Graduation Rates: What really matters?

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Questions

- What factors have the largest effect on college graduation rates?
- Do grade forgiveness policies matter, and what is the best one?
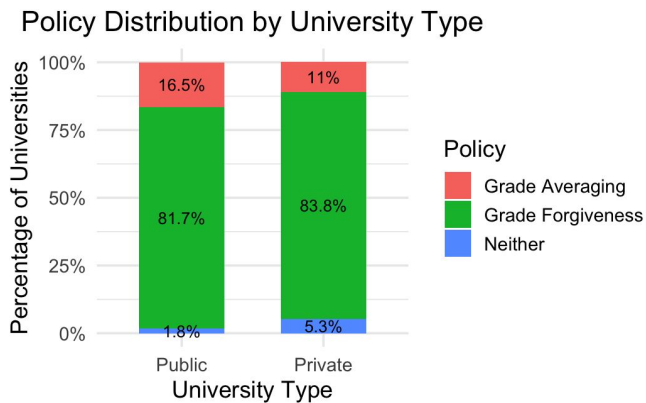
Potential Variables

- Grade Forgiveness Policy
- Public or Private University
- Tuition
- Enrollment totals
- Faculty numbers
- Student-to-Faculty Ratio
- Dominant race
- Amount of federal financial aid being given out

Grade Forgiveness Policy

- These policies are designed to allow students to retake a class in the event that they are not satisfied with their grade
- Grade Averaging: new grade is averaged with the old grade in student's GPA
- Grade Forgiveness: new grade replaces the old grade in student's GPA

Policy Distribution by University Type

Public or Private?

- Grad rates at private schools are, on average, about 15% higher than at public schools
- Approximately 30% of college students in the United States attend private schools
- Private schools have a much larger gap between averaging and forgiveness grad rates than public schools (~18% vs ~7%)

public_factor	avg_grad_rate	n
Public	0.4750505	6815
Private	0.6216308	2425

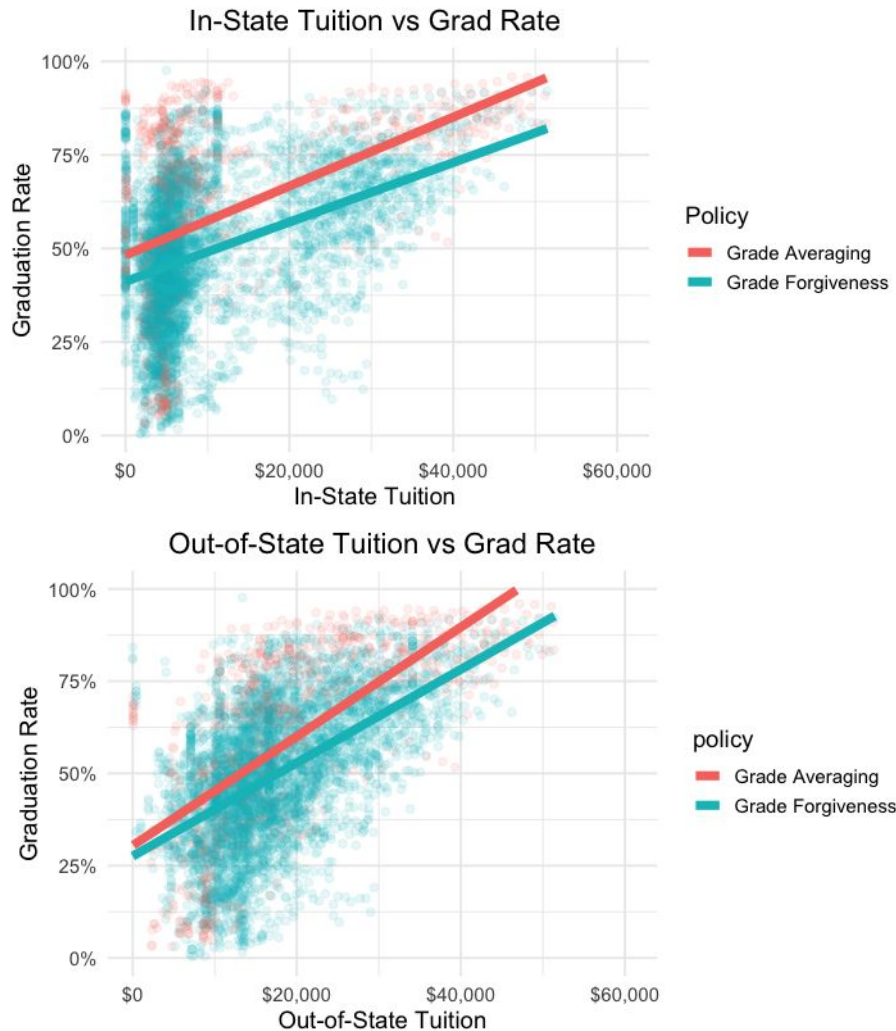|			
Grade Averaging	Public	0.5346265	1074
Grade Averaging	Private	0.7720706	255
Grade Forgiveness	Public	0.4620433	5683
Grade Forgiveness	Private	0.5878319	2054

