



Sentiment vs. Statistics: Pattern Detection Between Presidential Language and Economic Performance

Text Mining Final Paper

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1 Abstract

This paper examines whether U.S. presidential rhetoric reflects economic conditions. For this purpose we combined different analytical approaches to gain insights about the evolution of presidential speeches over time and explore differences across parties and specific historical moments, with special attention to economic conditions. We found that rhetoric remains consistently optimistic, with weak or no correlation to economic performance or public mood. Models performed better using textual features alone, suggesting that rhetorical framing is shaped more by institutional strategy than economic variables.

2 Introduction

Presidential speeches are intended to be the most public and influential forms of political communication. With Presidents being in such a position that holds the most power and knowledge, they are given the task of delivering speeches which serve a number of different purposes ranging from rallying national unity, managing crises, to shaping public opinion. Over time, presidential rhetoric has evolved alongside the evolution of media, government expectations, and public discourse, but what remains the same is the central role it plays in portraying the state of the nation. Speeches are designed to not only be informational, but they also function in being convincing, reassuring, and in general, reflect authority—ultimately shaping how citizens perceive the issues being addressed.

In this report, we want to answer the following research question: Does presidential rhetoric reflect economic conditions? Through an exploration of presidential speech tone in relation to historical context and economic trends, we aim to determine if or when such rhetoric is reactive or whether it is framed deliberately. Our approach combines text analysis with machine learning techniques to identify speech framing and sentiment dynamics over time. In doing so, we determine if presidential speeches adjust their rhetoric based on the state of the economy, or if they maintain a tone that is more stable and strategically consistent, regardless of external conditions.

3 Literature Review

The relationship between presidential rhetoric and public opinion is one that has been of interest and studied before. Wood, Owens, and Durham (2005) use vector autoregression (VAR) to measure the dynamic associations among presidential economic rhetoric, media, consumer sentiment, and macroeconomy such as GDP and unemployment. They simulate rhetorical tone shocks and demonstrate that consumers respond to presidential tone in their attitudes toward economic news, and thus prove that rhetoric can be used as a tool of indirect economic leadership. Similarly, Cohen and Hamman (2006) analyze how content and context of a speech determine the effect of the speech on public expectations. They reason that foreign policy speeches, especially if the presidents are popular, have more possibilities to create optimism than domestic or economic speeches, which will more likely be delivered during economic downturns and can express doubt rather than determination.

Building on these results, Cinelli et al. (2019) follows a network-based text mining approach to 951 presidential speeches, with a focus solely on economic vocabulary. After implementing frequency monitoring for economic glossary words, they define speech clusters and find a core-periphery pattern for economic discourse. These findings affirm the use of quantitative text analysis methods to identify patterns in presidential speech. Our study extends the current knowledge of these published papers by suggesting a hybrid model with sentiment analysis, economic indicators, and machine learning to examine presidential rhetoric. In combining linguistic features and contextual ones in a model of classification, this study delivers a more expandable method for monitoring political speech throughout time.

4 Data

In order to answer our research question, we used three complementary datasets. We started by aggregating a unified corpus of U.S. presidential speeches from 1789 to 2025. These speeches were scraped from the following websource and cleaned through a multi step preprocessing pipeline which contained the following steps: removal of unnecessary/common words (stopwords), tokenization, and lemmatizing. The second dataset contained the macroeconomic variables deemed useful for our analysis. We extracted data from the repository Federal Reserve Economic Data (FRED). We have considered the following three

key indicators to capture different dimensions of macroeconomic performance: real GDP, unemployment rate, and Consumer Price Index (CPI).

Lastly, we picked a dataset that captures the public's perception of the economy the University of Michigan's Consumer Sentiment Index (retrieved via FRED). This monthly index captures consumer confidence and expectations in the U.S. from 1952 to 2024.

5 Descriptive Analysis

Given the different sources of data at our disposal and their varying coverage, we decided to conduct a dual analysis. Presidential speeches were available from 1789 onward, while macroeconomic indicators and consumer sentiment data were available only from 1950 onward. We chose to exploit this divergence by constructing two distinct datasets and exploring the differences in corresponding model performance. Our primary objective was to determine whether presidential jargon reflects the economy or merely follows its own logic. To achieve this goal, we employed a variety of tools, which will be deeply analyzed throughout the sections of the paper. Combining different tools also helped us to assess the robustness of our findings.

