TAD-Replication-02

# Replication of “Measuring Emotion in Parliamentary Debates with Automated Textual Analysis”

## Data and Methods

In this part of replication, we focus on the 1973-1977 period and applied the key methods of data preprocessing, sentiment analysis, and temporal analysis using the original paper’s methodology.

We reference two key data sources from the original paper:

1. ***Raw debate text from Hansard*** (uk\_hansard\_1973\_1977.csv)
2. The authors’ pre-computed emotional measures and economic indicators:
   * ***emotion-final-y.csv***: Yearly aggregated data including:
     + Polarity measures (polar, polarg, polaro for overall, government, and opposition)
     + Economic indicators (recession, labor disputes (ldisp), unemployment, etc.)
   * ***emotion-final-q.csv***: Similar measures at quarterly intervals

Our replication adapts code from the following scripts in the original repository:

* ***emotion-main-models.R***: Contains their statistical analyses and visualization code
* ***lexicon-generator.R***: Documents their lexicon construction methodology

**Replication Steps:**

1. Basic sentiment analysis using their lexicon

2. Temporal aggregation of sentiment scores

3. Comparison with author’s output

4. Experiment with different lexicons

**Key differences from original:**

- We focus on 1973-1977 rather than the full 1909-2013 period

- We use their pre-constructed lexicon rather than building from word vectors

### 1. Data Loading and Initial Processing

# Load required libraries  
library(tidyverse)

## ── Attaching core tidyverse packages ──────────────────────── tidyverse 2.0.0 ──  
## ✔ dplyr 1.1.4 ✔ readr 2.1.5  
## ✔ forcats 1.0.0 ✔ stringr 1.5.1  
## ✔ ggplot2 3.5.1 ✔ tibble 3.2.1  
## ✔ lubridate 1.9.3 ✔ tidyr 1.3.1  
## ✔ purrr 1.0.2   
## ── Conflicts ────────────────────────────────────────── tidyverse\_conflicts() ──  
## ✖ dplyr::filter() masks stats::filter()  
## ✖ dplyr::lag() masks stats::lag()  
## ℹ Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors

library(lubridate)  
library(stringr)  
library(scales)

##   
## Attaching package: 'scales'  
##   
## The following object is masked from 'package:purrr':  
##   
## discard  
##   
## The following object is masked from 'package:readr':  
##   
## col\_factor

library(tidytext)  
library(ggplot2)  
library(gridExtra)

##   
## Attaching package: 'gridExtra'  
##   
## The following object is masked from 'package:dplyr':  
##   
## combine

# Read the data with explicit parsing  
hansard <- read.csv("uk\_hansard\_1973\_1977.csv",   
 sep = "\t", # tab delimiter  
 quote = "\"", # handle quotes properly  
 stringsAsFactors = FALSE,  
 encoding = "UTF-8")  
  
# print(head(df))  
  
# Read authors' preprocessed data  
yearly\_data <- read.csv("emotion-final-y.csv")  
quarterly\_data <- read.csv("emotion-final-q.csv")  
  
# Filter preprocessed data to our period  
yearly\_subset <- yearly\_data %>%  
 filter(year >= 1973 & year <= 1977)  
quarterly\_subset <- quarterly\_data %>%  
 filter(year >= 1973 & year <= 1977)

### 

### 2. Text Preprocessing

Following the author’s approach, we perform minimal text cleaning, only removing line breaks to preserve the original parliamentary language.

# Define preprocessing function  
preprocess\_speech <- function(text) {  
 text <- str\_replace\_all(text, "\\n", " ")  
 text <- str\_squish(text)  
 return(text)  
}  
  
# Clean dataset  
hansard\_clean <- hansard %>%  
 select(-person\_id) %>%  
 filter(!is.na(text)) %>%  
 mutate(  
 text\_processed = preprocess\_speech(text),  
 date = str\_extract(speech\_id, "[0-9]{4}-[0-9]{2}-[0-9]{2}"),  
 year = str\_extract(speech\_id, "[0-9]{4}")  
 )  
  
# Verify preprocessing  
print("Dataset dimensions after cleaning:")

## [1] "Dataset dimensions after cleaning:"

print(dim(hansard\_clean))

## [1] 286057 6

print("\nSample of original vs processed text:")

## [1] "\nSample of original vs processed text:"

sample\_comparison <- hansard\_clean %>%  
 select(text, text\_processed) %>%  
 head(5)  
print(sample\_comparison)

## text  
## 1 asked the Secretary of State for Trade and Industry whether he will make a statement about progress in administering financial assistance to the machine tool industry by his Department.  
## 2 All orders under the special scheme for public sector purchasing of machine tools have been placed.  
## 3 How much of this money has gone to the machine tool firm of Alfred Herbert in Coventry? How much has been spent on imported machine\n\ntools? Since this is taxpayers' money, intended to help the British industry, is it not a ridiculous practice to spend the money on imports?  
## 4 Less than 1 per cent. has been spent on imported machine tools. I am afraid that I could not, without notice, give the proportion of the total which has been spent at Alfred Herbert's.  
## 5 Is my right hon. Friend aware that the orders for machine tools in this country have risen dramatically during the last few months and that one of my constituents who has recently placed an order has had to wait three times as long as he would have done if he had placed it a couple of months ago?  
## text\_processed  
## 1 asked the Secretary of State for Trade and Industry whether he will make a statement about progress in administering financial assistance to the machine tool industry by his Department.  
## 2 All orders under the special scheme for public sector purchasing of machine tools have been placed.  
## 3 How much of this money has gone to the machine tool firm of Alfred Herbert in Coventry? How much has been spent on imported machine tools? Since this is taxpayers' money, intended to help the British industry, is it not a ridiculous practice to spend the money on imports?  
## 4 Less than 1 per cent. has been spent on imported machine tools. I am afraid that I could not, without notice, give the proportion of the total which has been spent at Alfred Herbert's.  
## 5 Is my right hon. Friend aware that the orders for machine tools in this country have risen dramatically during the last few months and that one of my constituents who has recently placed an order has had to wait three times as long as he would have done if he had placed it a couple of months ago?

### 3. Sentiment Analysis

We use the domain-specific parliamentary lexicon developed by the authors to compute sentiment score. The process involves:

1. Sentiment Computation:
   * **Match speech tokens** with lexicon entries
   * Calculate **mean polarity score** from matched words
   * Score range: -1 (most negative) to 1 (most positive)
2. Aggregation:
   * **Quarterly averaging** of speech-level scores
   * **Standard deviation calculation** to capture variability
   * **Normalization** to compare with authors’ scale

#### 

#### 3.1 Inspecting the Lexicon

# Read authors' lexicon  
lexicon <- read.csv("lexicon-polarity.csv", stringsAsFactors = FALSE)  
  
# Check lexicon structure  
print("\nLexicon structure:")

## [1] "\nLexicon structure:"

str(lexicon)

## 'data.frame': 4200 obs. of 4 variables:  
## $ lemma : chr "congratulate" "delighted" "high-quality" "tribute" ...  
## $ pos1 : chr "v" "a" "a" "n" ...  
## $ polarity: num 1 0.964 0.959 0.957 0.92 ...  
## $ seed : int 0 0 0 0 0 0 0 0 0 0 ...

print("\nSample of lexicon entries:")

## [1] "\nSample of lexicon entries:"

head(lexicon)

## lemma pos1 polarity seed  
## 1 congratulate v 1.0000000 0  
## 2 delighted a 0.9637092 0  
## 3 high-quality a 0.9594914 0  
## 4 tribute n 0.9572963 0  
## 5 commend v 0.9196902 0  
## 6 impressive a 0.9107024 0

#### 

#### 3.2 Compute Polarity for a small sample

# Define the function for computing polarity  
compute\_polarity <- function(text, lexicon) {  
 words <- unlist(strsplit(tolower(text), "\\s+"))  
 matches <- match(words, lexicon$lemma)  
 matched\_scores <- lexicon$polarity[matches[!is.na(matches)]]  
 if(length(matched\_scores) > 0) {  
 return(mean(matched\_scores, na.rm = TRUE))  
 } else {  
 return(NA)  
 }  
}  
  
# Test on first few speeches  
test\_cases <- head(hansard\_clean$text\_processed, 3)  
for(i in seq\_along(test\_cases)) {  
 cat("\nAnalyzing text", i, ":\n")  
 cat("Text:", substr(test\_cases[i], 1, 100), "...\n")  
 score <- compute\_polarity(test\_cases[i], lexicon)  
 cat("Final score:", score, "\n")  
}

##   
## Analyzing text 1 :  
## Text: asked the Secretary of State for Trade and Industry whether he will make a statement about progress ...  
## Final score: 0.4817999   
##   
## Analyzing text 2 :  
## Text: All orders under the special scheme for public sector purchasing of machine tools have been placed. ...  
## Final score: 0.3485371   
##   
## Analyzing text 3 :  
## Text: How much of this money has gone to the machine tool firm of Alfred Herbert in Coventry? How much has ...  
## Final score: 0.2007633

#### Observation:

1.The matched words reveal interesting aspects in the lexicon’s scoring scheme:

* **Action words** get moderate positive scores: “will” (0.33), “make” (0.43)
* **Progress-related words score higher**: “progress” (0.65), “assistance” (0.52)
* **Business terms** are neutral to positive: “firm” (0.53), “scheme” (0.38)
* **Negative critique words** score strongly negative: “ridiculous” (-1.00)

1. This suggests that the lexicon is more sensitive to the **action and progress-oriented language** which is typical in parliamentary discourse. It also captures strong negative sentiment in critical statements while assigning moderate scores to procedural/administrative language.

