Enhancing Financial Market Analysis and Prediction with Emotion Corpora and News Co-Occurrence Network

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About Me
SHAWN MCCARTHY HTTPS://WWW.LINKEDIN.COM/IN/SHAWNEMCCARTHY/

- AI Committee Member @ **AnitaB**
- PhD Candidate @ **University of Colorado Denver**
- Graduate Instructor @ **University of Colorado Denver**
- VP, Global Architecture and Risk @ **Manulife**

My Motto is "Inspire Growth"
My purpose is "to learn, adapt and evolve the innovation in others"

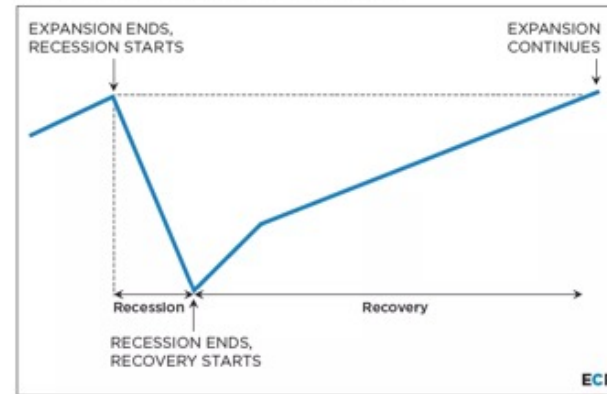ANITA B.ORG

Big Picture

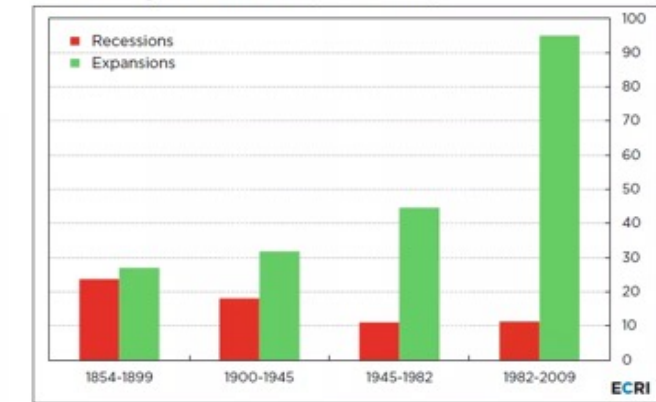**The business cycle refers to the fluctuations in economic activity over several months**

Problem >

- During a **recession**
  - Sales Fall
  - Income falls
 - Production falls
  - Employment Fall

The Solution >

1. Provide a macro learning model to better predict the business cycles so investors can better understand flucuations
2. To minimize risk by incorporating new insights into the stages of a cycle will provide better perspective of the overall cycle (as economy moves through periods of recession and recovery).
3. Understanding which sectors flourish at different phases of the business cycle will minimize risk by allowing investors to decrease holding in weakening sectors and increase in strengthening sectors.

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Problem statement

Unraveling the emotional undercurrents in financial news to predict market movements

A JOURNEY THROUGH THE PHASES
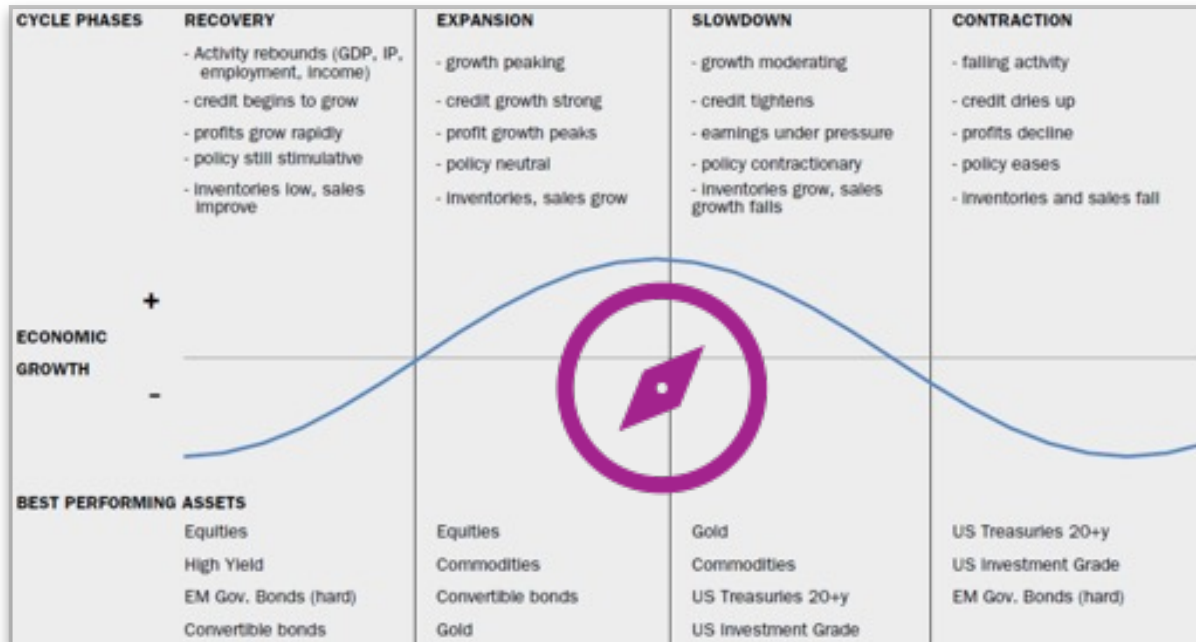
- Our approach seeks to identify shifting economic phase and provide a framework for making asset allocation decisions according to the probability that asset may outperform or underperform.
  - In intermediate-term how is asset performance driven by interest rates and inflation?
  - Can we determine sector performance based on the business cycle (early, mid, late, recession)?
  - Can we manage extrapolation bias (too much emphasis on recent price movements)?
  - Can we improve accuracy of phase identification?

