THE DECLINE OF ATTENTION SPANS: HOW SOCIAL MEDIA REWIRED OUR BRAI

NOVEMBER 25

U.S. is polarizing faster than other democracies, study finds

Americans' feelings toward members of the other political party

f

a study

PBS NEWS HO

Explo

politica

declinin

Jul 31, 2024 6:2

Has COVID destroyed our attention spans?

David Oliver

USA TODAY

st 47

By Laura Harris // Jul 05, 2025

The News Media Is Killing Itself Through Extreme Polarization

, and

By Agustino Fontevecchia, Contributor. ⓘ Former Forbes staffer, now Digital ...

Follow Author

PROB MODELING/STAT COMPUTING

The

DSAN DAILY

EXTRA! EXTRA! Global Analysis of Sentiment and Bias in News Headlines

Ellie Byrd, Erin Brzusek, Jeffrey Pinarchick, and Munashe Mhlanga

Describe the contents of your flyer here. Try to keep it simple and direct.

The Daily News

THE MOCK WEATHER REPORT
Be creative with your weather report. It's a flyer so you can say whatever you like it. Just make sure to try and make it interesting. Be creative. You can do this! Try and make it sound realistic and true. Have fun friends!

VOL. I...No. 1 | YOURNAME@EMAIL.COM | NEWS FOR TODAY | YOURWEBSITE.COM | PRICE

THE FLYER TITLE

PUT YOUR DESCRIPTIVE SUBTITLE HERE AND MAKE IT FIT

PICTURE CAPTION

Related title

YOUR NAME
YOUR LOCATION

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The story headline and picture

YOUR NAME
YOUR LOCATION

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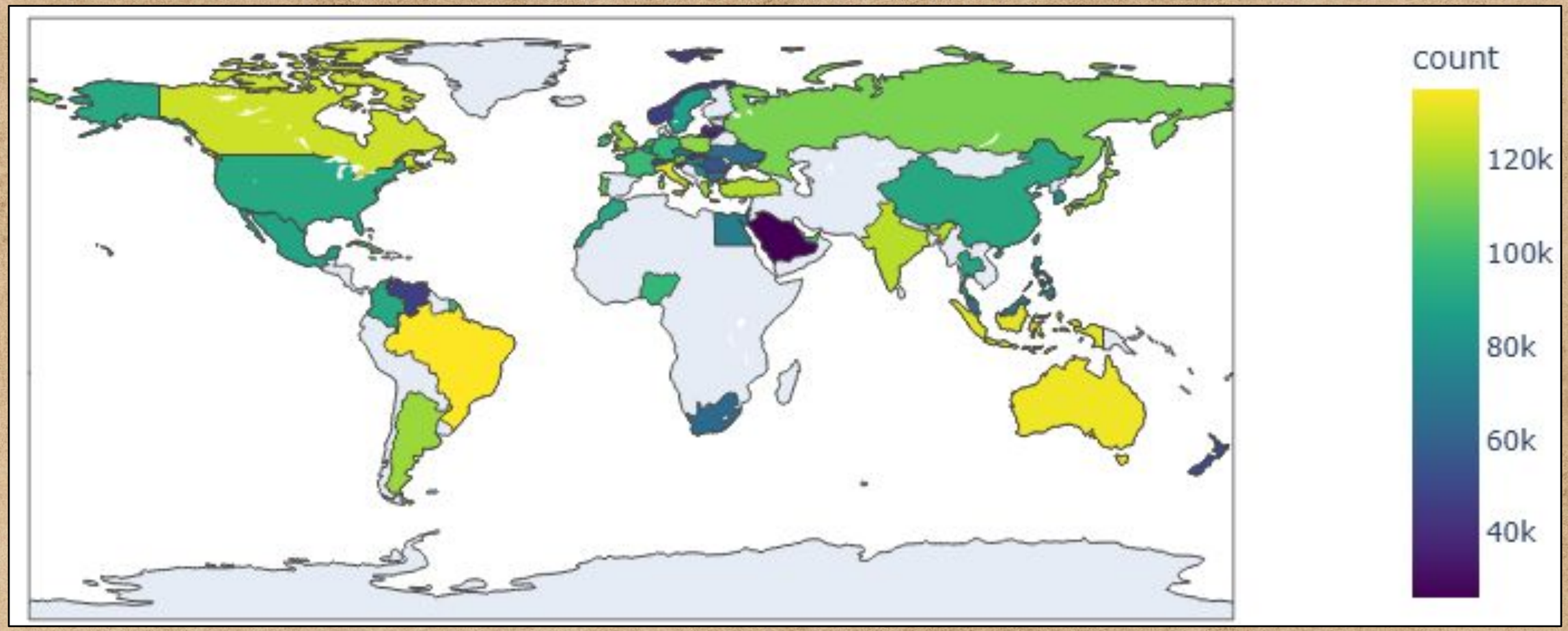
CONTENTS

DATA SCIENCE QUESTIONS

U.S. vs. World Media Sentiment and Bias

- Sentiment & Bias by Country and Category
- Relationship Between Sentiment and Bias
- Analysis Over Time Sentiment & Bias
- Forecasting Bias and Sentiment

DATA SOURCE & COLLECTION



Number of Articles by Country

DATA SOURCE & COLLECTION

Sentiment Analysis: VADER

How Trum… tech company… kTok

Positive: 0.778

The … it's myst… olor

Neutral: 0

Watch Ang… list Purposely… Model 3 Mirror

Negative: -0.551

DATA SOURCE & COLLECTION

Bias Classification: Dbias

Parents ... their symptoms ... for COVID-19 following ... reports

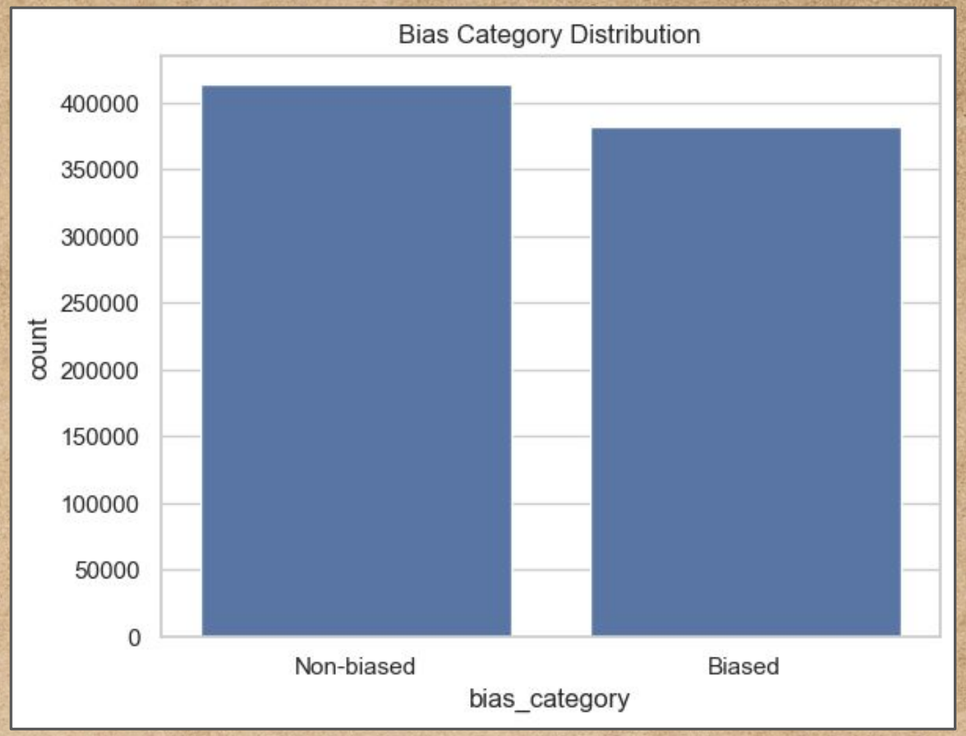
Biased: 0.969

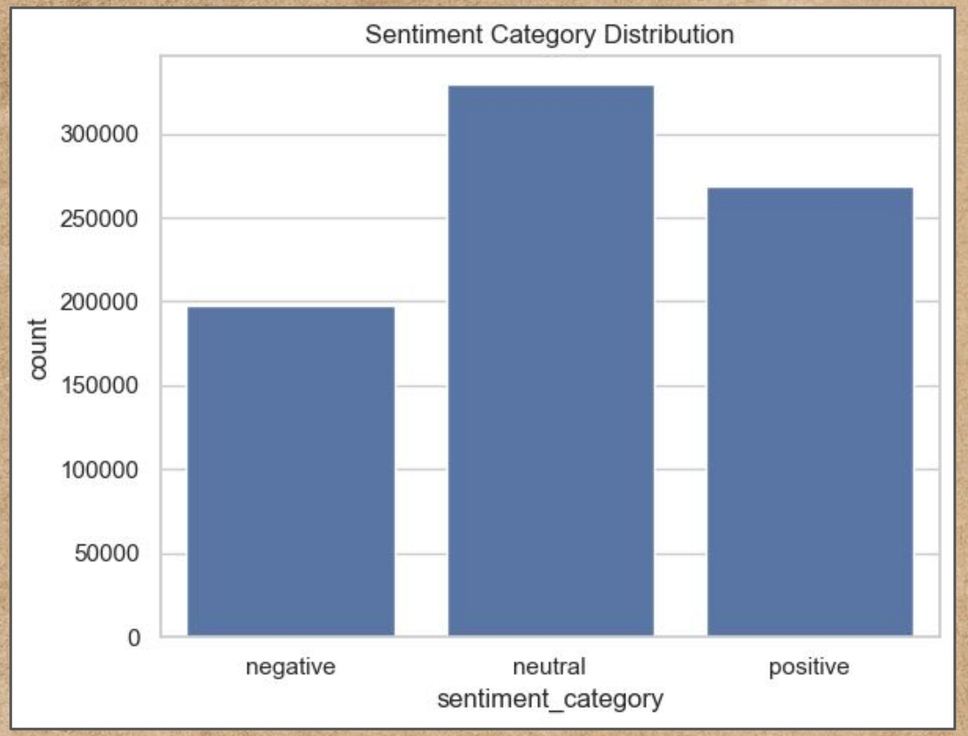
Available ... private jet ...

Non-biased: -0.905

EXPLORATORY DATA ANALYSIS

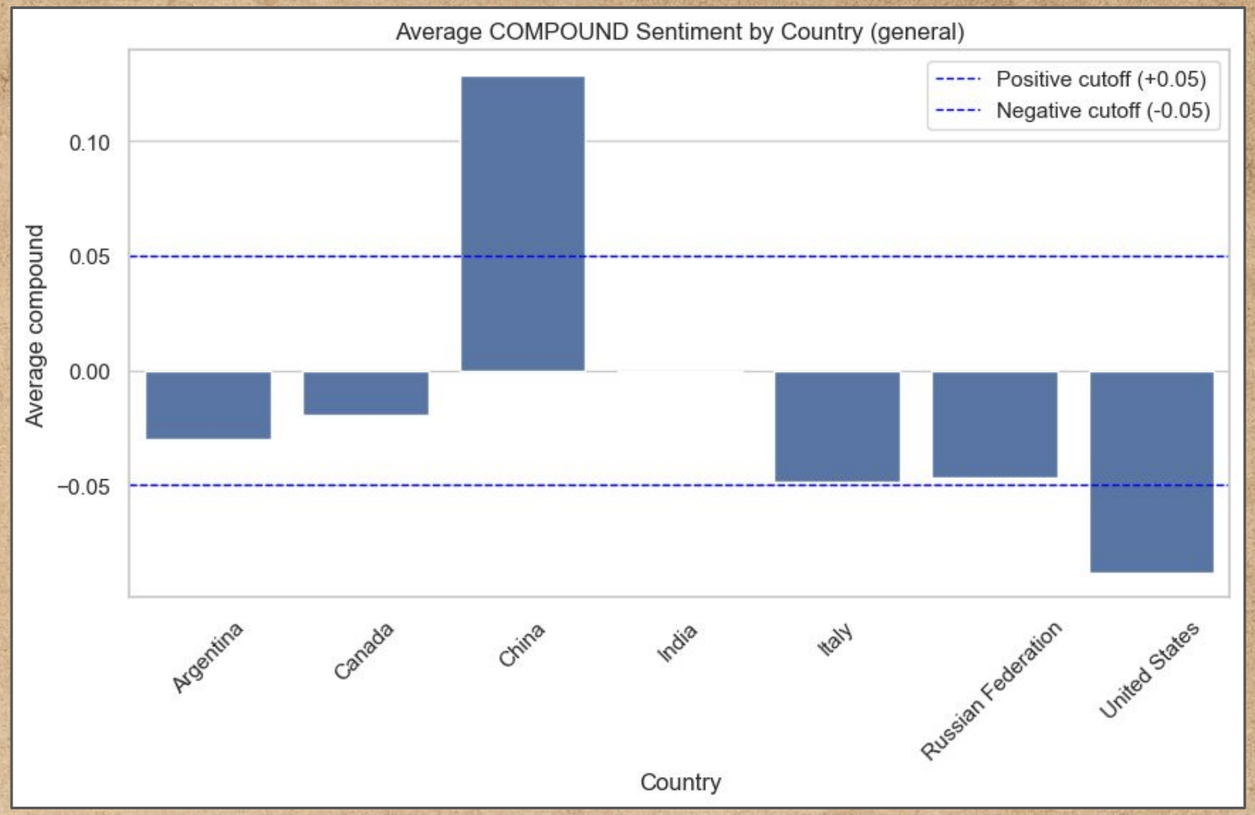
- **Distribution of Sentiment Scores (POS, NEU, NEG, COMP)** across 7 countries: India, Argentina, Canada, China, Italy, Russian Federation, and the United States
- **Distribution of Bias Scores** across 7 countries: India, Argentina, Canada, China, Italy, Russian Federation, and the United States