Additionally, we extracted textual features from the speeches and used tree-based classification to categorize the type of framing adopted based on several features. As previously mentioned, we constructed two models: one based solely on the speeches (and features derived from them) over a broad time range, and another incorporating macroeconomic indicators but limited to a shorter time frame. While classification was not the primary focus of the analysis, it was used as additional method to further confirm the conclusion drawn with previous analysis.

5.1 K-Means Clustering

A basic preliminary analysis consisting of word clouds and K-Means clustering confirmed that Presidential Speeches have evolved over time. It also revealed distinctive differences in language across historical periods (e.g., wars, earlier history, modern era). While this was somewhat expected and not particularly insightful in relation to our research question, it set the groundwork for further investigation into key patterns in addresses to the nation.



Figure 1: Word Clouds by Main Historical Period

- **Early America and Expansion (1780-1840):** A period marked by the building of the nation's institutional foundations and its early territorial growth. The frequent appearance of **law**, **duty**,

power, and **congress** reflects the focus on governance and national structure.

- **Civil War and Reconstruction (1840-1870)**: A time of national conflict and reunification, centered on slavery and constitutional questions. Words like **power**, **law**, **constitution**, **congress**, **territory**, **duty**, and **right** highlight the legal and moral struggles of this turbulent period.
- **Industrialization and Progressive Era (1870-1920)**: An era of rapid industrial growth and social reform. The presence of **great**, **work**, **law**, **congress**, and **must** reflects ambition, the rise of labor concerns, and the urgency for progressive action.
- **Great Depression and WWII (1920-1945)**: A period of deep economic hardship and global conflict. Dominant words like **must**, **world**, and **war** convey urgency, responsibility, and the U.S.'s growing role on the world stage.
- **Cold War Era (1945-1989)**: Defined by ideological tension and global strategy. Key terms such as **think**, **must**, **program**, and **help** reflect intellectual discourse, decisive action, and international aid initiatives.
- **Post-Cold War and Modern Era (1989-2026)**: Characterized by globalization, technology, and public engagement. Words like **want**, **people**, **time**, **world**, and **applause** illustrate a more personal, audience-focused rhetoric in a rapidly changing media environment.

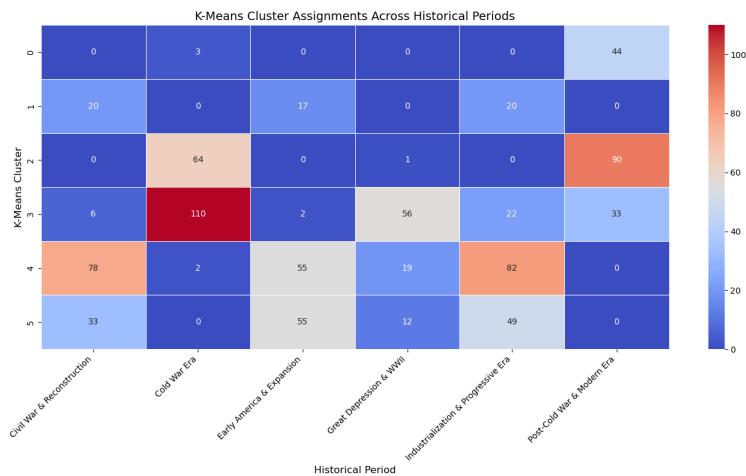


Figure 2: Distribution of Clusters Across Historical Periods

After finding evidence of an effective evolution in presidential jargon over time, we aimed to verify whether speeches naturally cluster according to the specific historical period. We defined 6 clusters and examined how many speeches belong to each cluster in every historical period. Additionally, we generated word clouds for each cluster. By analyzing both these representations, we identified the following patterns:

- **Cluster 2** is primarily present during the Cold War Era and the Modern Era. It contains words such as "time," "think," and "applause," which, as noted earlier, indicate a modern rhetoric. Given this, we can conclude that Cluster 2 represents more recent history.
- **Cluster 3** is mainly found during the Cold War, the Great Depression and WWII periods. It includes words such as "world," "must," "peace," "war," and "freedom," which are clearly associated with wartime speeches.
- **Cluster 4** is predominantly found in the early historical periods, which is confirmed by the most common words, including "power," "congress," "time," "constitution," "law," and "territory."



