```
import spacy
from textblob import TextBlob
from PyPDF2 import PdfReader
from collections import Counter
import matplotlib.pyplot as plt
import requests
import io

# Load spaCy's English model
nlp = spacy.load("en_core_web_sm")

# Define URLs for the PDFs in the GitHub repository
announcement_url = "https://raw.githubusercontent.com/DizheXia/Final-Project_Dylan-Kevin-Yuqing/8ebd
speech_url = "https://raw.githubusercontent.com/DizheXia/Final-Project_Dylan-Kevin-Yuqing/8ebdae087c

# Function to download and read PDF text
def read_pdf_from_url(url):
    response = requests.get(url)
    response.raise_for_status()  # Raise an error if the request fails
    file = io.BytesIO(response.content)
    reader = PdfReader(file)
    text = ""
    for page in reader.pages:
        text += page.extract_text()
    return text

# Read PDF texts from URLs
announcement_text = read_pdf_from_url(announcement_url)
speech_text = read_pdf_from_url(speech_url)

# Function to extract specific part-of-speech keywords
def extract_keywords(doc):
    adjectives = [token.text for token in doc if token.pos_ == "ADJ"]  # Adjectives
    modals = [token.text for token in doc if token.tag_ in ["MD"]]  # Modals (may, might, will)
    adverbs = [token.text for token in doc if token.pos_ == "ADV"]  # Adverbs
    return adjectives, modals, adverbs

# Analyze announcement text
announcement_doc = nlp(announcement_text)
announcement_adjectives, announcement_modals, announcement_adverbs = extract_keywords(announcement_d

# Analyze speech text
speech_doc = nlp(speech_text)
speech_adjectives, speech_modals, speech_adverbs = extract_keywords(speech_doc)

# Calculate sentence-level polarity for each text
def calculate_sentence_polarity(doc):
    sentences = [sent.text for sent in doc.sents]
    polarities = [TextBlob(sentence).sentiment.polarity for sentence in sentences]
    return sentences, polarities
```

```
announcement_sentences, announcement_polarities = calculate_sentence_polarity(announcement_doc)
speech_sentences, speech_polarities = calculate_sentence_polarity(speech_doc)

# Print part-of-speech keyword counts
def print_keyword_counts(adjectives, modals, adverbs, label):
    print(f"\n{label} Adjective Counts:", Counter(adjectives).most_common(10))