#### 

#### 3.3 Perform sentiment analysis on the whole dataset

# Calculate polarity for each speech individually  
polarities <- vector("numeric", nrow(hansard\_clean))  
for(i in 1:nrow(hansard\_clean)) {  
 polarities[i] <- compute\_polarity(hansard\_clean$text\_processed[i], lexicon)  
}  
hansard\_clean$polarity <- polarities  
  
# Check sentiment distribution  
print("Basic sentiment statistics:")

## [1] "Basic sentiment statistics:"

print(summary(hansard\_clean$polarity))

## Min. 1st Qu. Median Mean 3rd Qu. Max. NA's   
## -1.000 0.310 0.378 0.358 0.432 1.000 22804

#### Observations:

* Distribution shows reasonable variation: -1.0 to 1.0 (full range of sentiment)
* Central tendency is slightly positive (mean = 0.358, median = 0.378)
* Notable amount of missing values (**~22,800 speeches (8%) have no lexicon matches**, there’s potential bias in **which types of speeches are unmatchable**)
* Asymmetric distribution (more positive than negative scores), though it aligns with formal parliamentary language

### 

### 3.4 Quarterly Aggregation

This begins the core replication by computing the key metrics from the paper: (1) ***quarterly sentiment trends*** and (2) the ***comparison between government and opposition speeches***.

Other than quarterly aggregation, we also tabulated the **Standard Deviation** (the spread) of polarity score within each quarter to understand **if certain periods had more emotional volatility/consistency** in debates.

# Authors' rescaling function  
rescale <- function(x) {2/(max(x) - min(x))\*(x - min(x)) - 1}  
  
# Aggregate by quarter for comparison  
our\_quarterly <- hansard\_clean %>%  
 mutate(  
 # Create quarter labels  
 quarter = ceiling(as.numeric(substr(date, 6, 7))/3),  
 year\_quarter = paste0(year, "-Q", quarter)  
 ) %>%  
 # Calculate quarterly metrics  
 group\_by(year\_quarter) %>%  
 summarize(  
 avg\_polarity = mean(polarity, na.rm = TRUE), # Raw mean polarity  
 n\_speeches = n(), # Number of speeches per quarter  
 sd\_polarity = sd(polarity, na.rm = TRUE), # Spread of polarities  
 .groups = 'drop'  
 ) %>%  
 arrange(year\_quarter) %>%  
 mutate(  
 polarity\_diff = c(NA, diff(avg\_polarity)), # Quarter-to-quarter changes  
 polarity\_rescaled = rescale(avg\_polarity) # Re-scaled to [-1,1] range  
 )  
  
# Compare with authors' scores  
comparison <- our\_quarterly %>%  
 mutate(  
 year = as.numeric(substr(year\_quarter, 1, 4)),  
 quarter = as.numeric(gsub(".\*Q", "", year\_quarter))  
 ) %>%  
 left\_join(  
 select(quarterly\_subset, year, quarter, author\_polar = polar),  
 by = c("year", "quarter")  
 )  
  
print("Our quarterly averages:")

## [1] "Our quarterly averages:"

print(head(our\_quarterly))

## # A tibble: 6 × 6  
## year\_quarter avg\_polarity n\_speeches sd\_polarity polarity\_diff  
## <chr> <dbl> <int> <dbl> <dbl>  
## 1 1973-Q1 0.358 16412 0.151 NA   
## 2 1973-Q2 0.361 16586 0.137 0.00331   
## 3 1973-Q3 0.361 7078 0.141 0.0000796  
## 4 1973-Q4 0.358 15545 0.147 -0.00381   
## 5 1974-Q1 0.359 9962 0.144 0.00138   
## 6 1974-Q2 0.360 12138 0.146 0.00126   
## # ℹ 1 more variable: polarity\_rescaled <dbl>

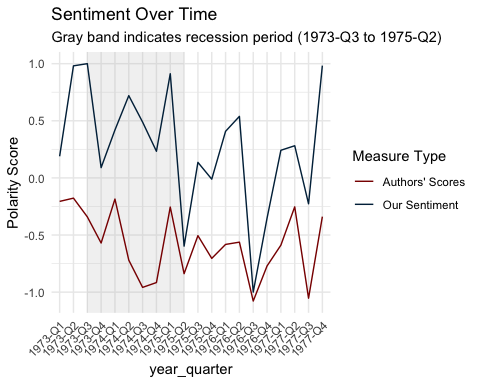
print("\nComparison with authors' scores:")

## [1] "\nComparison with authors' scores:"

print(head(comparison))

## # A tibble: 6 × 9  
## year\_quarter avg\_polarity n\_speeches sd\_polarity polarity\_diff  
## <chr> <dbl> <int> <dbl> <dbl>  
## 1 1973-Q1 0.358 16412 0.151 NA   
## 2 1973-Q2 0.361 16586 0.137 0.00331   
## 3 1973-Q3 0.361 7078 0.141 0.0000796  
## 4 1973-Q4 0.358 15545 0.147 -0.00381   
## 5 1974-Q1 0.359 9962 0.144 0.00138   
## 6 1974-Q2 0.360 12138 0.146 0.00126   
## # ℹ 4 more variables: polarity\_rescaled <dbl>, year <dbl>, quarter <dbl>,  
## # author\_polar <dbl>

# Plot comparing our rescaled scores with authors'  
ggplot(comparison) +  
 # Add recession shading  
 annotate("rect",  
 xmin = "1973-Q3",  
 xmax = "1975-Q2",  
 ymin = -Inf, ymax = Inf,  
 alpha = 0.2, fill = "gray") +  
 # Sentiment lines with group=1  
 geom\_line(aes(x = year\_quarter, y = polarity\_rescaled,   
 color = "Our Sentiment", group = 1)) +  
 geom\_line(aes(x = year\_quarter, y = author\_polar,   
 color = "Authors' Scores", group = 1)) +  
 theme\_minimal() +  
 theme(axis.text.x = element\_text(angle = 45, hjust = 1)) +  
 labs(title = "Sentiment Over Time",  
 subtitle = "Gray band indicates recession period (1973-Q3 to 1975-Q2)",  
 y = "Polarity Score",  
 color = "Measure Type") +  
 scale\_color\_manual(values = c("Our Sentiment" = "#002A48",   
 "Authors' Scores" = "#8B0000"))



# Print summary statistics  
print("Summary of our calculations:")

## [1] "Summary of our calculations:"

print(summary(comparison %>% select(polarity\_rescaled, author\_polar)))

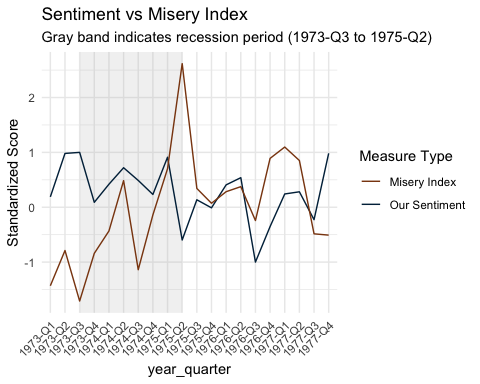
## polarity\_rescaled author\_polar   
## Min. :-1.00000 Min. :-1.0780   
## 1st Qu.: 0.06462 1st Qu.:-0.7878   
## Median : 0.26171 Median :-0.5762   
## Mean : 0.27175 Mean :-0.5803   
## 3rd Qu.: 0.58405 3rd Qu.:-0.3182   
## Max. : 1.00000 Max. :-0.1772

#### Comparisons:

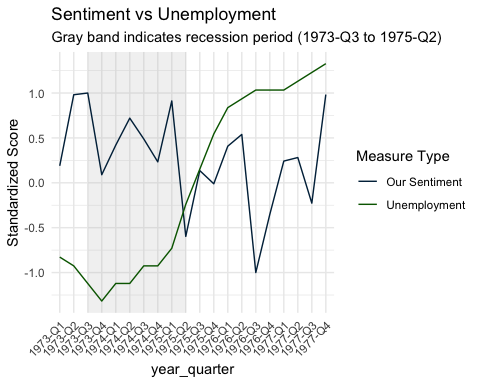
1. Scale and Distribution:

* Our rescaled scores has a positive mean (0.27), but shows more extreme swings.
* Authors’ scores are **consistently negative** (-1.08 to -0.18), with a more negative mean (-0.58)
* There are notable divergence (like in 1973-Q2/Q3, our scores peak, but author’s scores show negativity); but there’re also similar trends. For example, **both show a drastic slump in 1975-Q2 and 1976-Q3**, reflecting a response to exterior shocks.