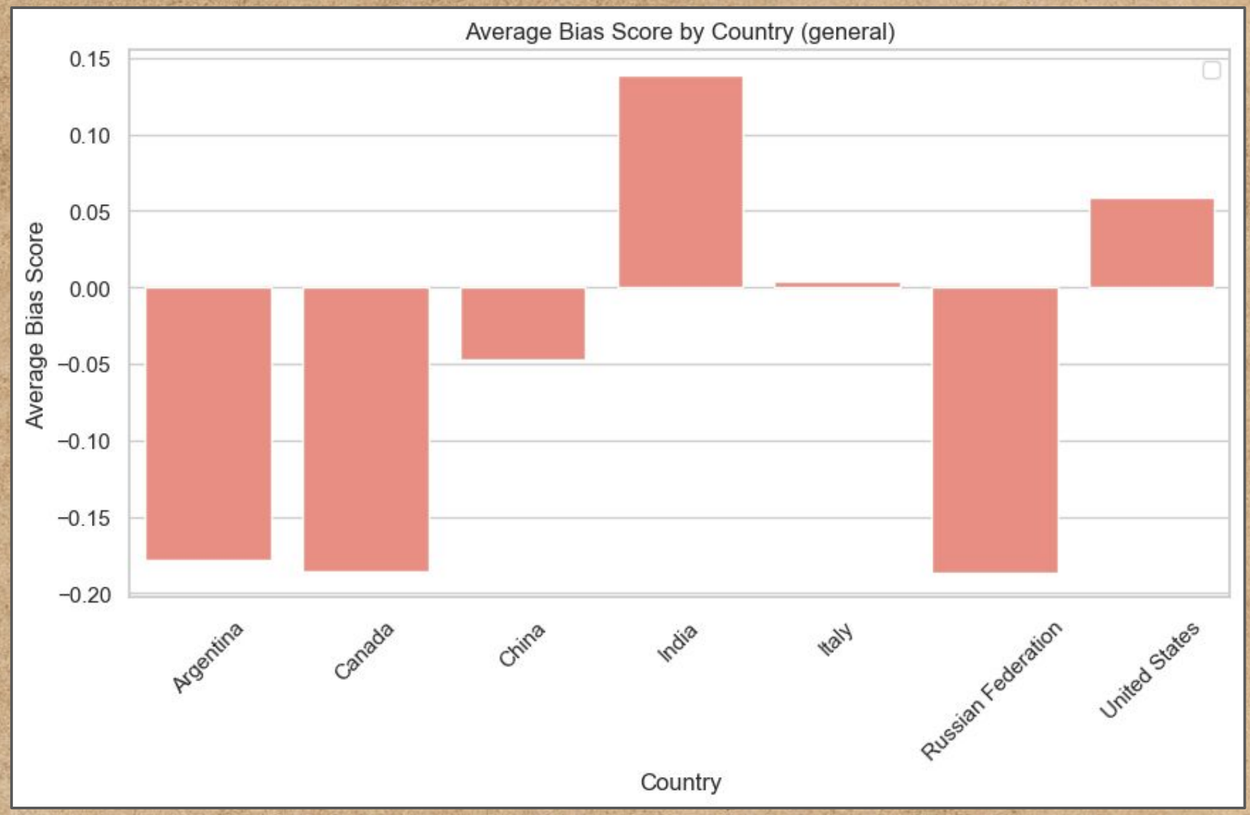




EXPLORATORY DATA ANALYSIS

- Average Compound **Sentiment** of **General Category** by Country
- Average **Bias** Score of **General Category** by Country





The DSAN Daily

HYPOTHESIS TESTING

HYPOTHESIS TESTING

T-Test: U.S. Sentiment Scores (Pre-2023)

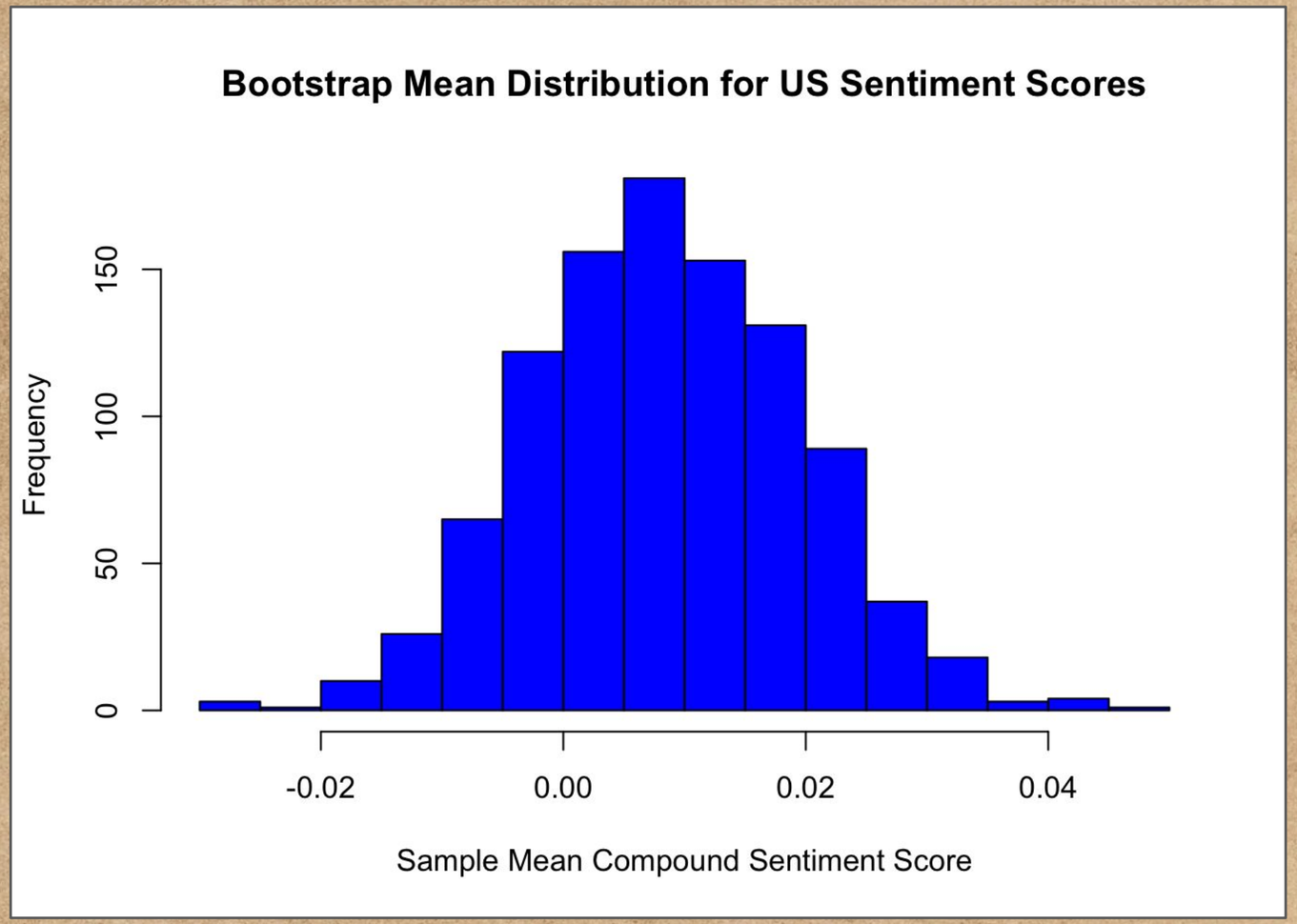
H0: The mean compound sentiment score in U.S. headlines equals 0

HA: The mean compound sentiment score in U.S. headlines is not 0

Using bootstrap sampling (1,000 samples of 1,000 headlines from 92,497 total), we estimated the distribution of the mean sentiment score.

With α = 0.05 and a p-value < 2.2e-16, we reject the null hypothesis

Conclusion: U.S. headline sentiment is significantly different from neutral



KEY TAKEAWAY #1:

U.S. headlines are not neutral!

Despite a small effect size, there is an overall measurable tendency toward positive sentiment for all categories!

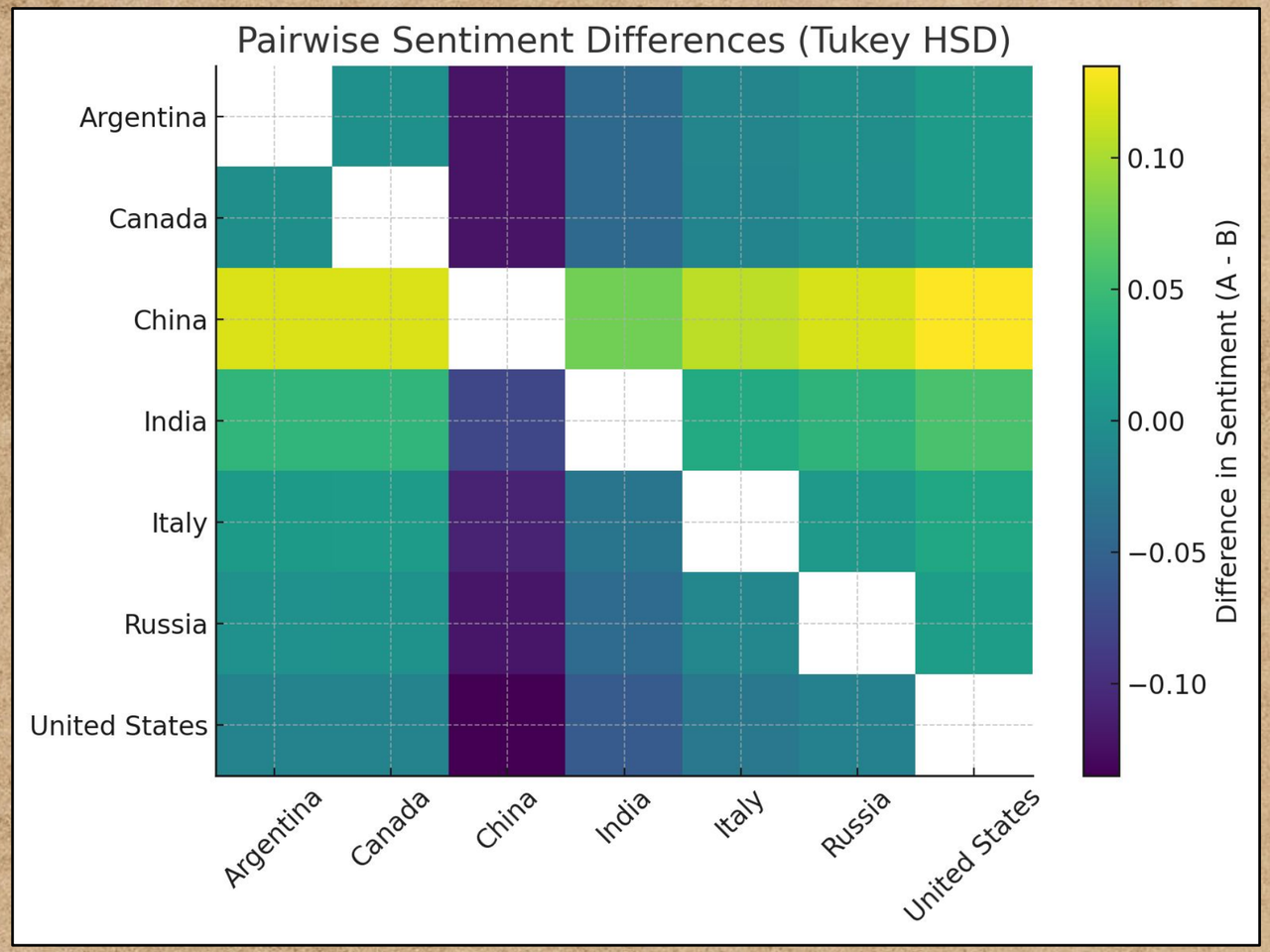
HYPOTHESIS TESTING

ANOVA – Do Sentiment Scores Differ Across Countries?

H0: All countries have the same mean compound sentiment score.

HA: At least one country differs in mean compound sentiment score.