    print(f"{label} Modal Counts:", Counter(modals).most_common(10))
    print(f"{label} Adverb Counts:", Counter(adverbs).most_common(10))

print_keyword_counts(announcement_adjectives, announcement_modals, announcement_adverbs, "Announceme
print_keyword_counts(speech_adjectives, speech_modals, speech_adverbs, "Speech")

# Visualize sentence-level polarity
def plot_polarities(polarities, title):
    plt.figure(figsize=(10, 6))
    plt.plot(polarities, alpha=0.75, label="Polarity Score")
    plt.axhline(0, color='red', linestyle='--', alpha=0.5, label="Neutral Polarity")
    plt.title(title)
    plt.xlabel("Sentence Number")
    plt.ylabel("Polarity")
    plt.legend()
    plt.grid(alpha=0.3)
    plt.show()

# Plot polarities for announcement and speech
plot_polarities(announcement_polarities, "Polarity of Sentences in FOMC Announcement")
plot_polarities(speech_polarities, "Polarity of Sentences in Fed Chair Speech")

# Updated function to include percentage calculation
def print_keyword_counts_with_percentage(adjectives, modals, adverbs, doc, label):
    total_words = len(doc)  # Total number of tokens in the document
    adjectives_count = len(adjectives)
    modals_count = len(modals)
    adverbs_count = len(adverbs)

    print(f"\n{label} Adjective Counts:", Counter(adjectives).most_common(10))
    print(f"Adjectives Percentage: {adjectives_count / total_words * 100:.2f}% of total words")

    print(f"{label} Modal Counts:", Counter(modals).most_common(10))
    print(f"Modals Percentage: {modals_count / total_words * 100:.2f}% of total words")

    print(f"{label} Adverb Counts:", Counter(adverbs).most_common(10))
    print(f"Adverbs Percentage: {adverbs_count / total_words * 100:.2f}% of total words")

# Use the updated function for both texts
print_keyword_counts_with_percentage(announcement_adjectives, announcement_modals, announcement_adve
print_keyword_counts_with_percentage(speech_adjectives, speech_modals, speech_adverbs, speech_doc, "
```

```
Announcement Adjective Counts: [('economic', 8), ('federal', 6), ('FOMC', 4), ('longer', 4),
('monetary', 3), ('moderate', 2), ('recent', 2), ('further', 2), ('maximum', 2), ('gradual', 2)]
Announcement Modal Counts: [('will', 9), ('should', 1)]