Figure 3: Word Clouds by Cluster

5.2 Readability Index

Still analyzing differences across historical periods and/or specific situations, we decided to calculate the Flesch Reading Ease score, to exactly quantify the complexity of presidential speeches and possibly uncover some patterns. The Flesch Reading Ease score evaluates text on a 100-point scale, with higher scores indicating more easily understood text. We hypothesized that Presidents might adopt a more cryptic jargon when addressing critical situations, such as wars or crises. We expected to see a lower readability score (indicating more complex speeches) during periods of economic difficulty, while we expected to have higher readability scores (indicating more accessible speeches) in periods of prosperity. Contrary to our initial hypothesis, we did not find evidence that economic conditions consistently influenced speech complexity. Instead, the most striking pattern observed was a general trend toward increasingly readable presidential rhetoric over time.

This finding suggests that presidential communication has evolved to become more accessible to the general public, regardless of economic conditions or the topic. This likely reflects broader changes in political communication strategy, media environments and audience expectations. Despite not confirming our original hypothesis, this readability feature still provides valuable insights into the evolution of presidential communication styles and serves as a useful variable in our classification models.

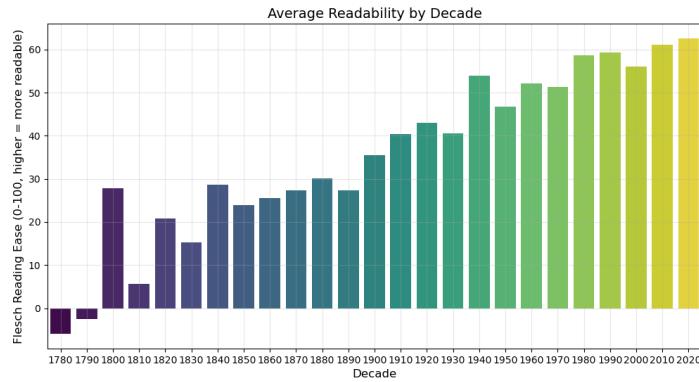


Figure 4: Readability Index over time

6 Presidential Sentiment and Economic Reality

As briefly discussed above, our main goal was understanding whether Presidential Speech is driven by real economic conditions or follows its own logic. To reach this purpose, we first conducted Sentiment Analysis on Presidential Speeches and plotted the evolution of this sentiment over time, comparing it with different economic indicators: GDP growth, per capita GDP, inflation rate, and unemployment rate.

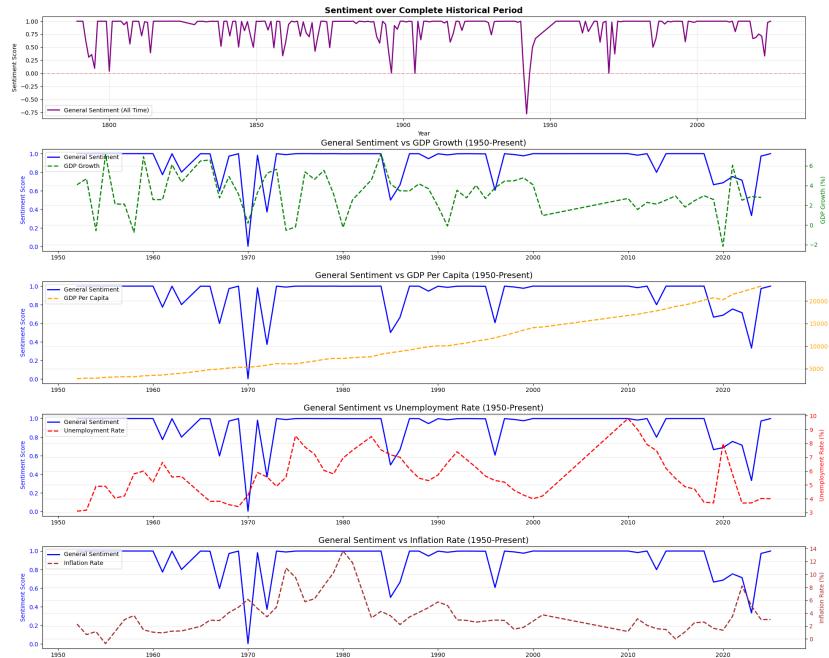


Figure 5: Presidential Speeches' Sentiment and Economic Indicators

- **Presidential Sentiment Trend (1789-Present):** Throughout American history, presidential rhetoric has generally maintained a positive sentiment, with notable exceptions during times of crisis or war.
- **Presidential Sentiment and GDP Growth (1950-Present):** A positive correlation between presidential sentiment and GDP growth can be observed during specific periods, such as the late 1960s and early 1970s. However, this relationship is not always consistent. For instance, during the 2008 financial crisis, sentiment remained surprisingly high despite negative GDP growth. In contrast, during the 2020 COVID-19 pandemic, they both dropped, and GDP recovered faster while sentiment remained lower for longer.