Tuition

- Yearly tuition payments
- In-state vs out-of-state
    - Only applies to Public schools
    - Approximately 25% of students pay out of state tuition
    - On average, out of state tuition is approximately three times as expensive

Tuition Cont.

In-State Tuition vs Grad Rate

Out-of-State Tuition vs Grad Rate

- Higher intercept (In-State): Public schools with low in-state tuition anchor the low tuition schools, giving stronger grad rates even at relatively lower tuition levels
- Steeper slope (Out-of-State): Public schools with high out-of-state tuition and private schools with higher grad rates explain why grad rates rise sharply with tuition
- Both effects highlight how institutional type and tuition can shape grad rates, variables that are critical for prediction
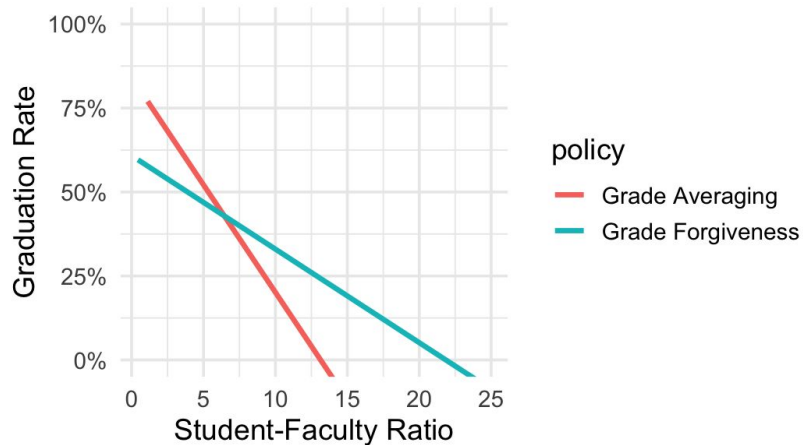
Student to Faculty Ratio

- Grad rates decrease with the student-faculty ratio
- Averaging has a harsher effect on GPA and therefore graduation rates, as it is harder to come back from a poor grade
- Forgiveness can help mitigate the negative effect of a high student-faculty ratio
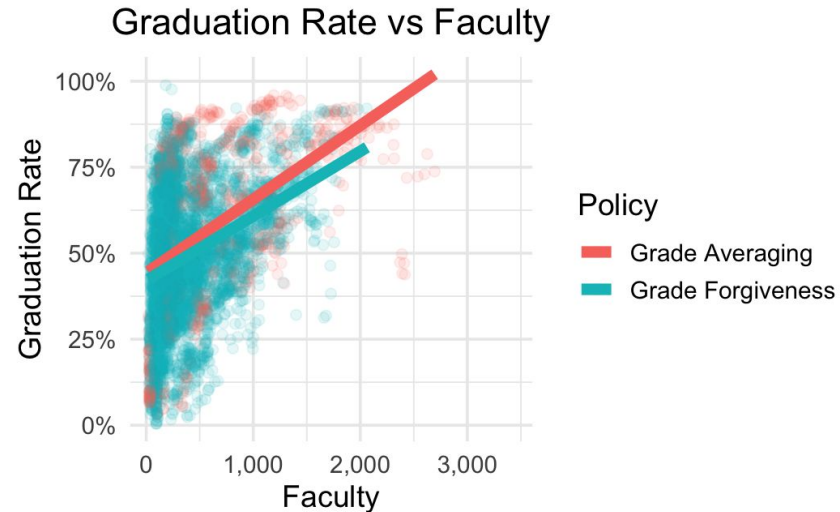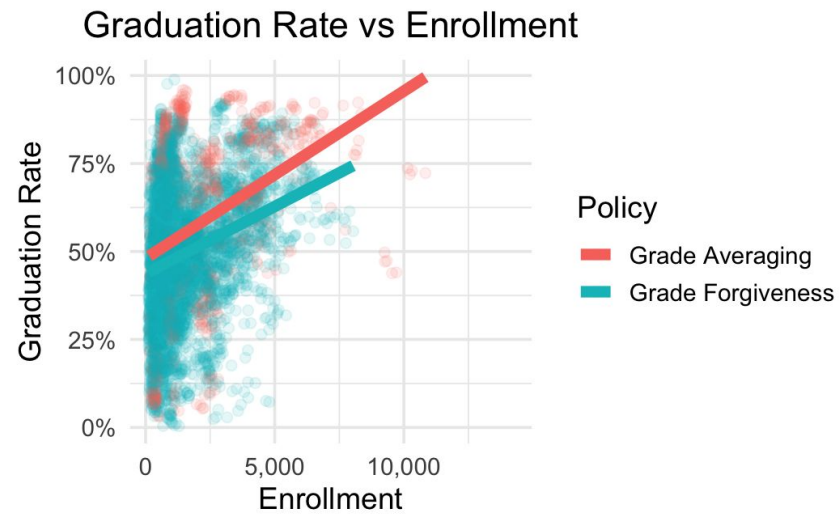- Averaging is more common in public schools

