



CIS 9655: DATA VISUALIZATION

Keys to Career Success: What Matters Most?

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Introduction

In this project, we run an analysis on 4 different dataset to understand how factors such as university rankings, GPA, field of study, geographic region, internships, and networking skills affect salaries and career progression in the US job market. Using multiple datasets, we aim to uncover trends that influence job promotions and overall work-life balance.

Additionally, we incorporate a salary dataset from the UK, enabling us to compare salaries across different industries in both regions. By visualizing these insights, we seek to identify patterns that highlight the differences and similarities between salary structures, career growth opportunities, and work-life balance in the US and UK job markets.

Through interactive and insightful visualizations using tools such as Tableau and Python, this project will provide a data-driven perspective on how education, experience, and networking impact career success and how these factors differ across two major economies.

Hypothesis statement:

Graduates from highly ranked institutions typically start off with higher starting salaries, however this benefit is not just influenced by university ranking alone, but also by few other factors such as geographic location, field of study, internships, job satisfaction, certifications and networking.

Methodology

- Data Cleaning and Preparation

Before diving into the analysis, the datasets were carefully checked for any missing or inconsistent values. Any gaps in the data were either filled using appropriate imputation methods or removed if necessary to maintain data integrity. Categorical variables were converted into numerical formats using techniques like one-hot and label encoding, making them easier to analyze and interpret.

- Visualization Techniques

To bring the data to life, various visualization tools such as Python (Matplotlib, Seaborn) and Tableau were used. A mix of scatter plots, bar charts, line graphs, box plots, and heatmaps

helped illustrate key trends and relationships between important variables. These visualizations made it easier to spot patterns and gain insights at a glance.

- Analytical Approach and Insights

The goal of this analysis was to understand what factors contribute to better job opportunities and higher salaries. By applying statistical analysis and exploring trends in the data, key insights were uncovered. The findings highlight which skills, industries, and career paths tend to lead to better outcomes, offering valuable guidance for students and professionals looking to maximize their job prospects and earning potential.

Findings & Discussion

Dataset 1: Education & Career Success (Kaggle)

To start the study of the effect of university ranking on starting job salary, Dataset 1 was utilized. The analysis of the first dataset produced multiple visualizations. The university rankings were divided into four bins or Tiers. Tier 1: 0-50 ranking, Tier 2: 51-200, Tier 3: 201-500 and Tier 4: 500+ . To start the analysis, a general overview was done to see the effect of different university tiers on the starting salary. Figure 1 shows that there was no visible difference in the starting salary across different university tiers. Among all 4 university categories, the starting median salary is around \$50K, which is a reasonable expectation as the US median salary in 2024 was around \$59,228 [1].

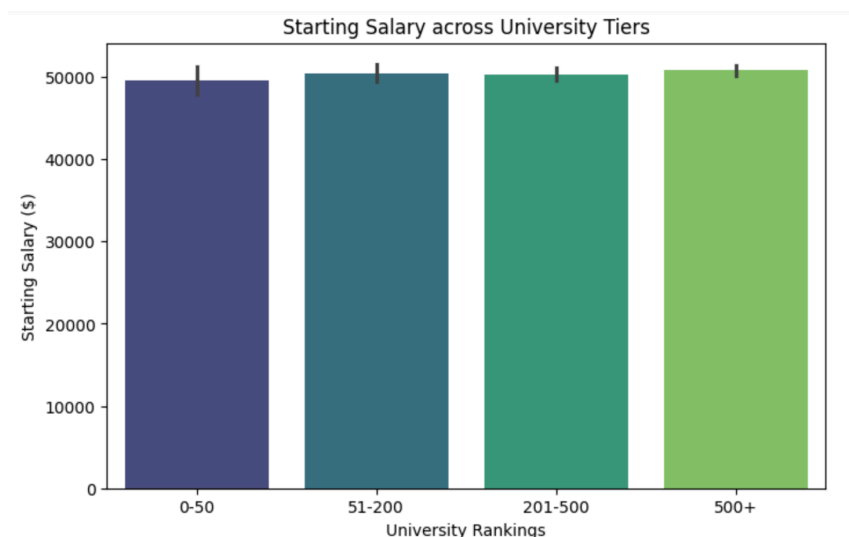


Figure 1: Starting Salary across different University tiers

To deepen the analysis of this dataset, the influence of various fields of study on starting salary was explored in Figure 2. The figure shows that the median starting salary is relatively consistent across all fields, with the exception of business, which appears slightly lower than the rest. This is somewhat unexpected, as Business is typically perceived as a higher-paying field. This figure also shows that Arts has outliers reaching the \$100K range. Even Though Arts is often assumed to offer one of the lowest starting salaries, certain roles within the field such as Game designer, digital artists and other creative roles – can offer competitive starting salaries[2].

The low median salary in Business may be explained by the presence of internship roles or unpaid experiences within the field, that as a result, might lower the median salary overall. Similarly, other high-earning outliers can be observed in fields like Engineering and law. This indicates that some graduates in those fields are entering well-paid positions. Overall, this figure raises many questions about how each field of study is defined and represented in this dataset. For example, “Could the medical salary here be a resident salary, and not an attending salary?”