- **Presidential Sentiment and GDP Per Capita(1950-Present):** There seems to be absence of correlation between sentiment and GDP per capita over time. While GDP per capita steadily increases, sentiment fluctuates more independently, not following a linear trend.
- **Presidential Sentiment and Unemployment Rate (1950-Present):** A clear inverse relationship is noticeable during key periods - when unemployment rises, sentiment tends to fall. This pattern is evident during multiple periods, such as the 1970s and the 1980s.
- **Presidential Sentiment and Inflation Rate (1950-Present):** The relationship between sentiment and inflation is more complex. During periods of high inflation, such as the 1970s and early 1980s, we observe drops in sentiment, but they do not align exactly with the inflation spikes. This suggests that the drops in sentiment may actually be independent of the high inflation. In contrast, the recent surge in inflation during 2021-2022 is perfectly aligned with a drop in sentiment.

Analyzing these patterns, we can already observe that Presidential Jargon aligns with economic conditions during certain periods. However, it is difficult to establish consistent, long-term correlations across history. This inconsistency may be due to several factors:

- **The influence of individual Presidents and Political Parties:** The way Presidents respond to economic conditions may vary significantly depending on the specific President and the political party they represent.
- **The severity of the crisis:** The level of responsiveness in Presidential rhetoric might be contingent on the severity of the economic event at hand. For example, a moderate economic crisis may not significantly alter Presidential speeches, which may remain optimistic. However, such optimism could be abandoned only in the face of severe crises or extraordinary challenges.

6.1 Economic Health Index

Since the state of the economy can not be well discerned considering each indicator on its own, we built a composite indicator that effectively represents the economic health. The index has been built in the following way:

- **GDP Growth and GDP per capita:** These are considered positive indicators for the economy, meaning higher values are better. Both variables are scaled to a range of 0 to 1.
- **Unemployment Rate:** As higher unemployment is undesirable, we invert this variable. This is done by subtracting the scaled unemployment rate from 1, so that lower unemployment rates yield higher scores.
- **Inflation Rate:** The inflation rate is treated differently. We apply a Gaussian transformation, where the optimal inflation rate is considered to be 2% (a typical target for central banks). Values closer to 2% are assigned higher scores, while values further from 2% (both higher and lower) receive lower scores.

After transforming the variables, we combine them into a single composite index using a weighted average.

¹ The formula for the index is:

$$\begin{aligned} \text{Economic Health Index} = & 0.3 \times \text{GDP Growth (scaled)} + 0.3 \times \text{GDP per capita (scaled)} \\ & + 0.25 \times \text{Unemployment Rate (inverted)} + 0.15 \times \text{Inflation Rate (optimal)} \end{aligned}$$

Finally, the Economic Health Index is standardized to the range of 0 to 1, ensuring that it can be easily interpreted and compared to the Presidential Speeches' Sentiment Score that has been previously computed. Figure 6 displays the Economic Health Index alongside the General Sentiment from Presidential Speeches over time.

¹The weights reflect the relative importance of each variable: GDP Growth (30%), GDP per capita (30%), Unemployment Rate (25%), Inflation Rate (15%).

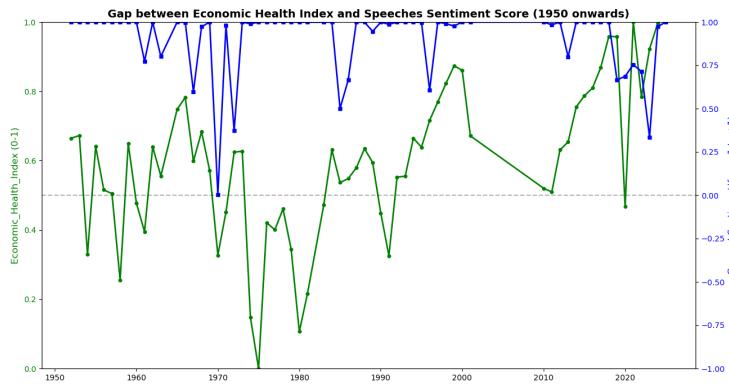


Figure 6: Gap between Economic Health Index and Presidential Speeches Sentiment Score (1950 onward)

