

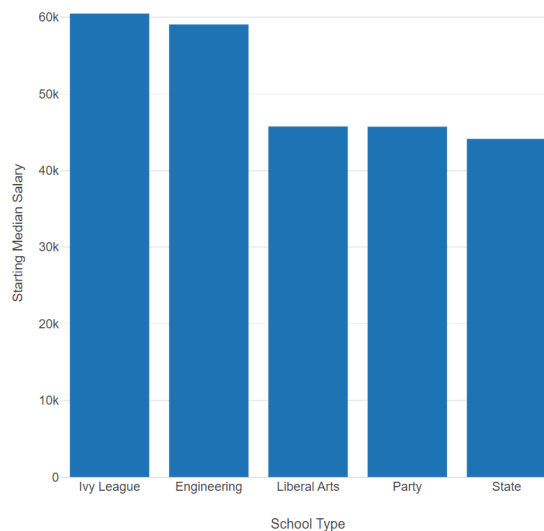
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### Cost-Effectiveness of College Data Analysis

**Introduction:** Soaring college costs have ignited a debate about the value of a traditional degree. Our analysis aimed to address this concern by identifying the most cost-effective approaches to higher education. This includes factors like the type of institution, chosen major, and college location. Unfortunately, gathering data specific to individual colleges proved challenging due to proprietary restrictions. Therefore, we focused primarily on state-based data to provide a comprehensive picture of where to find the most cost-effective college experiences. We organized our data analysis into 6 main questions to help come to a conclusion about how and where students can get the best ROI through college.

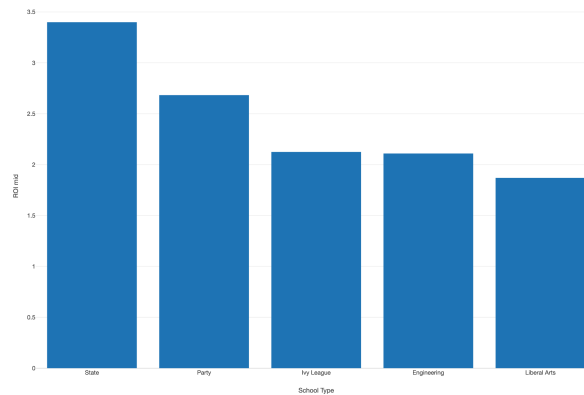
### Does the type of school one attends have any indication on financial success?

**Relationship Between School Type and Starting Median Salary**



This graph represents some of our preliminary analyses in determining what type of schools produce the most successful students. To no surprise, Ivy League schools produced the highest starting median salary. The distinction between party school and state school is very fine but within our data set it skewed some of the numbers when removing one category or the other, but pretty most party schools are state schools but not all state schools were considered party schools.

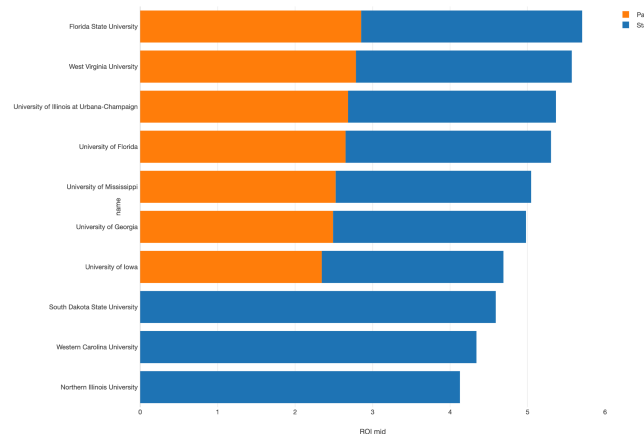
## Return on Investment (ROI) by School Type



This bar graph illustrates the ROI of mid-career pay by school type. ROI in this case was calculated by dividing mid-career by cost of attendance. The graph is considered surprising with state and party schools coming in first and second place respectively. Liberal arts, engineering, and Ivy League schools came in last with an approximate average ROI of 2 or 200%