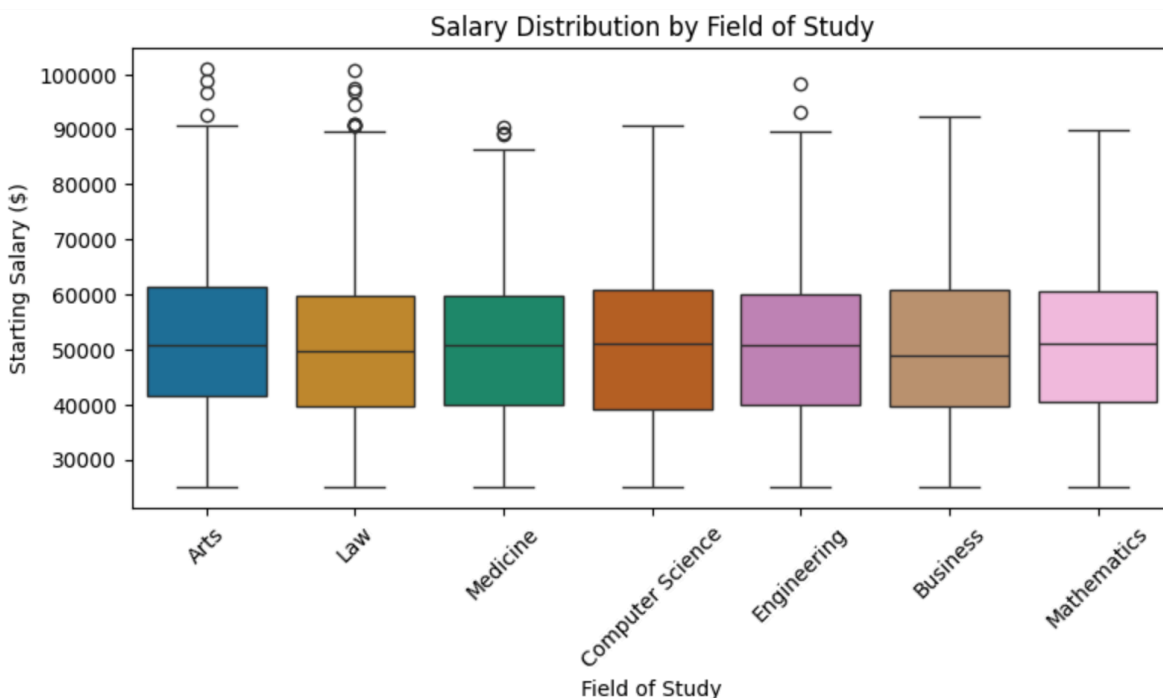


Figure 2: Starting Salary by Field of Study

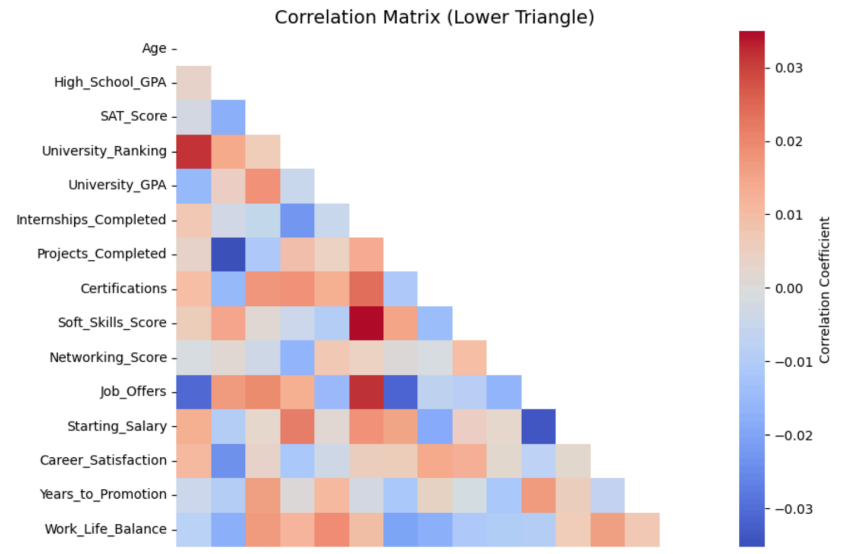


Figure 3: Correlation Matrix (Lower Triangle)

Since the initial graphs showed no apparent correlation between starting salary and either university ranking or field of study, a correlation matrix was generated to verify these observations. Figure 3 confirms that there are no strong correlations between starting salary and any of the variables present in this dataset. The correlation coefficients are close to zero, which indicates that the starting salary cannot be inferred or explained by other variables or factors in this dataset.

Data Set 2 (Pay Scale Website)

After our initial data set failed to show us any meaningful correlation, we decided its time to dive deeper and do some research on what other information is available out there. We ended up finding some very useful data but it was on a website, so for this part of the project we decided to web scrape the data into a data frame and then export it all to a csv file for further analysis. This data set included the columns: Rank, School Name, School Type, Early Career Pay, Mid Career Pay, % Stem Meaning and % High Meaning (basically the % of alumni who think that their work has positively impacted the world).

For our initial analysis, we looked at the correlation between US college ranks and early career salaries.