Grad Rate vs. Student-Faculty Ratio

public_factor	avg_fac_stu_ratio	n
Public	4.239236	6815
Private	3.778971	2425

Enrollment & Faculty

- Both variables have similar trends
- The ratio is the most statistically significant variable, but the overall numbers still have value in prediction
- While the line of best fit goes to 100%, this doesn't reflect the reality of having very high enrollment or faculty numbers
- Having historically low graduation rates could cause decrease in enrollment and faculty numbers, and vice versa

Graduation Rate vs Enrollment
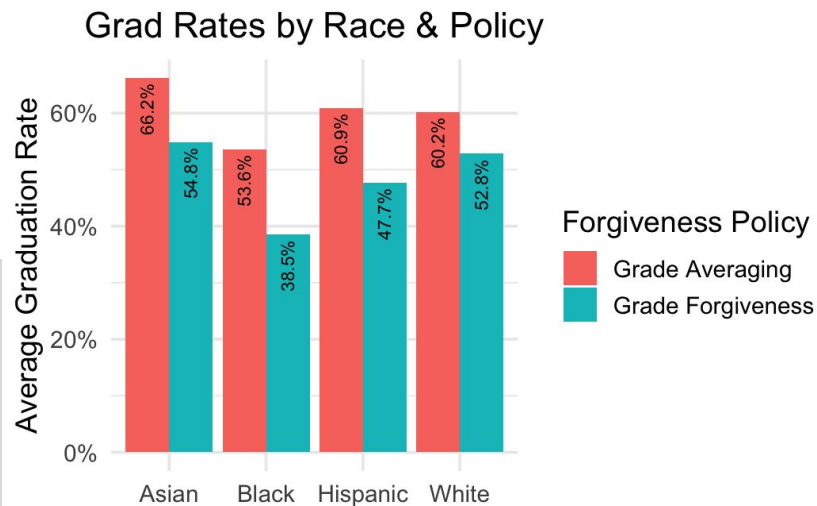

Graduation Rate vs Faculty

Race

- Surprisingly, averaging has higher graduation rates, regardless of the race
- While some of this can be attributed to sample size, the sample is large enough that this difference is significant
- Black students have the largest gap
- White students have the smallest gap

Grad Rates by Race & Policy

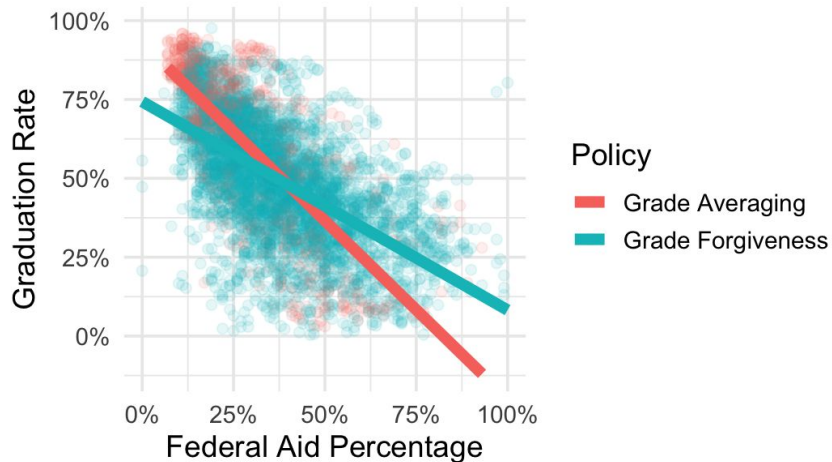| policy	avg_grad_rate	n
Grade Averaging	0.5849934	1329
Grade Forgiveness	0.4958885	7737