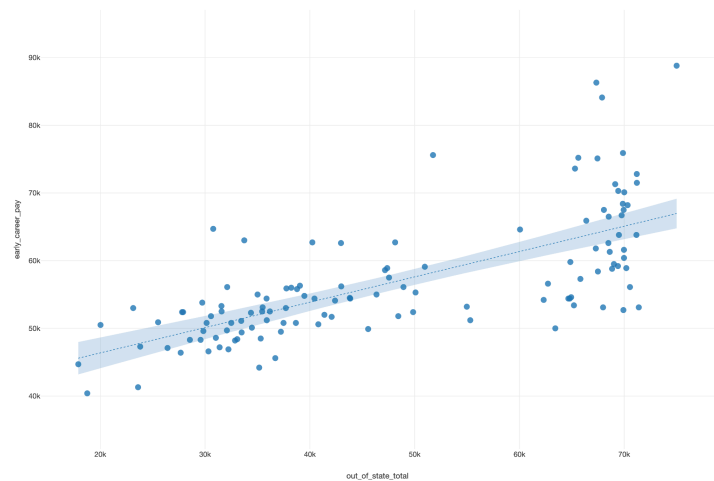
## Does a higher cost of school always mean more successful students?

### University by Mid-Career Salary Return on Investment



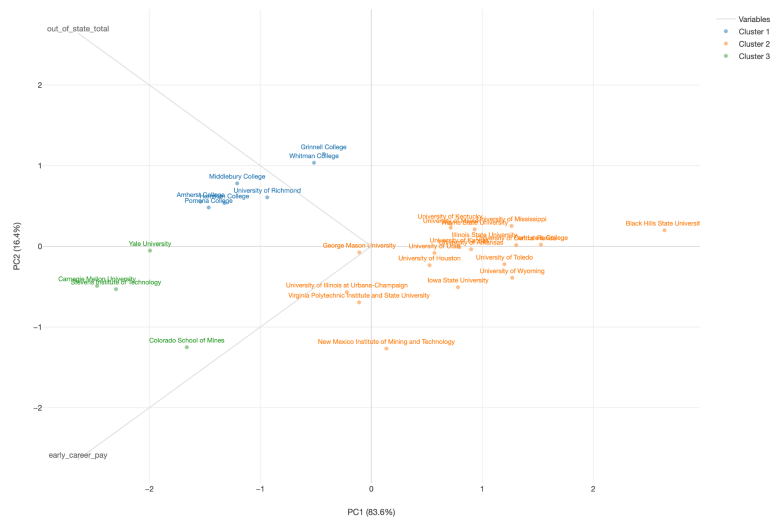
This graph shows the top 10 schools by ROI using the average mid-career salary data. We chose the mid-career average salary instead of the early-career one to determine the ROI in the long run. The graph surprised us because we expected the Ivy League's to have the highest ROI on the list. As we can see, state schools had the highest ROI with some of them exceeding 5x the return on investment because of their low cost of attendance. So, even though they may not produce the highest salaries, because of the low cost the vast majority of students can make a strong ROI from state and even party schools.

## Correlation of Early Career Pay by Total Out of State Tuition



The graph is a scatter plot that shows the relationship between the total cost and the early career pay for colleges. The scatter plot shows a strong positive correlation between the total cost and the average early career pay. However, the relationship is not perfectly linear, as there is still significant variance in the values. The points form a general upward-trending band than a tight line.

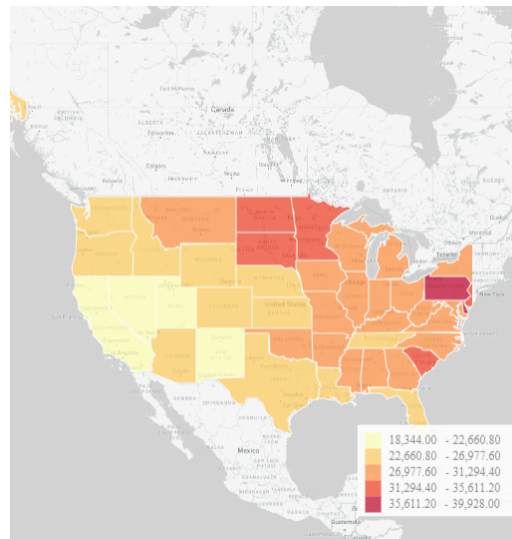
## 30 Colleges Clustered by Out of State Total Tuition and Early Career Pay



We sampled 30 colleges to do clustering on by out-of-state total and early career pay. We chose to divide them into 3 clusters based on the elbow test. The orange cluster represents the majority of colleges, mainly state schools, with a low out-of-state total and early career pay compared to other colleges. The blue cluster represents mainly liberal arts schools with a high cost of attendance and a medium early career pay. The green cluster mainly represents schools that are STEM-heavy with a higher early career salary compared to the blue cluster.