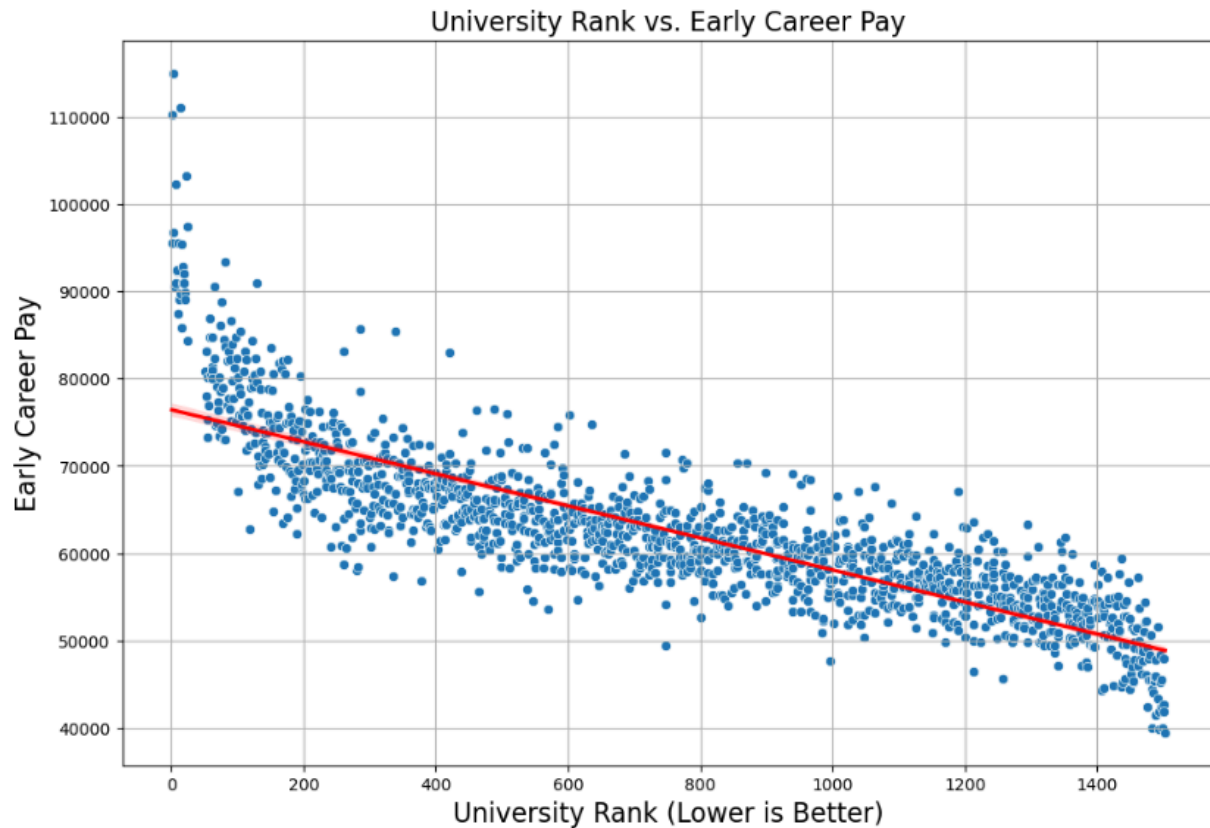


Figure 4: University Rank vs Early Career Pay

The figure above shows that the lower the rank of the university, the higher the salary they earn on average. This is completely different from our previous data set and actually shows that there is indeed a correlation between University Ranking and salaries earned after graduation. One unique aspect that this data set offers is the fact that there is a column for mid-career pay which brings a time factor in our analysis. We can see if the correlation persists over time when these graduates are older and have had some experience in their careers. And that is exactly what we will be looking at next.