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Announcement Adverb Counts: [('further', 2), ('however', 1), ('appreciably', 1), ('early', 1),
('partly', 1), ('currently', 1), ('Overall', 1), ('as', 1), ('closely', 1), ('reasonably', 1)]

Speech Adjective Counts: [('federal', 24), ('economic', 24), ('financial', 20), ('median', 15),
('appropriate', 12), ('low', 11), ('further', 10), ('longer', 10), ('monetary', 10), ('transitory',
10)]
Speech Modal Counts: [('will', 56), ('would', 53), ('could', 11), ('should', 8), ('might', 8),
('may', 7), ('ca', 4), ('’d', 4), ('Could', 3), ('ould', 2)]
Speech Adverb Counts: [('So', 33), ('very', 24), ('well', 20), ('so', 18), ('also', 16),
('carefully', 13), ('n', 11), ('longer', 9), ('more', 9), ('as', 8)]
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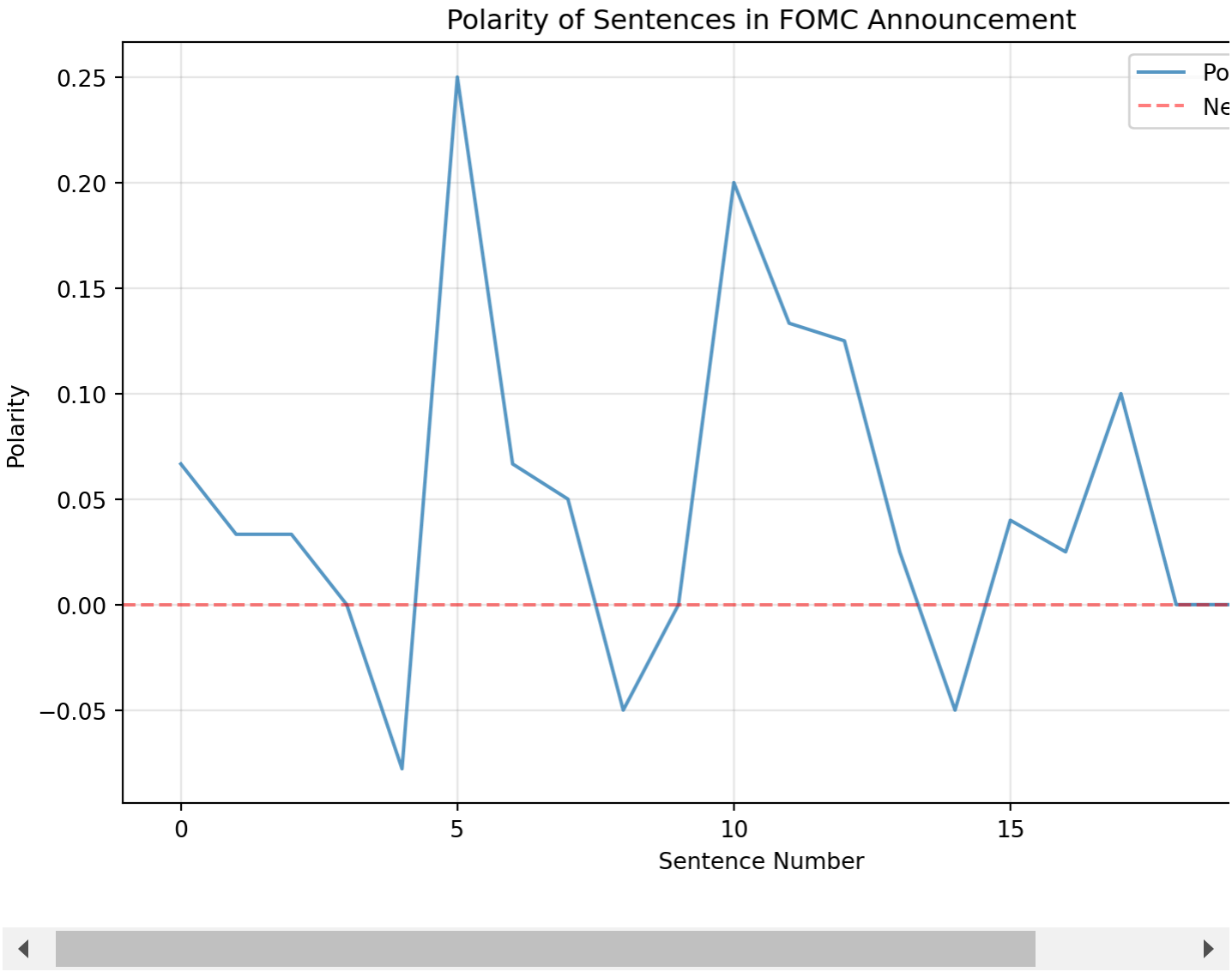

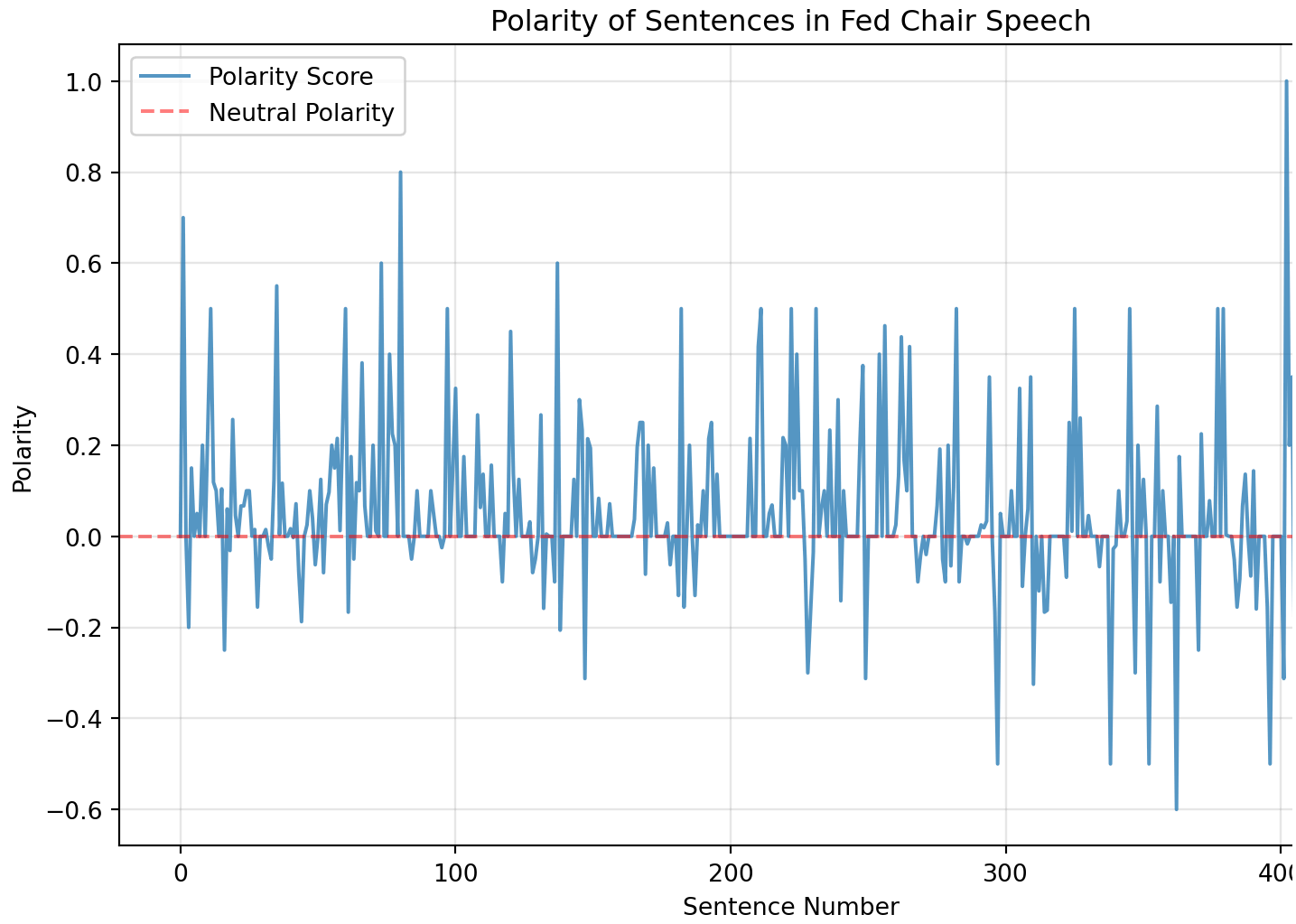


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Announcement Adjective Counts: [('economic', 8), ('federal', 6), ('FOMC', 4), ('longer', 4),
('monetary', 3), ('moderate', 2), ('recent', 2), ('further', 2), ('maximum', 2), ('gradual', 2)]
Adjectives Percentage: 8.61% of total words
Announcement Modal Counts: [('will', 9), ('should', 1)]
Modals Percentage: 1.29% of total words
Announcement Adverb Counts: [('further', 2), ('however', 1), ('appreciably', 1), ('early', 1),
('partly', 1), ('currently', 1), ('Overall', 1), ('as', 1), ('closely', 1), ('reasonably', 1)]
Adverbs Percentage: 2.19% of total words

Speech Adjective Counts: [('federal', 24), ('economic', 24), ('financial', 20), ('median', 15),
('appropriate', 12), ('low', 11), ('further', 10), ('longer', 10), ('monetary', 10), ('transitory',
10)]
Adjectives Percentage: 6.22% of total words
Speech Modal Counts: [('will', 56), ('would', 53), ('could', 11), ('should', 8), ('might', 8),
('may', 7), ('ca', 4), ('’d', 4), ('Could', 3), ('ould', 2)]
Modals Percentage: 1.41% of total words
Speech Adverb Counts: [('So', 33), ('very', 24), ('well', 20), ('so', 18), ('also', 16),
('carefully', 13), ('n', 11), ('longer', 9), ('more', 9), ('as', 8)]
Adverbs Percentage: 3.86% of total words