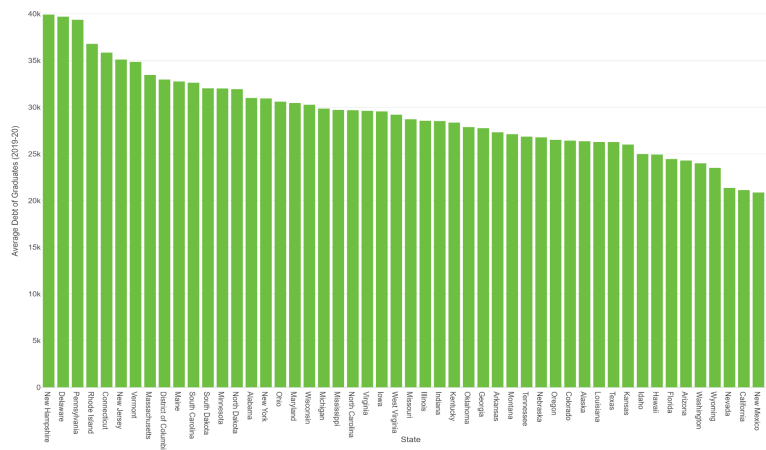
### Where is college the highest financial burden on students?

#### Percent of Graduates with Debt After Graduation by State (2019-20)



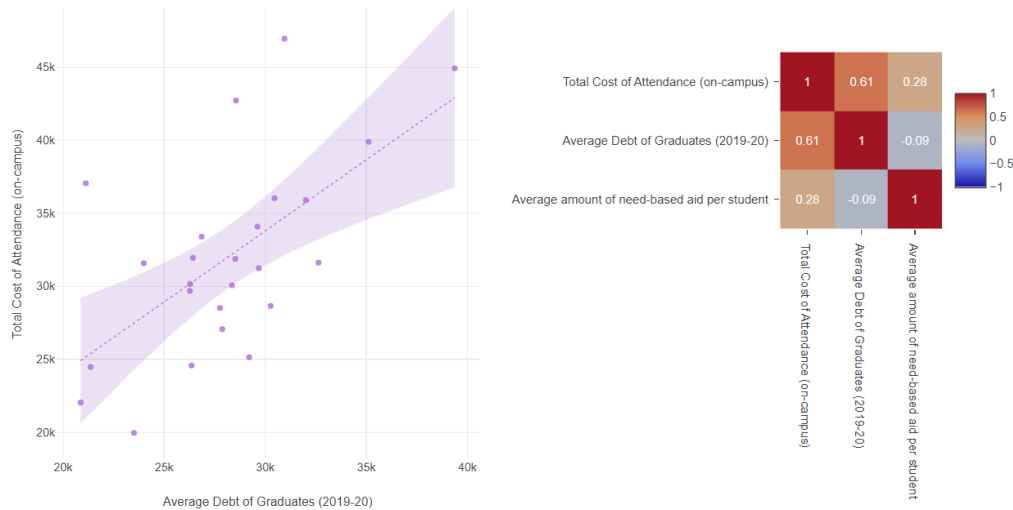
This graph displays the percent of graduates with debt from the years 2019-2020 by state in descending order. Pennsylvania and South Dakota looks to be the states with the highest percentage of student debt, at over 70%, with Utah being the state with the least, at around 40%. This allows us to paint a picture of states with on the whole the poorest (having the highest debt ) individuals.