# Check available economic indicators  
# names(quarterly\_subset) # This shows all columns including economic indicators  
  
# join economic data  
comparison\_with\_econ <- comparison %>%  
 left\_join(  
 select(quarterly\_subset, year, quarter, misery, unemp, ldisp),  
 by = c("year", "quarter")  
 )  
  
# plot Misery Index  
ggplot(comparison\_with\_econ) +  
 # Add recession shading  
 annotate("rect",  
 xmin = "1973-Q3",  
 xmax = "1975-Q2",  
 ymin = -Inf, ymax = Inf,  
 alpha = 0.2, fill = "gray") +  
 geom\_line(aes(x = year\_quarter, y = polarity\_rescaled,   
 group = 1, color = "Our Sentiment")) +  
 geom\_line(aes(x = year\_quarter, y = scale(misery)[,1],   
 group = 1, color = "Misery Index")) +  
 theme\_minimal() +  
 theme(axis.text.x = element\_text(angle = 45, hjust = 1)) +  
 labs(title = "Sentiment vs Misery Index",  
 subtitle = "Gray band indicates recession period (1973-Q3 to 1975-Q2)",  
 y = "Standardized Score",  
 color = "Measure Type") +  
 scale\_color\_manual(values = c("Our Sentiment" = "#002A48",   
 "Misery Index" = "#8B4513"))



# plot Unemployment  
ggplot(comparison\_with\_econ) +  
 # Add recession shading  
 annotate("rect",  
 xmin = "1973-Q3",  
 xmax = "1975-Q2",  
 ymin = -Inf, ymax = Inf,  
 alpha = 0.2, fill = "gray") +  
 geom\_line(aes(x = year\_quarter, y = polarity\_rescaled,   
 group = 1, color = "Our Sentiment")) +  
 geom\_line(aes(x = year\_quarter, y = scale(unemp),   
 group = 1, color = "Unemployment")) +  
 theme\_minimal() +  
 theme(axis.text.x = element\_text(angle = 45, hjust = 1)) +  
 labs(title = "Sentiment vs Unemployment",  
 subtitle = "Gray band indicates recession period (1973-Q3 to 1975-Q2)",  
 y = "Standardized Score",  
 color = "Measure Type") +  
 scale\_color\_manual(values = c("Our Sentiment" = "#002A48",   
 "Unemployment" = "#006400"))



#### Observations:

1. There’s a notable **inverse relationship** in several periods (e.g., 1974-Q4 to 1975-Q2), which is consistent with the author’s findings.
2. Some periods strangely show **parallel movement** (e.g., early 1974)
3. Sentiment is expected to **constantly lag behind** misery index changes, **but the reverse is true** in some cases, challenging the assumption that parliamentary discourse is “directed” by change in economic conditions.

### 4. Alternative Lexicons – AFINN

In this section, we compare our domain-specific lexicon with AFINN, **a general-purpose sentiment lexicon** built on social media texts, which might be better at capturing casual language and emotional terms. AFINN scores words on **a scale from -5 (very negative) to +5 (very positive)**–potentially better at capturing intensity of sentiment–which offers a different approach to sentiment scoring than our binary/continuous parliamentary lexicon.

This comparison will help us understand how domain-specific adaptation affects sentiment analysis results, as well as the **points of decision-making when applying off-the-shelf lexicons** for sentiment analysis.

We use the same preprocessing and aggregation methods but apply AFINN’s scoring system, then standardize both measures for fair comparison. This reveals whether general sentiment tools can capture the same patterns we observed in parliamentary language.

#### Applying AFINN Lexicon

### Alternative Lexicon Comparison  
# First get AFINN lexicon  
library(tidytext)  
afinn\_sentiment <- get\_sentiments("afinn")  
  
# Look at AFINN structure  
print("AFINN lexicon preview:")

## [1] "AFINN lexicon preview:"

head(afinn\_sentiment, 10)

## # A tibble: 10 × 2  
## word value  
## <chr> <dbl>  
## 1 abandon -2  
## 2 abandoned -2  
## 3 abandons -2  
## 4 abducted -2  
## 5 abduction -2  
## 6 abductions -2  
## 7 abhor -3  
## 8 abhorred -3  
## 9 abhorrent -3  
## 10 abhors -3

print("\nAFINN stats:")

## [1] "\nAFINN stats:"

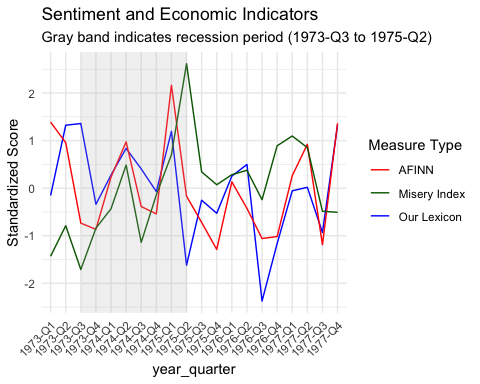
print(paste("Number of words:", nrow(afinn\_sentiment)))

## [1] "Number of words: 2477"

# Function to compute AFINN sentiment scores  
compute\_afinn\_sentiment <- function(text) {  
 # Split text into words  
 words <- tibble(word = unlist(strsplit(tolower(text), "\\s+")))  
   
 # Match with AFINN lexicon  
 matched\_words <- words %>%  
 inner\_join(afinn\_sentiment, by = "word")  
   
 # Calculate average sentiment score  
 if(nrow(matched\_words) > 0) {  
 return(mean(matched\_words$value, na.rm = TRUE))  
 } else {  
 return(NA)  
 }  
}  
  
# Apply AFINN to our speeches  
hansard\_clean <- hansard\_clean %>%  
 mutate(afinn\_score = sapply(text\_processed, compute\_afinn\_sentiment))  
  
# Aggregate by quarter like before  
afinn\_quarterly <- hansard\_clean %>%  
 mutate(  
 quarter = ceiling(as.numeric(substr(date, 6, 7))/3),  
 year\_quarter = paste0(year, "-Q", quarter)  
 ) %>%  
 group\_by(year\_quarter) %>%  
 summarize(  
 avg\_afinn = mean(afinn\_score, na.rm = TRUE),  
 n\_speeches = n(),  
 sd\_afinn = sd(afinn\_score, na.rm = TRUE),  
 .groups = 'drop'  
 )  
  
# Compare with our original scores  
comparison\_lexicons <- comparison %>%  
 left\_join(afinn\_quarterly, by = "year\_quarter")  
  
comparison\_lexicons <- comparison\_lexicons %>%  
 left\_join(  
 select(quarterly\_subset, year, quarter, misery),  
 by = c("year", "quarter")  
 )

#### Visualize the sentiment trends

# Visualization of Lexicon Comparison (along with Misery Index)  
ggplot(comparison\_lexicons) +  
 # Sentiment lines  
 geom\_line(aes(x = year\_quarter, y = scale(polarity\_rescaled),   
 color = "Our Lexicon"), group = 1) +  
 geom\_line(aes(x = year\_quarter, y = scale(avg\_afinn),   
 color = "AFINN"), group = 1) +  
 geom\_line(aes(x = year\_quarter, y = scale(misery),   
 color = "Misery Index"), group = 1) +  
 # Add recession period marker  
 annotate("rect",   
 xmin = which(comparison\_lexicons$year\_quarter == "1973-Q3"),  
 xmax = which(comparison\_lexicons$year\_quarter == "1975-Q2"),  
 ymin = -Inf, ymax = Inf,  
 alpha = 0.2, fill = "gray") +  
 theme\_minimal() +  
 theme(axis.text.x = element\_text(angle = 45, hjust = 1)) +  
 labs(title = "Sentiment and Economic Indicators",  
 subtitle = "Gray band indicates recession period (1973-Q3 to 1975-Q2)",  
 y = "Standardized Score",  
 color = "Measure Type") +  
 scale\_color\_manual(values = c("Our Lexicon" = "blue",   
 "AFINN" = "red",  
 "Misery Index" = "darkgreen"))



#### Pattern Divergence:

1. The first major divergence appears in **1975-Q2** which is at the height of energy crisis. AFINN shows a much higher peak than our lexicon, though both peaks appear prior to the Misery Index.

A possible reason is that most texts during this period are about **energy policy and oil markets**, which might require the use of more stern expression and harsher language. Since AFINN is built from social media, it might be **more sensitive to emotional language** than our’s that is better suited for parliamentary formality.

1. A second different sensitivity appears in **1976-Q3** where our lexicon shows a deep slump approximating -2.5.
2. There’s a clear **lag effect** between sentiment change and economic indicators – only **the direction is unclear**
3. **AFINN is more volatile** during economic stress periods (more sensitive to emotional language)

#### 

#### Analyze the speeches with most divergent sentiment scores

Note: The scoring scales are different (AFINN: -5 to 5, Ours: -1 to 1), so the absolute difference should not be taken as a reference.