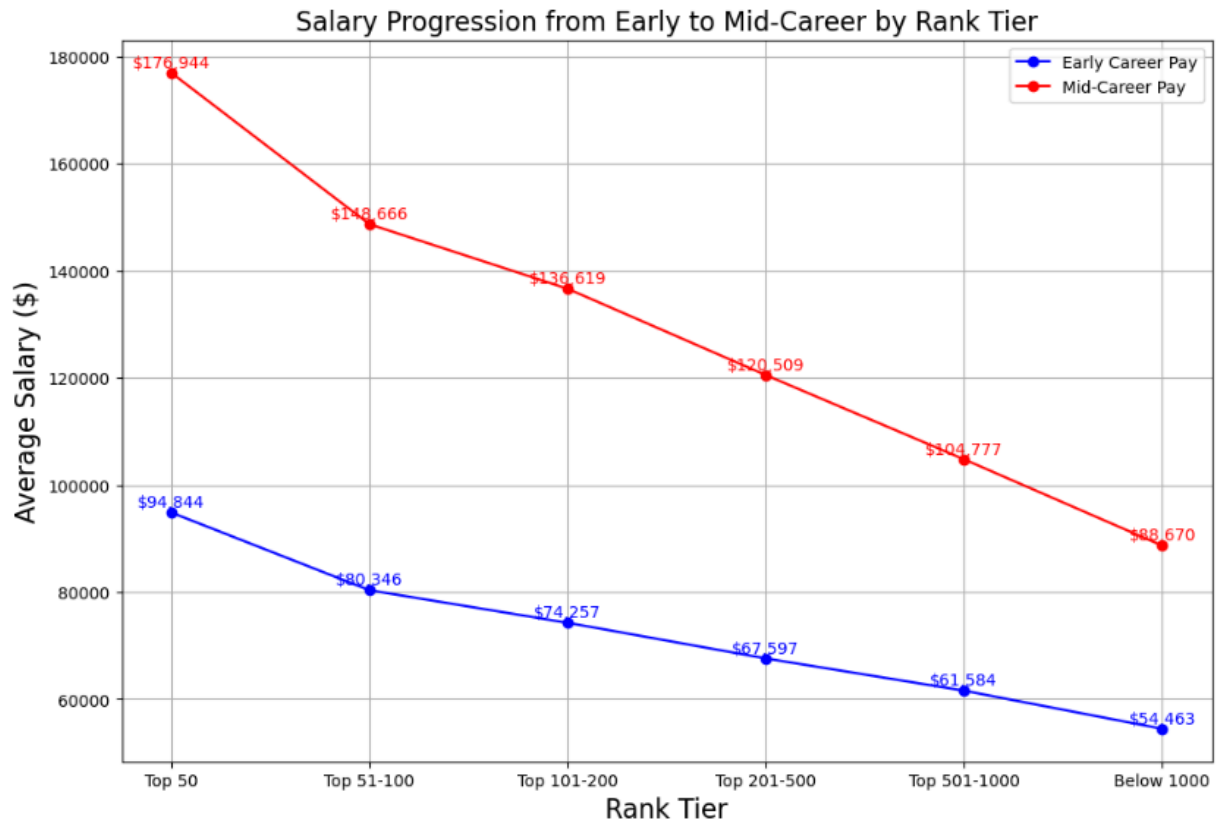


Figure 5: Salary Progression by Rank Tier

This figure above is a turning point in our narrative so far. Let us go over the methodology before diving into the importance for this. Since this dataset had 1500+ colleges, we decided to make things easier for us and do binning with each bins being 50. Then we calculated the average salary in those set bins. This method was done both for Early and Mid Career, giving us an amazing visual salary progression over time for each tier of college. So, this graph right here can be described as the epitome of statistical storytelling. This opens up the idea that the impact of attending a top college not only has an immediate impact on salary but also carries forward into career growth. So, university ranking does matter for salaries and offers long term financial benefits. In the world of finance this would be a good return on investment situation.

Analyzing this trend a little bit deeper we can see that the sharpest drop off happens around the top 200 colleges, perhaps that is a point of interest where institutional brands start losing their value. This data set also hosts one more interesting column which might reveal why this trend is the way it is.

The column in question is the Alumni work impact column which essentially lists the percentage of people who believe that their career had a positive impact on the world. From a time perspective we should look at mid-career salaries and its correlation to this column to see if people later in their career feel satisfied by the work they have done by attending these top universities. The figure below is the visual and what it revealed is quite interesting.