#### Average Debt of Graduates by State (2019-2020)



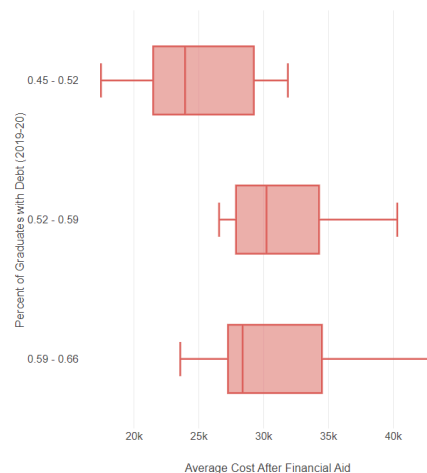
This graph shows the average debt of college graduates from 2019-2020 by state. As you can see, New Hampshire is the state with the highest average debt, at around \$40,000. Utah, similarly to the percent of students with debt graph above this one, has the lowest amount of average debt after graduation, at around \$20,000- or half of New Hampshire's. This can help us determine a geographical variance in the accumulation of debt by college attendees in each state.

### Relationship Between Cost of School and Debt of Graduates



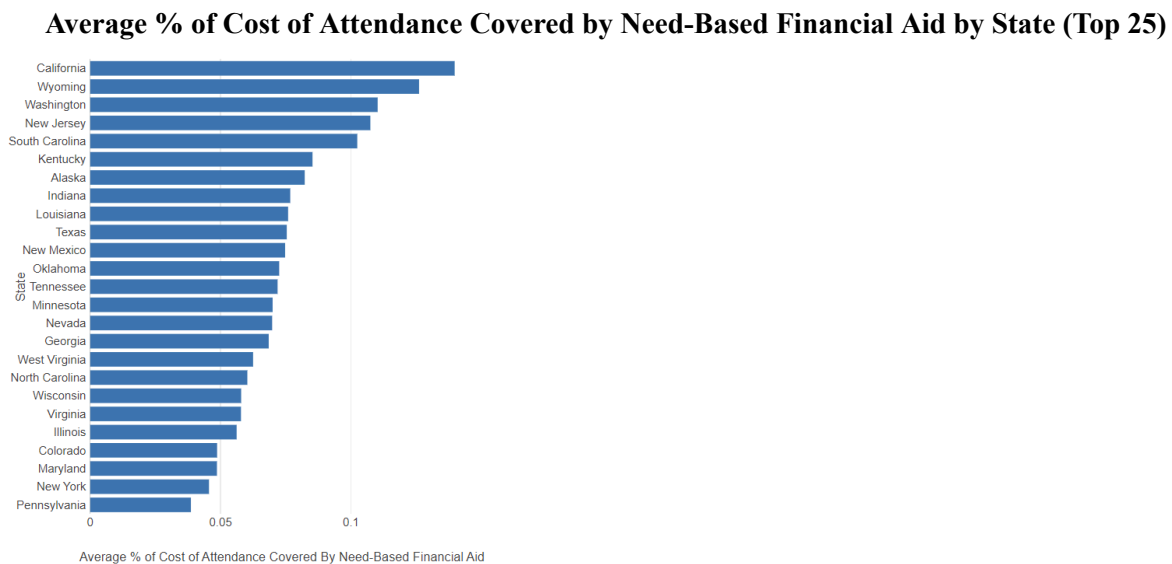
This scatter plot shows the relationship between the total cost of attendance and the average debt of graduates. This plot shows that there is a direct relationship between the total cost of attendance and the average debt of graduates. The correlation graph on the right shows that the strength of the correlation is **0.61**, which is slightly strong.