Significant differences exist between countries, p-value: <2e-16



HYPOTHESIS TESTING

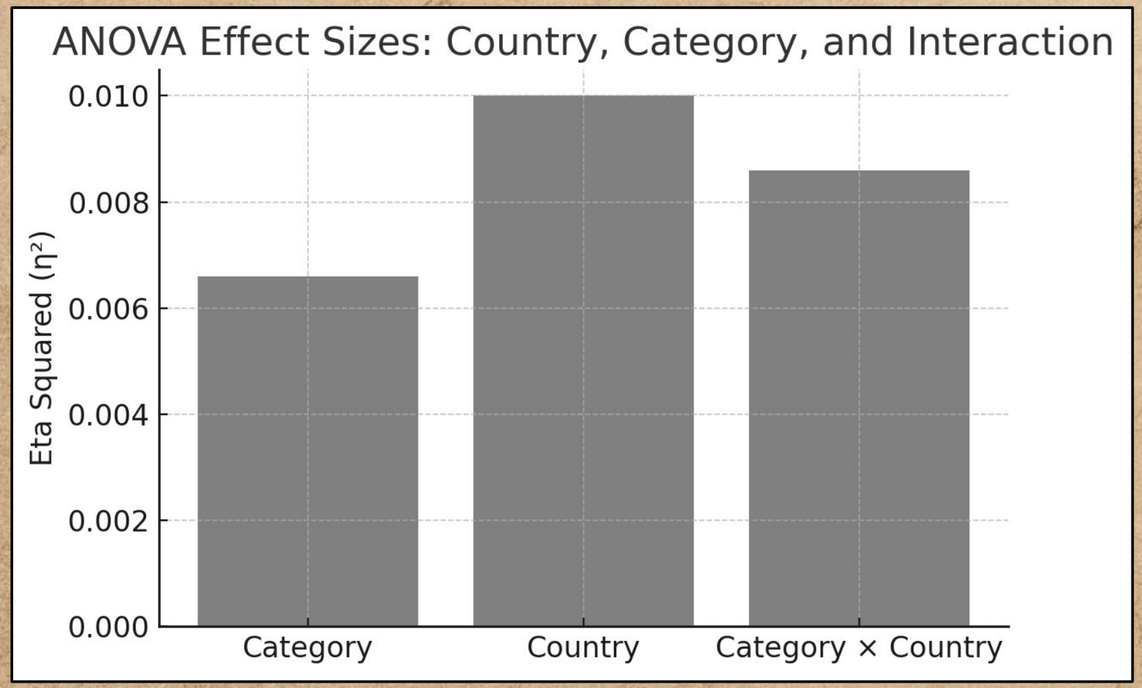
ANOVA – Does an article's country~category combination influence its compound sentiment score?

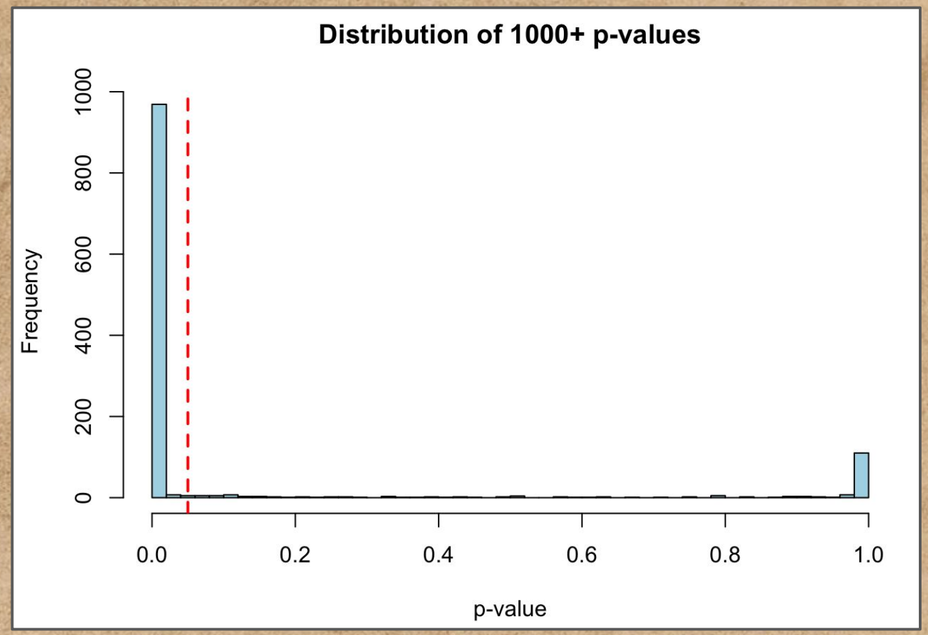
HO: All country~category groups have equal mean sentiment scores

HA: At least one group has a different mean sentiment score

Conclusion: Reject Null Hypothesis, Article category significantly affects compound sentiment scores

η^2 measures how much of the variation in sentiment scores is explained by each factor





KEY TAKEAWAY #2:

Significant differences between countries' average compound sentiment exist!

Category of article can influence average compound sentiment score.

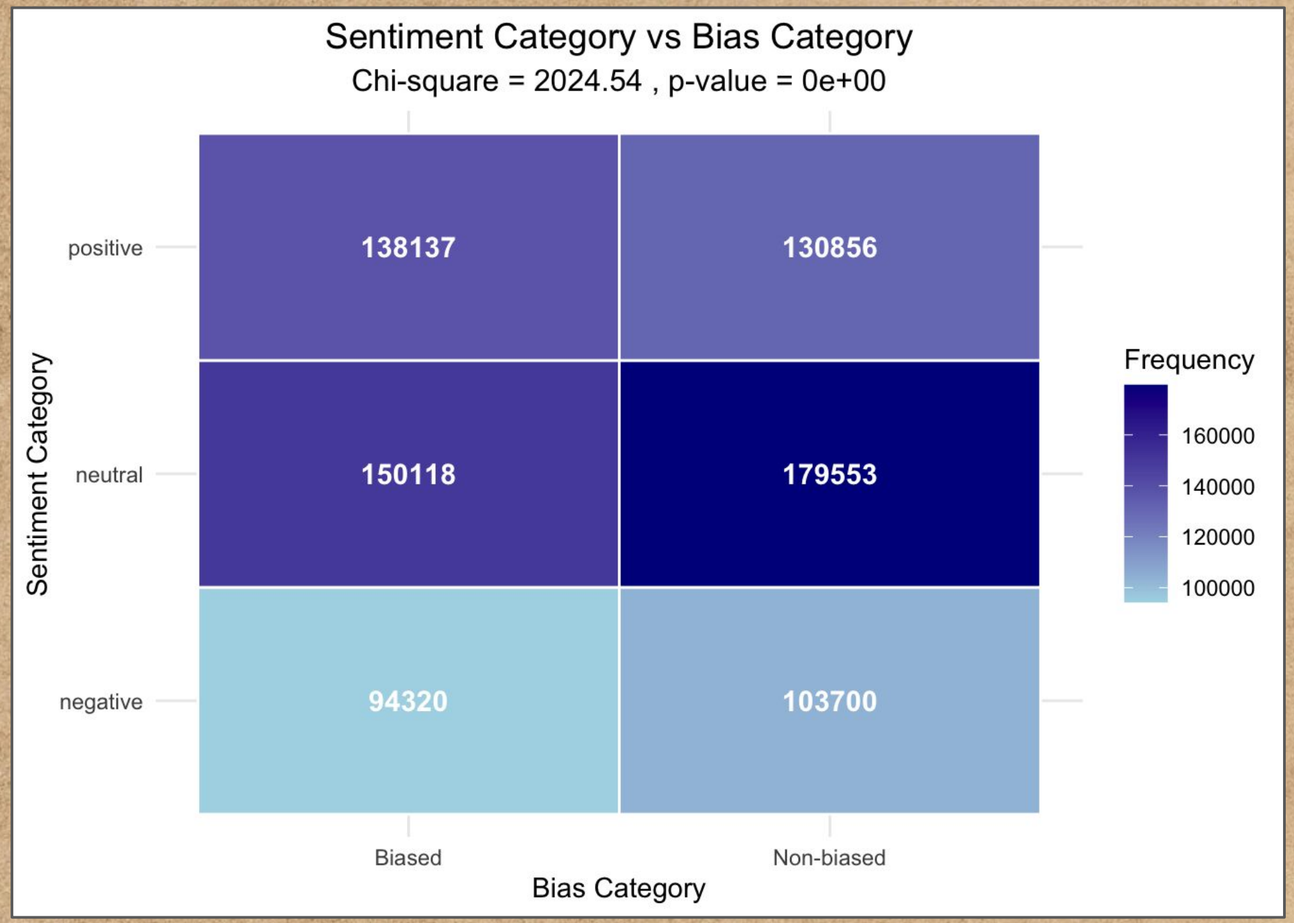
HYPOTHESIS TESTING

Chi-Square Test of Independence: Comparing Sentiment to Bias

HO: Sentiment and Bias are independent

Ha: Sentiment and bias are associated

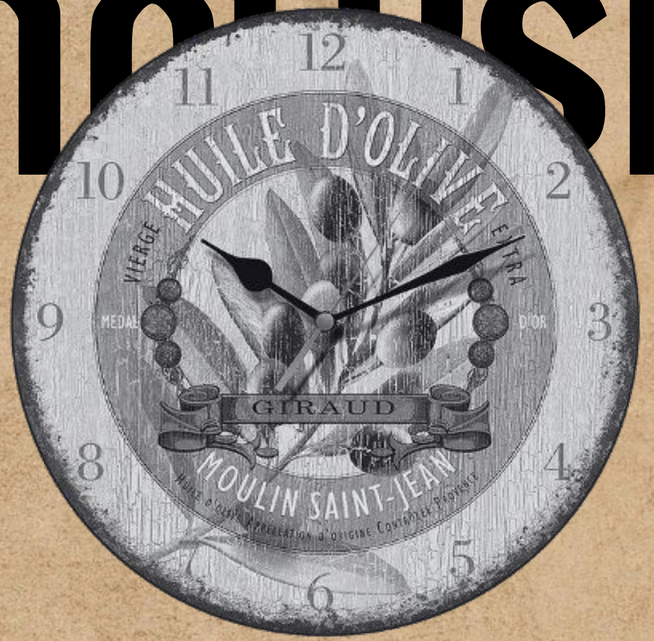
Conclusion: p-value < 2.2e-16, reject the null hypothesis



KEY TAKEAWAY #3:

Sentiment and Bias are dependent!

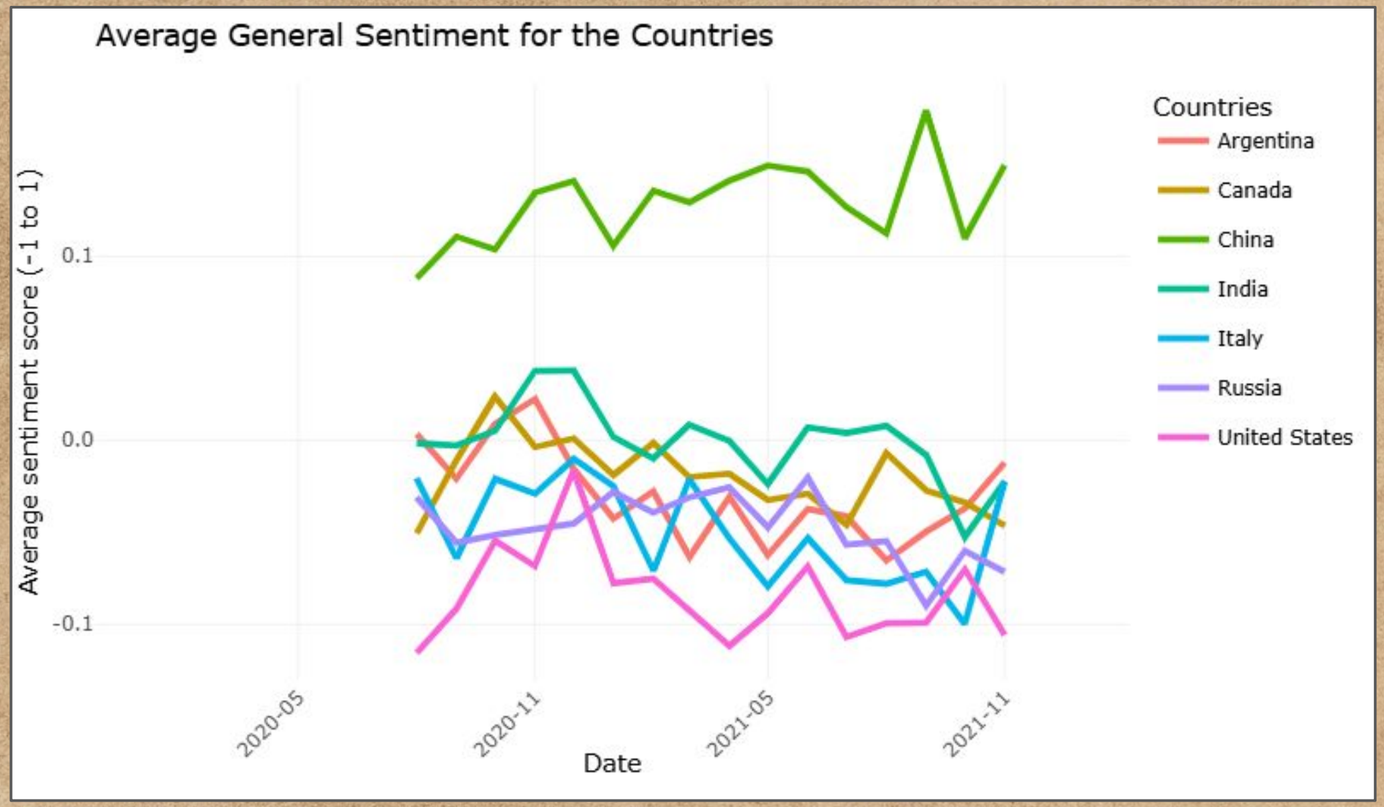
TIME SERIES ANALYSIS



TIME SERIES ANALYSIS

In the **general news category**, most countries have an average sentiment score of neutral (-0.05 < compound score < 0.05) except for the **USA** and **China**