# Extract the speeches with most divergent sentiment scores  
divergent\_speeches <- hansard\_clean %>%  
 mutate(year\_quarter = paste0(year, "-Q",   
 ceiling(as.numeric(substr(date, 6, 7))/3))) %>%  
 filter(year\_quarter %in% c("1975-Q2", "1976-Q3")) %>%  
 mutate(  
 sentiment\_diff = abs(scale(afinn\_score)[1] - scale(polarity)[1])  
 ) %>%  
 arrange(desc(sentiment\_diff)) %>%  
 select(year\_quarter, text\_processed, afinn\_score, polarity) %>%  
 head(10)  
  
# Print sample divergent speeches  
print("Speeches with largest sentiment score differences:")

## [1] "Speeches with largest sentiment score differences:"

print(divergent\_speeches)

## year\_quarter  
## 1 1975-Q2  
## 2 1975-Q2  
## 3 1975-Q2  
## 4 1975-Q2  
## 5 1975-Q2  
## 6 1975-Q2  
## 7 1975-Q2  
## 8 1975-Q2  
## 9 1975-Q2  
## 10 1975-Q2  
## text\_processed  
## 1 asked the Secretary of State for Energy whether he will make a statement about the latest meeting of the International Energy Agency.  
## 2 The International Energy Agency's Governing Board met in Paris on 19th and 20th March. It agreed three inter-related measures of co-operation in the accelerated development of new energy sources. It also discussed the approach that participating countries would adopt in the dialogue between oil consumers and producers, the preparatory meeting for which is taking place in Paris today. 7th April.  
## 3 Since the agency has powers which are a good deal more supranational than any possessed by the EEC, including powers relating to the allocation of our oil supplies, will the Minister ask his right hon. Friend to seek a suitable occasion to explain how he supports British membership of the agency while opposing British membership of the EEC?  
## 4 There is a clear distinction between the two sorts of association. The International Energy Agency is concerned to deal with the situation where there is a shortfall in oil supplies, and the automatic arrangements come into effect in that arrangement. They are different sorts of organisations, but both involve a certain element of diminution of sovereignty.  
## 5 What is the justification for this body taking measures to keep up the price of oil?  
## 6 The body is proposing to explore the possibility of having a floor price for oil to preserve the investments which some other countries, including this one, are making in alternative energy sources.  
## 7 Do the Government intend to bring the agreement before the House of Commons? Is any action required by this House before the Government can ratify the agreement, as they have to do before the end of May?  
## 8 I think that the agreement is published as a Command Paper, and I am sure that the right hon. Gentleman and many of his hon. Friends have read it already. It requires to be ratified by the House.  
## 9 asked the Secretary of State for Energy what is his estimate of the expected production of oil from the North Sea in 1975 and in each of the following three years.  
## 10 My right hon. Friend will be publishing this month estimates of production and reserves of oil and gas in the 1975 Report to Parliament.  
## afinn\_score polarity  
## 1 NA 0.3960288  
## 2 1.0 0.4681631  
## 3 2.5 0.3301716  
## 4 1.0 0.2453608  
## 5 NA 0.4203066  
## 6 NA 0.5330889  
## 7 1.0 0.3942952  
## 8 1.5 0.4920953  
## 9 NA 0.3692293  
## 10 NA 0.2197630

# Check NA patterns in our analysis  
na\_pattern <- hansard\_clean %>%  
 filter(is.na(afinn\_score)) %>%  
 select(text\_processed, polarity, afinn\_score) %>%  
 head(10)  
  
print("\nExample speeches with NA AFINN scores:")

## [1] "\nExample speeches with NA AFINN scores:"

print(na\_pattern)

## text\_processed  
## 1 All orders under the special scheme for public sector purchasing of machine tools have been placed.  
## 2 Is my right hon. Friend aware that the orders for machine tools in this country have risen dramatically during the last few months and that one of my constituents who has recently placed an order has had to wait three times as long as he would have done if he had placed it a couple of months ago?  
## 3 No, Sir.  
## 4 I note what my hon. Friends says. The hon. Member for Putney (Mr. Hugh Jenkins) has a later Question on this point and I do not think that I should seek to anticipate my reply to it.  
## 5 asked the Secretary of State for Trade and Industry if he will make an early official visit to the Yorkshire and Humberside region to discuss the effects on the region's industry of the suggested development of a regional airport.  
## 6 asked the Secretary of State for Trade and Industry if he will visit Yorkshire and Humberside to discuss the modernisation needs of industry.  
## 7 Will the right hon. Gentleman tell the House what is the purpose of his visit, whom he intends to meet and whether he will have talks on the expansion of Yeadon airport?  
## 8 When I have completed the programme I will let the right hon. Gentleman know.  
## 9 asked the Secretary of State for Trade and Industry what discussions he is having regarding the development of a regional airport in the Yorkshire and Humberside region, and its effects on the industry of the region.  
## 10 Will my hon. Friend say whether the Leader of the Opposition was correct in saying that the Labour Government would have required a 50 per cent. participation in both the North Sea and the Irish Sea?  
## polarity afinn\_score  
## 1 0.3485371 NA  
## 2 0.3932245 NA  
## 3 NA NA  
## 4 0.3860283 NA  
## 5 0.4050212 NA  
## 6 0.4262463 NA  
## 7 0.3971836 NA  
## 8 0.4012762 NA  
## 9 0.4116411 NA  
## 10 0.3774740 NA

#### Analyzing the Divergent Speeches:

1. Aligned with what the plot shows, most texts are about **energy policy and oil markets during 1975-Q2**.
2. The divergent speeches in AFINN shows interesting patterns:

* Missing scores (NA) appear for many **technical/policy questions**
* Higher scores (2.5) for EEC membership discussion
* Moderate scores (1.0-1.5) for procedural statements

1. Our lexicon shows relatively consistent scoring (0.22-0.53) across all speeches. It has the highest for **policy proposals** (0.53 for “floor price” discussion), and lower for **technical questions** (0.22-0.35).

#### Likely reasons for NAs:

* **Domain mismatch**: AFINN’s **social media focus** might be a mismatch for the formal parliamentary language
* **Technical vocabulary**: Highly technical terms like energy policy terms aren’t in AFINN
* **Procedural language**: Parliamentary procedures use niche, specific phrases

#### 

#### Remove NAs and re-examine most divergent speech

# Remove NAs and recalculate divergent speeches  
divergent\_speeches\_clean <- hansard\_clean %>%  
 filter(!is.na(afinn\_score)) %>%  
 mutate(year\_quarter = paste0(year, "-Q",   
 ceiling(as.numeric(substr(date, 6, 7))/3))) %>%  
 filter(year\_quarter %in% c("1975-Q2", "1976-Q3")) %>%  
 mutate(  
 sentiment\_diff = abs(scale(afinn\_score)[1] - scale(polarity)[1])  
 ) %>%  
 arrange(desc(sentiment\_diff)) %>%  
 select(year\_quarter, text\_processed, afinn\_score, polarity) %>%  
 head(10)  
  
# Print sample divergent speeches  
print("Speeches with largest sentiment score differences (NAs removed):")

## [1] "Speeches with largest sentiment score differences (NAs removed):"

print(divergent\_speeches\_clean)

## year\_quarter  
## 1 1975-Q2  
## 2 1975-Q2  
## 3 1975-Q2  
## 4 1975-Q2  
## 5 1975-Q2  
## 6 1975-Q2  
## 7 1975-Q2  
## 8 1975-Q2  
## 9 1975-Q2  
## 10 1975-Q2  
## text\_processed  
## 1 The International Energy Agency's Governing Board met in Paris on 19th and 20th March. It agreed three inter-related measures of co-operation in the accelerated development of new energy sources. It also discussed the approach that participating countries would adopt in the dialogue between oil consumers and producers, the preparatory meeting for which is taking place in Paris today. 7th April.  
## 2 Since the agency has powers which are a good deal more supranational than any possessed by the EEC, including powers relating to the allocation of our oil supplies, will the Minister ask his right hon. Friend to seek a suitable occasion to explain how he supports British membership of the agency while opposing British membership of the EEC?  
## 3 There is a clear distinction between the two sorts of association. The International Energy Agency is concerned to deal with the situation where there is a shortfall in oil supplies, and the automatic arrangements come into effect in that arrangement. They are different sorts of organisations, but both involve a certain element of diminution of sovereignty.  
## 4 Do the Government intend to bring the agreement before the House of Commons? Is any action required by this House before the Government can ratify the agreement, as they have to do before the end of May?  
## 5 I think that the agreement is published as a Command Paper, and I am sure that the right hon. Gentleman and many of his hon. Friends have read it already. It requires to be ratified by the House.  
## 6 Is my hon. Friend reasonably confident that levels of production will not be disappointing in the next two or three years, despite the unusually adverse wind and weather conditions experienced in recent months?  
## 7 Like all enterprises in the North Sea, ours are subject to the accidents of working in such a hostile environment. It is especially disappointing that there will be a hold-up in production from the Argyll field due to the damage done to the production riser. This is one of the difficulties which cannot be avoided in North Sea oil development. There will be less oil landed this year than was thought at one time. We believe, however, that the targets for the 1980s will be maintained.  
## 8 A great deal of wind on this subject has come from the Government. Is Government policy itself, which involves the taking of participation in the North Sea fields, accepted by the Government as being the cause of delay in North Sea development?  
## 9 There is no evidence to indicate that the Government's proposals on participation have had any effect on development in the North Sea. At the moment, more rigs are exploring the North Sea than ever before.  
## 10 Will my hon. Friend confirm the report in theFinancial Timesthis morning by a stockbroker indicating that there has been no delay due to Government policy in this respect?  
## afinn\_score polarity  
## 1 1.000000 0.46816312  
## 2 2.500000 0.33017160  
## 3 1.000000 0.24536082  
## 4 1.000000 0.39429525  
## 5 1.500000 0.49209525  
## 6 0.000000 0.38904101  
## 7 -1.333333 0.22807242  
## 8 1.000000 0.09971034  
## 9 -1.000000 0.45623240  
## 10 -1.000000 0.09037013

#### Observations:

Since the AFINN score and our lexicon are in different scales, the absolute ranking of these texts are not meaningful. However it’s still interesting to examine sample texts that receive negative AFINN score while scoring high with our lexicon.

