

Data Visualization

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Final Project Report

**"Exploring the Factors Affecting University Rankings and
International Student Decision Making"**

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Introduction:

A crucial choice that students must make in today's globalized society is which institution to attend. A common method for evaluating and contrasting the quality of various universities is to utilize university rankings. But depending on the technique employed, the elements that affect university rankings might change, therefore it's critical to comprehend how these rankings are created and what aspects are considered.

The impact of fees on international students in the United States, university rankings year over year, QS ranking and tuition cost, the effect of corruption on international students, university rankings and measures of life satisfaction, undergraduate enrollment and rankings, and more will all be covered in this report. Do inhabitants in nations with highly regarded universities have the most contented and happy lives? How does freedom affect a university's ranking according to regions, and how significant is academic research to a university?

Particularly in the United States, where the expense of education may be relatively expensive, the effect of fees on overseas students is an important consideration. Additionally, comparing university rankings from year to year can show how institutions change and advance through time. Another essential element that students may consider when choosing a university is the QS ranking and tuition price because it offers details on both the educational quality and the cost of attendance.

Additionally, because corruption may have a substantial influence on educational quality and overall institution rankings, it is a topic that is receiving more and more attention: how it affects overseas students. Measures of life satisfaction, undergraduate enrolment, and rankings are among significant factors that students may consider while choosing an institution.

The survey will also examine whether the inhabitants of nations with highly regarded institutions are the happiest and most contented, as well as how freedom affects regional differences in university rankings. Finally, we will look at the significance of academic research for universities because it has a big influence on rankings and public perception.

The project is ambitious in its scope since I am combining columns from six different data sets and also it seeks to provide a comprehensive understanding of the factors that influence university rankings and student decision-making. It draws upon various external sources to support its findings and recommendations.

Finally, my research questions are:

1. What are all the factors do international students may consider while choosing a university?
2. Do top universities in the US have high undergrad enrollment?
3. What is the relationship between QS University Rankings, GDP, and life expectancy?
4. Do countries with high-ranked universities have the happiest and most satisfied populations?
5. Do top universities have high tuition fees?
6. What are all the factors that affect the rankings of the university?

Methodology:

For this project I have data from 6 different sources and links for those data sources are given below:

1. <https://www.kaggle.com/datasets/padhmam/qs-world-university-rankings-2017-2022>
2. <https://data.world/promptcloud/world-happiness-report-2019/workspace/file?filename=world-happiness-report-2019.csv>
3. https://www.kaggle.com/datasets/jessemostipak/college-tuition-diversity-and-pay?select=tuition_cost.csv
4. <https://knoema.com/pslcsag/world-university-ranking-full-list-2011-2019>
5. <https://data.world/ian/united-states-university-rankings/workspace/file?filename=united-states-university-rankings-QueryResult.xlsx>
6. <https://www.kaggle.com/datasets/kumarajarshi/life-expectancy-who>

To answer my research questions, I have linked the QS world ranking data to all other data sources. There were not many missing values in the data set, however I have removed some of the unwanted columns from all the data sources.

The labels of each column in all the datasets have been explained below:

1) QS World Rankings:

It has a total of 11 features.

- university - name of the university
- year - year of ranking
- rank_display - rank given to the university.
- score - score of the university
- country - country in which the university is located.
- city - city in which the university is located.
- region - continent in which the university is located.
- research_output - quality of research at the university
- student_faculty_ratio - number of students assigned to per faculty.
- international_students - number of international students enrolled at the university.
- size - size of the university in terms of area.
- faculty_count - number of faculty or academic staff at the university.

2) World Happiness Index:

- Country: country in which all the measures are calculated.
- Corruption : The extent to which Perception of Corruption contributes to Happiness Score.
- Ladder: The Cantril Ladder is a measure of life satisfaction.
- Freedom: The extent to which Freedom contributed to the calculation of the Happiness Score.
- Healthy Life Expectancy: The extent to which Life expectancy contributed to the calculation of the Happiness Score.
- Log of GDP per capita: The extent to which GDP contributes to the calculation of the Happiness Score.

3) Tuition Cost Data:

- State: Name of the state in the US where university is located
- University Name: Name of the university
- In state tuition: Tuition for in-state residents in USD.
- In state total: Total cost for in-state residents in USD (sum of room and board + in-state tuition)
- Out of state tuition: Tuition for out-of-state residents in USD.
- Out of state total: Total cost for out-of-state residents in USD (sum of room and board + out of state tuition)

4) World's University rankings by Times Higher Education:

This data includes top universities in the world as per the most recent World University Rankings by Times Higher Education (THE). Overall universities' performance score is assessed based on the following parameters:

- teaching score: The learning environment.
- research score: Volume, income, and reputation of research.
- citations score: Research influence.
- international outlook score :International staff, students and research.

5) US universities rankings:

- Name: Name of the institution.
- Rank: Rankings of universities in the US
- Tuition and fee: Combined tuition and fees (in thousands of dollars). For public universities with different tuition structure for in-state vs. out-of-state students, this number reflects out-of-state tuition.
- Undergrad Enrollment: Number of enrolled undergraduate students.
- US cities: Names of different cities in the US.

6) Life Expectancy Report :

- Country: Name of the country.
- Year : Year in which the parameters have been measured or calculated.
- Status: Developing or developed.
- Life expectancy: Life expectancy in age.
- GDP : GDP of a particular country.
- Population: Population of a particular country according to year.

Analysis:

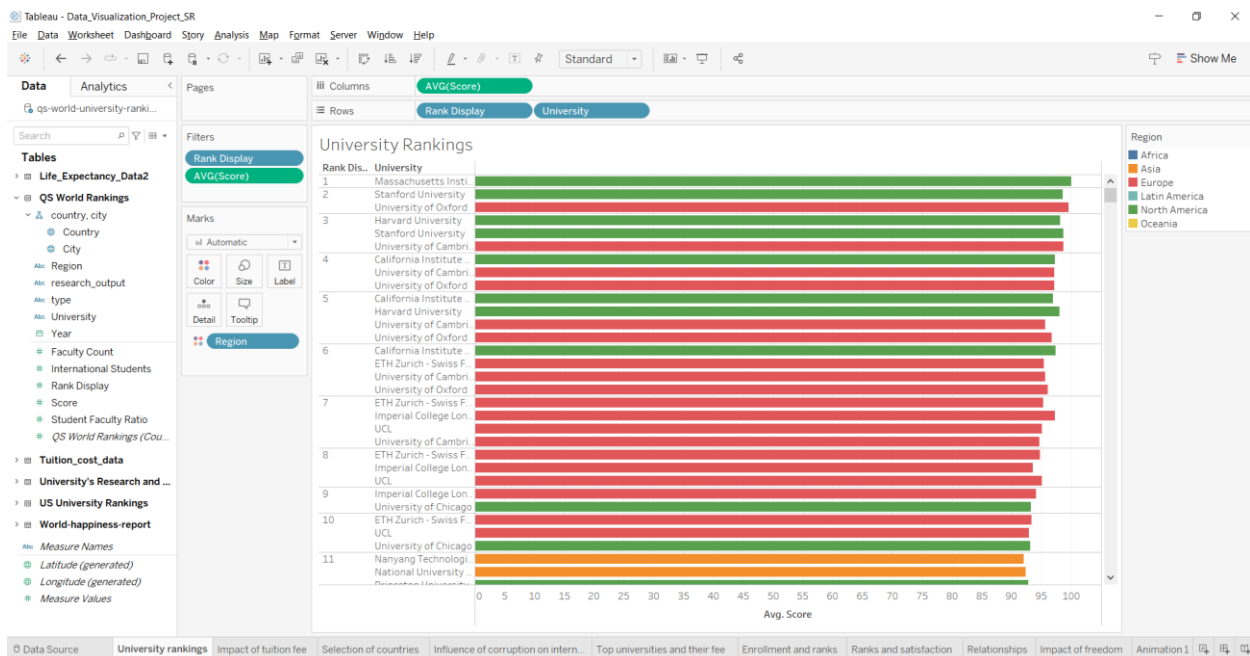
Visualization 1:

