-.034	-.079
	(.090)	(.080)	(.093)	(.087)
Hispanic	**.346**	-.114	.175	-.048
	(.128)	(.113)	(.139)	(.130)
Other race	-.127	-.050	-.088	-.063
	(.202)	(.180)	(.205)	(.192)
Not a Citizen of the	-.082	.187	-.159	**.417**
United States	(.148)	(.132)	(.149)	**(.140)**
SAT Score/100	**.064**	-.034	.049	-.033
	(.024)	(.022)	(.027)	(.025)
Own views far right	**-.683**	**.625**		
	(.275)	**(.245)**		
Own views conservative	**-.529**	**.503**		
	(.175)	**(.155)**		
Own views middle of	**-.464**	.211		
road	**(.164)**	(.146)		
Own views liberal	-.227	.112		
	(.162)	(.144)		
Moderate (principal			**-.352**	**.148**
component)			**(.067)**	**(.062)**
Conservative (principal			**-.542**	**.465**
component)			**(.105)**	**(.099)**
Roommate far right	-.214	-.161		
	(.276)	(.246)		
Roommate conservative	-.176	-.233		
	(.165)	(.147)		
Roommate middle of	-.072	**-.310**		
road	(.156)	**(.139)**		
Roommate liberal	-.149	**-.293**		
	(.158)	**(.140)**		
Moderate roommate			.020	-.003
(principal component)			(.064)	(.060)
Conservative roommate			-.010	.000
(principal component)			(.099)	(.093)
Major and Institution Fixed Effects	YES	YES	YES	YES
Sample Size	391	391	321	321

Note: Bolded peer coefficients are significant at the 5% level.

Table 4:
Roommate Models
Derivatives from Probit Model
(Standard errors in parenthesis)

	Striver	Intellectual	Unconnected	Careerist
Female	.021	.018	-.034	.035
	(.052)	(.073)	(.067)	.058
Black	.197	.329	-.196	-.364
	(.170)	(.238)	(.221)	.184
Asian	-.027	.026	.106	-.096
	(.093)	(.130)	(.120)	.101
Hispanic	.116	-.070	-.108	-.022
	(.142)	(.199)	(.183)	.155
Other race	-.143	-.274	**.813**	-.358
	(.223)	(.234)	**(.287)**	.241
Not a Citizen of the United States	-.118	.154	-.160	.122
	(.167)	(.234)	(.216)	.192
SAT Score/100	.016	.019	.048	**-.080**
	(.028)	(.038)	(.035)	**.030**
Striver pre-college	.126			
	(.066)			
Intellectual pre-college		.021		
		(.076)		
Unconnected pre-college			.120	
			(.066)	
Careerist pre-college				**.384**
				(.082)
Striver roommate	.098			
	(.059)			
Intellectual roommate		-.029		
		(.070)		
Unconnected roommate			-.104	
			(.065)	
Careerist roommate				-.001
				(.079)
Major fixed effects	YES	YES	YES	YES
Institution fixed effects	YES	YES	YES	YES
Sample Size	231	231	231	231

Note: Bolded peer coefficients are significant at the 5% level.

Table 5:
Clustering Variables

Weight	Variable Name	Significance
	RELIGION	
2	act8802	Frequency of attending religious services
1	charpar3	Agreement with 'my parents could be characterized as deeply religious'
	COMMUNACTIVISM	
1	act8804	Frequency of participating in organized demonstrations in past year
1	goals04	Importance of "influencing the political structure"
1	goals05	Importance of "influencing social values"
1	goals18	Importance of "keeping up to date with political affairs"
1	act8823	Frequency of performing volunteer work in past year
2	hrspwk07	Hours per week in last year of high school spent on volunteer work
1	goals16	Importance of "participating in a community action program"
	ATHLETIC	
1	act8805	Frequency of 'won a varsity letter for sports' in past year
1	hrspwk04	Hours per week in last year of high school spent on exercising/sports
	PARTYING	
1	act8811	Frequency of smoking cigarettes in past year
1	act8812	Frequency of drinking beer in past year
1	act8813	Frequency of drinking wine/liquor in past year
1	act8814	Frequency of staying up all night in past year
3	hrspwk05	Hours per week in last year of high school spent on partying
1	choose04	How important was 'this college has a good reputation for social activities'
	CULTINT	
1	act8824	Frequency of visiting an art gallery/museum in past year
1	charpar2	Agreement with parents 'interested in cultural pursuits'
1	reason08	In going to college, how important was 'to make me a more cultivated person'
1	reason05	" " 'a general education and appreciation of ideas'
1	reason10	" " 'to learn about things that interest me'
	ARTWRITE	
2	slfrat02	Relative self-rating on artistic ability
2	slfrat15	Relative self-rating on writing ability
1	goals01	Importance of "becoming accomplished in one of the performing arts"
1	goals11	Importance of "writing original works"
1	goals12	Importance of "creating artistic work"
	DRIVE	
1	slfrat03	Relative self-rating on competitiveness
1	slfrat04	Relative self-rating on drive to achieve
1	slfrat07	Relative self-rating on leadership ability
	POPULARITY	
1	slfrat05	Relative self-rating on emotional health
1	slfrat10	Relative self-rating on popularity
1	slfrat11	Relative self-rating on popularity with the opposite sex