#### Sample Text 9 (afinn score of -1.00000, polarity of 0.45623240)

* Text: “There is no evidence to indicate that the Government’s proposals on participation have had any effect on development in the North Sea. At the moment, more rigs are exploring the North Sea than ever before.”
* Analysis: AFINN might have scored **“no evidence”** and **“effect”** negatively, while the custom lexicon recognizes this as **neutral technical language** about development

#### Sample Text 7 (afinn score of -1.33333, polarity of 0.22807242)

* Text: “Like all enterprises in the North Sea, ours are subject to the accidents of working in such a hostile environment. It is especially disappointing that there will be a hold-up in production from the Argyll field due to the damage done to the production riser. This is one of the difficulties which cannot be avoided in North Sea oil development. There will be less oil landed this year than was thought at one time. We believe, however, that the targets for the 1980s will be maintained.”
* Analysis: AFINN might have heavily weighted words like **“hostile,” “damage,” and “difficulties”** negatively, while the custom lexicon understands these as **standard technical descriptions** of North Sea operations

#### Sample Text 5 (afinn score of 1.50000, polarity of 0.49209525) – more positive by our lexicon

* Text: “I think that the agreement is published as a Command Paper, and I am sure that the right hon. Gentleman and many of his hon. Friends have read it already. It requires to be ratified by the House.”
* Analysis: AFINN misses the formal parliamentary **context**, while the custom lexicon recognizes the positive procedural language about **ratification**

#### Sample Text 2 (afinn score of 2.50000, polarity of 0.33017160) – more positive by AFINN

* Text: “Since the agency has powers which are a good deal more supranational than any possessed by the EEC, including powers relating to the allocation of our oil supplies, will the Minister ask his right hon. Friend to seek a suitable occasion to explain how he supports British membership of the agency while opposing British membership of the EEC?”
* Analysis: AFINN might have overweighted positive terms like **“good”** and **“supports,”** while the custom lexicon better understands the neutral nature of procedural questions about membership

#### However, we need to check the computed sentiment for these sample texts to confirm our assumption, and to see which words actually drives the discrepency

#### 

#### Examine the sentiment of 4 sample most divergent texts

analyze\_sentiment\_comparison <- function(text, custom\_lexicon, afinn\_sentiment) {  
 # Split text into words  
 words <- unlist(strsplit(tolower(text), "\\s+"))  
   
 # Find matches in custom lexicon  
 custom\_matches <- words[words %in% custom\_lexicon$lemma]  
 custom\_scores <- sapply(custom\_matches, function(w) {  
 score <- custom\_lexicon$polarity[custom\_lexicon$lemma == w]  
 paste(w, ":", round(score, 3))  
 })  
   
 # Find matches in AFINN  
 afinn\_matches <- words[words %in% afinn\_sentiment$word]  
 afinn\_scores <- sapply(afinn\_matches, function(w) {  
 score <- afinn\_sentiment$value[afinn\_sentiment$word == w]  
 paste(w, ":", score)  
 })  
   
 # Calculate overall scores  
 custom\_score <- mean(sapply(custom\_matches, function(w)   
 custom\_lexicon$polarity[custom\_lexicon$lemma == w]), na.rm = TRUE)  
 afinn\_score <- mean(sapply(afinn\_matches, function(w)   
 afinn\_sentiment$value[afinn\_sentiment$word == w]), na.rm = TRUE)  
   
 # Print results  
 cat("\nText:", substr(text, 1, 200), "...\n")  
 cat("\nCustom Lexicon matches:\n")  
 if(length(custom\_scores) > 0) {  
 cat(paste(custom\_scores, collapse = "\n"), "\n")  
 } else {  
 cat("No matches found\n")  
 }  
 cat("Overall custom score:", round(custom\_score, 3), "\n")  
   
 cat("\nAFINN Lexicon matches:\n")  
 if(length(afinn\_scores) > 0) {  
 cat(paste(afinn\_scores, collapse = "\n"), "\n")  
 } else {  
 cat("No matches found\n")  
 }  
 cat("Overall AFINN score:", round(afinn\_score, 3), "\n")  
 cat("\n", rep("-", 80), "\n")  
}  
  
# Selected sample texts  
texts <- c(  
 "There is no evidence to indicate that the Government's proposals on participation have had any effect on development in the North Sea. At the moment, more rigs are exploring the North Sea than ever before.",  
   
 "Like all enterprises in the North Sea, ours are subject to the accidents of working in such a hostile environment. It is especially disappointing that there will be a hold-up in production from the Argyll field due to the damage done to the production riser. This is one of the difficulties which cannot be avoided in North Sea oil development. There will be less oil landed this year than was thought at one time. We believe, however, that the targets for the 1980s will be maintained.",  
   
 "I think that the agreement is published as a Command Paper, and I am sure that the right hon. Gentleman and many of his hon. Friends have read it already. It requires to be ratified by the House.",  
   
 "Since the agency has powers which are a good deal more supranational than any possessed by the EEC, including powers relating to the allocation of our oil supplies, will the Minister ask his right hon. Friend to seek a suitable occasion to explain how he supports British membership of the agency while opposing British membership of the EEC?"  
)  
  
# Analyze each text  
for(i in 1:length(texts)) {  
 cat("\nAnalyzing Text", i)  
 analyze\_sentiment\_comparison(texts[i], lexicon, afinn\_sentiment)  
}

##   
## Analyzing Text 1

## Warning in mean.default(sapply(custom\_matches, function(w)  
## custom\_lexicon$polarity[custom\_lexicon$lemma == : argument is not numeric or  
## logical: returning NA

##   
## Text: There is no evidence to indicate that the Government's proposals on participation have had any effect on development in the North Sea. At the moment, more rigs are exploring the North Sea than ever be ...  
##   
## Custom Lexicon matches:  
## participation : 0.476  
## effect : 0.33  
## development : 0.521  
## c("more : 0.498", "more : 0.419")   
## Overall custom score: NA   
##   
## AFINN Lexicon matches:  
## no : -1   
## Overall AFINN score: -1   
##   
## - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   
##   
## Analyzing Text 2

## Warning in mean.default(sapply(custom\_matches, function(w)  
## custom\_lexicon$polarity[custom\_lexicon$lemma == : argument is not numeric or  
## logical: returning NA

##   
## Text: Like all enterprises in the North Sea, ours are subject to the accidents of working in such a hostile environment. It is especially disappointing that there will be a hold-up in production from the Ar ...  
##   
## Custom Lexicon matches:  
## like : 0.551  
## all : 0.34  
## c("subject : 0.324", "subject : -0.604")  
## working : 0.34  
## will : 0.329  
## hold-up : -0.543  
## production : 0.323  
## field : 0.428  
## c("damage : -0.337", "damage : -1")  
## production : 0.323  
## will : 0.329  
## will : 0.329   
## Overall custom score: NA   
##   
## AFINN Lexicon matches:  
## like : 2  
## accidents : -2  
## hostile : -2  
## disappointing : -2  
## damage : -3  
## avoided : -1   
## Overall AFINN score: -1.333   
##   
## - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   
##   
## Analyzing Text 3

## Warning in mean.default(sapply(custom\_matches, function(w)  
## custom\_lexicon$polarity[custom\_lexicon$lemma == : argument is not numeric or  
## logical: returning NA

##   
## Text: I think that the agreement is published as a Command Paper, and I am sure that the right hon. Gentleman and many of his hon. Friends have read it already. It requires to be ratified by the House. ...  
##   
## Custom Lexicon matches:  
## agreement : 0.395  
## as : 0.393  
## c("command : 0.68", "command : 0.432")  
## c("sure : 0.768", "sure : 0.668")  
## right : 0.495  
## gentleman : 0.417  
## read : 0.296   
## Overall custom score: NA   
##   
## AFINN Lexicon matches:  
## agreement : 1  
## ratified : 2   
## Overall AFINN score: 1.5   
##   
## - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   
##   
## Analyzing Text 4

## Warning in mean.default(sapply(custom\_matches, function(w)  
## custom\_lexicon$polarity[custom\_lexicon$lemma == : argument is not numeric or  
## logical: returning NA

##   
## Text: Since the agency has powers which are a good deal more supranational than any possessed by the EEC, including powers relating to the allocation of our oil supplies, will the Minister ask his right hon ...  
##   
## Custom Lexicon matches:  
## agency : 0.365  
## c("good : 0.468", "good : 1")  
## c("more : 0.498", "more : 0.419")  
## will : 0.329  
## right : 0.495  
## friend : 0.336  
## seek : 0.333  
## suitable : 0.677  
## occasion : -0.603  
## membership : 0.349  
## agency : 0.365  
## membership : 0.349   
## Overall custom score: NA   
##   
## AFINN Lexicon matches:  
## good : 3  
## supports : 2   
## Overall AFINN score: 2.5   
##   
## - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

#### Comparisons & New Insights:

#### Sample Text 9 (afinn score of -1.00000, polarity of 0.45623240)

* Text: “There is no evidence to indicate that the Government’s proposals on participation have had any effect on development in the North Sea. At the moment, more rigs are exploring the North Sea than ever before.”
* In previous analysis we thought “no evidence” and “effect” drove negative AFINN scores, but actually **AFINN only matched “no” (-1) but missed “evidence” and “effect”**. The custom lexicon found more nuanced matches including **“participation” (0.476), “effect” (0.33), “development” (0.521)**.
* The discrepancy in scores partly comes from AFINN’s **limited coverage but strong negative weighting of “no”**, while custom lexicon **captures more domain-specific terms with positive scores.**

#### Sample Text 7 (afinn score of -1.33333, polarity of 0.22807242)

* Text: “Like all enterprises in the North Sea, ours are subject to the accidents of working in such a hostile environment. It is especially disappointing that there will be a hold-up in production from the Argyll field due to the damage done to the production riser. This is one of the difficulties which cannot be avoided in North Sea oil development. There will be less oil landed this year than was thought at one time. We believe, however, that the targets for the 1980s will be maintained.”
* Our original analysis was mostly correct about negative terms driving AFINN’s score - AFINN indeed picked up multiple negative words: “accidents” (-2), “hostile” (-2), “disappointing” (-2), “damage” (-3), “avoided” (-1). The custom lexicon found many more words but with moderate scores, including **positive ones like “working” (0.34), “production” (0.323)**.
* Interestingly, some words have multiple scores in custom lexicon (e.g., “subject”: 0.324/-0.604, “damage”: -0.337/-1.0) suggesting context sensitivity.