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A comparison of the Federal Reserve’s FOMC announcement and the accompanying speech by the Fed Chair reveals notable differences in linguistic composition, particularly in the usage of adjectives, modal verbs, and adverbs.

- The announcement is characterised by a prevalence of adjectives, which account for 8.61% of the total words. The announcement is notable for its relatively high proportion of adjectives, which constitute 8.61% of the total number of words. The most frequently occurring adjectives are “economic,” “federal,” “FOMC,” and “longer.” This reflects a focus on institutional references, policy horizons, and economic conditions.
- Modals: The modal verbs (e.g., “will,” “should”) are used at a rate of 1.29%. The frequent use of the modal verb “will” suggests a forward-looking stance and planned policy actions.
- Adverbs: Adverbs account for 2.19% of the total number of words. Terms such as “further,” “however,” and “currently” indicate subtle shifts in perspective, qualifications of statements, and temporal framing.

A summary of the speech is provided below: - Adjectives: Adjectives account for 6.22% of the total number of words, which is a relatively lower proportion than that observed in the announcement. The use of terms such as “federal,” “economic,” “financial,” “appropriate,” and “transitory” suggests an emphasis on conditions, policy suitability, and evolving circumstances. - Modals: The speech employs a greater number of modal verbs (1.41% of total words) than the announcement, with “will,” “would,” and “could” being the most prevalent. This indicates an increased focus on potential scenarios, policymaker intentions, and conditional outcomes. - Adverbs: The speech employs a greater number of adverbs than the announcement, with the former containing 3.86% of total words. The use of common adverbs, such as “so,” “very,” “well,” “also,” and “carefully,” conveys stance, degree, and manner, thereby adding depth to the Chair’s explanatory narrative.

In conclusion, the announcement is more adjective-heavy, framing the current economic landscape and policies. In contrast, the speech relies more on modal verbs and adverbs to explore possibilities, clarify intent, and describe the manner in which policies may unfold.