Metrics Final Project: Dorm Effects at Reed
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Abstract:
We examined a comprehensive dataset of Reed College students spanning 14 years. Controlling for academic aptitude variables we determined which on-campus dorms were most influential on academic success. We found seven dorms had a significant impact on GPA at the 5% level, all with positive effects.

Introduction:
In this project, we explored whether the specific dorm in which students lived in their freshmen year affects their freshman year GPA. We used freshmen year data only, since freshmen are more or less randomly assigned to their dorm rooms. In contrast, sophomores, juniors, and seniors all have the freedom to choose the dorms they live in, should they decide to live on campus in the first place. Therefore, self-selection bias is a strong possibility for all students except freshmen.

We expected to find that dorms with better study conducive atmospheres (e.g. quieter, less crowded, fewer distractions, etc.) would have higher average GPA's, since freshmen typically require time to adjust to Reed's study culture, and dorms with better atmospheres may assist in this transition. We also expected freshman living in dorms located away from the center of campus to have higher average GPA's since the distance away from campus activities makes for a more peaceful and less distracting study environment.

After testing multiple different specifications, the one that we decided on was the regression of freshman year GPA (*fygpa*) on freshman year dorm assignment dummies (*freshdormfinalenc*) along with major dummies (*majpenc*), race dummies (*ethnicenc*), gender dummies (*genderenc*), freshman year credits enrolled (*fygpahours*), inverted reader rating (*irdr*), highschool gpa (*hsgpa*), and sat verbal score (*satv*).

Data:
Our data set was comprised of observational data for 10,090 individual students across 14 years from 1989 to 2002. The variables in the dataset are listed in the table below,

Variable Names

case	**Student identifier**
zip1	**5-digit zip code of record for student**
hssize	**Size of HS graduating class**
hsrank	**HS class rank**
hsgpa	**HS GPA (unweighted)**

majpenc	**Primary major**
majs	**Secondary major (if ad-hoc interdisciplinary)**
majd	**Second major (if double major)**
rdr	**Reader Rating (0–5 scale with smaller = better)**
irdr	**6 - Reader Rating (0-5 scale with larger = better)**
yearterm	**Year and Semester (199301 = fall of 1992–93) in which student was first enrolled as a full-time student**
finaid	**A dummy variable for whether a student received financial aid**
uggpa	**Reed undergrad GPA**
satv	**SAT verbal score**
satm	**SAT math score**
genderenc	**Female (sex = 1), Male (sex = 2), or Neutral (sex = 3)**
ethnicenc	**CN = Caucasian, BK = black, AN = Asian, HC = Hispanic, UN = unreported, NA = native American, OR = other**
citz	**A dummy variable for whether or not a student is a US Citizen**
state	**State of residence**
admtype	**FR = regular freshman admit, TR = transfer, E# = early decision**
ughours	**Undergrad units completed at Reed**
degree	**A dummy variable for whether a BA was awarded**

grad1	**Graduation date**
freshdormfinalenc	**Freshman year dorm**
fygpa	**Freshman year GPA**
fygpa_hum	**Freshman year GPA (without Hum 110)**
fygpahours	**Freshman year course hours**

We decided not to include data for all students with less than five freshmen-year undergraduate units (*fygpahours* < 5). We reasoned that they were not full-time students, since a normal freshman year course load at Reed is 7 to 8 units. Our goal in this project is to determine how the dorms freshmen live in might affect their freshman year gpa. Students that aren't taking a full-time course load likely have extenuating circumstances. Including these data points could distort the dorm effect unnecessarily. Excluding these students drops 185 observations from our dataset.

We also checked Admissions Office Reader Ratings and High School GPAs for unrealistic or impossible data entries. Reader Ratings are on a scale from 1 to 5, so we were prepared to eliminate data for students with a reader rating that fell outside of that range. However, we did not find any such data to eliminate. For High School GPAs, reasoning that AP and/or Honor courses could provide a GPA boost of up to 1.0, we were prepared to eliminate data for students with High School GPAs that were above a 5.0 or below 0. However, we again did not find any such data to eliminate.