### Box Plot of Relationship Between Average Cost After Financial Aid and Percent of Graduates with Debt



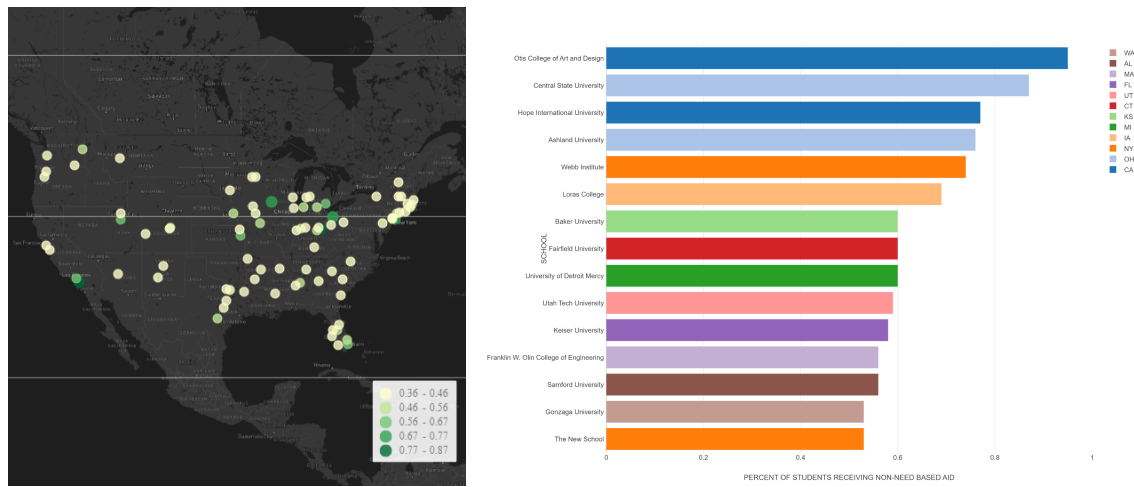
This box plot shows the distribution of the percent of graduates with debt with the average cost of attendance after financial aid. The box plot indicates a direct relationship between the cost of attendance after financial aid and the percentage of graduates with debt. However, an anomaly is observed where the median percent of graduates with debt is higher in the second group compared to the highest group, suggesting additional factors influencing debt accumulation beyond just the cost of attendance. We will explore scholarship and financial aid data next to further explore this.

### **Where do students receive the most financial aid?**



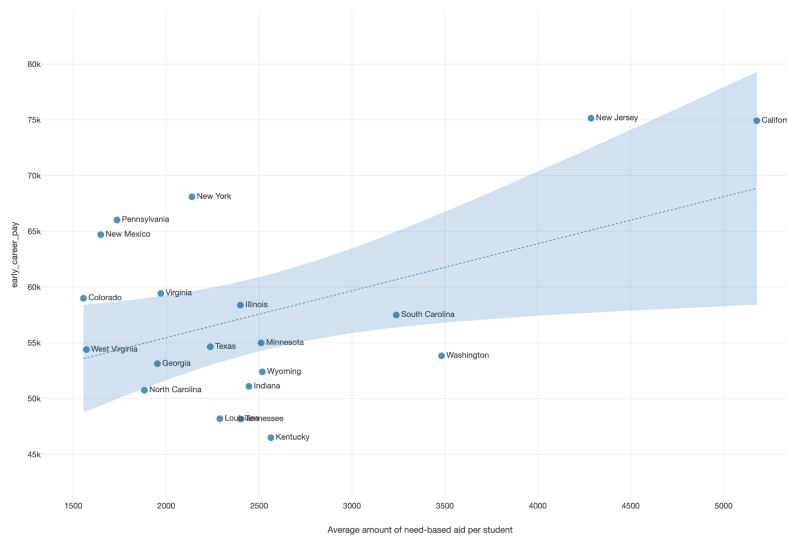
Though higher costs of school usually indicate higher debt after school which is a burden to graduates, This graph spotlights the top 25 states with the highest average percentage of college costs covered by need-based financial aid. California takes the lead, with need-based aid offsetting 14% of the total cost. Notably, this figure excludes merit-based scholarships. This data is particularly interesting when considering California's ranking among the most expensive states for college. It suggests that California offers substantial need-based aid, potentially contributing to their lower average student debt levels, despite the high overall cost. This was a key insight from this graph alone.

## Map of Top 100 Schools Based on Percent of Students Receiving Merit-Based Scholarship (2022-2023)



Two visualizations reveal the colleges that award the most merit scholarships (financial aid not based on need). The map likely shows the geographic distribution of these top schools, while the bar chart focuses on the specific institutions with the highest percentages of students receiving merit aid. This data aligns with the trend of California being a state known for generous financial aid options.