This visualization is a horizontal bar chart that shows the ranking of several colleges and their names along the y-axis and the average score along the x-axis. The color of the bars is determined by the area to which each institution belongs, with North America depicted in green, Europe in red, Asia in orange, Latin America in light blue regions in gray and Oceania in yellow.

The bar chart shows that the Massachusetts Institute of Technology (MIT), which is located in North America, has the highest ranking of all universities mentioned. Furthermore, the top ten colleges are largely concentrated in North America and Europe. Individuals interested in applying to colleges may find this information valuable because it offers an indication of which universities are highly rated worldwide and where they are located.

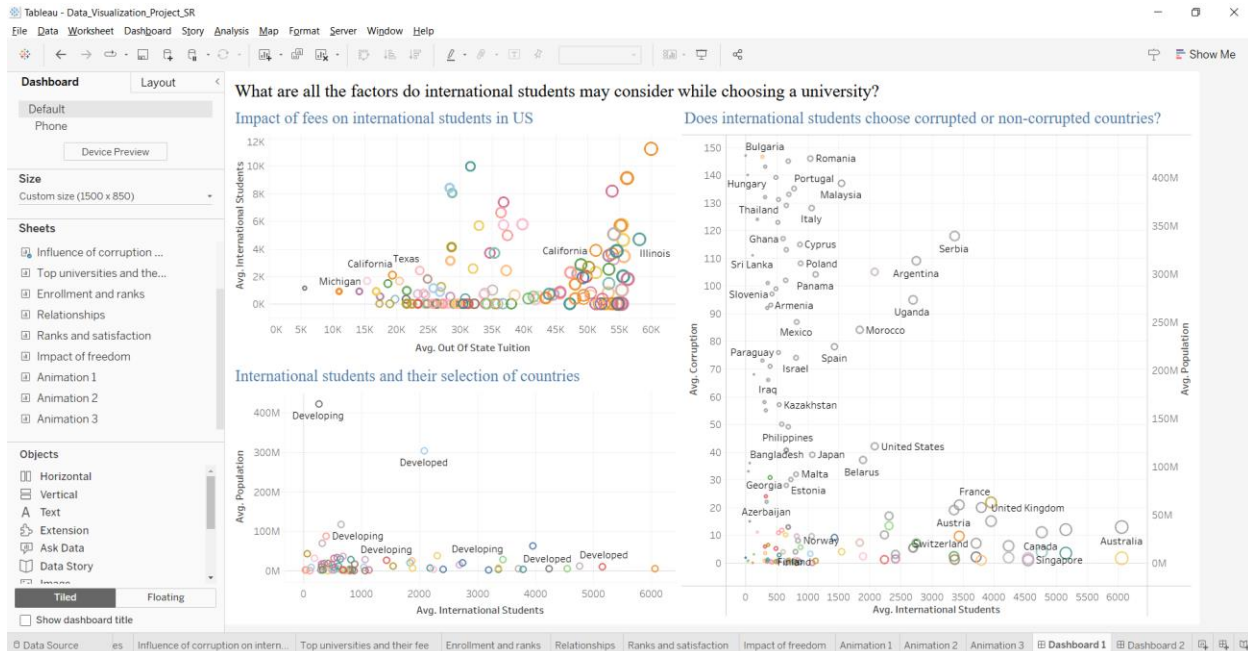
Additionally, the use of color in this image aids in the distinction of institutions from various areas and facilitates simple comparisons between them. When evaluating the geographic distribution of highly ranked colleges, researchers and policymakers may find it beneficial to utilize this method of color coding to show patterns and trends. Overall, this visualization efficiently communicates crucial details regarding regional variances and institution rankings in a simple and easy-to-understand style.

Universities and their rankings:



Research question 1:

What are all the factors do international students may consider while choosing a university?



Visualization 2:

Many competent foreign students who want to study in the United States may find it difficult to do so since the tuition and fees for international students are much more expensive than those for in-state and out-of-state students. From the scatter plot it is evident that more international students choose high-cost universities like Columbia university and University of Southern California.

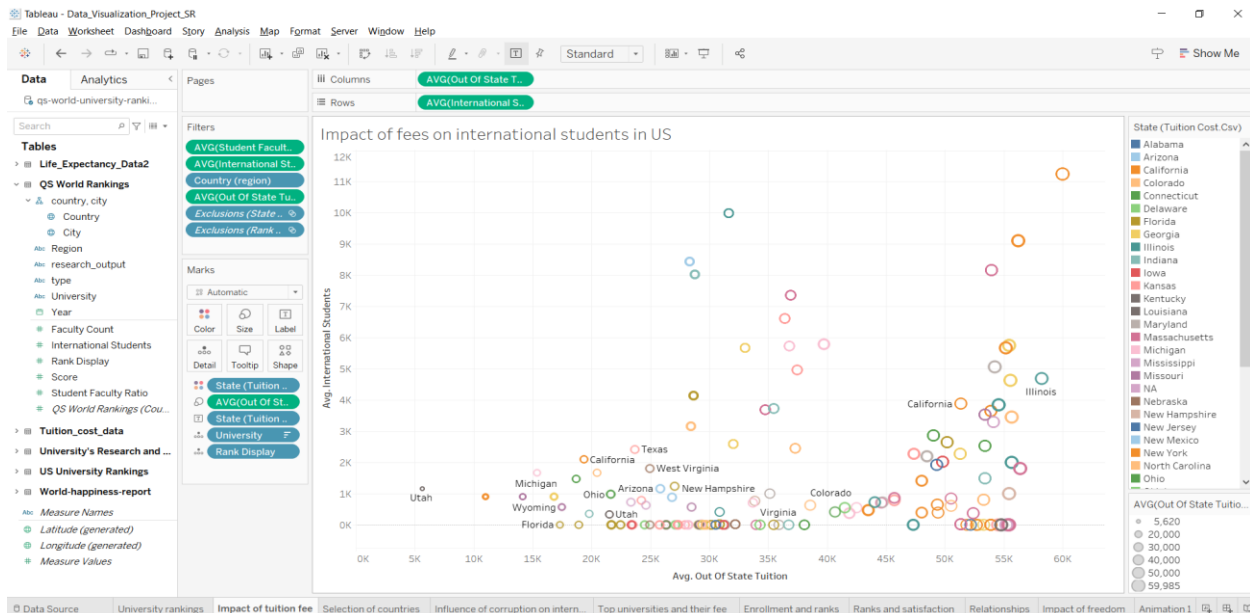
From the visualization we can notice that even though the out of state tuition fees are 59985\$ the number of international students is 11252 which is quite high, we also know that cost of living in New York is higher than other states in the US.