Results and Analysis:

We begin our analysis with a standard OLS regression of freshman year GPA (*fygpa*) on freshman year credit hours (*fygpahours*), inverted reader rating (*irdr*), high school GPA (*hsgpa*), math SAT score (*satm*), verbal SAT score (*satv*), whether the student received financial aid (*finaid*) and the factor dummy variables for major (*i.majpenc*), ethnicity (*i.ethicenc*), gender (*i.genderenc*), and the freshman dorm (*i.freshdormfinalenc*). An abbreviated table with the results from this preliminary regression is reported below,

```
. reg fygpa fygpahours irdr hsgpa satm satv finaid i.majpenc i.ethnicenc i.genderenc i.freshdormfinalenc
```

Source	SS	df	MS
Model	169.622952	83	2.04365002
Residual	336.554194	1397	.240912093
Total	506.177146	1480	.342011585

```
Number of obs =     1481
F( 83,  1397) =     8.48
Prob > F      =   0.0000
R-squared     =   0.3351
Adj R-squared =   0.2956
Root MSE      =   .49083
```

fygpa	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
fygpahours	.1638742	.0172607	9.49	0.000	.1300146	.1977339
irdr	.2705363	.0373151	7.25	0.000	.1973367	.3437359
hsgpa	.226718	.0439024	5.16	0.000	.1405964	.3128397
satm	.0003652	.0002308	1.58	0.114	-.0000876	.0008179
satv	.0005397	.0002104	2.57	0.010	.000127	.0009525
finaid	.0042753	.0283519	0.15	0.880	-.0513417	.0598922

From this original regression we were able to reject the null hypothesis that *fygpahours*, *irdr,* and *hsgpa* had no effect on *fygpahours* at the 5% significance level. We strongly suspected that there may be heteroskedasticity in our sample, and therefore our t-statistics for these results may be biased. We performed a Breusch-Pagan test for heteroskedasticity, the results of which are reported below,

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of fygpa

         chi2(1)      =    38.21
         Prob > chi2  =   0.0000
```

The results of the test indicated that we strongly rejected the null hypothesis of constant variance ($\chi^2 =$ 38.21), given this result, our subsequent analysis will use White's robust standard errors. After using robust SE's we found that *satm* and *finaid* remain insignificant, so we dropped these from our regression. For the remaining parameters, F-tests determine whether they belong in our regression. Results for these tests are as follows:

F-test for *i.majpenc* = 0

testparm i.majpenc

```
 F( 35,  1401) =    2.00
      Prob > F =    0.0005
```

F-test for *i.genderenc* = 0

```
. testparm i.genderenc

 ( 1)  1.genderenc = 0

       F(  1,  1401) =    6.56
            Prob > F =    0.0105
```

F-test for *i.freshdormfinalenc* = 0

testparm i.freshdormfinalenc

```
F( 35,  1401) =    1.56
     Prob > F =    0.0197
```

F-test for *i.ethnicenc* = 0

testparm i.ethnicenc

