Slide 1:
Hello, we are team 3! Through our project, we seek to find the impact of the government on human freedom.

Slide 2:
To begin…

Slide 3:
Governments play a pivotal role in shaping the socio-political landscape of their respective nations, influencing everything from economic policies to social rights and individual liberties.

Slide 4:
As societies evolve, understanding the intricate dynamics between government efficacy and the maintenance of human freedoms becomes paramount.

Slide 5:
The purpose of our project is to employ statistical analysis and machine learning techniques to forecast how the effectiveness of a government might impact future levels of human freedom within a given country.

Slide 6:
We seek not only to enhance our understanding of governance dynamics but also to offer insights that can inform policy-making and foster the advancement of individual liberties worldwide.

Slide 7:
To explore this complex relationship, We used the 'Human Freedom Index' dataset from Kaggle.

Slide 8:
This dataset provides several distinct indicators of personal and economic freedom across various areas as seen here.

Slide 9:
Our dataset has 3465 rows with 141 distinct variables.

Slide 10:
So now we have identified our dataset, we want to find the impact of the government on their population’s freedom score.

Slide 11:
This brings us to our problem statement. How might the effectiveness of a government impact the future levels of human freedom, and what can be done to improve them?

Slide 12:

But before we begin, we need to ensure that our data is ready for analysis. We focused on cleaning and preparing the dataset. As we have a few variables with high null counts…

Slide 13:
We decided to drop variables with over 40% null value. Variables with a significant number of missing values may introduce bias or reduce the effectiveness of our analysis.

Slide 14:
Next, we grouped the data by country and replaced missing values with the country mean for each specific variable. However, there are still null values.

Slide 15:
Thus, we grouped the data by region and replaced missing values with the regional mean.

Slide 16:
Finally, after cleaning the data, we dropped the remaining variables with leftover null values to avoid any data inconsistencies.

Slide 17:
For this project, we used tools and techniques learned in this course, such as data cleaning, grouping, and visualization techniques. Additionally, we explored advanced data handling methods and visualizations to improve the overall quality of our analysis.

Slide 18:
We start by sorting the countries based on their human freedom score. We shall focus on the top and bottom 10 countries for our project.

Slide 19:
For easy viewing, here are the top and bottom 10 countries ranked according to their human freedom scores.

Slide 20:
Next, we can apply machine learning, specifically linear regression to determine the significance of each variable. We do this so that we can determine which variables affect their hf_scores the most. We start with the top 10 countries. After importing the linear regression class and excluding redundant columns, the data is split into features and a target variable for use in a linear regression model.

Slide 21:
An instance of the LinearRegression class is created and fitted using the features and the target. This process involves training the model to understand the relationship between the features and the target variable.

Slide 22:

The code analyzes the feature importance in a linear regression model. It begins by retrieving the coefficients of the fitted model, which show the importance and direction of each feature. A bar graph can be plotted to visualize the sorted features and their absolute importances, allowing for easy interpretation.

Slide 23, 24:
We then do the same for the bottom 10 countries.

Slide 25:
A bar graph can be plotted to visualize the sorted features and their absolute importances for the bottom 10 countries, allowing for easy interpretation.

Slide 26:
Now that we have retrieved the feature importance of the top and bottom 10 countries based on their variables against hf_score…

Slide 27:
We concentrate on the top 5 variables that have the greatest impact on the HF score in the top and bottom 10 countries, and this can be done using our linear regression previously.

Slide 28:
The top 5 most significant variables are then sorted and displayed using bar charts here.

Slide 29:
For our top 10 countries, the most significant variable is ef_regulation_credit. This variable represents the level of regulation on credit to markets. A higher value indicates less regulation in credit markets, promoting economic growth for human freedom.

Slide 30:
Next, lower regulation on interest rates fosters competition and more favorable borrowing conditions, boosting economic activity and financial inclusion.

Slide 31:
Less stringent regulations on private credit encourage a vibrant credit market with diverse lending options, fostering economic growth and personal empowerment.

Slide 32:
Diverse ownership models in the credit sector enhance competition, leading to efficient capital allocation and improved services for consumers.