1	slfrat14	Relative self-rating on self-confidence (social)
2	hrspwk02	Hours per week in last year of high school spent on socializing with friends
	POLITICS	Compilation of many questions indicating political preferences. A higher score means more to the right.
2	views07	Agreement with "Abortion should be legalized"
2	views09	Agreement with "If two people really like each other, it's all right for them to have sex even if they've known each other only for a very short time"
2	views11	Agreement with "A couple should live together for some time before deciding to get married"
1	views14	Agreement with "It is important to have laws prohibiting homosexual relationships"
3.5	views05	Agreement with "There is too much concern in the courts for the rights of criminals"
3.5	views08	Agreement with "The death penalty should be abolished"
2.3333	views02	Agreement with "The Federal government is not doing enough to promote disarmament"
2.3333	views06	Agreement with "Federal military spending should be increased"
2.3333	views21	Agreement with "The federal government should do more to control the sale of handguns"
2.3333	views12	Agreement with "Marijuana should be legalized"
2.3333	views17	Agreement with "Employers should be allowed to require drug testing of employees or job applicants"
2.3333	views18	Agreement with "The best way to control AIDS is through widespread, mandatory testing"
3.5	views01	Agreement with "The Federal government is not doing enough to protect the consumer from faulty goods and services"
3.5	views22	Agreement with "A national health care plan is needed to cover everybody's health care costs"
3.5	views03	Agreement with "The Federal government is not doing enough to control environmental pollution"
3.5	goals14	Importance of "becoming involved in programs to clean up the environment"
14	poliview	Choice selected from "How would you characterize your political views"

Table 6:
Mismatch Models
Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Very Satisfied with Education	4766	.7068821	.4552398	0	1
Would Choose Same School	4766	.7159043	.4510299	0	1
Very Satisfied with Life	4766	.3850189	.4866508	0	1
Took Non-profit Job	4766	.1852707	.3885577	0	1
Voted in 96	4766	.7650021	.424042	0	1
Income very Important	4766	.3094838	.4623294	0	1
Service Very Important	4766	.4129249	.4924112	0	1
Intellectualism high	4766	.2471674	.4314102	0	1
Career goals high	4766	.1869492	.3899117	0	1
Working on PhD	4766	.0998741	.2998635	0	1

Table 7: Mismatch Models
Derivatives from Probit Model
(Standard errors in parenthesis)

	Very satisfied with Education	Would choose same school	Very Satisfied with Life	Took Non-Profit Job	Voted in 96	Income very Important	Service very important	Intellectualism High	Career goals high	Working toward PhD
Female	**.041**	**.040**	.025	**.054**	**.055**	**-.113**	**.118**	**.038**	-.031	-.008
	(.015)	**(.015)**	(.016)	**(.011)**	**(.014)**	**(.015)**	**(.016)**	**(.017)**	(.016)	(.010)
Black	**-.085**	**-.085**	**-.104**	.028	.018	.032	.022	.019	-.000	.028
	(.027)	**(.027)**	**(.024)**	(.022)	(.023)	(.026)	(.027)	(.032)	(.027)	(.021)
Asian	-.026	-.036	**-.075**	-.017	**-.117**	**.069**	-.038	-.005	.035	-.004
	(.027)	(.028)	**(.027)**	(.020)	**(.028)**	**(.029)**	(.029)	(.031)	(.033)	(.015)
Hispanic	.016	.052	.009	.038	.006	.059	.007	-.046	-.001	-.006
	(.039)	(.037)	(.043)	(.037)	(.037)	(.043)	(.044)	(.043)	(.044)	(.025)
Other race	-.031	-.042	-.020	-.032	-.044	-.043	.026	.039	-.042	.002
	(.038)	(.039)	(.039)	(.027)	(.037)	(.035)	(.040)	(.045)	(.038)	(.023)
Not a Citizen of the United States	.051	**.048**	-.004	-.013	**-.488**	.024	-.055	-.021	.001	**.068**
	(.037)	**(.036)**	(.042)	(.031)	**(.040)**	(.041)	(.042)	(.048)	(.046)	**(.032)**
SAT Score/100	.003	-.009	**.013**	.007	.006	**-.048**	**-.022**	**.030**	**-.028**	**.022**
	(.005)	.006	**(.006)**	(.005)	(.005)	**(.006)**	**(.006)**	**(.007)**	**(.006)**	**(.004)**
Cluster type one attends cluster two	.023	.020	.027	-.008	-.027	-.006	-.021	-.008	.028	**-.029**
	(.026)	(.026)	(.027)	(.019)	(.024)	(.025)	(.028)	(.029)	(.029)	**(.013)**
Cluster type one attends cluster three	-.048	**-.071**	**-.085**	-.003	.024	**-.051**	.013	**.062**	-.029	.018
	(.028)	**(.028)**	**(.025)**	(.019)	(.023)	**(.025)**	(.028)	**(.030)**	(.026)	(.017)
Cluster type two attends cluster one	-.015	-.051	-.026	-.032	.049	.038	**.069**	-.026	-.031	.030
	(.028)	(.030)	(.030)	(.025)	(.024)	(.029)	**(.032)**	(.037)	(.027)	(.028)
Cluster type two attends cluster three	**-.106**	**-.098**	**-.121**	.030	.015	**-.067**	.041	.068	-.040	**.053**
	(.033)	**(.033)**	**(.029)**	(.030)	(.027)	**(.027)**	(.034)	(.041)	(.028)	**(.031)**
Cluster type three attends cluster one	.070	**.064**	.036	**-.053**	**-.073**	.056	.012	-.037	.013	-.017
	(.031)	**(.030)**	(.039)	**(.022)**	**(.037)**	(.041)	(.038)	(.034)	(.043)	(.017)
Cluster type three attends cluster two	.051	-.009	.017	.003	-.017	.004	-.031	-.022	.004	-.004
	(.041)	(.044)	(.050)	(.035)	(.045)	(.050)	(.048)	(.046)	(.054)	(.025)
Major fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Institution fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample Size										

Note: Bolded peer coefficients are significant at the 5% level.