```
F(  6,  1401) =    2.22
     Prob > F =    0.0387
```

As we can see from the above F-tests, we reject the null hypotheses at the 5% level that these factor variables have zero effect on *fygpa*. For these factor variables we set the most prevalent category as the base: English for major, Caucasian for ethnicity, male for gender, and ODB for dorm. Given the results from the previous regression our final regression took on the following form,

reg fygpa fygpahours irdr hsgpa satv i.majpenc i.ethnicenc i.genderenc i.freshdormfinalenc, robust

An outreg table summarizing the complete results of this regression is included in the Appendix. Below is a table summarizing the statistically significant results (at the 10%, 5%, and 1%) for the dorms in our regression:

Dorm (ID and name)	**Coefficients (*** = 1%, ** = 5%, * = 10%)**	**# Observations in regression**
6 = Chittick	0.177 (0.056)***	90
8 = New Foster 1	0.330 (0.096)***	17
11 = Old Foster 1	0.187 (0.101)*	18
17 = New Mac 2	0.172 (0.085)**	23
18 = New Mac 3	0.149 (0.087)*	29

19 = Old Mac 1	0.214 (0.084)**	12
20 = Old Mac 2	0.137 (0.067)**	53
23= Sullivan	0.204 (0.093)**	30
28 = Old Scholz 2	0.242 (0.103)**	18
36 = German Haus	0.244 (0.143)*	9

Considering the possible ordinal nature of our regressor, *fygpa*, we decided to consider an ordered probit model and compare these results to our OLS regression above. A complete outreg table summarizing the results of this probit regression is included in the Appendix.

We found a few specific meaningful differences in the results between the OLS and ordered probit regressions. Specifically: New Mac 2 (OLS t-statistic = 2.02) and Old Mac 2 (OLS t-statistic = 2.04) are no longer significant at 5% level. However, as we see from the OLS t-statistics, these results were borderline significant at the 5% significance level in the OLS regression, so it is not particularly concerning that these have shifted to the 10% level. Newly significant dorms are only significant at the 10% level, so these results are not particularly meaningful. Given these rather minor changes, we decided to remain with our OLS regression for the sake of simplicity.

When we consider the possibility for type 1 error, we have to be hesitant about whether we can derive any strong conclusions from our results. If we assume that none of the dorms have a significant effect on freshman year GPA, given our standard of 95% confidence, we would still expect to find two falsely significant results out of our group of 40 dorms. We found seven significant coefficients, only four of which are actually usable (i.e. the observation sample was non-trivial, we chose > 20 observations). Hence, we only found two more significant dorm coefficients than we would expect to have found if none of the dorms had a significant effect on freshman year GPA.

A major problem with our regression is that the explanatory power of our regression is so low that our root mean square error (0.49 units of GPA) is uncomfortably large compared with our estimated coefficients. This is not an easy problem to fix, as it requires us to gather more explanatory variables on the students in our sample to supplement our regression. Alternatively, it is possible that filling in our missing data for students in the sample could help. However, neither of these options may realistically be possible. Additionally, the large amount of missing data and the small number of observations for any specific dorm or major hinders our ability to pursue further cross-sectional analysis such as interaction terms. The low explanatory power of our data--a direct cause of the massive amount of missing data for individuals, is therefore the largest limiting factor of this analysis.

Conclusion:

The dorms that have significant coefficients represent an interesting subset of the dorms at Reed College. Most of the dorms represented are part of the Foster-Scholz-Macnaughton dormitory block. This block is described as one of the least preferable areas and one of the oldest parts of the campus. It is also known for its large windows, providing an excellent view of the morose portland landscape. It is also worth noting that the quiet dorm is on Macnaughton 3, a dorm known for enforcing a study conducive, noise reduced atmosphere after certain hours of the night. However, most of the Foster-Macnaughton block are not theme-dorm based, with Mad Sci being the only themed dorm.

One potential reason for the FSM block's positive effect on GPA may be due to the emphasis on the common rooms being an appealing part of the buildings. The Foster-Scholz common room has soda machines, a large TV, a wooden piano, and an expansive window area. Even without the amenities, the common room bridges the two dormitories and is quite large. It is also located next to the main entrance into both Foster and Scholz. Parker's research on peer effects may support the notion that a stronger sense of community leads to improved academic performance.

Sullivan I also has a significant coefficient and a plausible explanation. Sullivan is mostly a theme dorm, with the top two floors as the Substance-free dorms and half of the bottom floor as the Arabic Culture dorm. Hence, only half of Sullivan I is without a theme, and Sullivan I may be capturing the effect of a self-selection bias. Since these dorms are requested, the population of students coming to these two themed residences may have an effect on the small population that was randomly selected. This would also support the aforementioned *peer effect* that we cited as being the explanation for the difference in GPA.

Finally, it is important to note the strong statistical significance of our constant term ($t = 3.17$) in our final regression. A coefficient of -0.646 indicates that caucasian, male, english majors, living in ODB, enjoy a 0.646 grade point loss on their GPA. Additionally, with an RMSE of 0.49, this coefficient is the only coefficient with a large enough magnitude to reliably predict an effect beyond that which could be attributed to RMSE. This specific result requires perhaps additional research into the possibility of negative peer effects not only within dorms, but across ethnicities and majors. As a whole, this result and the other results in our analysis reflect an inconclusive, yet implied effect of freshman residentiality on freshman year GPA. Future research into this subject should attempt to gather more complete data on individuals, as well as to possibly control for specific dorm qualities to analyze the effect beyond specific dorms, and more so the characteristics of the dorms that cause these effects.