#### Sample Text 5 (afinn score of 1.50000, polarity of 0.49209525) – more positive by our lexicon

* Text: “I think that the agreement is published as a Command Paper, and I am sure that the right hon. Gentleman and many of his hon. Friends have read it already. It requires to be ratified by the House.”
* Previously we thought custom lexicon assigned highly positive score for ratification. But surprisingly, **“ratified” (2) is in AFINN but not in custom lexicon**. The custom lexicon captures more parliamentary language (“command”, “gentleman”, “agreement”). And **affirmative words like ‘sure’ and ‘command’ seem to drive the positivity in scoring.**

#### Sample Text 2 (afinn score of 2.50000, polarity of 0.33017160) – more positive by AFINN

* Text: “Since the agency has powers which are a good deal more supranational than any possessed by the EEC, including powers relating to the allocation of our oil supplies, will the Minister ask his right hon. Friend to seek a suitable occasion to explain how he supports British membership of the agency while opposing British membership of the EEC?”
* We assumption that AFINN might have overweighted “good” and “supports” was correct - it indeed gives high scores to “good” (3) and “supports” (2). The custom lexicon however **found many more words with moderate scores**.
* Agin, some words like “Good” has multiple scores in custom lexicon (0.468/1.0), showing context sensitivity.

#### Conclusions:

1. The comparison shows that a large factor driving the divergence is that the custom lexicon **consistently captures more words** but **assigns moderate scores** (typically between -0.6 and 0.8), while **AFINN identifies fewer words but assigns more extreme integer scores** (-3 to +3). This difference in ***coverage*** and ***scoring granularity*** becomes particularly apparent in formal parliamentary language, where AFINN might only catch a few emotionally charged words (like “hostile” or “disappointing”) with strong scores, while the custom lexicon recognizes many procedural and technical terms (like “participation,” “development,” “command”) with nuanced scores.
2. Looking at specific words that are picked up, AFINN tends to focus on **clearly emotional or evaluative terms** (“good,” “hostile,” “disappointing”), assigning them strong sentiment values. In contrast, the custom lexicon recognizes **a wide array of domain-specific language**.
3. However, some formal terms we might expect in parliamentary discourse (like “ratified”) are curiously absent from the custom lexicon, while appearing in AFINN.

#### Implications:

* Strength of using a custom lexicon is its broader coverage and context sensitivity.
* Weakness however is that the moderate scoring approach might potentially **underestimate extreme emotional expressions** that a general purpose lexicon like AFINN captures well.
* There might be a trade-off between **domain specificity** and **emotional intensity** in representing the “true” sentiment of texts: The custom lexicon might better reflect the measured tone typical of parliamentary discourse, but we could also argue that it could **potentially bias the analysis toward the middle**.

### 

### 5. Alternative Lexicon: LSD2015

library(quanteda)

## Package version: 4.2.0  
## Unicode version: 14.0  
## ICU version: 71.1

## Parallel computing: disabled

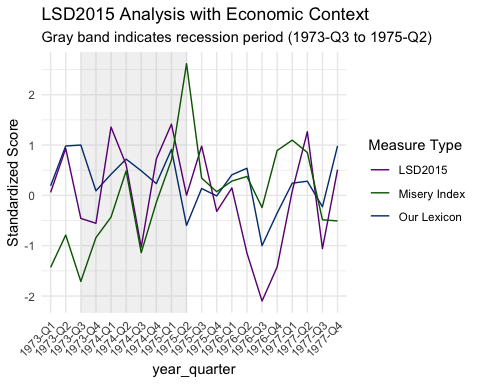
## See https://quanteda.io for tutorials and examples.

library(quanteda.sentiment)

##   
## Attaching package: 'quanteda.sentiment'

## The following object is masked from 'package:quanteda':  
##   
## data\_dictionary\_LSD2015

# Create corpus and calculate LSD sentiment  
corpus\_hansard <- corpus(hansard\_clean$text\_processed)  
liwc\_scores <- textstat\_polarity(corpus\_hansard,   
 dictionary = data\_dictionary\_LSD2015)  
  
# Add scores to main dataframe  
hansard\_clean <- hansard\_clean %>%  
 mutate(liwc\_score = liwc\_scores$sentiment)  
  
# Now aggregate by quarter  
liwc\_quarterly <- hansard\_clean %>%  
 mutate(  
 quarter = ceiling(as.numeric(substr(date, 6, 7))/3),  
 year\_quarter = paste0(year, "-Q", quarter)  
 ) %>%  
 group\_by(year\_quarter) %>%  
 summarize(  
 avg\_liwc = mean(liwc\_score, na.rm = TRUE),  
 .groups = 'drop'  
 )  
  
# Join with comparison data  
comparison\_with\_liwc <- comparison\_with\_econ %>%  
 left\_join(liwc\_quarterly, by = "year\_quarter")  
  
# Plot  
ggplot(comparison\_with\_liwc) +  
 annotate("rect",  
 xmin = "1973-Q3",  
 xmax = "1975-Q2",  
 ymin = -Inf, ymax = Inf,  
 alpha = 0.2, fill = "gray") +  
 geom\_line(aes(x = year\_quarter, y = polarity\_rescaled,   
 group = 1, color = "Our Lexicon")) +  
 geom\_line(aes(x = year\_quarter, y = scale(avg\_liwc),   
 group = 1, color = "LSD2015")) +  
 geom\_line(aes(x = year\_quarter, y = scale(misery),  
 group = 1, color = "Misery Index")) +  
 theme\_minimal() +  
 theme(axis.text.x = element\_text(angle = 45, hjust = 1)) +  
 labs(title = "LSD2015 Analysis with Economic Context",  
 subtitle = "Gray band indicates recession period (1973-Q3 to 1975-Q2)",  
 y = "Standardized Score",  
 color = "Measure Type") +  
 scale\_color\_manual(values = c("Our Lexicon" = "#013D80",   
 "LSD2015" = "#6B1082",  
 "Misery Index" = "#006400"))



#### Analyze the 10 most discrepent texts

# Function to analyze discrepancies between Custom and LSD lexicons  
analyze\_discrepant\_texts <- function(data, lexicon, type="LSD") {  
 # Select correct score column based on type  
 score\_col <- if(type=="LSD") "liwc\_score" else "bing\_score"  
   
 # Find most discrepant texts  
 discrepant\_texts <- data %>%  
 filter(!is.na(!!sym(score\_col)) & !is.na(polarity)) %>%  
 mutate(  
 sentiment\_diff = abs(scale(!!sym(score\_col))[1] - scale(polarity)[1]),  
 comparison\_score = !!sym(score\_col) # Store comparison score  
 ) %>%  
 arrange(desc(sentiment\_diff)) %>%  
 select(text\_processed, polarity, comparison\_score) %>%  
 head(10)  
   
 # Analyze each text  
 for(i in 1:nrow(discrepant\_texts)) {  
 cat("\nAnalyzing Text", i, "\n")  
 cat("Full Text:", discrepant\_texts$text\_processed[i], "\n\n")  
 cat("Custom Score:", round(discrepant\_texts$polarity[i], 3), "\n")  
 cat(type, "Score:", round(discrepant\_texts$comparison\_score[i], 3), "\n\n")  
   
 # Get word-level scores  
 words <- unlist(strsplit(tolower(discrepant\_texts$text\_processed[i]), "\\s+"))  
   
 # Custom lexicon matches  
 custom\_matches <- words[words %in% lexicon$lemma]  
 custom\_scores <- sapply(custom\_matches, function(w) {  
 score <- lexicon$polarity[lexicon$lemma == w]  
 paste(w, ":", round(score, 3))  
 })  
   