Public two-year institutions have seen a decrease in the number of international students enrolled, while private four-year institutions have seen an increase, possibly indicating that international students are choosing institutions with more expensive tuition and fees that provide better academic programs and resources.

Another way to analyze the impact of fees on international students is to look at the financial aid and scholarship opportunities available to them. Many institutions offer merit-based and need-based financial aid to international students, but the availability and amount of aid may vary depending on the institution and the student's country of origin. Additionally, some institutions may offer tuition discounts or waivers to international students who enroll in certain programs or

who meet specific academic criteria. However, these opportunities may not be widely advertised or accessible to all international students.

Impact of fees on International Students:



Visualization 3:

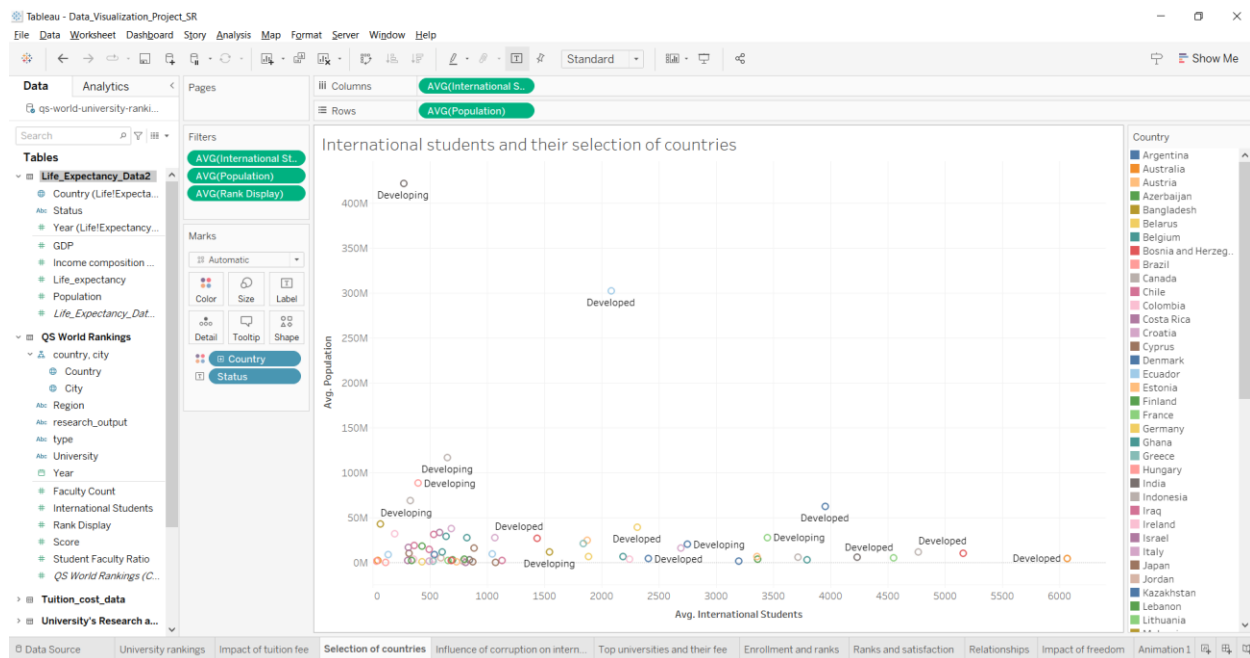
The following datasets could be used to explore the relationship between international students and their selection of countries in terms of developed and developing countries:

- QS World University Rankings
- Life Expectancy Report

International students are an important source of revenue and talent for many universities around the world. There is often a difference in the number of international students studying in developed countries versus developing countries.

From the below visualization it is clear that international students tend to study in developed countries than in developing countries. There are various perspectives as to why international students choose rich nations over underdeveloped countries. These include economic theory, education quality theory, political stability theory, and cultural theory. According to these views, foreign students are drawn to nations with strong economies, high-quality education systems, political stability and safety, and cultures that are similar to their own. Individual factors such as personal preferences, family connections, and financial considerations may also influence their decisions. The datasets provided above might be used to test these hypotheses and investigate the factors that impact foreign students' decisions to study in developed vs developing nations.

International students and selection of countries



Visualization 4:

The notion that less corrupted nations have a larger average number of overseas students might be explained by a number of reasons, including:

Education Quality: Countries with lower levels of corruption may have more transparent and merit-based education systems that place academic excellence above bribes and nepotism. This might attract international students looking for a high-quality education as well as an opportunity to develop their academic and professional careers.

Political Stability: Countries with lower levels of corruption may also be more politically stable and peaceful, allowing international students to study and live in a safe and secure atmosphere. This may attract international students looking for a stable and safe atmosphere in which to study.

Economic possibilities: Countries with lower levels of corruption may have more transparent and stable business environments, attracting foreign students looking for economic possibilities and career options.

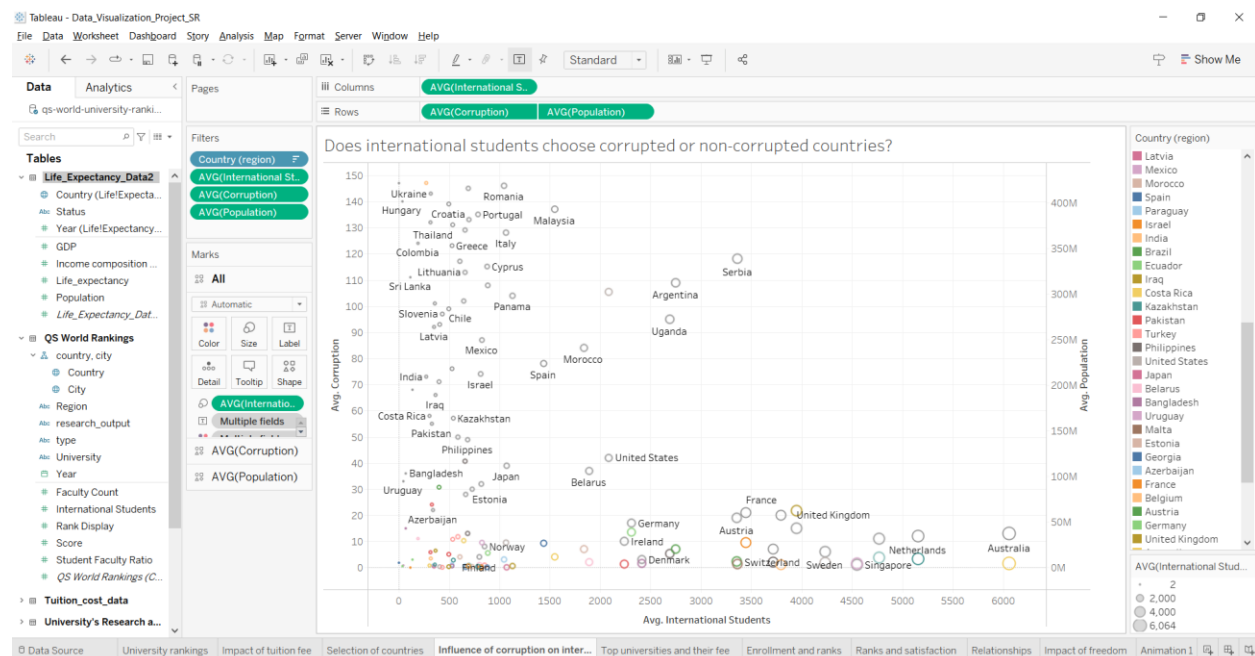
Reputation and Perception: Nations with lower levels of corruption may have a better global image and perception, which may attract more overseas students who see these nations as ideal locations to study.