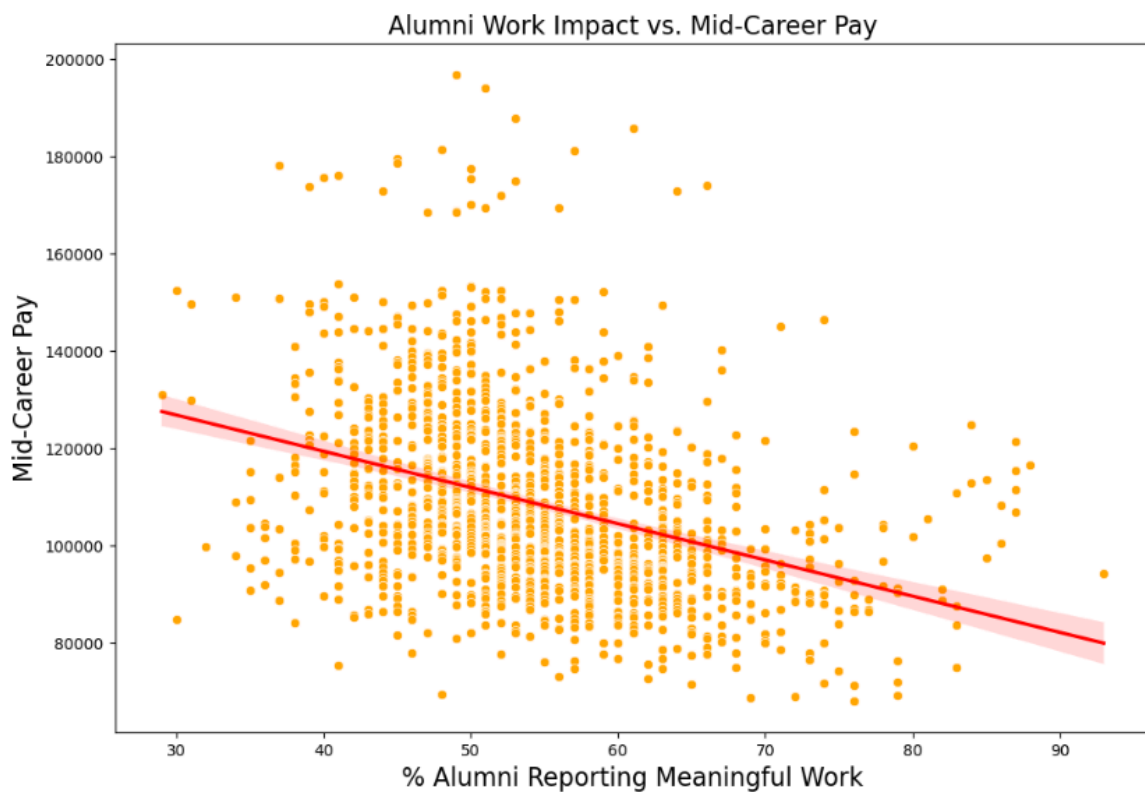


Figure 6: Alumni Work Impact vs Mid Career Pay

The figure above tells a surprising and thought provoking story. This visual was made by plotting the mid-career salaries against the percentage of alumni who reported meaningful work in their field. Since the scatter plot was a little chaotic, we decided to do a regression line to figure out what kind of correlation we have here. Unlike the previous visual which showed a positive correlation between ranking and salary outcomes, this one is an inverse relationship.

This unusual trend implies that people who are purpose driven may not always be gifted with financial reward. In other words, the people who feel that their work is making a positive impact in the world tend to earn less. But perhaps there is a deeper reason for this, perhaps those people are choosing different majors such as in education and public service while the higher salaried graduates are working in tech and medicine. This could be further analyzed from another data set but for now the perspective stands that higher salaries does not always equal

career satisfaction or just satisfaction in general. Perhaps the cost of sacrificing one's work life balance to earn more money has a negative long term effect which doesn't necessarily equate to what university they graduated from. This also goes against our idea of equating the word success with financial gain because that is clearly not the case here. There are hidden factors, perhaps qualitative factors that we can't see yet. Either way this analyzing of alumni gave us the idea to further analyze if this is the case in a different geographical region and to analyze what kind of qualitative factors influence the salaries vs ranking positive trend. This will be further examined in the two data sets to come.

Data Set 3 (UK Data)

In order to examine whether geographical region has an effect on average salary, the UK salary dataset was analyzed across different industries. This dataset was intentionally included to provide a non-US perspective and to broaden the geographical scope of the analysis.

Figure 7 shows the mean salary across various industries or job sectors in the UK. Due to the large number of sectors in Dataset 3, the visualization appears to be somewhat crowded and a bit challenging to interpret. As a result, a more focused analysis was conducted by isolating the 10 highest-paying and 10 lowest-paying job categories.