 # Comparison lexicon matches  
 if(type == "LSD") {  
 comp\_matches <- words[words %in% names(data\_dictionary\_LSD2015)]  
 comp\_scores <- sapply(comp\_matches, function(w) {  
 score <- ifelse(data\_dictionary\_LSD2015[[w]] == "positive", 1, -1)  
 paste(w, ":", score)  
 })  
 } else {  
 comp\_matches <- words[words %in% bing\_sentiment$word]  
 comp\_scores <- sapply(comp\_matches, function(w) {  
 sentiment <- bing\_sentiment$sentiment[bing\_sentiment$word == w]  
 score <- ifelse(sentiment == "positive", 1, -1)  
 paste(w, ":", score)  
 })  
 }  
   
 cat("Custom Lexicon matches:\n")  
 if(length(custom\_scores) > 0) {  
 cat(paste(custom\_scores, collapse = "\n"), "\n")  
 } else {  
 cat("No matches found\n")  
 }  
   
 cat("\n", type, "Lexicon matches:\n")  
 if(length(comp\_scores) > 0) {  
 cat(paste(comp\_scores, collapse = "\n"), "\n")  
 } else {  
 cat("No matches found\n")  
 }  
   
 cat("\n", rep("-", 80), "\n")  
 }  
}  
  
cat("=== LSD Comparison ===\n")

## === LSD Comparison ===

analyze\_discrepant\_texts(hansard\_clean, lexicon, "LSD")

##   
## Analyzing Text 1   
## Full Text: asked the Secretary of State for Trade and Industry whether he will make a statement about progress in administering financial assistance to the machine tool industry by his Department.   
##   
## Custom Score: 0.482   
## LSD Score: 1.609   
##   
## Custom Lexicon matches:  
## will : 0.329  
## make : 0.428  
## c("progress : 0.646", "progress : 0.497")  
## assistance : 0.524   
##   
## LSD Lexicon matches:  
## No matches found  
##   
## - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   
##   
## Analyzing Text 2   
## Full Text: All orders under the special scheme for public sector purchasing of machine tools have been placed.   
##   
## Custom Score: 0.349   
## LSD Score: 1.099   
##   
## Custom Lexicon matches:  
## all : 0.34  
## special : 0.327  
## scheme : 0.379   
##   
## LSD Lexicon matches:  
## No matches found  
##   
## - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   
##   
## Analyzing Text 3   
## Full Text: How much of this money has gone to the machine tool firm of Alfred Herbert in Coventry? How much has been spent on imported machine tools? Since this is taxpayers' money, intended to help the British industry, is it not a ridiculous practice to spend the money on imports?   
##   
## Custom Score: 0.201   
## LSD Score: 0   
##   
## Custom Lexicon matches:  
## much : 0.458  
## c("firm : 0.528", "firm : 0.301")  
## much : 0.458  
## c("help : 0.56", "help : 1")  
## ridiculous : -1   
##   
## LSD Lexicon matches:  
## No matches found  
##   
## - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   
##   
## Analyzing Text 4   
## Full Text: Less than 1 per cent. has been spent on imported machine tools. I am afraid that I could not, without notice, give the proportion of the total which has been spent at Alfred Herbert's.   
##   
## Custom Score: -0.191   
## LSD Score: -1.099   
##   
## Custom Lexicon matches:  
## afraid : -1  
## give : 0.618   
##   
## LSD Lexicon matches:  
## No matches found  
##   
## - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   
##   
## Analyzing Text 5   
## Full Text: Is my right hon. Friend aware that the orders for machine tools in this country have risen dramatically during the last few months and that one of my constituents who has recently placed an order has had to wait three times as long as he would have done if he had placed it a couple of months ago?   
##   
## Custom Score: 0.393   
## LSD Score: 0.511   
##   
## Custom Lexicon matches:  
## right : 0.495  
## friend : 0.336  
## as : 0.393  
## long : 0.348  
## as : 0.393   
##   
## LSD Lexicon matches:  
## No matches found  
##   
## - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   
##   
## Analyzing Text 6   
## Full Text: My hon. Friend is right to say that there has been a substantial increase in orders for machine tools in the third quarter of the year, but it would still be the case that there is substantial spare capacity in the majority of firms.   
##   
## Custom Score: 0.373   
## LSD Score: 1.609   
##   
## Custom Lexicon matches:  
## friend : 0.336  
## right : 0.495  
## say : 0.359  
## substantial : 0.349  
## substantial : 0.349  
## capacity : 0.35   
##   
## LSD Lexicon matches:  
## No matches found  
##   
## - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   
##   
## Analyzing Text 7   
## Full Text: On the broader question, may I ask when the Minister will be commenting on the general investment outlook, in view of the forecasts for 1973 which are now well below the earlier forecasts? There is an obvious crisis of confidence and a general anxiety. Will the Government now be making an authoritative statement on investment prospects, including those for machine tools?   
##   
## Custom Score: 0.369   
## LSD Score: 0.336   
##   
## Custom Lexicon matches:  
## broader : 0.388  
## will : 0.329  
## investment : 0.34  
## view : 0.3  
## well : 1  
## crisis : -0.335  
## confidence : 0.389  
## will : 0.329  
## authoritative : 0.613  
## investment : 0.34   
##   
## LSD Lexicon matches:  
## No matches found  
##   
## - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   
##   
## Analyzing Text 8   
## Full Text: We had a debate about investment before the recess. All the indications are still of a substantial upturn in investment during this year.   
##   
## Custom Score: 0.357   
## LSD Score: 0   
##   
## Custom Lexicon matches:  
## debate : 0.418  
## investment : 0.34  
## all : 0.34  
## substantial : 0.349  
## investment : 0.34   
##   
## LSD Lexicon matches:  
## No matches found  
##   
## - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   
##   
## Analyzing Text 9   
## Full Text: asked the Secretary of State for Trade and Industry if he will ban night jet charter flights after 1973.   
##   
## Custom Score: 0.329   
## LSD Score: 0   
##   
## Custom Lexicon matches:  
## will : 0.329   
##   
## LSD Lexicon matches:  
## No matches found  
##   
## - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   
##   
## Analyzing Text 10   
## Full Text: Will my hon. Friend recognise the extreme hardship of those who have to live beneath the flight paths and who are kept awake night after night by these night jet charter flights? Will he offset this against the quite small increase in fares which would result from a ban on night jet charter flights?   
##   
## Custom Score: -0.026   
## LSD Score: -0.847   
##   
## Custom Lexicon matches:  
## will : 0.329  
## friend : 0.336  
## recognise : 0.372  
## c("extreme : -0.36", "extreme : -0.361")  
## hardship : -0.647  
## will : 0.329  
## result : -0.541   
##   
## LSD Lexicon matches:  
## No matches found  
##   
## - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

#### Observations:

We can’t see which words contribute to the score because LSD2015 works differently - it categorizes text into positive/negative categories rather than assigning individual word scores.

Despite that, it shows very different overall scores while custom lexicon assigns moderate scores (typically between -1 and 1) for the selected texts.

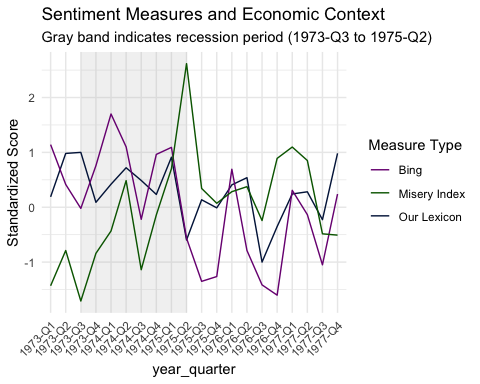
Intriguingly, for Text 3: “How much of this money has gone to the machine tool firm of Alfred Herbert in Coventry? How much has been spent on imported machine tools? Since this is taxpayers’ money, intended to help the British industry, is it not a ridiculous practice to spend the money on imports?”, custom lexicon assigns a positive score while LSD assigns a zero. The tone is apparantly negative, but custom lexicon assigns quite a high score for ***“much”***.

### Alternative Lexicon: Bing

library(tidytext)  
library(tidyr)  
  
# Get Bing lexicon  
bing\_sentiment <- get\_sentiments("bing")  
  
# Function to compute Bing sentiment  
compute\_bing\_sentiment <- function(text) {  
 words <- tibble(word = unlist(strsplit(tolower(text), "\\s+"))) %>%  
 inner\_join(bing\_sentiment, by = "word")  
   
 # Calculate ratio of positive to negative words  
 if(nrow(words) > 0) {  
 score <- sum(words$sentiment == "positive") - sum(words$sentiment == "negative")  
 return(score/nrow(words)) # Normalize by number of matched words  
 } else {  
 return(NA)  
 }  
}  
  
# Calculate Bing scores  
hansard\_clean <- hansard\_clean %>%  
 mutate(bing\_score = sapply(text\_processed, compute\_bing\_sentiment))

## Warning: There were 31 warnings in `mutate()`.  
## The first warning was:  
## ℹ In argument: `bing\_score = sapply(text\_processed, compute\_bing\_sentiment)`.  
## Caused by warning in `inner\_join()`:  
## ! Detected an unexpected many-to-many relationship between `x` and `y`.  
## ℹ Row 100 of `x` matches multiple rows in `y`.  
## ℹ Row 6217 of `y` matches multiple rows in `x`.  
## ℹ If a many-to-many relationship is expected, set `relationship =  
## "many-to-many"` to silence this warning.  
## ℹ Run `dplyr::last\_dplyr\_warnings()` to see the 30 remaining warnings.