Shown in Figure 6, the green line represents the Economic Health Index, while the blue line shows the General Sentiment. Overall, we observe periods of alignment and divergence between the two. In the 1950s and 1960s, sentiment remained relatively stable or optimistic, even amid economic fluctuations and recovery phases. The 1970s and the "stagflation" era show the strongest divergences, with presidential rhetoric struggling to match worsening economic conditions. Moving into the 1990s, despite sustained economic growth, sentiment dropped sharply, highlighting potential disconnects between macroeconomic indicators and political communication. In the 2000s and 2010s, sentiment remained consistently high, even during events like the 2008 financial crisis. Finally, in the late 2010s and early 2020s, the Economic Health Index surpassed sentiment for the first time, as external crises such as the COVID-19 pandemic and geopolitical conflicts began to heavily influence presidential tone, independent of immediate economic data.

Based on the analysis of Presidential Sentiment and the Economic Health Index, the conclusions drawn are similar to those from previous analyses. We observed a stronger alignment between the Economic Health Index and Presidential Sentiment (compared to the alignment with individual economic indicators), but this alignment still appears to be contingent upon specific historical periods rather than forming a generalizable pattern.

This analysis further supports the conclusion that presidential speeches are generally not dependent on economic conditions, as they almost always maintain an optimistic tone. They seem to respond to actual economic conditions only when these conditions are exceptionally severe. Additionally, we computed the correlation between the Economic Health Index and Presidential Sentiment, which was found to be -0.06. This provides further confirmation of the lack of consistent patterns between the two variables.

6.2 Consumers Sentiment

Considering this "Optimistic Gap", we decided to further investigate whether people are actually influenced by presidential optimism, or if, conversely, they shape their perceptions solely based on actual economic indicators. To make this comparison possible, we used data provided by the University of Michigan, where they conduct and execute a survey for a random sample of consumers in order to calculate the Index of Consumer Sentiment (ICS). Based on their reasoning, the ICS is composed of five key questions that encompass different topics related to economic perception, such as individuals' past and future financial situations, current business conditions, long-term economic prospects, and the timing for any major purchases. The relative score is then calculated for each of the index questions, rounded to the nearest whole number, and the sum is calculated. This sum is divided by the total for the 1966 base period and added by 2 in order to adjust for changes in sample design. (University of Michigan, n.d.) This equation is shown as:

$$\text{ICS} = \frac{X_1 + X_2 + X_3 + X_4 + X_5}{6.7558} + 2.0$$

For our analysis, the ICS data is first grouped by year to get the mean value, and then rescaled in order to match the -1 to 1 scale the Presidential Sentiment follows. Figure 7 is an addition to Figure 6, with the inclusion of the consumer sentiment trend which appears to follow the trajectory of the

economy and shows little evidence of being influenced by ‘Presidential Optimism’. We can observe how the public seems to respond more strongly to concrete economic signals rather than political speeches, even though one of the main purposes of presidential speeches is to target the citizens of the country and in a way shape their perception. This pattern seems to reverse only after 2020, probably due to exceptional global events such as the COVID-19 pandemic and geopolitical conflicts. Moreover, for the first time, Consumer Sentiment aligns more closely with the trend of presidential rhetoric, where both decline sharply, although the drop in consumer sentiment is more pronounced. The correlation between the Economic Health Index and Consumer Sentiment yields a coefficient of approximately 0.31 which is moderately positive and suggests that although improvements in the economy are generally associated with a more favorable consumer sentiment, the majority of public perception seems to be shaped by other possible factors, such as personal experiences, social media, or news framing. In contrast, the correlation between Presidential Sentiment and Consumer Sentiment yields a coefficient of approximately -0.003 which is a very minute impact and indicates that optimistic presidential rhetoric does not meaningfully influence people’s perception. Overall, we can conclude that while presidential rhetoric tends to maintain an inherently optimistic tone, its ability to influence public sentiment is limited and often overshadowed by real-world conditions and other forms of media.