Research shows that news tends to skew negative due to negativity bias where **humans naturally pay more attention to negative information**



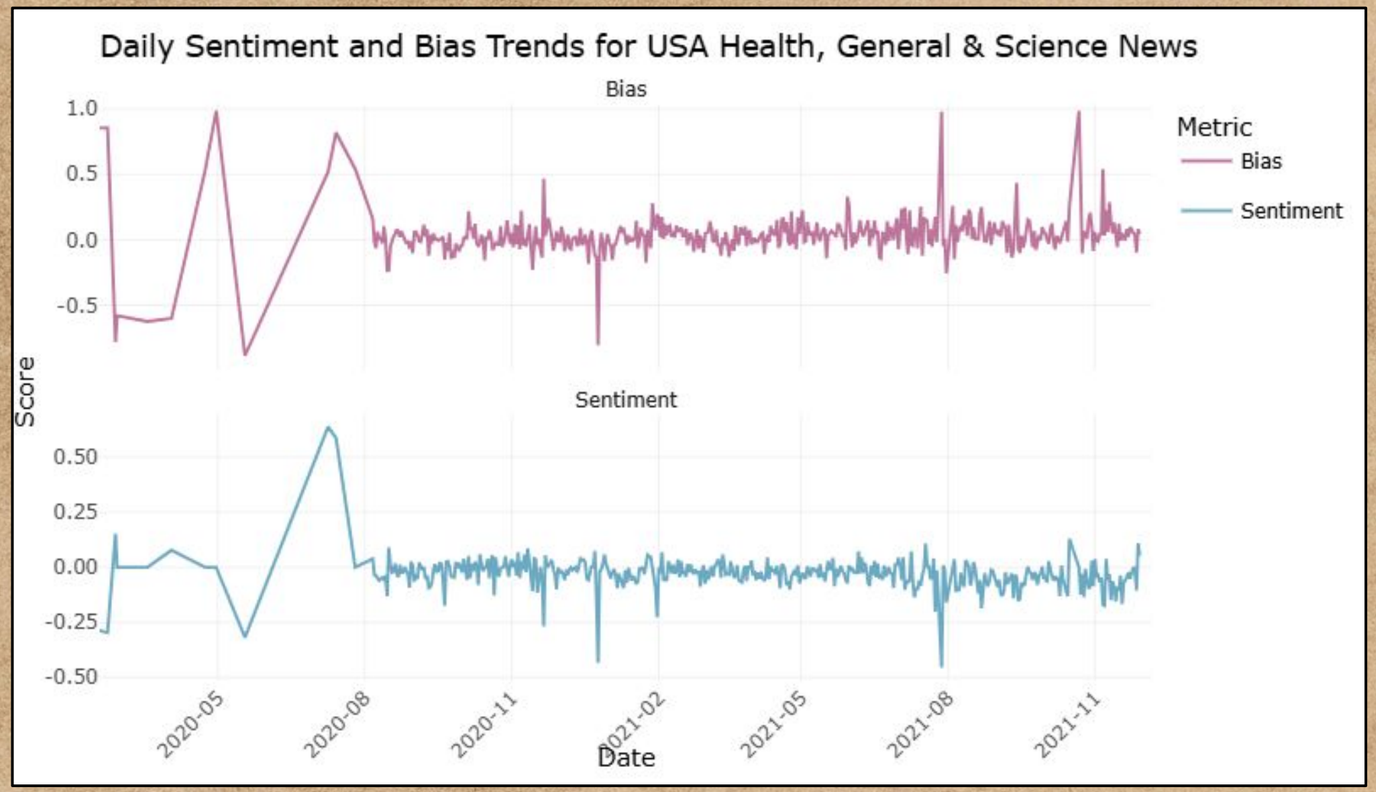
TIME SERIES ANALYSIS

July 2020 there peaks of both positive sentiment and high bias.

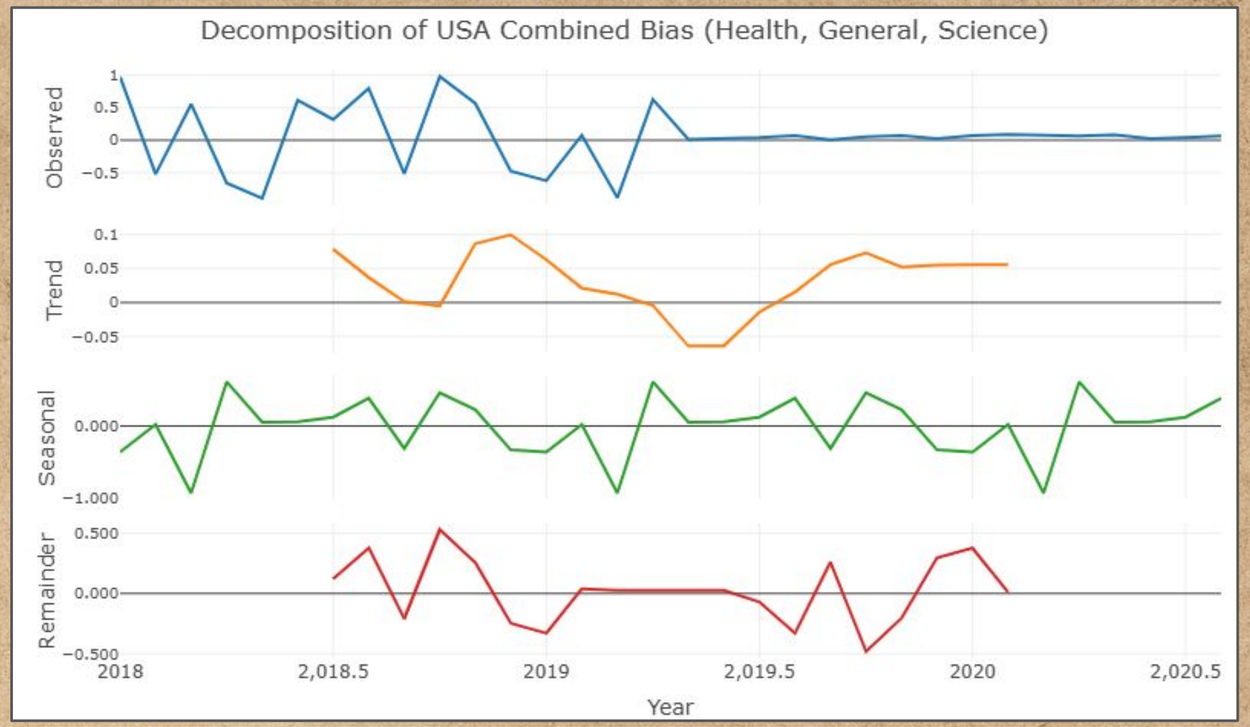
In **November 2020** we see negative sentiment and higher bias, which could be related to the climbing COVID infection rates or 2020 election news.

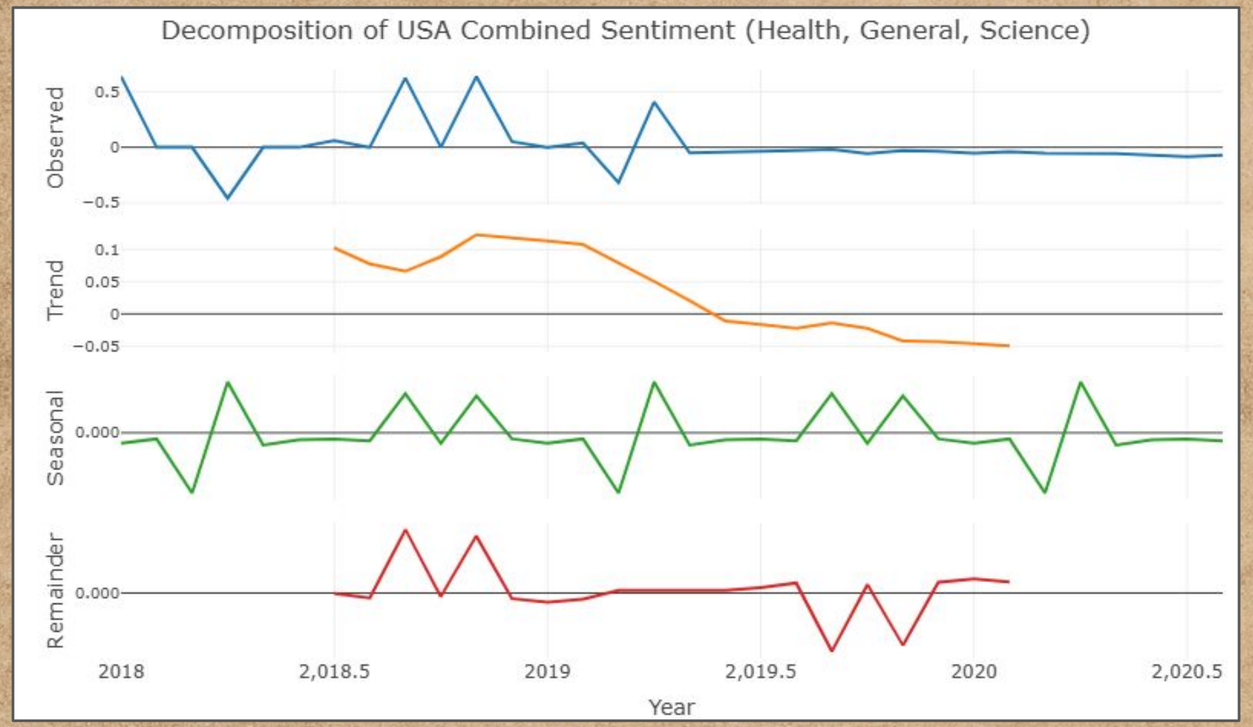
Around **Christmas 2020** we get a dip towards negative sentiment and more non-biased news.

July 2021 saw the lowest sentiment of and high bias, potentially corresponding to the Delta variant surge.



TIME SERIES ANALYSIS





The decomposition shows a **gradual decline in overall news sentiment** since 2015, reflecting increasingly neutral or negative coverage over time. Superimposed on this trend is a clear **seasonal pattern**, with predictable dips early in the year, spikes around mid-year events, smaller mid-year peaks, and another year-end spike likely tied to holidays or major announcements.