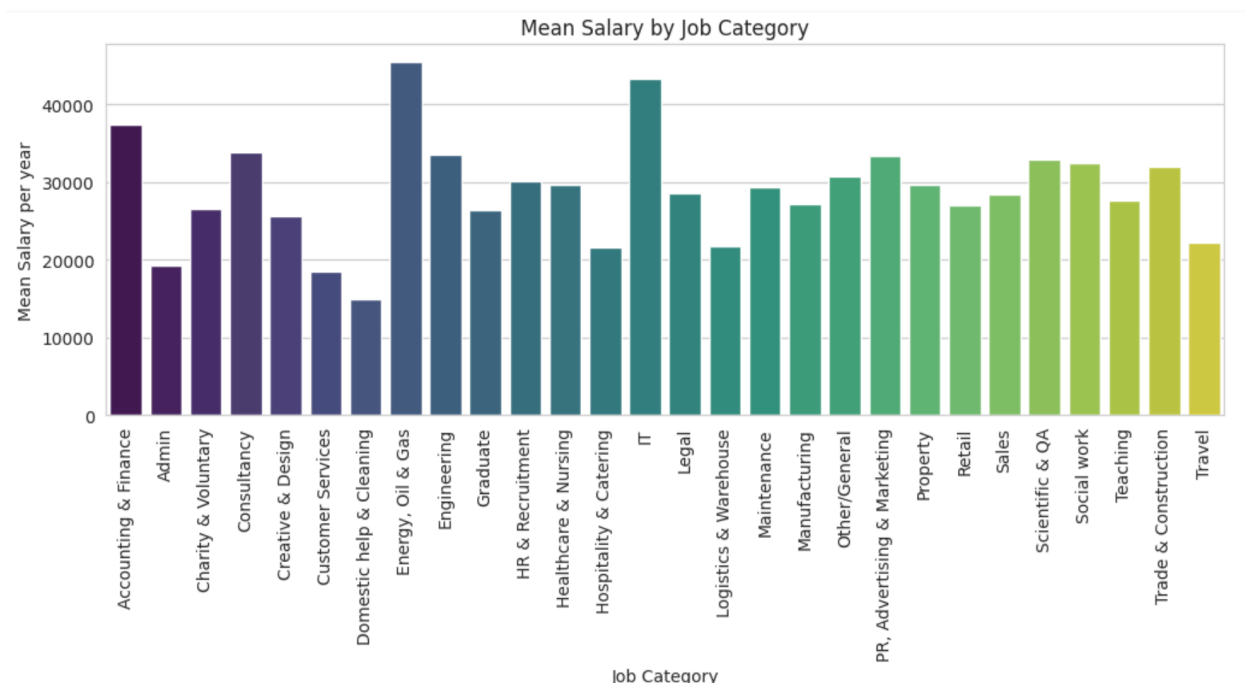


Figure 7: Mean Salary by Job Category

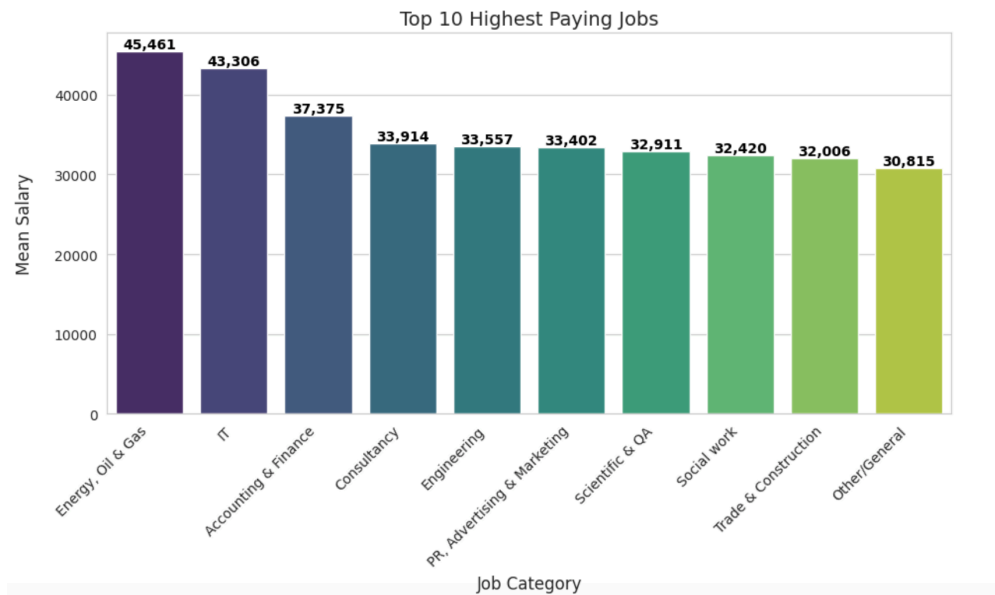


Figure 8: Top 10 Paying Industries/Jobs

Figure 8 highlights the top 10 highest-paying job categories in this dataset. The results show that Energy, Oil & Gas and IT lead with the highest average salaries of around £43,000, followed by Accounting & Finance and Consultancy. Surprisingly, fields such as Social Work and Trade & Construction also appear in the top 10. This suggests that high-paying opportunities also exist beyond the traditional high-earning industries, like finance, business, and law. Overall, this demonstrates that certain sectors in the job market, which are often overlooked in salary research, like Dataset 1, can still offer competitive wages.

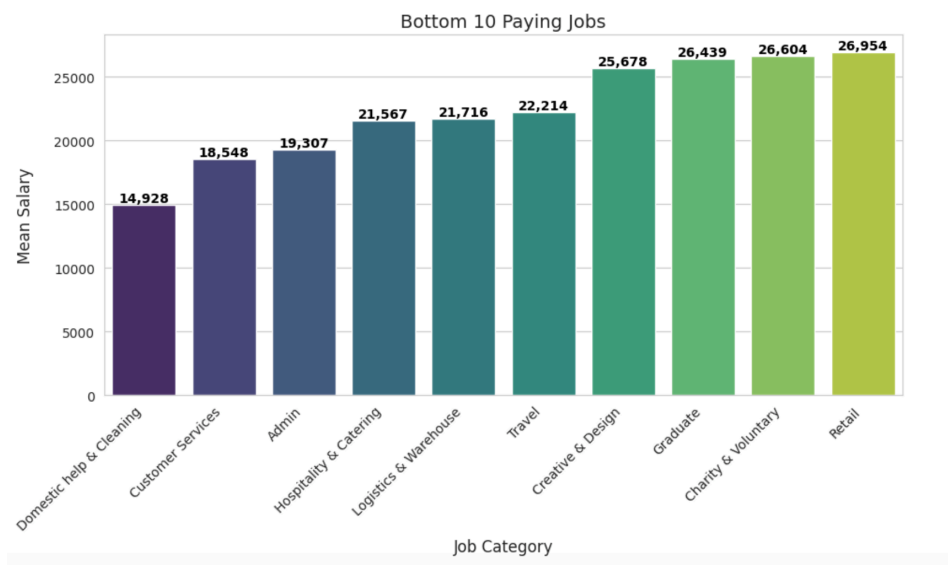


Figure 9: Bottom 10 Paying Industries/Jobs

Figure 9 displays the 10 lowest-paying job categories, with Domestic Help & Cleaning, Customer Services, and Admin roles having mean salaries below £20,000. This might be explained by the fact that sometimes these roles are either entry-level positions with limited employment growth, or they are just severely underpaid [3].