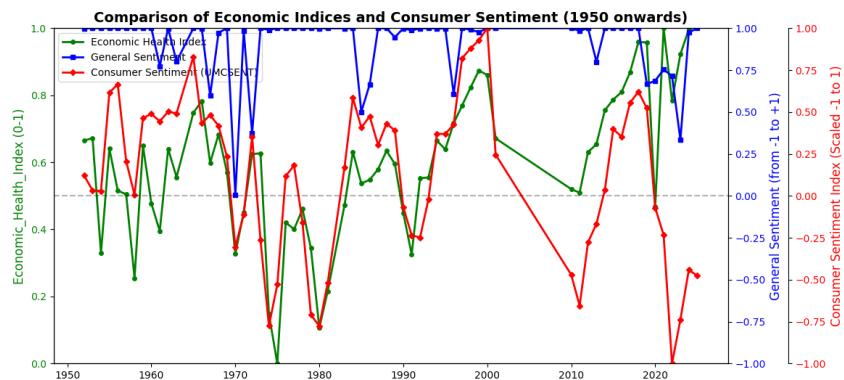


Figure 7: Gap between Economic Health Index, Presidential Speeches Sentiment Score and Consumers Sentiment Score (1950 onward)

7 Tree-based Classification

The following classification has been done using the aforementioned dual approach:

- Figure 8 and Figure 9 are referred to the dataset that only contains presidential speeches (and features extracted from them) for a broad period of time that goes from 1789 to now.
- Figure 10 and Figure 11 are referred to the dataset that includes also macroeconomic indicators and consumer sentiment, for a shorter period of time (1950-2024).

Considering the results obtained so far, we decided to adopt this method to further validate our results. Indeed, by comparing accuracies score of the model and especially the feature importance we can understand which features are relevant in classifying the speech and also whether adding more economic features increases the model performance.

7.1 Feature Extraction

In order to perform this classification task, which, as mentioned earlier, is not the primary focus of our analysis but rather serves as a tool to validate our findings, we created additional features from the textual data available:

- **Emotions:** We identified words associated with four general emotions - optimism, concern, confidence, and uncertainty - and created four new columns to capture the percentage of the speech corresponding to each emotion.
- **Themes:** We defined several major economic themes, including jobs, inflation, monetary policy, fiscal policy, international trade, and inequality.

- **Frames:** The type of frame used was considered the target variable, with four different framings: crisis, opportunity, leadership, and values. If none of the words defined in our four lists appeared in a speech, it was assigned to the 'neutral framing' category.

Additionally, we included features that had already been discussed earlier in the paper:

- The presidential speeches' sentiment score was used in both datasets.
 - Economic indicators (GDP growth, GDP per capita, unemployment rate, and inflation rate), along with the Economic Health Index, were included only in the economic dataframe.
 - The Readability Score was included in both datasets.
 - The consumer sentiment score was included only in the economic dataframe (due to the availability of data).
 - The cluster membership was included in both datasets.
 - Historical period, party affiliation, year, and decade were included in both datasets.

7.2 Comparison of Results

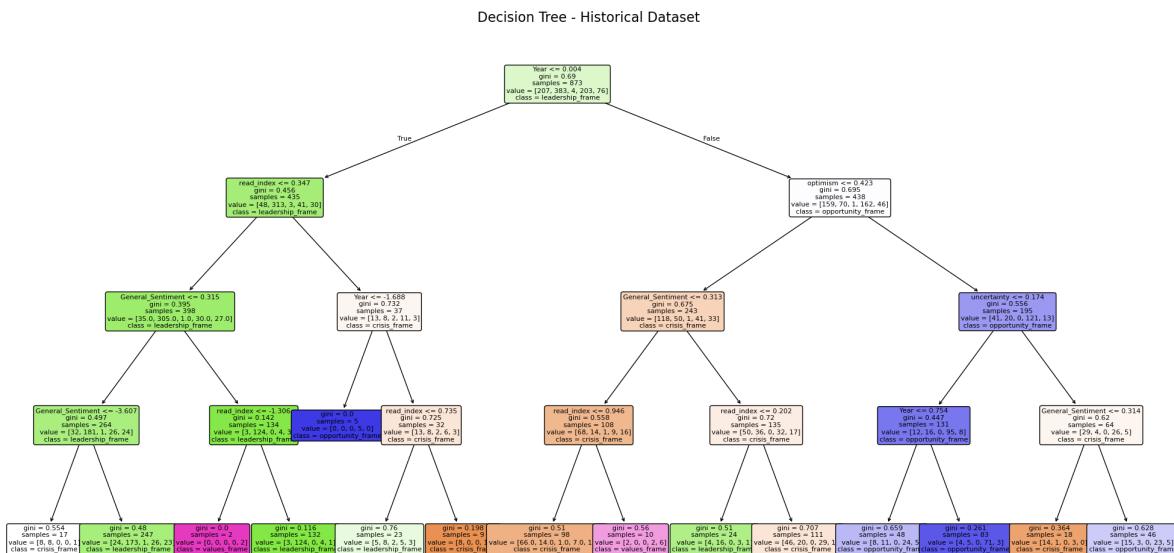


Figure 8: Decision Tree with Textual Data (1789-onward)