KEY TAKEAWAY #4:

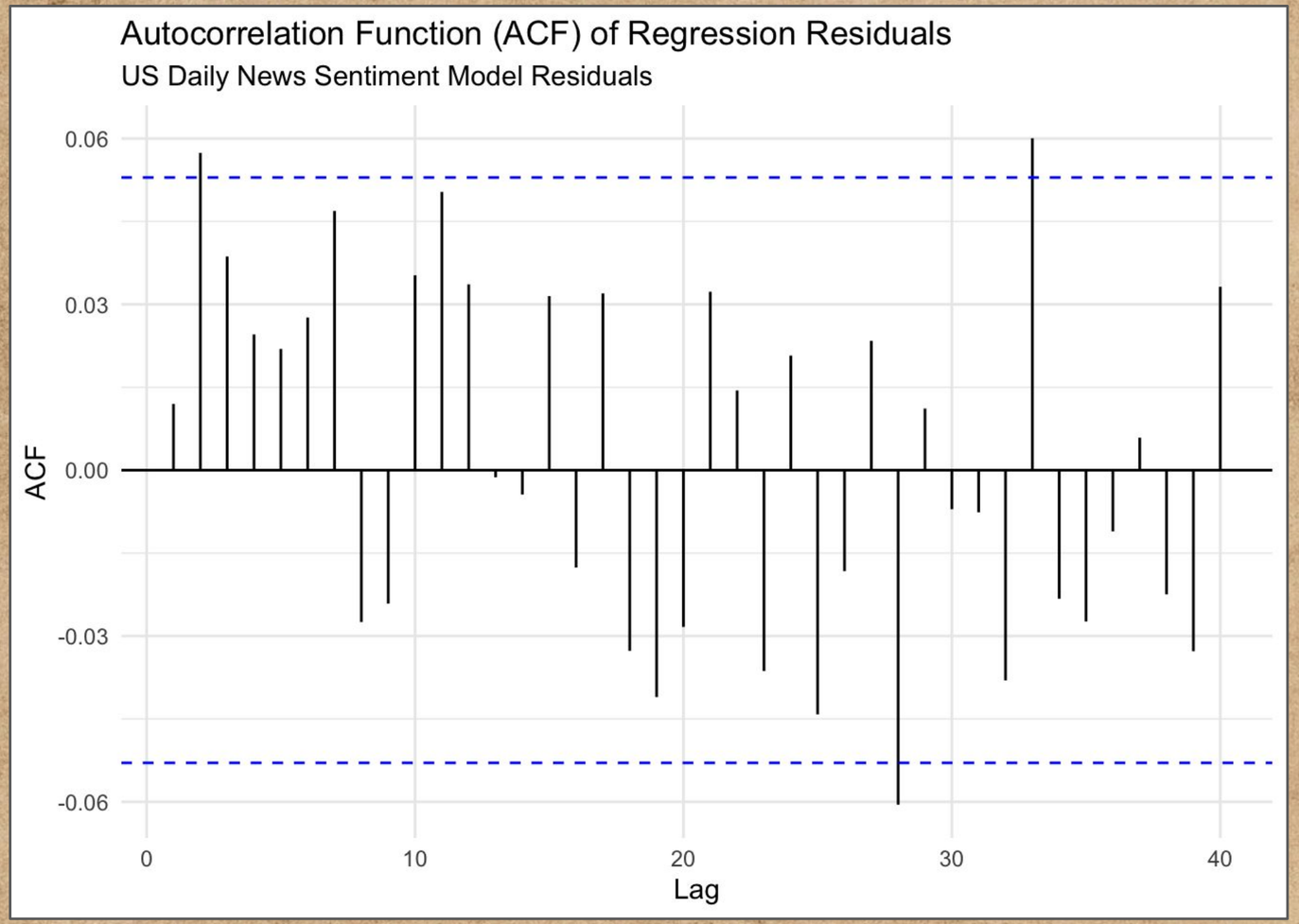
US has consistently lower
average sentiment over time
than other countries!

US average sentiment is trending
more negative, while average
bias has less visible trend.

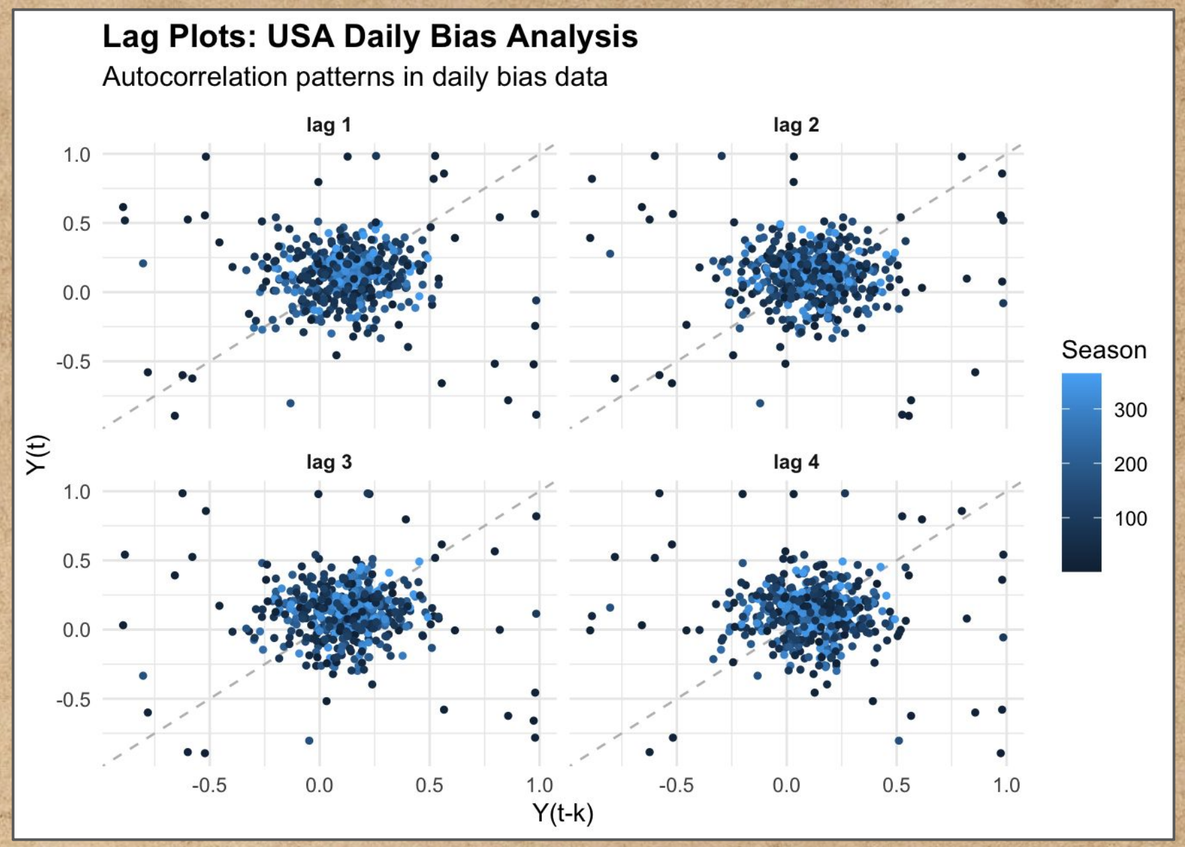
TIME SERIES ANALYSIS

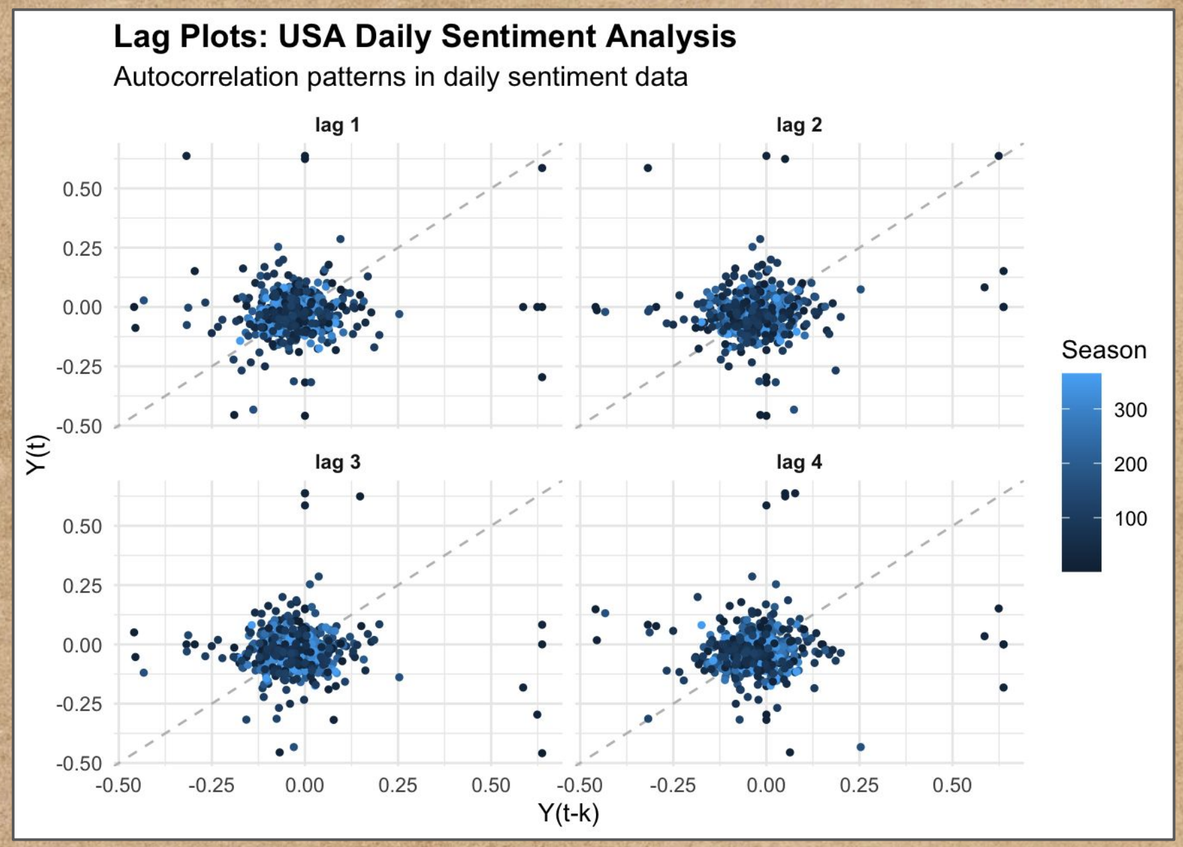
The ACF plot of regression residuals shows **low autocorrelation,** with only three minor spikes outside the confidence bounds: at lag 2, and around lags 30–35.

The spikes may reflect **small short-term** or **monthly cycles** in news sentiment not fully accounted for by the model