Finally, providing the UK salary dataset observations along with the US datasets, offers valuable insight into how geography influences salary trends. The top-paying job sectors in the UK differ from those typically seen in the US. These differences suggest that each country's unique economic priorities and societal needs shape which fields tend to earn higher starting salaries.

Research Paper

Even after analyzing the 3rd data set on UK salaries, we encountered a roadblock in determining our next steps. We realized that there are indeed underlying factors that we can't see yet and that is affecting our ability to come up with a solid conclusion. So, we took a different approach. We decided to do some research by ourselves and see if we can find any scholarly publication that would help us support and dive deeper into our analysis.

Utilizing ResearchGate, we received access to a publication by Hans-Georg Wolff and Klaus Moser titled “Effects of Networking on Career Success: A Longitudinal Study” published in 2009.

This study investigated how networking affects career success over time using a longitudinal design, which was a step beyond the traditional one-time snapshot approach. This paper looked at surveys from 235 German professionals over 3 years and it was extremely crucial for our analysis due to the following reasons:

- It showed that networking is positively related to career satisfaction.
- It showed that networking is positively related to salary.

Now this is how it all ties in together. First, we have to ask ourselves, what advantages do top-ranked universities offer that lower-ranked ones do not? The answer is simple: better quality of education, better faculty, better alumni and better networking opportunities. So, if there is indeed a correlation between networking opportunities and salary, as shown in this paper, it means that we need to focus on those qualitative factors and find a data set that have those factors listed. This leads to our final data set analysis.

Data Set 4

This final data set was actually the missing piece we have been looking for and it also connects back to our previous findings. From the research paper and from our previous analysis we found that qualitative factors such as alumni connections and quality of education plays a big role to career success over time of high ranked college graduates. So, using keywords such as “alumni” and “networking”, we found this dataset that has rankings for top schools in the US, UK and even Canada for the year 2012. It consisted of rankings for quality of education (lower the better), rankings for impact of research onto the world and most importantly number of people who got hired through alumni connections (which is essentially networking). So, by analyzing this particular data set, we were able to paint a more holistic picture to why there is a correlation that exists between higher salary, career success and the school these graduates graduated from.

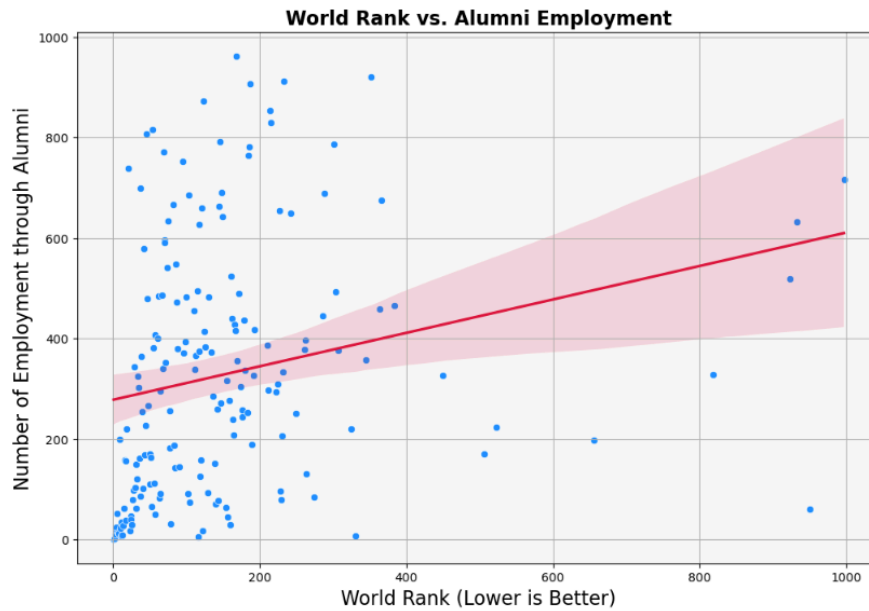


Figure 10: World Rank vs Number of Employment Through Alumni

After some initial cleaning, we looked at how the ranking of the universities around the world correlated with the number of people who got hired through Alumni connections and the results were quite interesting. The figure above shows the correlation and since the data points were a little spread out, we decided to do a regression line to get a better sense of what is going on. We can see a clearly positive trend (although not that strong) here. Also we kind of see how the alumni hires are more clustered towards the top 200 colleges, this suggests that there is a higher chance that you will be employed through alumni if you already go to a top school. This makes sense because a lot of top schools tend to have amazing alumni connections which the students can leverage. These hires also tend to be in top companies around the world, which ends up having higher salaries. So, this intake does allow us to answer the question of why top ranked schools perform better; however, this data set also has other qualitative factors that we can look at. Will they offer similar insights? The figure below dives into that.