# Aggregate by quarter  
bing\_quarterly <- hansard\_clean %>%  
 mutate(  
 quarter = ceiling(as.numeric(substr(date, 6, 7))/3),  
 year\_quarter = paste0(year, "-Q", quarter)  
 ) %>%  
 group\_by(year\_quarter) %>%  
 summarize(  
 avg\_bing = mean(bing\_score, na.rm = TRUE),  
 .groups = 'drop'  
 )  
  
# Join and plot  
comparison\_with\_bing <- comparison\_with\_econ %>%  
 left\_join(bing\_quarterly, by = "year\_quarter")  
  
# Plot comparison  
ggplot(comparison\_with\_bing) +  
 annotate("rect",  
 xmin = "1973-Q3",  
 xmax = "1975-Q2",  
 ymin = -Inf, ymax = Inf,  
 alpha = 0.2, fill = "gray") +  
 geom\_line(aes(x = year\_quarter, y = polarity\_rescaled,   
 group = 1, color = "Our Lexicon")) +  
 geom\_line(aes(x = year\_quarter, y = scale(avg\_bing),   
 group = 1, color = "Bing")) +  
 geom\_line(aes(x = year\_quarter, y = scale(misery),  
 group = 1, color = "Misery Index")) +  
 theme\_minimal() +  
 theme(axis.text.x = element\_text(angle = 45, hjust = 1)) +  
 labs(title = "Sentiment Measures and Economic Context",  
 subtitle = "Gray band indicates recession period (1973-Q3 to 1975-Q2)",  
 y = "Standardized Score",  
 color = "Measure Type") +  
 scale\_color\_manual(values = c("Our Lexicon" = "#021B48",   
 "Bing" = "#7B0082",  
 "Misery Index" = "#006400"))



# Use the same function as before to analyze discrepancies between lexicons  
cat("\n=== Bing Comparison ===\n")

##   
## === Bing Comparison ===

analyze\_discrepant\_texts(hansard\_clean, lexicon, "Bing")

##   
## Analyzing Text 1   
## Full Text: asked the Secretary of State for Trade and Industry whether he will make a statement about progress in administering financial assistance to the machine tool industry by his Department.   
##   
## Custom Score: 0.482   
## Bing Score: 1   
##   
## Custom Lexicon matches:  
## will : 0.329  
## make : 0.428  
## c("progress : 0.646", "progress : 0.497")  
## assistance : 0.524   
##   
## Bing Lexicon matches:  
## progress : 1   
##   
## - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   
##   
## Analyzing Text 2   
## Full Text: How much of this money has gone to the machine tool firm of Alfred Herbert in Coventry? How much has been spent on imported machine tools? Since this is taxpayers' money, intended to help the British industry, is it not a ridiculous practice to spend the money on imports?   
##   
## Custom Score: 0.201   
## Bing Score: -1   
##   
## Custom Lexicon matches:  
## much : 0.458  
## c("firm : 0.528", "firm : 0.301")  
## much : 0.458  
## c("help : 0.56", "help : 1")  
## ridiculous : -1   
##   
## Bing Lexicon matches:  
## ridiculous : -1   
##   
## - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   
##   
## Analyzing Text 3   
## Full Text: Less than 1 per cent. has been spent on imported machine tools. I am afraid that I could not, without notice, give the proportion of the total which has been spent at Alfred Herbert's.   
##   
## Custom Score: -0.191   
## Bing Score: -1   
##   
## Custom Lexicon matches:  
## afraid : -1  
## give : 0.618   
##   
## Bing Lexicon matches:  
## afraid : -1   
##   
## - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   
##   
## Analyzing Text 4   
## Full Text: Is my right hon. Friend aware that the orders for machine tools in this country have risen dramatically during the last few months and that one of my constituents who has recently placed an order has had to wait three times as long as he would have done if he had placed it a couple of months ago?   
##   
## Custom Score: 0.393   
## Bing Score: 1   
##   
## Custom Lexicon matches:  
## right : 0.495  
## friend : 0.336  
## as : 0.393  
## long : 0.348  
## as : 0.393   
##   
## Bing Lexicon matches:  
## right : 1   
##   
## - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   
##   
## Analyzing Text 5   
## Full Text: My hon. Friend is right to say that there has been a substantial increase in orders for machine tools in the third quarter of the year, but it would still be the case that there is substantial spare capacity in the majority of firms.   
##   
## Custom Score: 0.373   
## Bing Score: 1   
##   
## Custom Lexicon matches:  
## friend : 0.336  
## right : 0.495  
## say : 0.359  
## substantial : 0.349  
## substantial : 0.349  
## capacity : 0.35   
##   
## Bing Lexicon matches:  
## right : 1   
##   
## - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   
##   
## Analyzing Text 6   
## Full Text: On the broader question, may I ask when the Minister will be commenting on the general investment outlook, in view of the forecasts for 1973 which are now well below the earlier forecasts? There is an obvious crisis of confidence and a general anxiety. Will the Government now be making an authoritative statement on investment prospects, including those for machine tools?   
##   
## Custom Score: 0.369   
## Bing Score: 0.5   
##   
## Custom Lexicon matches:  
## broader : 0.388  
## will : 0.329  
## investment : 0.34  
## view : 0.3  
## well : 1  
## crisis : -0.335  
## confidence : 0.389  
## will : 0.329  
## authoritative : 0.613  
## investment : 0.34   
##   
## Bing Lexicon matches:  
## well : 1  
## crisis : -1  
## confidence : 1  
## authoritative : 1   
##   
## - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   
##   
## Analyzing Text 7   
## Full Text: Will my hon. Friend recognise the extreme hardship of those who have to live beneath the flight paths and who are kept awake night after night by these night jet charter flights? Will he offset this against the quite small increase in fares which would result from a ban on night jet charter flights?   
##   
## Custom Score: -0.026   
## Bing Score: -1   
##   
## Custom Lexicon matches:  
## will : 0.329  
## friend : 0.336  
## recognise : 0.372  
## c("extreme : -0.36", "extreme : -0.361")  
## hardship : -0.647  
## will : 0.329  
## result : -0.541   
##   
## Bing Lexicon matches:  
## hardship : -1   
##   
## - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   
##   
## Analyzing Text 8   
## Full Text: I am well aware that this disturbance at night causes hardship to a number of people, and my hon. Friend represents their case very powerfully. But I cannot believe that the step which he advocates would he justified when he remembers that this section of the industry carries 10 million passengers a year from United Kingdom airports and that it would cause grave damage to a large number of people if a total ban were placed on one-third of their potential operating time.   
##   
## Custom Score: 0.077   
## Bing Score: -0.2   
##   
## Custom Lexicon matches:  
## well : 1  
## disturbance : -0.515  
## hardship : -0.647  
## friend : 0.336  
## very : 0.458  
## believe : 0.299  
## step : 0.3  
## united : 0.428  
## c("cause : -0.29", "cause : -0.96")  
## c("grave : -0.433", "grave : -0.783")  
## c("damage : -0.337", "damage : -1")  
## potential : 0.331   
##   
## Bing Lexicon matches:  
## well : 1  
## disturbance : -1  
## hardship : -1  
## advocates : 1  
## damage : -1   
##   
## - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   
##   
## Analyzing Text 9   
## Full Text: Is my hon. Friend aware that the sharp reduction in the number of night jet take-offs from Heathrow, introduced for the first time in the summer season of 1972, has been warmly welcomed by communities living around Heathrow but that many people still think there are too many night jet takeoffs? Will my hon. Friend try to enforce this virtual ban more stringently in the summer season of 1973?   
##   
## Custom Score: 0.431   
## Bing Score: 0.333   
##   
## Custom Lexicon matches:  
## friend : 0.336  
## warmly : 0.811  
## living : 0.299  
## will : 0.329  
## friend : 0.336  
## try : 0.407  
## c("more : 0.498", "more : 0.419")   
##   
## Bing Lexicon matches:  
## sharp : 1  
## warmly : 1  
## stringently : -1   
##   
## - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   
##   
## Analyzing Text 10   
## Full Text: asked the Secretary of State for Trade and Industry if he will make an early official visit to Yorkshire and Humberside to discuss the changing industrial infrastructure and the need for improving communications, including the development of a regional airport.   
##   
## Custom Score: 0.414   
## Bing Score: 1   
##   
## Custom Lexicon matches:  
## will : 0.329  
## make : 0.428  
## early : 0.326  
## c("visit : 0.523", "visit : 0.426")  
## c("need : 0.469", "need : 0.314")  
## development : 0.521  
## regional : 0.303   
##   
## Bing Lexicon matches:  
## improving : 1   
##   
## - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

#### Observations:

#### Text 1:

“asked the Secretary of State for Trade and Industry whether he will make a statement about progress in administering financial assistance to the machine tool industry by his Department.”

* Custom lexicon assigns a positive (0.482) score from multiple terms, while Bing assigns a strong positive (1) from single word “progress”.
* This exemplifies that in the context of parliamentary language, Bing’s ***limited coverage can indeed lead to oversimplified scoring.***

#### Text 6:

“On the broader question, may I ask when the Minister will be commenting on the general investment outlook, in view of the forecasts for 1973 which are now well below the earlier forecasts? There is an obvious crisis of confidence and a general anxiety. Will the Government now be making an authoritative statement on investment prospects, including those for machine tools?”

* The custom lexicon assigns a nuanced score of 0.369 balancing positive and negative terms, and also picks up more economic context words like “investment” “will” “broader”,
* Bing gives a moderate positive (0.5) from multiple extreme scores, and they are mostly ***emotional terms (“crisis”, “confidence”)***. This again demonstrates that a limit in scope while heavy emphasis on emotional intensity could make a lexicon less suitable in this research.