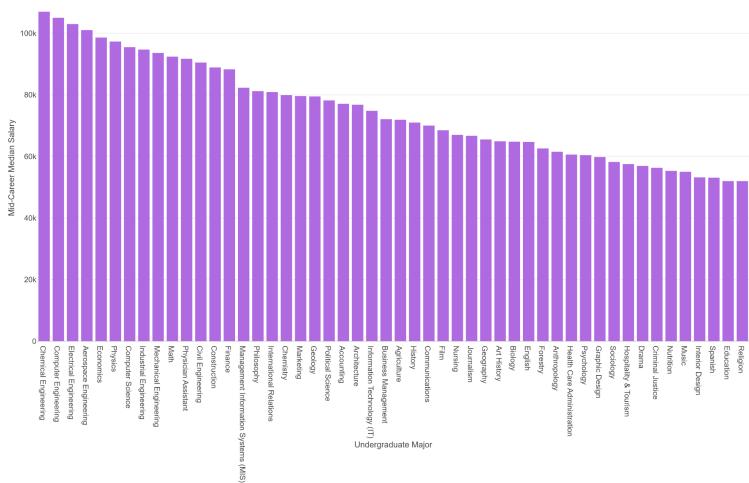
## Correlation between Average Early Career Pay and Average Amount of Need-based Aid by State



We also wanted to find out whether increased scholarships led to higher salaries after graduation. An analysis of state data reveals a weak correlation between the average amount of need-based financial aid offered and average early career pay for graduates. Across most states, the average need-based aid falls below \$3,000, while average early career pay sits under \$70,000. California and New Jersey stand out as exceptions, boasting both the highest average need-based aid and the highest average early career pay. This graph suggests that need-based scholarship is not a strong indicator of financial success.

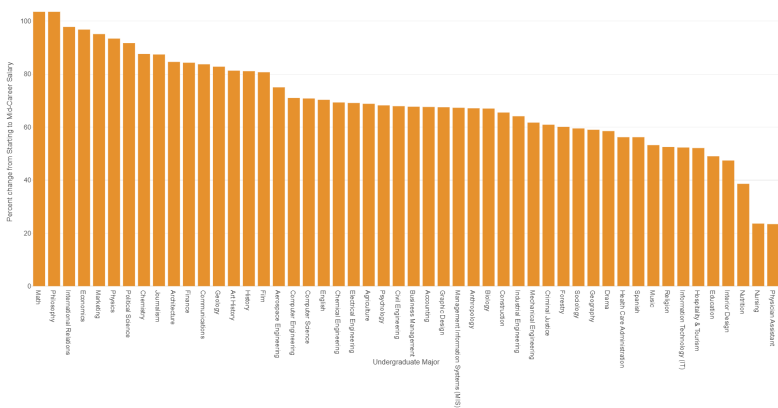
Does your degree effect how well you do after school?

Mid-Career Salary by Undergraduate Major



This dataset portrays mid-career salary by undergraduate major in descending order to paint a picture of how much money will be made by profession. It can then be used to infer how successful the students are in their careers. It looks like engineering of all types and physics are the leading undergraduate majors in terms of salary, with subjects such as drama, education, music, religion, and the arts being laggards. Some additional datasets we used highlight the success of stem majors, and it was good to see the success of individual majors back this thesis up.

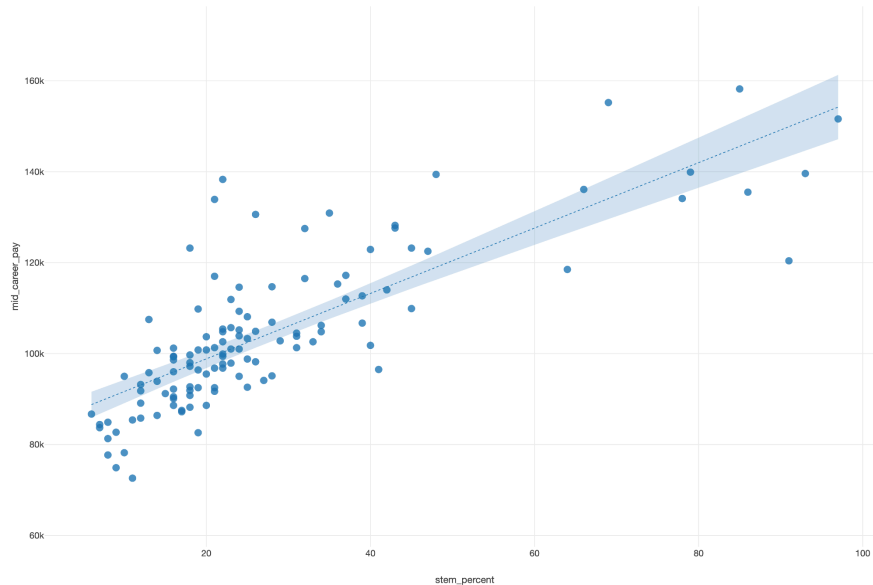
Percentage Change from Starting to Mid-Career Salary by Undergraduate Major



This graph takes a deeper look at salary trends across different college majors. It presents both starting and mid-career median salaries, along with the percentage change between them. This allows you to see the earning potential growth associated with each major. Essentially, it reveals which fields offer the most significant salary increase as you gain experience and move into mid-career positions.