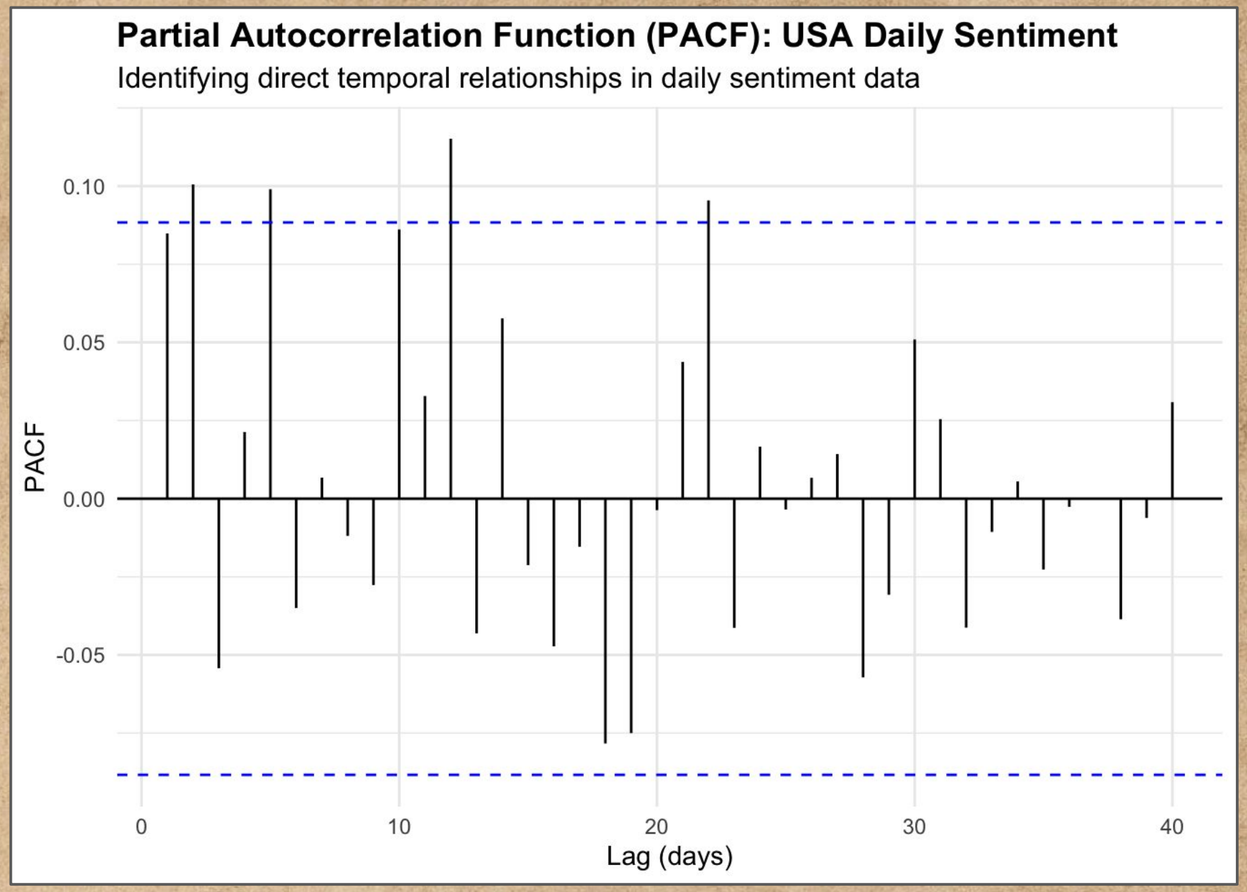
TIME SERIES ANALYSIS

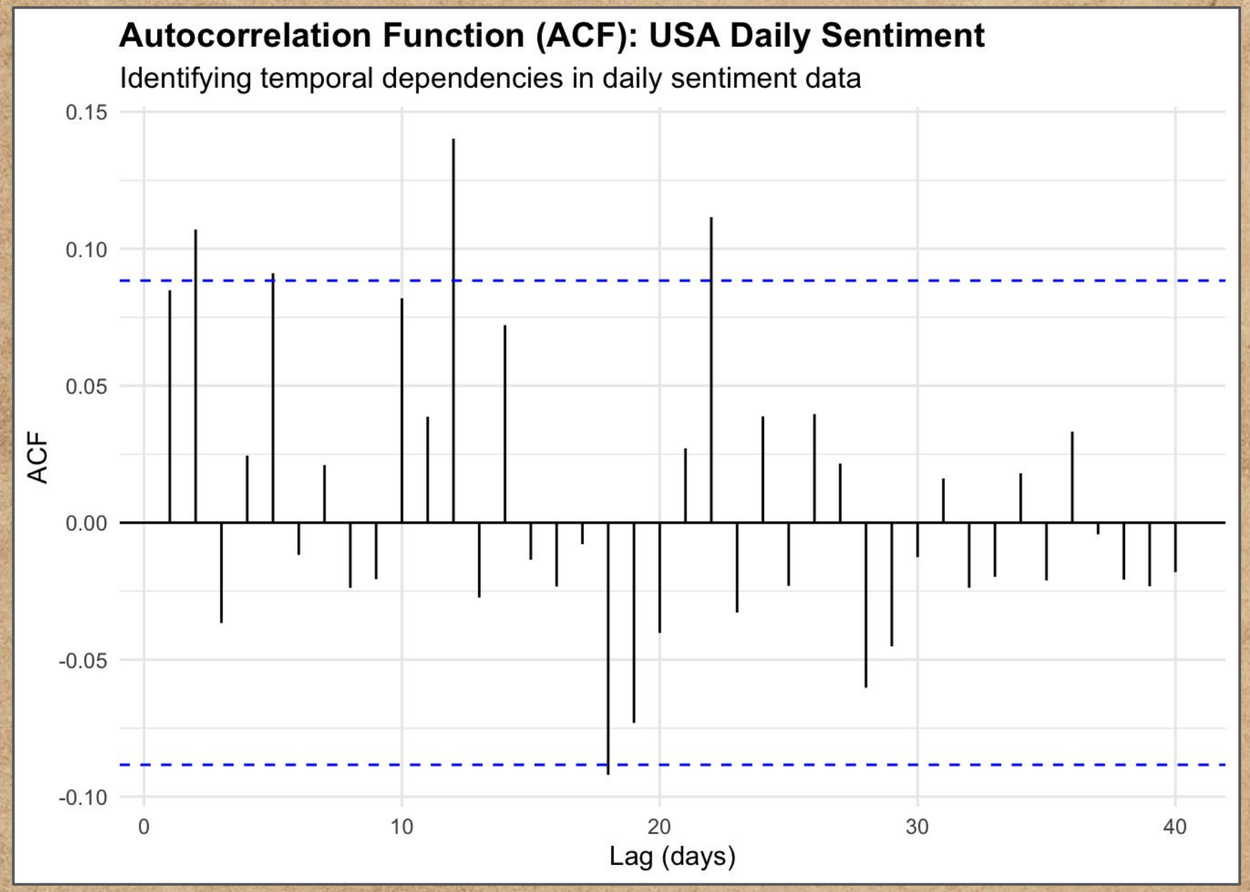




The lag plots of daily sentiment and bias show points **scattered around zero**, forming a roughly circular pattern. This indicates that consecutive daily sentiment and bias values are **largely independent, with no strong linear autocorrelation.**

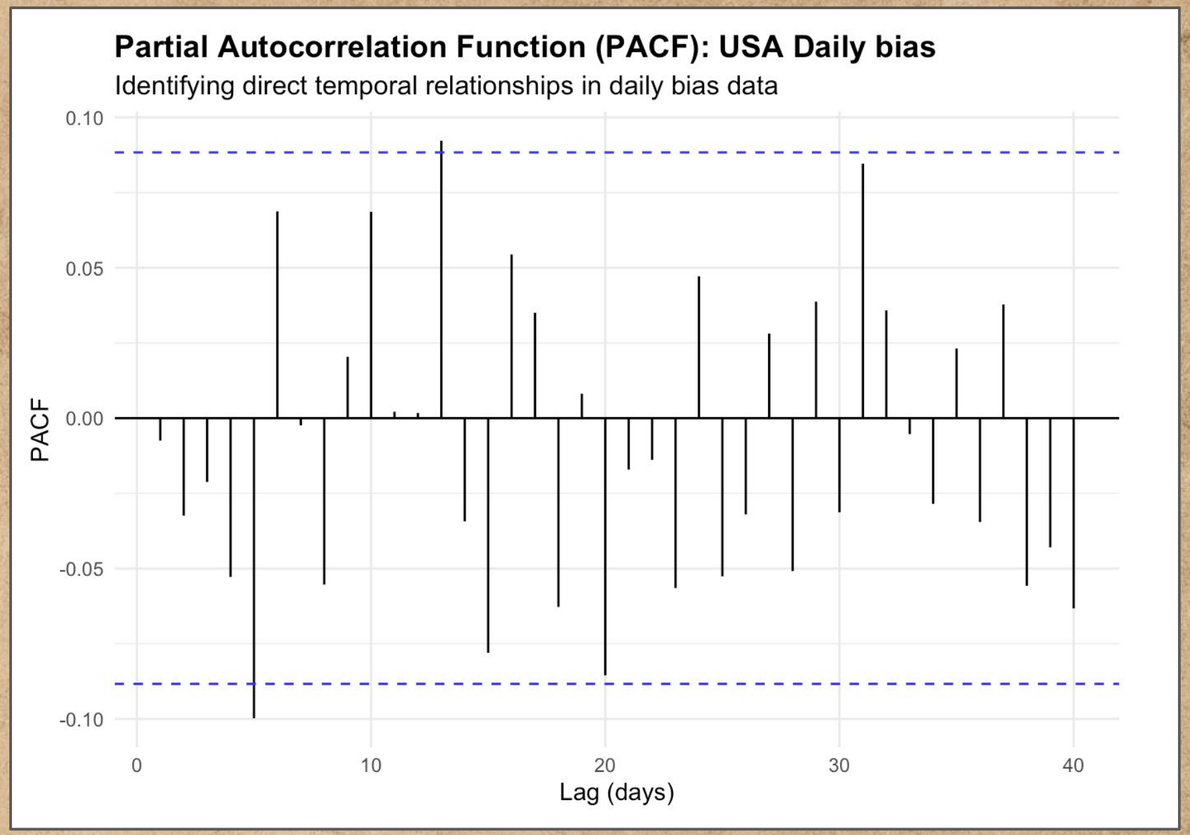
TIME SERIES ANALYSIS

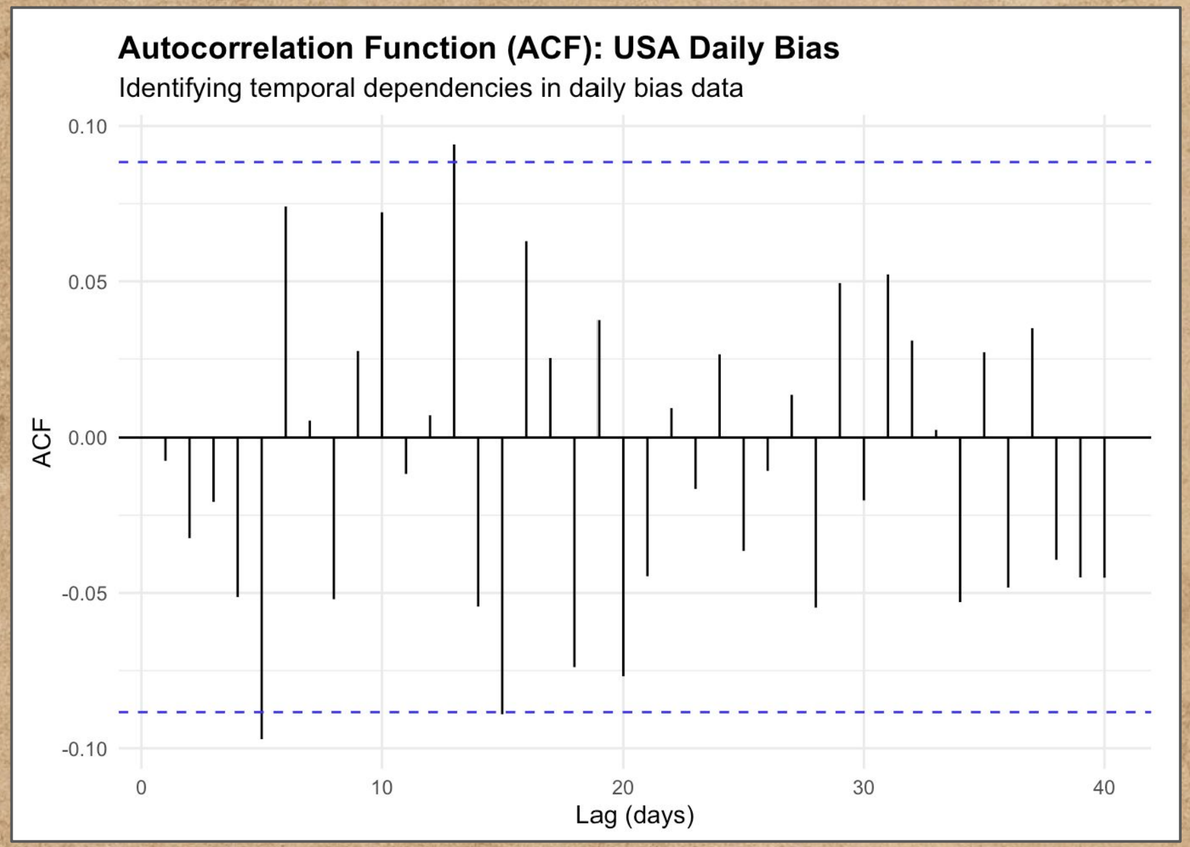




The ACF of the daily sentiment series shows that **most autocorrelations fall within the confidence bounds**, indicating weak temporal dependence. The PACF of daily sentiment shows **only four lags with significant partial autocorrelation**, indicating that short-term dependencies exist for a few immediate days.