Overall, the thesis and the below visualization holds that less corrupted nations may attract overseas students owing to reasons such as educational quality, political stability, economic

opportunity, and reputation. In this visualization we can see that Australia which has average corruption rate 13, has around average of 6000 international students than Bulgaria which has average corruption rate 147, has average of 2 international students which is very less as compared to all other countries.

These factors may contribute to an increase in international student enrollment in less corrupt countries. This theory is tested by examining the relationship between corruption levels and international student enrollment in various countries.

Do international students choose corrupt or non-corrupt countries?



Research Question 2:

Do top universities in the US have high undergrad enrollment?

Visualization 5:

I have utilized the United States University Rankings dataset to answer this research question. I have investigated the link between university ranking and undergraduate enrolment to see if leading institutions in the United States have high undergraduate enrollment.

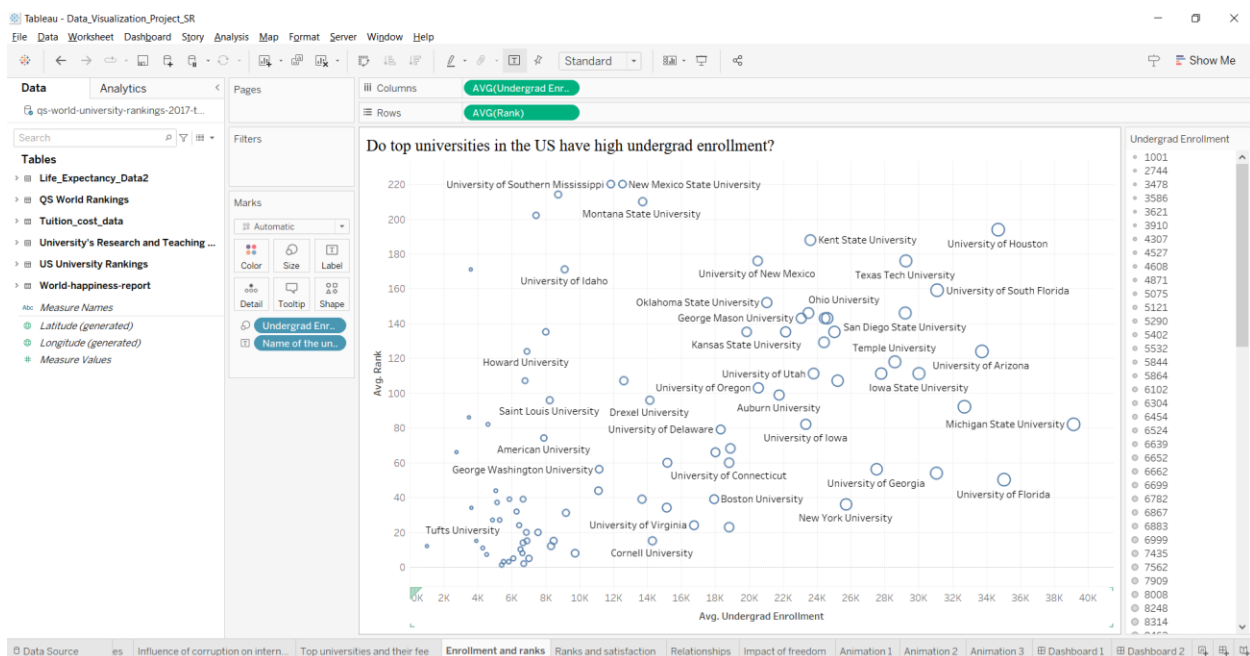
While visualization this data I realized that many of the top ranked universities in the US such as Stanford University, Harvard University etc. have low undergrad enrolment as compared to high undergrad enrolment in the universities like University of Houston and Kent State University.

One possible explanation for this pattern is the "selectivity theory." Top colleges, according to this notion, may be more stringent in their admissions processes, resulting in a lower undergraduate enrolment. This selectivity might be attributed to a number of issues, including limited capacity or a desire to maintain a high degree of academic achievement.

Another notion that might explain why top colleges have lower undergraduate enrolment is the "elite theory." According to this notion, prominent colleges may purposely limit undergraduate enrolment in order to retain their exclusivity and prominence. This exclusivity may be regarded as a mark of prestige, and it may be necessary for attracting top faculty, research funding, and other resources.

Overall, these hypotheses show that university ranking, and undergraduate enrolment may have a beneficial association. However, other factors such as location, program offerings, and affordability may also influence undergraduate enrollment.

Do top universities in the US have high undergrad enrollment?



Research Question 3:

What is the relationship between QS University Rankings, GDP, and life expectancy?

Visualization 6:

To answer your research question, we can use the following datasets:

QS World University Rankings : This dataset provides university rankings based on factors such as academic reputation, employer reputation, faculty/student ratio, and citations per faculty.

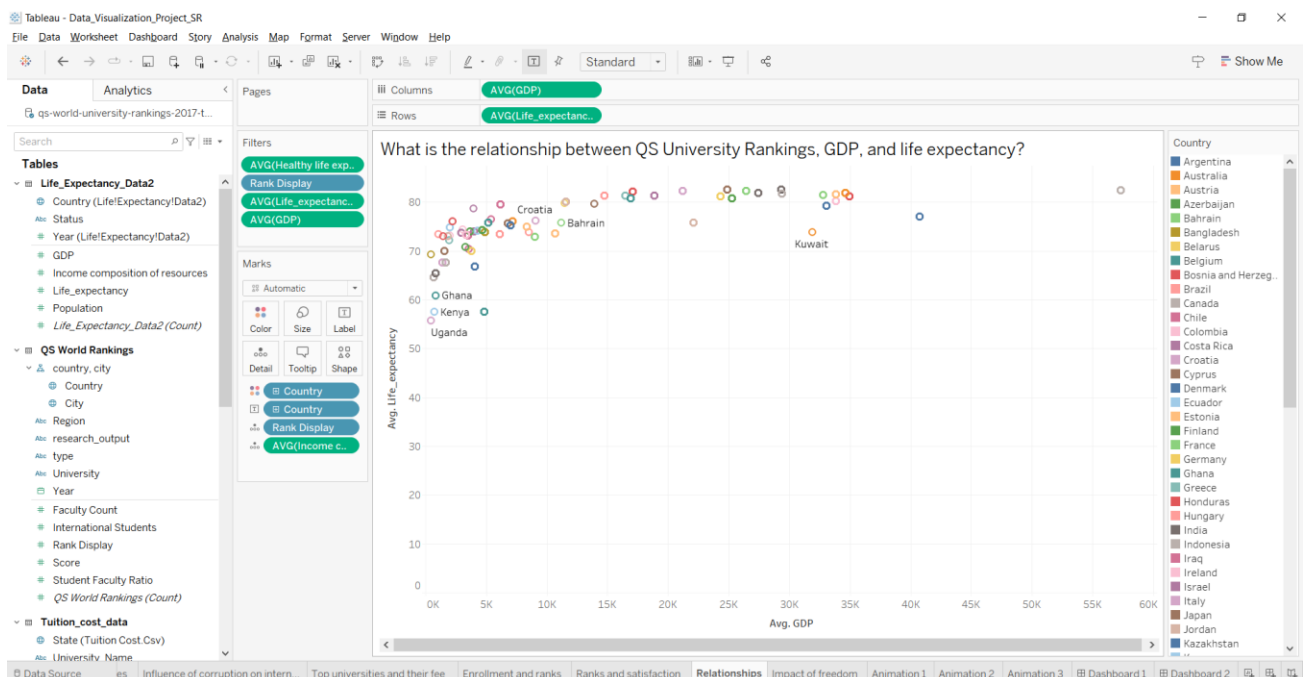
Life Expectancy Dataset : This dataset provides information on life expectancy in different countries and GDP.