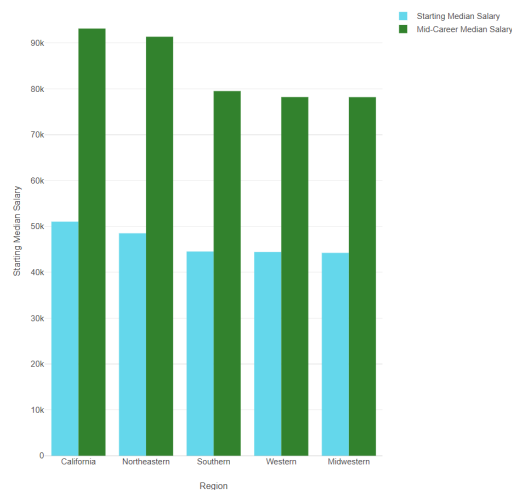
## Correlation Between Stem Percent and Mid-Career Pay



A general trend we saw within majors is that stem majors, especially within facets of engineering, had higher salaries with higher growth potential. We wanted to explore the relationship between schools with more STEM majors and mid-career pay from these schools. This scatter plot shows the relationship between the percentage of STEM graduates and the mid-career pay they receive. Each dot represents a data point that correlates a specific STEM percentage (within US universities - STEM % of the whole) with a corresponding mid-career salary. The trend line and the shaded area (which represents the confidence interval), show a positive correlation. In other words, as the percentage of STEM within a university increases, the mid-career pay increases as well.

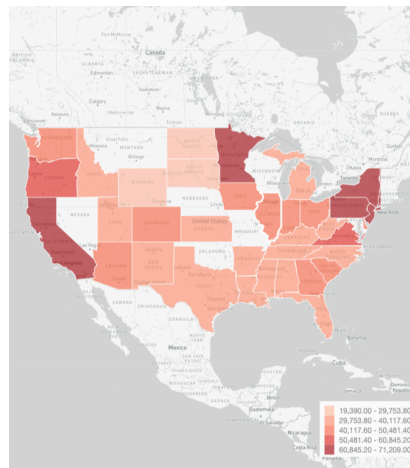
## Does *where* you attend college affect your financial success?

### Starting and Mid-Career Salary Based on Region of School



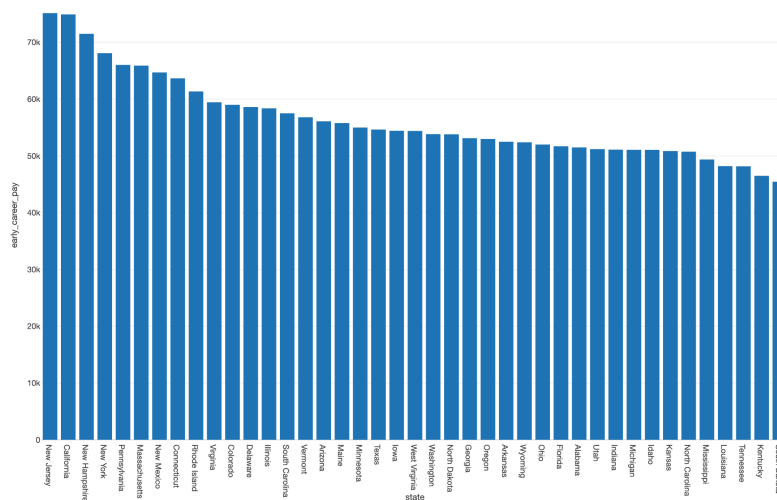
This graph compares starting and mid-career median salaries across five U.S. regions. California leads with the highest salaries at both career stages and the Midwestern region has the lowest starting salaries. Mid-career salaries are significantly higher than starting salaries in all regions, indicating salary growth over time. The California and Northeastern regions are quite comparable, both being the highest among the regions shown. In contrast, the Southern, Western, and Midwestern regions have more similar salary trajectories, with the Southern region slightly outpacing the Western in terms of mid-career median salary.