Key Drivers of World University Rankings

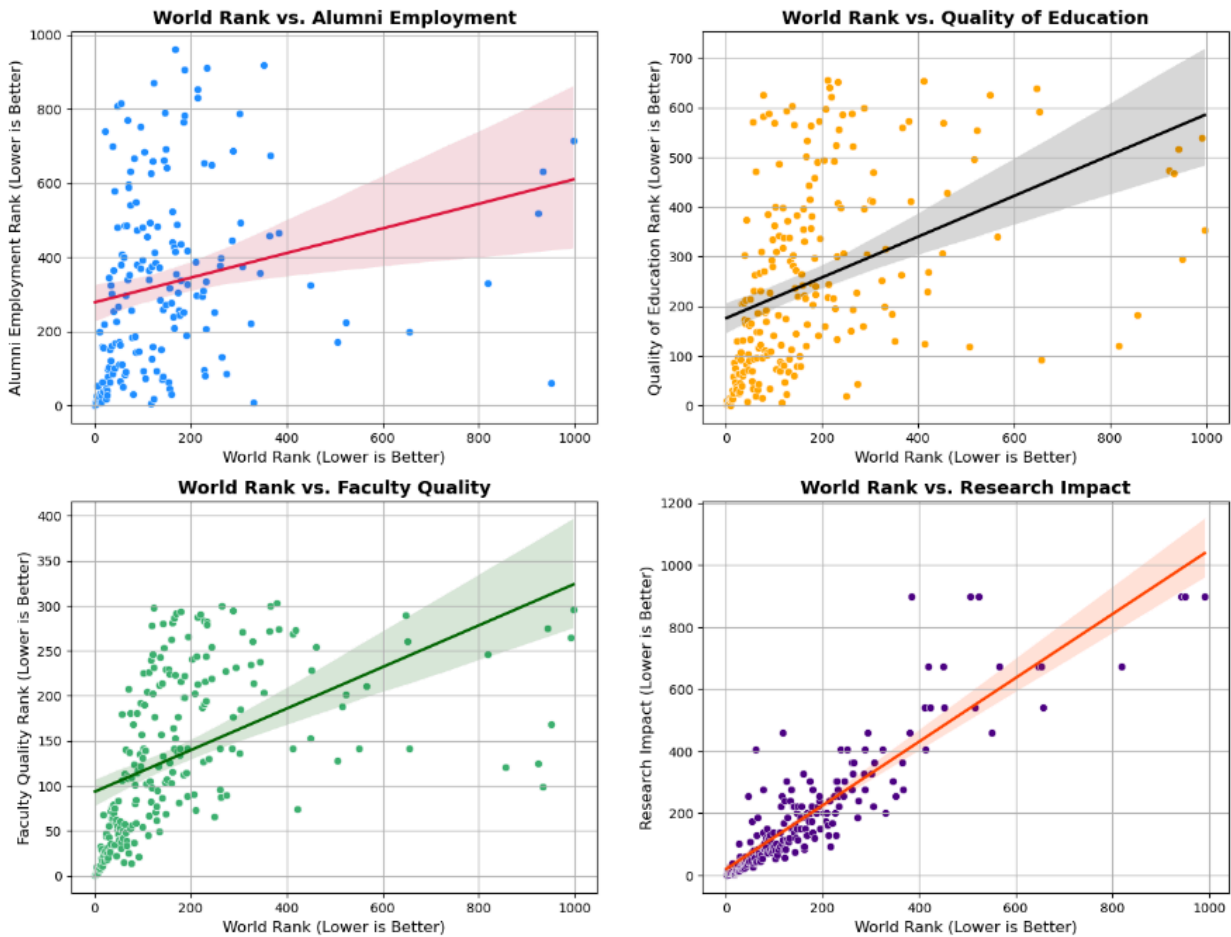


Figure 11: World Rank vs Qualitative Factors

The four graphs in the figure above explore key qualitative factors: Alumni Employment, Quality of Education, Faculty Quality and Research Impact. Despite measuring different aspects of university performance, they all exhibit a consistent trend which is that the top-ranked universities tend to perform better across each of these dimensions. It is most noticeable in the Research Impact vs Word Rank graph where we can see a strong cluster amongst the top 200 universities, suggesting that they have better quality of research, better equipment for research and actually have a positive impact on the world.

These patterns help validate the reasoning to why there is such a strong trend of top ranked graduates earning more money in their early and mid careers.

Conclusion

This analysis shows that university rankings do make a real difference in career success, especially when it comes to salary and job opportunities. Top-ranked universities offer more than just a good name, they provide strong faculty, better research opportunities, and powerful alumni networks that help graduates move ahead in their careers. The data clearly shows that people from higher-ranked universities tend to earn more, while salaries drop for those from lower-ranked schools, especially beyond the Top 200.

At the same time, we have found out from our research paper, networking is just as important for career growth. Building connections and relationships can open doors to better job opportunities and higher salaries.

In the end, while rankings matter, they shouldn't be the only factor in choosing a university. The best school for your career may not always be the best for your personal goals. It's important to find a balance between career goals, career opportunities, and what feels right for you.

References

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[2] <https://www.ziprecruiter.com/g/Highest-Paying-Artist-Jobs>

[3] <https://www.bls.gov/ooh/office-and-administrative-support/secretaries-and-administrative-assistants.htm#:~:text=%2444%2C480-,The%20median%20annual%20wage%20for%20secretaries%20and%20administrative%20assistants%20was,percent%20earned%20more%20than%20%2474%2C160.>

[4] <https://www.payscale.com/college-salary-report/bachelors>

[5] https://www.researchgate.net/publication/23971043_Effects_of_Networking_on_Career_Success_A_Longitudinal_Study