By analyzing these datasets, we can explore the relationship between university rankings, GDP, and life expectancy. From the below visualization we can notice that Switzerland is an outlier, and far more ahead than all other countries, with average life expectancy of 82 years, 6th rank and average GDP of 57,363. On the other hand, Uganda has average life expectancy of 55.71 years, 701st rank and average GDP of 421, which is the lowest of all the countries.

One probable explanation is that university rankings and GDP have a favorable association. Countries with stronger economy may have greater resources to invest in higher education, resulting in universities with higher rankings.

Similarly, to conclude, there might be a link between university rankings and life expectancy. Higher-ranked institutions may attract more brilliant students and give greater access to healthcare, leading to longer life expectancy. However, it is important to note that other factors, such as cultural differences, government policies, and historical events, may influence the relationship between these variables.

What is the relationship between QS University Rankings, GDP, and life expectancy?



Research question 4:

Do countries with high-ranked universities have the happiest and most satisfied populations?

Visualization 7:

To answer the research question, I have used the following datasets:

World Happiness Report - This dataset provides information on the happiness levels of people in different countries, as well as factors such as ladder, social support, and freedom to make life choices.

QS World University Rankings- This dataset provides university rankings based on factors such as academic reputation.

Life Expectancy data: This dataset provides the population variable.

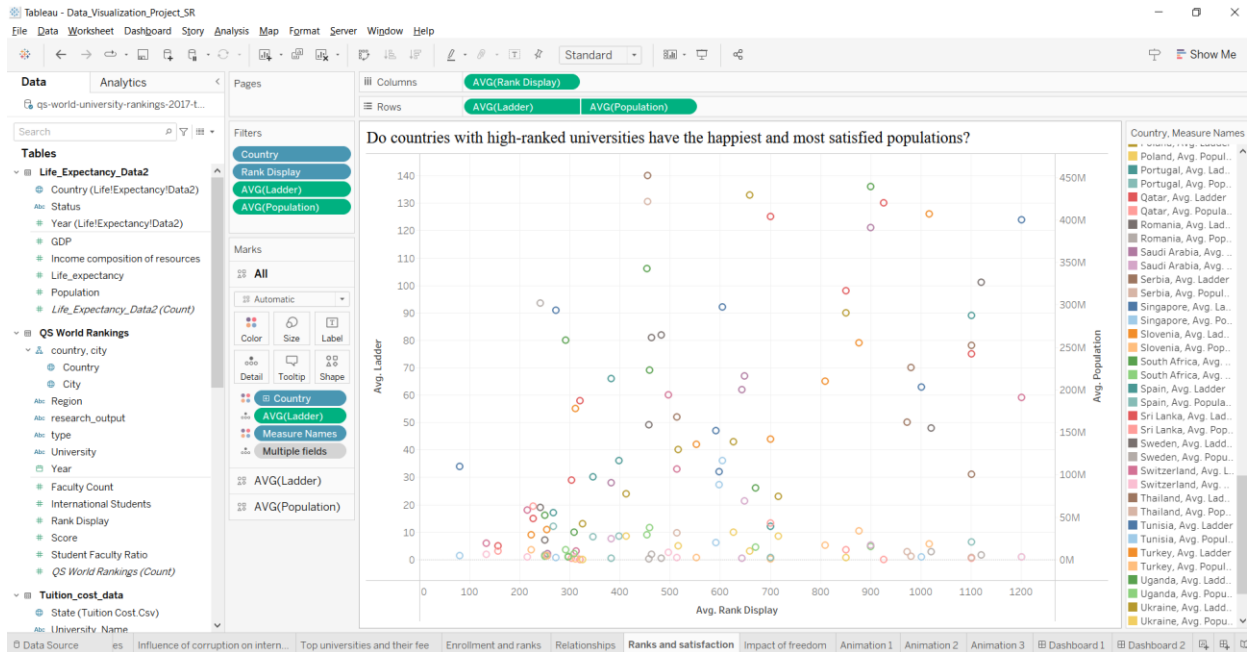
According to your dual axis visualization, there appears to be a negative association between average ladder score (indicating happiness levels) and university rankings. As a result, countries with greater levels of happiness may have lower-ranked colleges.

One possible explanation for this association is that nations with greater levels of happiness or more average ladder may prioritize other aspects such as work-life balance, social ties, and leisure time above academic accomplishment. This might lead to reduced university funding and worse academic attainment.

Furthermore, countries with lower levels of happiness may place a greater emphasis on academic success in order to improve their economic prospects and social mobility. This might lead to more investment in institutions and improved academic attainment.

It is crucial to note, however, that correlation does not always indicate causation, and there may be other variables at work that impact both happiness levels and university rankings. To properly comprehend the link between these factors, a more extensive examination of the data would be required.

Do countries with high-ranked universities have the happiest and most satisfied populations?



Research Question 5:

Do top universities have high tuition fees?

Visualization 8:

The "Tuition cost data" dataset, for example, covers tuition costs for colleges in the United States. There is a small positive association between university ranking and tuition costs in this dataset, implying that higher-ranked universities have somewhat higher tuition prices in the US.

Based on the plot and data provided, we can see that there is a significant discrepancy in tuition prices between private and public institutions, particularly among top-ranking universities. According to the plot, the average out-of-state tuition cost for top private institutions is \$50,000, while public universities have a lower average out-of-state tuition cost.