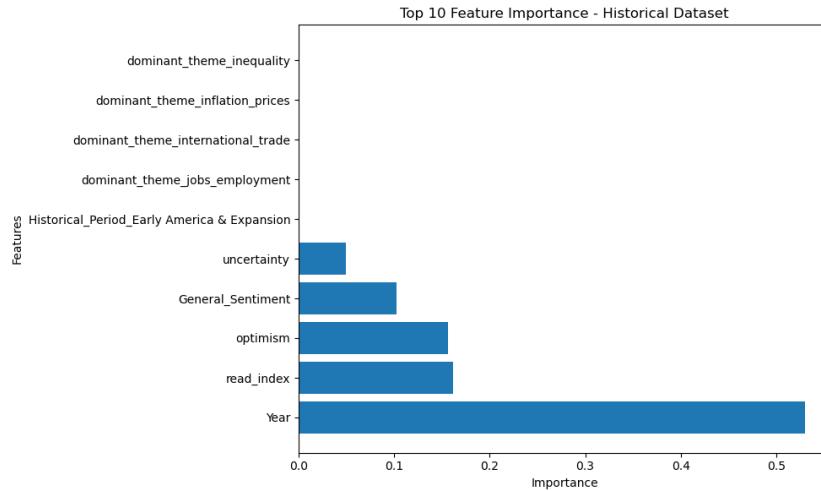


Figure 9: Feature Importance - only Textual Data

The first model, which relied solely on textual data, achieved an accuracy of 0.68. In contrast, the model that incorporated both textual data and economic indicators performed less effectively, with an accuracy of only 0.61. This result suggests that the framing adopted in presidential speeches is only minimally influenced by objective economic conditions. The inclusion of economic indicators, rather than enhancing the model's performance, actually led to a decrease in accuracy. This implies that, while economic variables such as the unemployment rate and per capita GDP are present among the most important features, they only emerge as significant after the textual features. This highlights their relatively low importance in comparison to the content of the speeches themselves. This finding aligns well with the earlier observation of a persistent gap between Presidential Sentiment and the Economic Health Index, further suggesting that presidential rhetoric does not directly respond to economic conditions.

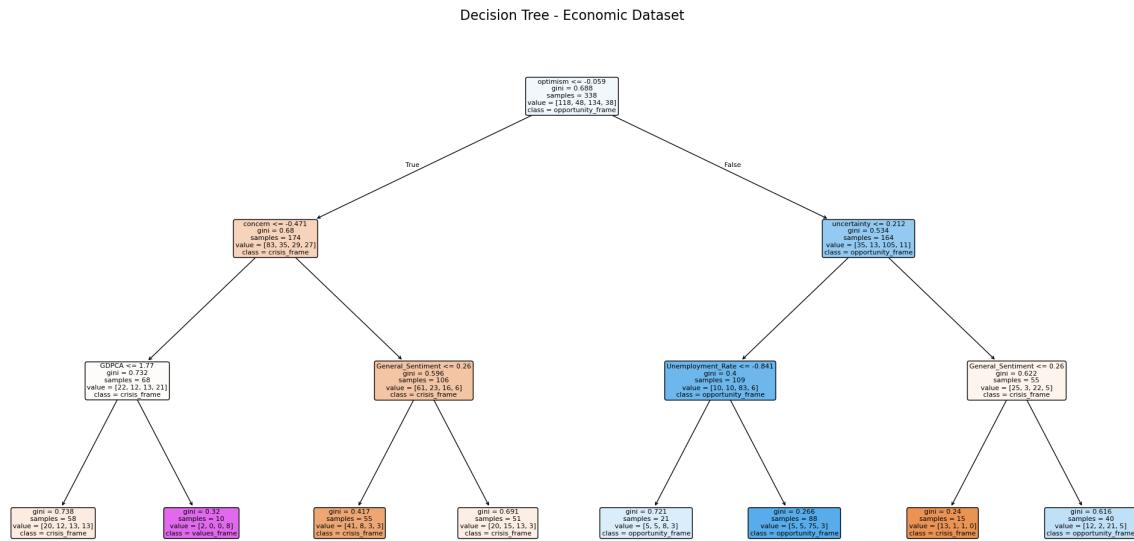


Figure 10: Decision Tree with Textual Data, Macroeconomic Indicators and Consumers Sentiment