### Average Cost of School By State



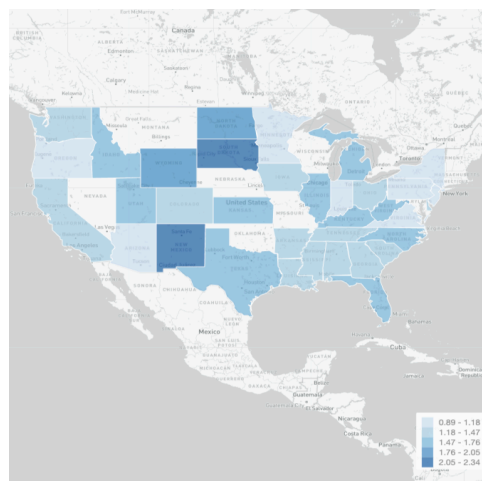
Our analysis began by examining the cost of college across different states. As expected, states with a high cost of living, such as New York, Connecticut, New Jersey, and California, also had the most expensive colleges. This finding aligns with our initial hypothesis. We then leveraged this data to investigate a further question: Does a higher cost of college translate to greater student success? The next graph delves into that question.

### Median Starting Salary By State (Top 40 States)



This graph initially suggests a correlation between higher school costs and graduates' starting salaries, particularly in New Jersey, California, and New York. However, we acknowledge that starting salary alone might not be the best measure of success, especially when considering the financial burden of attending these expensive schools. The next graph will delve deeper into this issue.

### Average Return On Investment (ROI) by State Map



This graph challenges the assumption that a college's cost directly reflects its return on investment (ROI) based on starting salary. It examines ROI by state, calculated as the median starting salary divided by the average tuition cost. Interestingly, states like New Mexico and South Dakota, with lower tuition costs, show higher ROIs despite potentially lower starting salaries compared to states with more expensive colleges. This suggests that affordability plays a more significant role in ROI than initially expected.

**Conclusion:**

Our analysis sheds the light on the topic of cost-effectiveness vs value in higher education in the United States. Although prestigious universities like Ivy League schools and liberal arts schools produce graduates with higher early career salaries, they do not necessarily offer the best return on investment due to their high cost of attendance. From our analysis, we found that state schools usually provide a better ROI because of their low cost of attendance and solid early career salary. We also found that a university's cost of attendance does not directly correlate with student debt levels, as some states, like California, offer substantial financial aid that can help offset the high cost of attendance.

Furthermore, our analysis shows that STEM fields have higher average starting salary and greater salary growth potential compared to other fields and majors. The location of the school also played a big role in both starting salaries and salary growth potential. Generally, states with a higher cost of living like California and states in the Northeast region offer higher starting salaries than other states. However, it's important to note that states with lower costs like New Mexico may still provide a better overall ROI for college graduates. Our analysis concludes that prospective college students should heavily weigh factors such as school type, available majors, location, and average financial aid package when choosing their university to ensure the best possible return on their investment.

**Datasets:**

<https://www.kaggle.com/datasets/wsj/college-salaries>

[https://www.kaggle.com/datasets/jessemostipak/college-tuition-diversity-and-pay?select=salary\\_potential\\_csv](https://www.kaggle.com/datasets/jessemostipak/college-tuition-diversity-and-pay?select=salary_potential_csv)

<https://ticas.org/interactive-map/>

<https://www.usnews.com/best-colleges/rankings/most-merit-aid>

<https://universitybusiness.com/these-25-states-provide-the-most-need-based-financial-aid-why-it-matters-to-your-school/>

We utilized these datasets and merged many of them by majors and/or states to fully understand the complexities and nuances of our analysis. This approach addressed the challenge of limited publicly available university-level data. It's important to note that all data on tuition, cost, and median salaries is from 2019-2021. While our merit-based scholarship data is from a slightly different timeframe (2022-2023), it reflects consistent patterns.