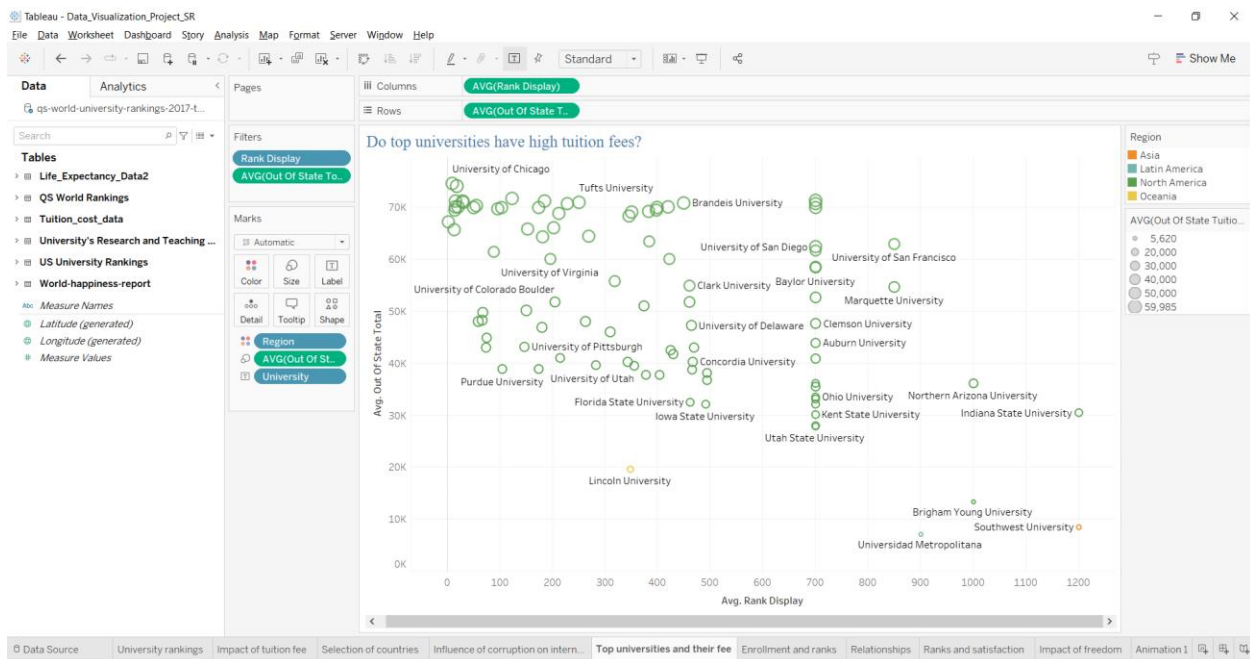
The visualization also exposes that some public institutions charge more to go out-of-state than top private colleges. University of San Francisco, for example, has the highest out-of-state tuition expense while ranking exceptionally low. This might be attributed to a number of variables, including location, program quality, and status. Private institutions, on the other hand, generally demand higher tuition rates due to their capacity to produce cash from sources other than governmental financing.

Furthermore, we can see that there are more than ten universities with the same ranking, 701, but tuition fees vary significantly. The average out-of-state tuition is \$17,000 at the University of

Wyoming and \$54,000 at Southern Methodist University. This implies that ranking is not the sole factor influencing the tuition costs imposed by colleges. Other considerations, like location, degrees offered, and reputation, are also important in setting tuition prices.

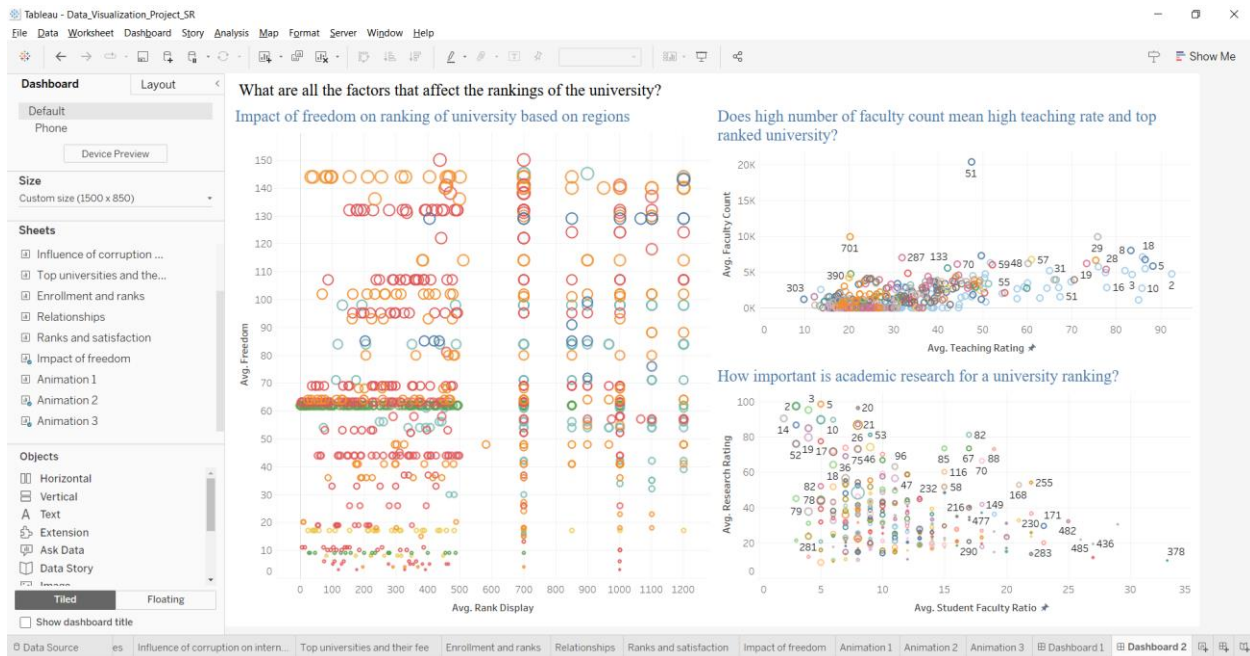
In conclusion, based on the plot and data provided, private institutions tend to charge more tuition costs than public universities, particularly top-ranked universities. Tuition fees, on the other hand, are not primarily determined by university ranking and vary widely depending on other criteria.

Do top universities have high tuition fees?



Research Question 6:

What are all the factors that affect the rankings of the university?



Visualization 9:

To analyze the impact of freedom on university rankings based on regions, we can use the following datasets:

- QS World University Rankings by Region
- World Happiness Index

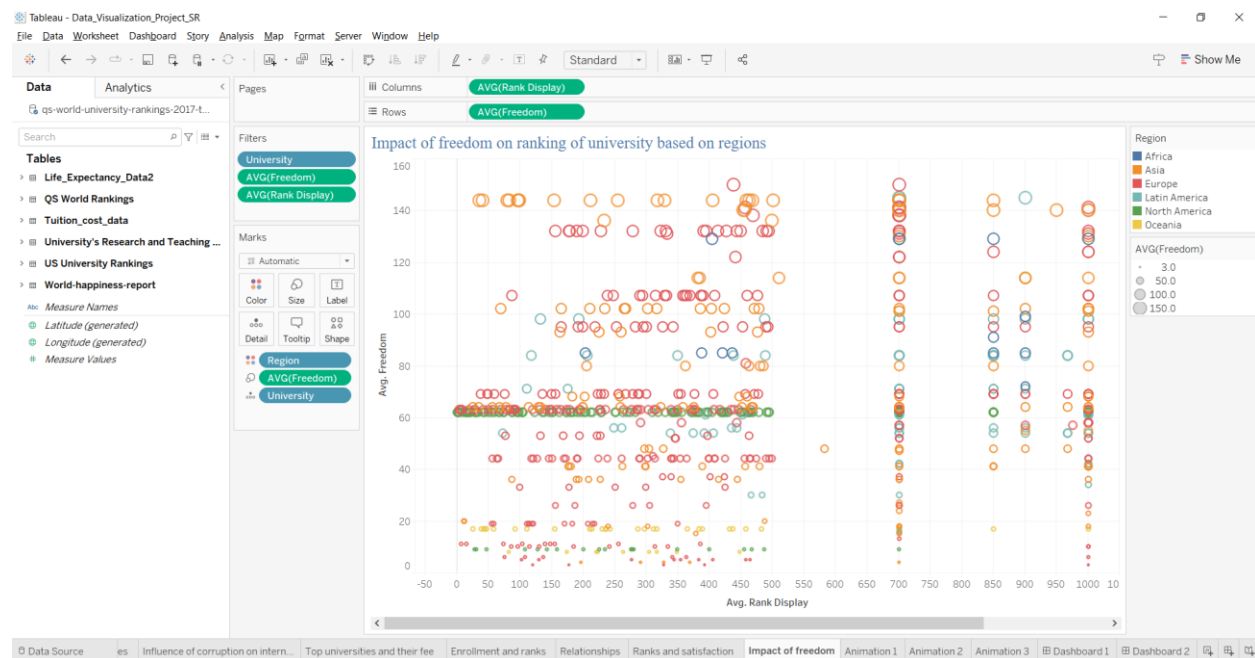
From the below visualization it is evident that the argument underlying the influence of freedom on university rankings based on regions might be explained by the assumption that academic freedom and political freedom are inextricably or closely linked. Academic freedom refers to the freedom of researchers and students to pursue knowledge and study without censorship, political intervention, or fear of retaliation. In nations with a high degree of political freedom, there is typically a commensurate degree of academic freedom, which may contribute to the creation of great universities and a healthy academic community.

Furthermore, countries with high levels of freedom like South Korea in the above visualization, may invest more in higher education and research, resulting in higher-quality universities and higher rankings. In contrast, in nations with weaker degrees of freedom, academic institutions may face political pressures, censorship, or other constraints that might stifle their development and ranking.

Overall, the link between freedom and university rankings is complicated and varied, impacted by a multitude of factors such as government regulations, societal views about education, and R&D

financing. The datasets described above might be used to put this idea to the test and investigate the influence of freedom on university rankings in various parts of the world.

Impact of freedom on ranking of university based on regions.



Visualization 10:

Academic research is very important in establishing a university's rating. Research production is frequently seen as one of the most important aspects in university rankings since it demonstrates an institution's contribution to the area of knowledge and innovation.

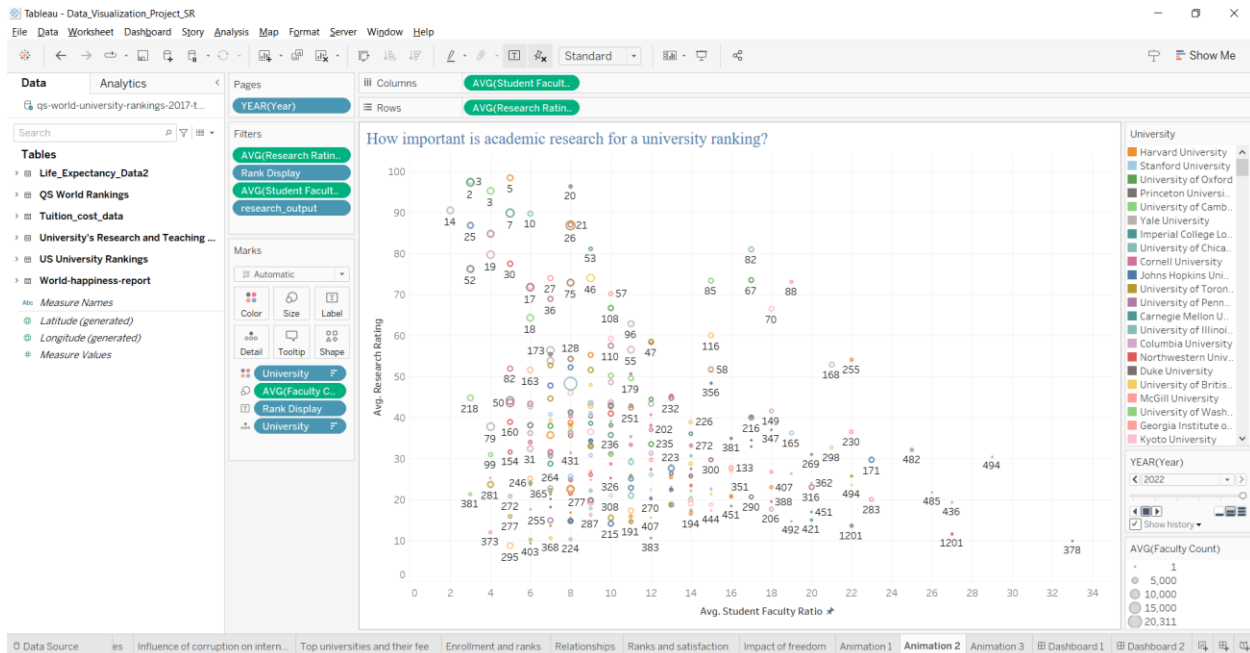
From the below visualization we can see that all the top universities like Stanford University, University of Oxford, Harvard University etc. have high average research rating output is a major measure in the methodology of several university ranking systems, including QS, THE, and ARWU. For example, one of the six variables used to evaluate institutions in the QS ranking system is research output. The quantity of research papers produced by a university and their effect in the academic world as assessed by citations is how research output is measured.

Furthermore, academic research frequently attracts funding and grants from both the public and private sectors, allowing universities to invest in infrastructure, hire top faculty, and provide students with more research opportunities. The capacity of a university to attract and retain excellent researchers and professors is also an essential component in its ranking.

Also, research output can improve a university's reputation and global recognition, leading to increased student and faculty mobility, industry collaboration, and alumni engagement. All of these elements have a substantial impact on a university's rating.

In conclusion, academic research is an important aspect in deciding a university's ranking since it stimulates innovation, improves its reputation, attracts money and top people, and creates worldwide relationships.

How important is academic research for a university ranking?



Visualization 11:

The QS World University Rankings dataset and World University Ranking Full List dataset are used to answer this research question. These datasets provide information on the number of faculty members, teaching rating and the rankings of universities.