Slide 33:
Lastly, greater protection of freedom of expression supports open discourse and political participation, contributing to a vibrant and inclusive society.

Slide 34:
For our bottom 10 countries, the most significant variable, government transfers, represent transfers as a percentage of GDP. High government transfers may signal extensive welfare programs, but heavy reliance could lead to economic inefficiencies and hinder long-term growth.

Slide 35:
Government transfers data means that reliable data on government spending ensures transparency and accountability, supporting effective policy making and human freedom.

Slide 36:
Restrictions on political parties impede political pluralism and democratic participation, limiting human freedom and governance quality.

Slide 37:
A burdensome regulatory environment can stifle entrepreneurship, investment, and economic growth, creating barriers to opportunity and innovation.

Slide 38:
Lastly, overly restrictive labor market regulations can hinder job creation and productivity, requiring balanced policies for inclusive growth and human freedom.

Slide 39:
Now that we have identified our top 5 most significant variables and how the government plays a role in contributing to human freedom, we can implement machine learning to predict future values of human freedom scores using said 5 variables.

Slide 40:
We can use a machine learning model known as Gradient Boosting Machine (GBM) to predict future values of hf_scores until 2040. This algorithm combines several weak learners into strong learners, in which each new model is trained to minimize the loss function such as mean squared error or cross-entropy of the previous model using gradient descent.

Slide 41:
We begin by importing the necessary libraries and define the years for prediction, which range from 2021 to 2040. We initialize two Gradient Boosting models: for the top 10 countries and the bottom 10 countries. Next, we split the data. This ensures we have separate data for model training and testing toy evaluate performance.

Once the data is split, we fit the models using the training data. This training process enables the models to learn the relationships between the input features and the target variable (HF scores). Based on the error-number of tree relationship, we can see that the model minimizes the error with around 70 trees used. This will be our perimeter for predicting future values.

Slide 42:
To start predicting future values, we initialize two Gradient Boosting models, for the top 10 countries and bottom 10 countries. Next we train the model and use the models to make predictions on the data. To ensure that the predicted HF scores fall within a realistic range, we clip the predicted values between 0 and 10.

Slide 43:
With our trained gradient boosting model, we are able to predict the human freedom score from 2021 to 2040 using the top 5 most significant variables.

Slide 44:
Using our predicted data, we can do a time-series analysis from 2000 to 2040.

Slide 45:
Based on our findings, we can see how significant of a role the government plays in affecting the hf_scores of the bottom 10 countries. The predicted values range from around 5.5 to 3.2.

Slide 46:
Through this analysis, countries at the bottom can learn from those at the top. In the top 10 countries, policies that prioritize economic freedom, regulatory efficiency, and civil liberties contribute to robust socio-economic outcomes and high levels of human freedom. Conversely, the bottom 10 countries face challenges related to governance effectiveness, regulatory burdens, and political rights, which may impede progress toward greater human freedom.

Slide 47:
There are several pros and cons in using the gradient boosting model.

Slide 48:
However, we have chosen to use this model in our analysis as it produces a high predictive accuracy. Given the complexity of the relationship between government effectiveness and human freedom, we need a model capable of capturing nonlinear and intricate patterns in the data.

Slide 49:
So what can governments do to improve the level of human freedom?

Slide 50:
The first thing is to promote economic freedom. By reducing barriers and safeguarding property rights we can stimulate innovation, thereby expanding opportunities and human freedom.

Slide 51:

Next is to Strengthen Democratic Institutions. This can be done by investing in transparent and accountable governance structures, and rule of law mechanisms that can bolster political freedoms, fostering inclusive societies.

Slide 52:
Social justice can be advanced by implementing equitable policies that address poverty and inequality. This can enhance human dignity and equal access to opportunities, promoting a more just and inclusive society.

Slide 53:
Lastly, safeguarding fundamental rights such as freedom of expression is crucial for nurturing democratic culture and individual autonomy, safeguarding human freedom against encroachments by authoritarian regimes.

Slide 54:
By prioritizing these strategies and fostering synergies between governance, economic development, and human rights agendas, countries can chart a path toward a more prosperous and free future for all individuals. With that we've come to the end of our video, thank you.