Financial Aid

- Federal Aid is more relevant than State Aid, as it is typically a much larger percentage of the tuition
- The more students receiving financial aid, the lower the grad rate is
- Schools with high aid rates likely serve low-income and first generation students who face barriers to graduate
- When aid is high, averaging can make an already difficult situation worse
- Forgiveness can mitigate some of the outside issues and boost grad rates, leading to the rates being more stable

Grad Rate vs Federal Aid Percentage

Averaging or Forgiveness?

- While the graduation rates are higher for schools with averaging policies, it is hard to be sure if this is a cause or an effect
    - Schools that are higher rated may not want to use forgiveness in order to prevent a moral hazard issue, while lower rated schools might want to improve grad rates that are already low
    - Ignoring moral hazard, forgiveness should increase the odds of a student graduating more than averaging, and it probably still does, but it's impossible to firmly prove this
- Unfortunately, there is no simple answer as to which is better, and every school has to make their own decision based on their needs and a multitude of factors
    - Each policy has their own pros and cons
    - Forgiveness is the favorite around the country
    - A very small number of schools have no such policy

Predicting Grad Rates

- Using all of these variables, I created a model to predict the graduation rate for a school during any given year
- The R^2 value is 0.65, suggesting the model has strong predictive power
    - 65% of the variation in grad rates can be explained by the model
    - Adjusted R^2 is 0.6493, meaning that almost all variables are relevant
- The average values of the actual and the predicted grad rate are nearly identical
    - The model is not perfect, and there are instances where the predicted value is either negative or above 1 (100%), both of which are not possible

```
> summary(gradeforgive$grad6per)
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
  0.004   0.375   0.518   0.514   0.666   0.988
> summary(gradeforgive$predicted_gradper)
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
-0.1507  0.3905  0.5032  0.5097  0.6228  1.1085
```

Predicting Grad Rates

```
Coefficients:
                        Estimate  Std. Error  t value  Pr(>|t|)
(Intercept)             6.337e-01   1.319e-02   48.029  < 2e-16
instatetuition         -1.287e-06   6.055e-07   -2.126  0.03358
outofstatetuition       9.329e-06   4.890e-07   19.080  < 2e-16
enrolltotal             1.735e-05   3.369e-06    5.151  2.68e-07
faculty                 3.756e-05   1.242e-05    3.025  0.00250
fac_student_ratio      -1.774e-02   1.242e-03  -14.284  < 2e-16
fedaid                 -5.541e-01   1.336e-02  -41.488  < 2e-16
policyGrade Forgiveness -2.364e-02  4.725e-03   -5.003  5.83e-07
policyNeither           5.810e-03   1.178e-02    0.493  0.62194
public_factorPrivate    4.403e-02   8.908e-03    4.943  7.91e-07
top_raceWhite          -4.819e-02   7.562e-03   -6.372  2.01e-10
top_raceAsian          -8.665e-03   1.178e-02   -0.735  0.46208
top_raceHispanic        2.411e-02   8.929e-03    2.700  0.00695
```

Variable	Effect	Significance
instatetuition	negative	significant
outofstatetuition	positive	very significant
enrolltotal	positive	very significant
faculty	positive	significant
fac_student_ratio	negative	very significant
fedaid	strong negative	very significant
forgiveness	negative	significant
neither	neutral	not significant
private	positive	significant
white	negative	very significant
asian	neutral	not significant
hispanic	positive	significant

Final Takeaways

- Higher student–faculty ratios are associated with lower graduation rates
- Schools with more students on federal aid typically report lower graduation rates
- Graduation rates are strongly correlated with tuition
- Grade Forgiveness policies are an effective tool, but overall less significant than outside factors such as size and resources, things that may not be in a schools control
- It is impossible to infer with certainty that one policy is superior to the other

Thank you!