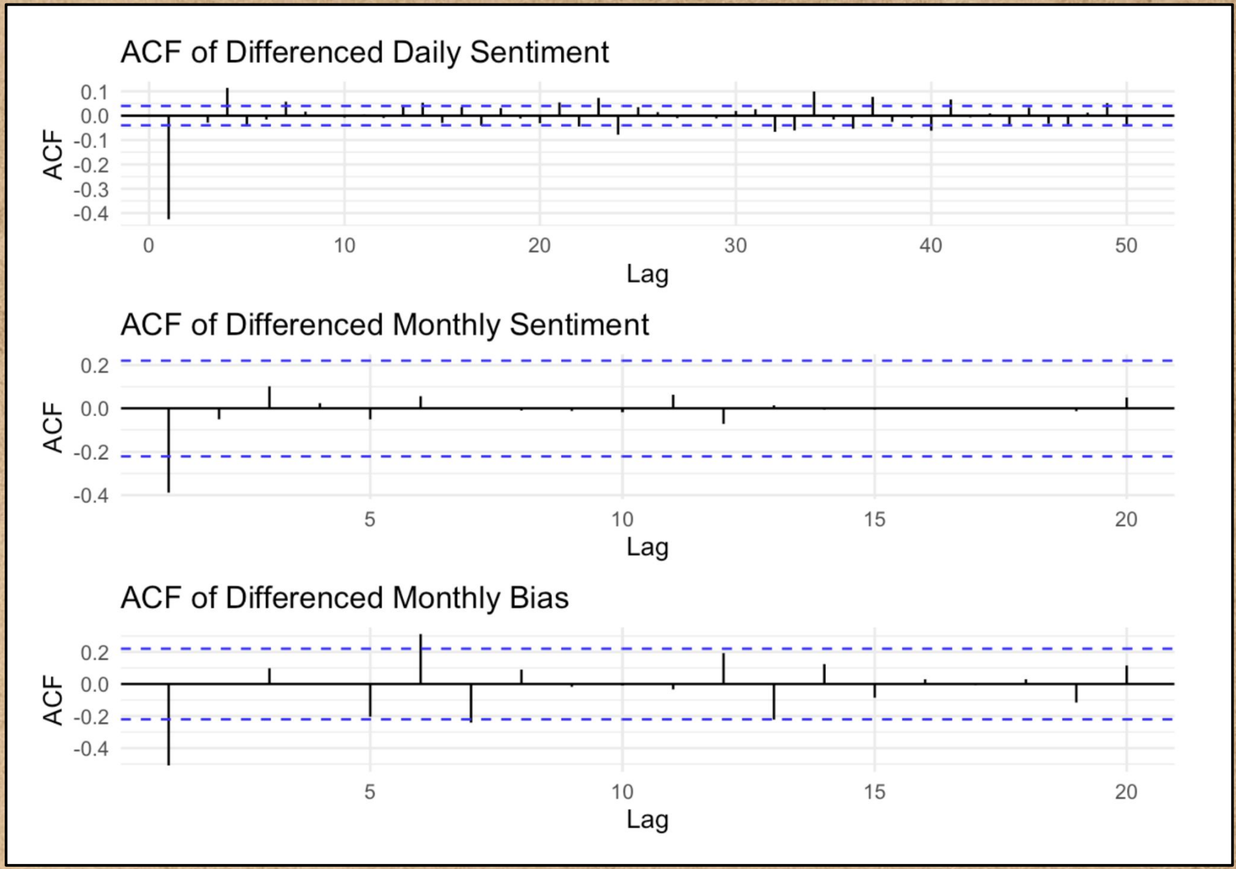
TIME SERIES ANALYSIS

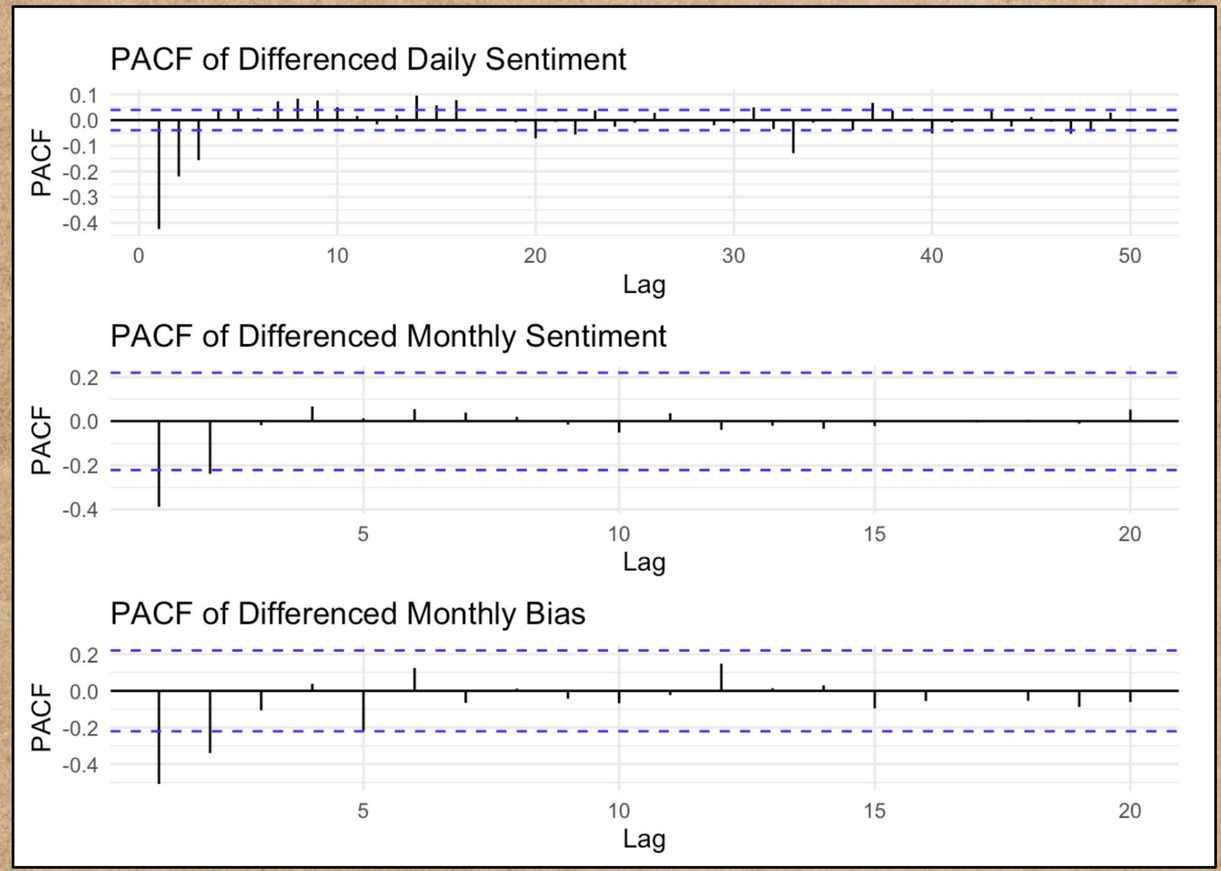




The ACF of the daily bias series shows that **most autocorrelations fall within the confidence bounds**, indicating weak temporal dependence. The PACF of daily sentiment shows **only two lags with significant partial autocorrelation**.

TIME SERIES ANALYSIS





The ACF and PACF plot of the differenced monthly sentiment and bias show that **most autocorrelations fall within the significance bounds** after the first few lags. Further ACF and PACF of second order differencing show that the daily sentiment series may be over-differenced.

TIME SERIES ANALYSIS

ARIMA Model Comparison for Monthly Sentiment

p	d	q	AIC	BIC	AICc
0	1	0	-60.523	-58.154	-60.471
0	1	1	-79.372	-74.633	-79.214
0	1	2	-78.295	-71.186	-77.975
1	1	0	-74.502	-69.763	-74.344
1	1	1	-77.974	-70.866	-77.654
1	1	2	-76.588	-67.110	-76.047
2	1	0	-78.827	-71.719	-78.507
2	1	1	-77.034	-67.556	-76.493
2	1	2	-75.234	-63.387	-74.412

The manual model with the lowest AIC was the 0,1,1. The alternative produced by the auto arima method was 1, 0, 1 with a higher AIC of -79.72

TIME SERIES ANALYSIS

Model Performance Comparison

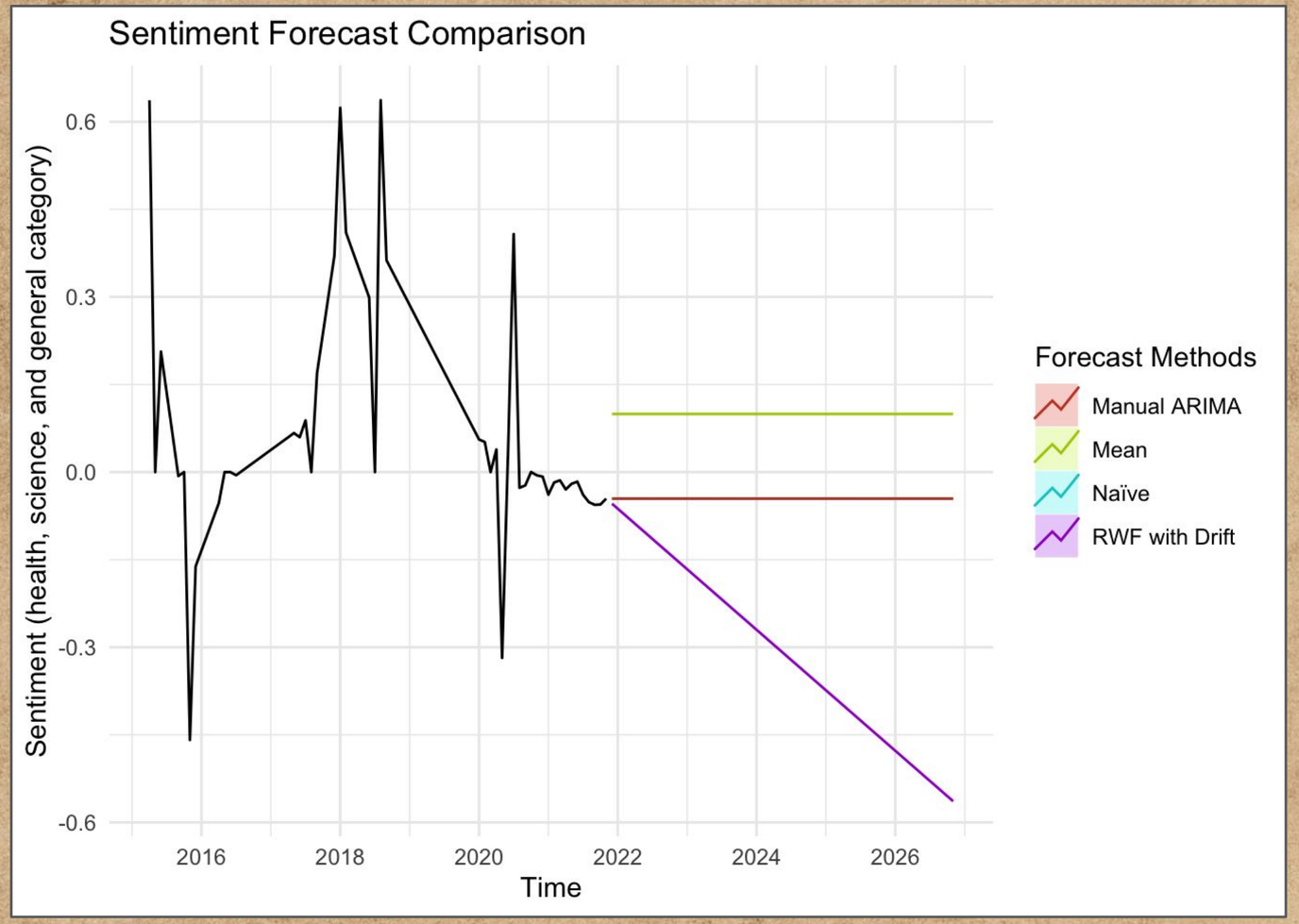
Method	MAE	RMSE	MAPE
Manual ARIMA	0.025	0.027	52.577
Auto ARIMA	0.075	0.080	167.259
Naive	0.025	0.027	52.577
Mean	0.155	0.156	403.982
RWF with Drift	0.009	0.014	28.218

The random walk with drift has a lower MAE, RMSE, and MAPE, outperforming both the Manual ARIMA and Auto Arima

Best model for sentiment forecasting: **RWF with Drift**

TIME SERIES ANALYSIS

The best model, the random walk with drift predicted a decline in sentiment for the following months after the end of 2021.



TIME SERIES ANALYSIS

ARIMA Model Comparison for Monthly Bias

p	d	q	AIC	BIC	AICc
0	1	0	86.386	88.755	86.438
0	1	1	48.804	53.543	48.962
0	1	2	49.000	56.109	49.320
1	1	0	59.552	64.291	59.710
1	1	1	48.933	56.041	49.253
1	1	2	48.622	58.100	49.163
2	1	0	49.579	56.688	49.899
2	1	1	50.401	59.879	50.942
2	1	2	52.362	64.210	53.184

The manual model with the lowest AIC was the 1,1,2. The alternative produced by the auto arima method was 4, 0, 1 with a lower AIC of 42

TIME SERIES ANALYSIS

Model Performance Comparison

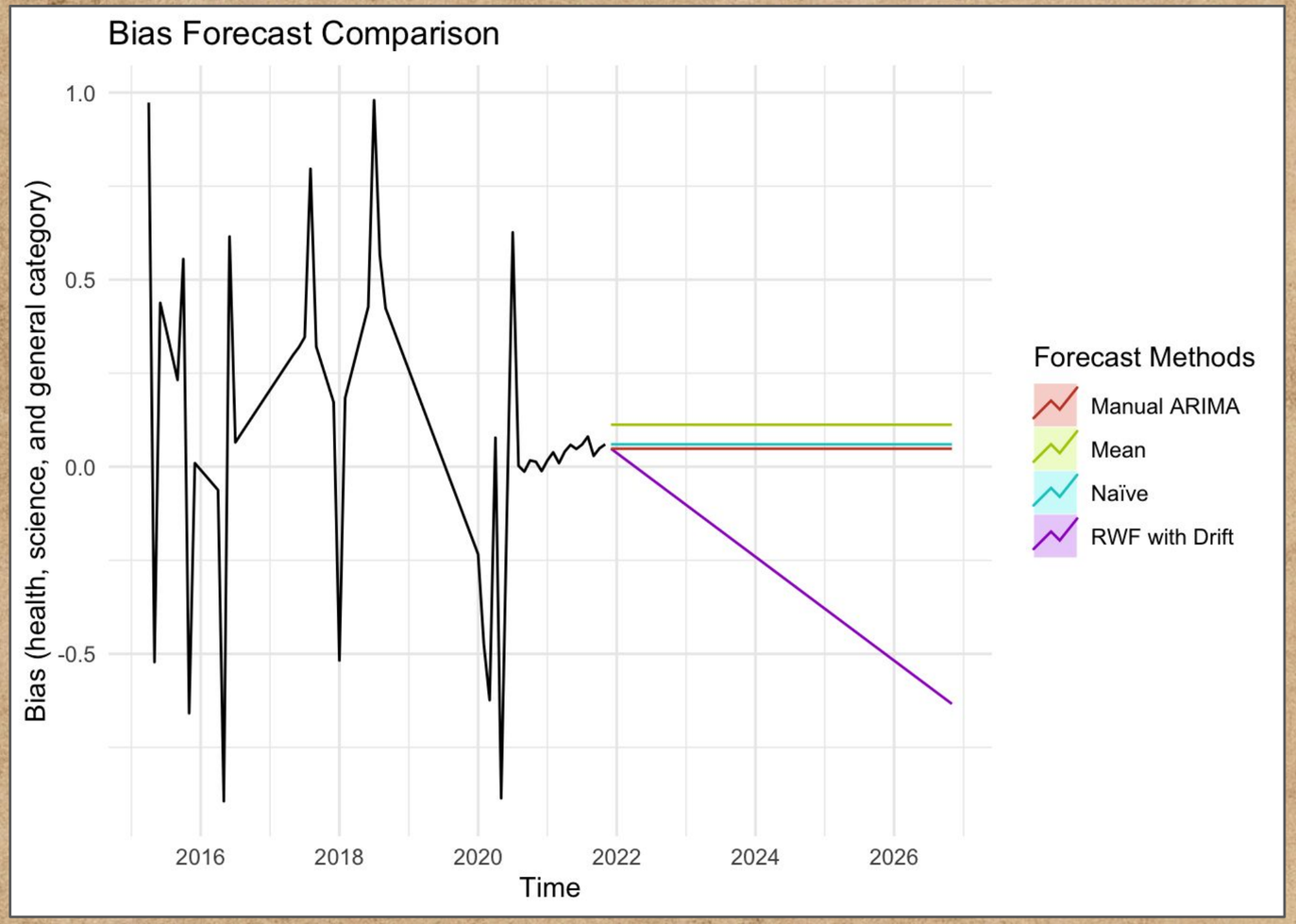
Method	MAE	RMSE	MAPE
Manual ARIMA	0.024	0.029	40.491
Auto ARIMA	0.032	0.037	73.795
Naive	0.012	0.016	29.161
Mean	0.063	0.065	137.971
RWF with Drift	0.040	0.047	71.534