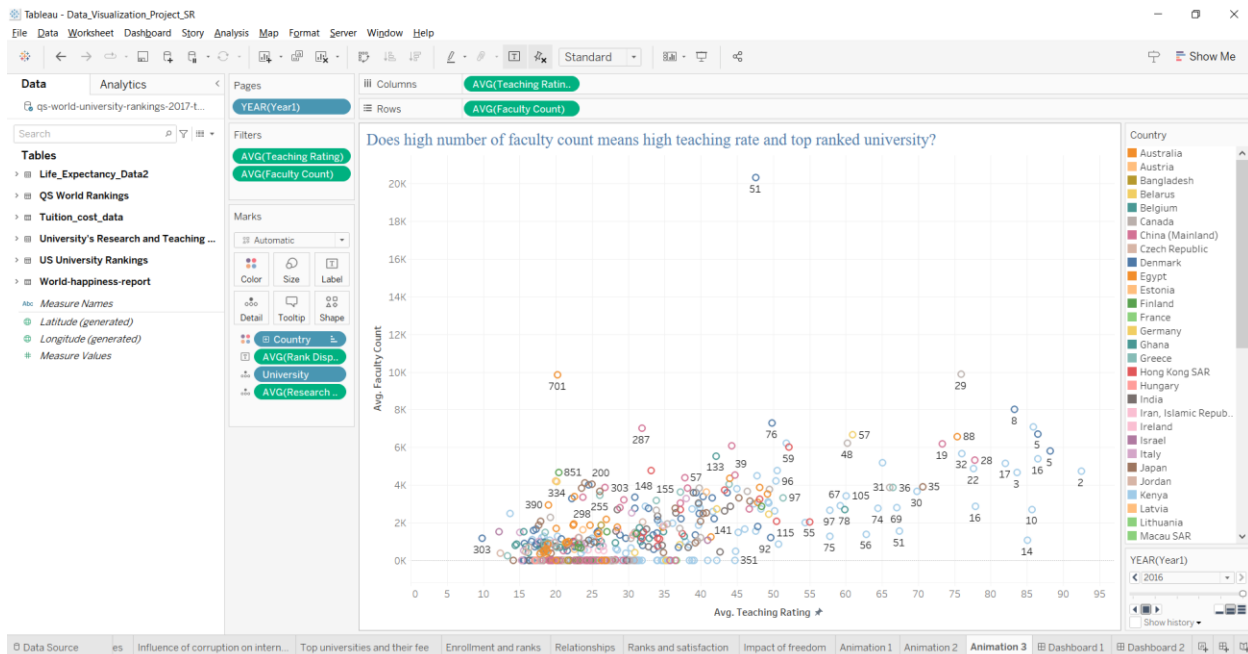
According to the dataset analysis and the below visualization, there is a positive association between the number of faculty members and university ranking. Universities having a larger number of faculty members tend to be ranked higher. This does not always imply that a larger number of faculty members results in a greater teaching rate.

A university's rating is determined by a variety of characteristics, including research output, internationalization, and reputation, in addition to teaching quality. As a result, having a large number of faculty members may not be enough to assure a top-ranked university, University of Bristol is the best example for this, since the average faculty count is around 20k, but the average teaching rate is 47 which made it the outlier in the dataset.

Furthermore, various factors such as curriculum quality, teaching methodologies, and student-teacher ratio influence teaching quality. As a result, a university with a large number of faculty members may not have a high teaching rate or quality.

To summarize, while a larger number of faculty members may indicate a better-resourced institution, it does not ensure a greater teaching rate or a top-ranked university. The quality of teaching and university ranking are impacted by a variety of elements, therefore assessing an institution's overall performance requires a comprehensive approach.

Does high number of faculty count mean high teaching rate and top ranked university?



Conclusion:

I have derived the following findings for the six research questions from the examination of the various datasets:

1. What are all the factors do international students may consider while choosing a university? When international students choose a university, they consider several factors such as the cost of tuition and fees, the university's resources and academic programs, and the availability of financial help and scholarships. Location, cost of living, and reputation are other important factors that could influence their decision. Political stability, safety, economic opportunities, and educational excellence are also crucial elements that could impact their choice. Moreover, individual preferences, familial connections, and language barriers may play a role in their decision-making process. Overall, selecting a university is a complex process for foreign students that requires careful consideration of multiple factors.
2. Do top universities in the US have high undergrad enrollment? According to the findings, there is no direct relationship between a university's rating and its undergraduate

enrolment. Top-ranked institutions in the United States may have low or high undergraduate enrolment, whereas lower-ranked colleges may likewise have low or high student enrollment. As a result, generalizing that elite colleges in the United States have large undergraduate enrolment is incorrect. Personal preferences, academic aspirations, financial concerns, and program availability all influence the decision to attend a university.

3. What is the relationship between QS University Rankings, GDP, and life expectancy? Based on the data analysis, it is reasonable to conclude that there is a link between university rankings, GDP, and life expectancy. According to the statistics, nations with more GDP tend to have higher-ranked universities, and higher-ranked institutions may attract more bright students and give better access to healthcare, resulting in a longer life expectancy. However, other factors may also play a role in determining university rankings and life expectancy, and more research is needed to fully understand the relationship between these variables.
4. Do countries with high-ranked universities have the happiest and most satisfied populations? According to the findings, there appears to be a negative relationship between university rankings and happiness levels. Nations with higher levels of happiness have lower-ranked universities, whereas nations with lower levels of happiness have better-ranked universities. However, a correlation does not always imply causation, and more research is needed to fully understand the relationship between these factors. Other factors, such as cultural differences, government policies, and historical events, might potentially influence the association between happiness levels and university rankings.
5. Do top universities have high tuition fees? According to the visualization of the "Tuition cost data" dataset, there is a modest positive association between university ranking and tuition costs in the United States, with higher-ranked colleges having slightly higher tuition prices. The biggest discrepancy in tuition expenses, however, is between private and public colleges, notably among top-ranked universities. Tuition expenses are also influenced by other criteria including location, program quality, and reputation. As a result, ranking is not the only determinant in deciding tuition rates.
6. What are all the factors that affect the rankings of the university? Rankings of universities are impacted by a number of variables, including faculty size, faculty quality, curriculum quality, instructional methods, and student-teacher ratio. Government laws, cultural attitudes toward education, academic and political freedom in the area, and R&D funding are further critical elements that might influence a university's rating. By obtaining money and grants from the public and commercial sectors, universities may also increase their infrastructure spending, employ top teachers, and provide students additional research opportunities, all of which will boost their rankings. As a result, to evaluate the entire performance of an institution while considering all of these elements, a thorough methodology is needed.

In conclusion, there is no one technique that works for all students when picking the correct university. And it is important to take a comprehensive approach while evaluating a university's overall performance and selecting a university.

Additional Research Questions:

Based on the analysis of the above datasets, some additional research questions that could be explored are:

1. How does the gender distribution of faculty members and students affect the ranking of universities?
2. Is there a correlation between the availability of research funding and the research output of a university?
3. How does the globalization of universities impact their ranking and reputation?
4. What is the relationship between the ranking of universities and their accessibility for students with disabilities?
5. How do government policies and regulations regarding higher education impact the ranking and quality of universities?
6. Is there a correlation between the diversity of student population and the ranking of universities?
7. How does the quality of infrastructure and technology available at universities impact their ranking and reputation?
8. What is the impact of extracurricular activities and student engagement opportunities on the ranking and reputation of universities?
9. How do rankings of universities vary across different fields of study and academic disciplines?
10. What is the relationship between the alumni network and the ranking of universities?