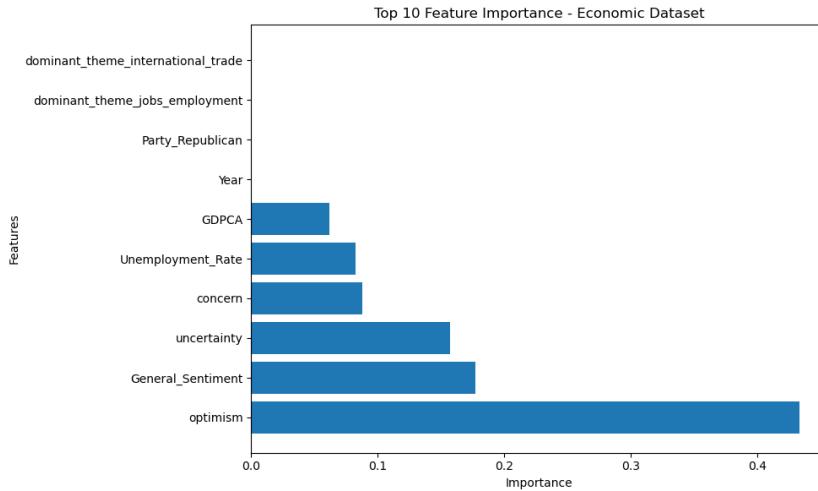


Figure 11: Feature Importance - Broader Set of Covariates

When we used only the textual data, we achieved a respectable accuracy, which confirms that our text processing approach effectively captured meaningful patterns within presidential rhetoric. The emotional tone, dominant themes, and linguistic characteristics of the speeches provided sufficient information to predict the framing strategies used by presidents. This result underscores the value of textual analysis in understanding political communication.

Furthermore, when considering the trade-off between sample size and feature richness, the evidence suggests that sample size is more important than incorporating additional economic features. The larger dataset, which spans a longer historical period, provides valuable insights by capturing broader historical patterns. In contrast, adding economic indicators within a limited timeframe does not significantly improve the model and, in fact, diminishes its performance. This suggests that the extra features do not add meaningful information but may introduce noise that confounds the model.

One possible explanation for the decrease in accuracy when adding economic indicators could be the nearly negligible negative correlation between the Economic Health Index and the sentiment of presidential speeches. Given that there is essentially no correlation between these economic indicators and the tone of the speeches, incorporating them into the model essentially introduces irrelevant information. This results in increased noise, which likely explains the observed drop in accuracy.

Ultimately, these findings reinforce our broader conclusion that presidential rhetoric follows its own logic rather than reflecting economic reality. Presidents frame economic issues based on political considerations and communication strategies rather than in direct response to objective economic indicators.

8 Conclusions and Future Directions

We successfully answered our research question: we found that rhetoric does not consistently reflect economic conditions. While short-term sentiment shifts can be observed during moments of national crisis – such as the 1970s stagflation or the COVID-19 pandemic—these are exceptions. Throughout time, presidential rhetoric has remained remarkably stable and optimistic, regardless of economic performance. Additionally, our classification models reinforce this finding. When economic indicators were added to the models, we saw a decline in accuracy, which suggests that macroeconomic variables introduce noise instead of actual explanatory power. Contrarily, textual features such as emotional tone, readability, and thematic framing were far more predictive of rhetorical structure. This suggests that presidential rhetoric is shaped more by strategic communication goals than by real-time economic conditions.

As a complement, we examined public sentiment using the University of Michigan’s Consumer Sentiment Index. The analysis showed that while public sentiment tracks closely with actual economic trends, it does not appear to be meaningfully influenced by presidential rhetoric. We found this particularly interesting as it suggests that presidents may aim to shape perception, but economic reality plays a stronger role in how people feel.

As future directions of our work and based on our findings, we believe it could be interesting to examine alternative drivers such as media framing, economic news coverage, or social media narratives to better understand how the public forms economic perceptions.

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