The Naive model has a lower MAE, RMSE, and MAPE, outperforming both the Manual ARIMA and Auto Arima

Best forecasting model for bias: **Naive model**

TIME SERIES ANALYSIS

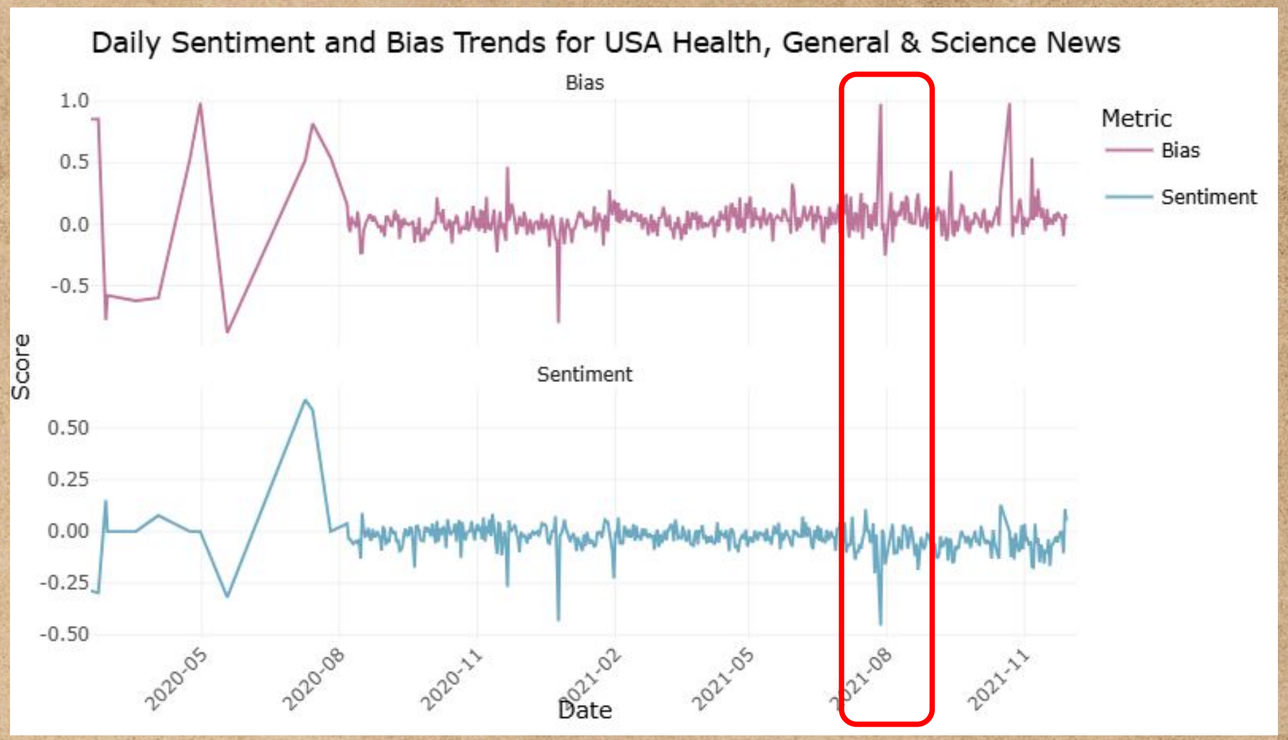
Naive model predicted a stable bias for as had existed before the forecast window,

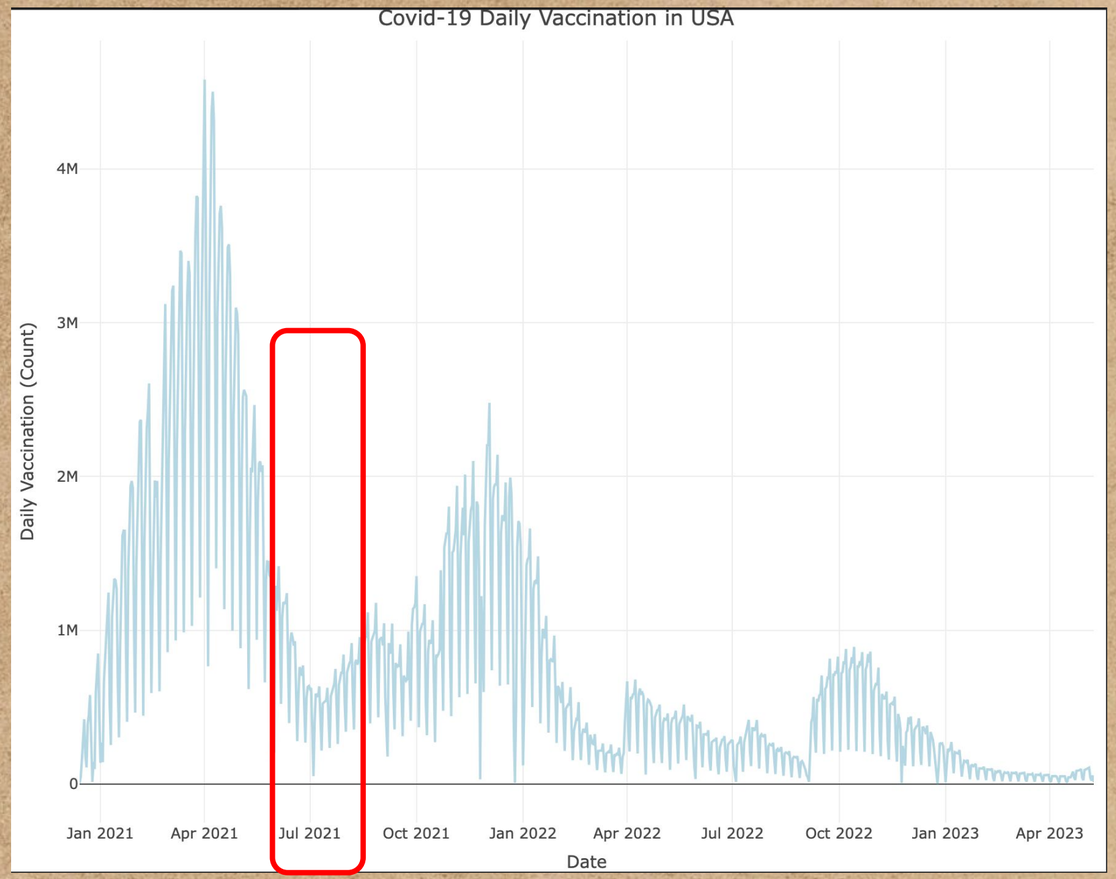


KEY TAKEAWAY #5:

For sentiment, our forecasting models predict a consistent negative sentiment or a decline in sentiment.

TIME SERIES ANALYSIS





CONCLUSIONS

The Call—Chronicle—Examiner

SAN FRANCISCO, THURSDAY, APRIL 19, 1906.

EARTHQUAKE AND
SAN FRANCISCO IN

DEATH AND DESTRUCTION HAVE BEEN THE FATE OF SAN FRANCISCO. SHAKEN BY A TEMBLOR AT 5:13 O'CLOCK YESTERDAY M
AND SCOURGED BY FLAMES THAT RAGED DIAMETRICALLY IN ALL DIRECTIONS, THE CITY IS A MASS OF SMOULDERING RUINS. AT SIX
INGLY PLAYING WITH INCREASED VIGOR, THREATENED TO DESTROY SUCH SECTIONS AS THEIR FURY HAD SPARED DURING THE EAR
PATH IN A TRIANGUAR CIRCUIT FROM THE START IN THE EARLY MORNING, THEY JOCKEYED AS THE DAY WANED, LEFT THE BUSINESS
VASTATED, AND SKIPPED IN A DOZEN DIRECTIONS TO THE RESIDENCE PORTIONS. AS NIGHT FELL THEY HAD MADE THEIR WAY OVE
SPRINGING ANEW TO THE SOUTH THEY REACHED OUT ALONG THE SHIPPING SECTION DOWN THE BAY SHORE, OVER THE HILLS AN
STREETS. WAREHOUSES, WHOLESALE HOUSES AND MANUFACTURING CONCERNS FELL IN THEIR PATH. THIS COMPLETED THE DEST
AS THE "SOUTH OF MARKET STREET." HOW FAR THEY ARE REACHING TO THE SOUTH ACROSS THE CHANNEL CANNOT BE TOLD AS T
SAN FRANCISCO PAPERS.

AFTER DARKNESS,THOUSANDS OF THE HOMELESS WERE MAKING THEIR WAY WITH THEIR BLANKETS AND SCANT PROVISIONS
FIND SHELTER. THOSE IN THE HOMES ON THE HILLS JUST NORTH OF THE HAYES VALLEY WRECKED SECTION PILED THEIR BELON
ONS AND AUTOMOBILES WERE HAULING THE THINGS AWAY TO THE SPARSELY SETTLED REGIONS. EVERYBODY IN SAN FRANCISCO
BELIEF IS FIRM THAT SAN FRANCISCO WILL BE TOTALLY DESTROYED.

DOWNTOWN EVERYTHING IS RUIN. NCT A BUSINESS HOUSE STANDS. THEATRES ARE CRUMBLED INTO HEAPS. FACTORIES AND CO
THEIR FORMER SITES. ALL OF THE NEWSPAPER PLANTS HAVE BEEN RENDERED USELESS, THE "CALL" AND THE "EXAMINER" BUILDING
ROOMS ON STEVENSON STREET BEING ENTIRELY DESTROYED.

IT IS ESTIMATED THAT THE LOSS IN SAN FRANCISCO WILL REACH FROM $150,000,000 TO $200,000,000. THESE FIGURES ARE IN THE
PARTIAL ACCOUNTING IS TAKEN.

ON EVERY SIDE THERE WAS DEATH AND SUFFERING YESTERDAY. HUNDREDS WERE INJURED, EITHR BURNED, CRUSHED OR STR
INGS AND ONE OF TEN DIED WHILE ON THE OPOPERATING TABLE AT MECHANICS' PAVILION. IMPROVISED AS A HOSPITAL FOR THE

TODAY'S UPDATES

BREAKING NEWS!!

VOL EST 1889 LOS ANGELES CA NOVEMBER 07 1890 2¢

THE SURPRISING ORIGINS

HOUSE RENT

THE DAILY MAIL

OLD WORLD NEWS

CONCLUSION

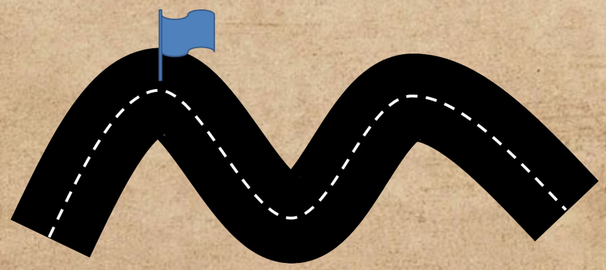
There is a **significant connection** between sentiment and bias!

US has **different sentiment and bias** than other countries!

Category of news can affect sentiment, along with country!

US sentiment is trending **downward**, towards **negativity**!

LIMITATIONS / PATH FORWARD



- **Machine-Translated Titles:**
  - Sentiment may be distorted by translation artifacts; nuance and tone can be lost
- **Basic Sentiment Model (VADER):**
  - VADER struggles with sarcasm, idioms, political tone, and domain-specific language
- **Apply Transformer-Based Models:**
  - Use BERT or RoBERTa for multilingual contextual sentiment instead of relying on Google Translate + VADER
- **Use Target-Specific Sentiment Tools:**
  - Incorporate the *NewsSentiment* Python package to better capture tone and sentiment towards sentence targets
- **Use Sentiment and Bias to Predict Vaccination Rates or Other Phenomena**

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THANK YOU!