Part of an overall larger context

DECODING EMOTIONS IN FINANCIAL NEWS: A NEW FRONTIER IN MARKET ANALYSIS

- Time series analysis is widely used in fields such as business, economics, finance, science, and engineering.

- Our approach seeks to identify shifting economic phase and provide a framework for making asset allocation decisions according to the probability that asset may outperform or underperform.

- **First step** is news emotion sentiment as a real-time signal

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Intro: Enhancing Financial Market Analysis
## ABSTRACT - THE POWER OF EMOTION IN FINANCIAL MARKETS

- This study employs an improved natural language processing algorithm to analyze over 500,000 financial news articles from sixteen major sources across 12 sectors, with the top 10 companies in each sector. The analysis identifies shifting economic activity based on emotional news sentiment and develops a news co-occurrence network to show relationships between companies even across sectors. This study created an improved corpus and algorithm to identify emotions in financial news

Journal of Risk and Financial Management

Our findings suggest that emotional sentiment analysis provide valuable insights for financial market analysis and prediction. Emotions aren't just for humans - they're driving our financial markets too!

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Related Works
SENTIMENT ANALYSIS - BEYOND TRADITIONAL MARKET ANALYSIS
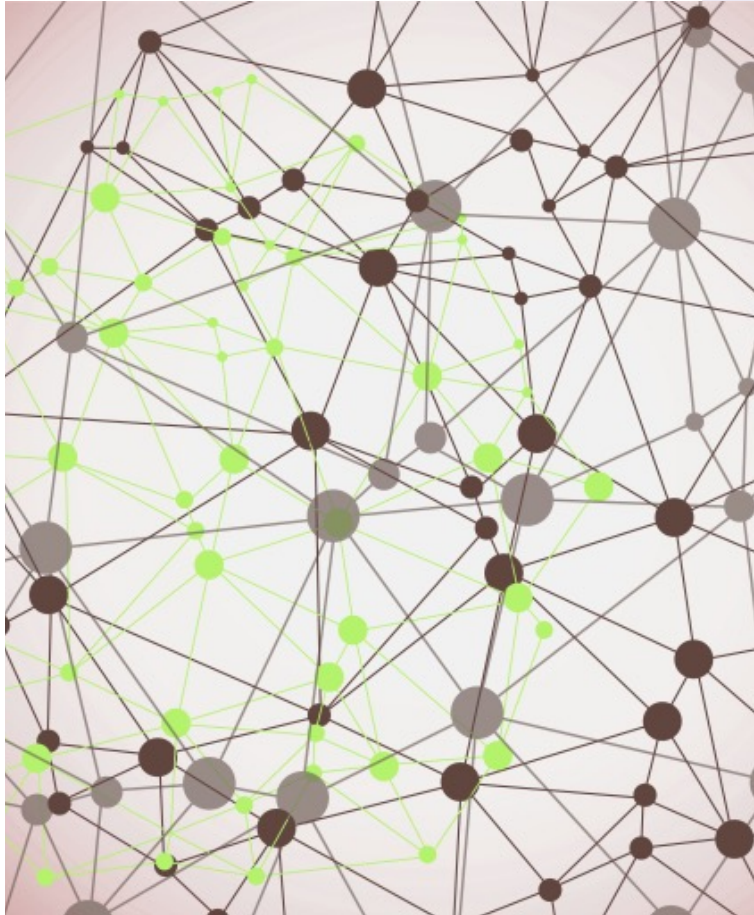
1. **Background:** Sentiment analysis is an active research field, used widely in social platforms and compliance platforms like Microsoft's, which utilizes machine learning to detect emotions such as harassment.

2. **Research Inspiration:** Based on Vishnubhotla and Mohammad (2022), we expanded the NRC emotion lexicon from five to eight emotions and included Plutchik's 30 distinct emotions. We also incorporated a financial glossary for financial news research.

3. **Methodology:** Leveraging the work of Dhar and Bose (2020), we extended the TextBlob and Text2Emotion frameworks to include financial terminology and multi-word identification, creating a comprehensive financial lexicon from Investopedia (6253 terms).

4. **Improving Co-occurrence Analysis:** Based on Wan et al. (2021), we developed an enhanced emotional algorithm to create co-occurrence news networks. The algorithm identifies companies appearing in the news on the same day with the same emotion and significant market correction ($\pm 2\%$). We added weights to network edges based on shared emotions across different days, improving emotional categorization beyond polarity.

5. **Objective:** This research aims to better analyze financial articles and news networks, leading to more insightful correlations and market movement predictions.

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Background – Identifying New Emotions

BROADENING THE EMOTIONAL SPECTRUM: NEW EMOTIONS THAT SHAPE OUR FINANCIAL MARKETS.

Mixed Emotion	Top 2 Emotions	Mixed Emotion	Top 2 Emotions
Love	Joy + trust	Remorse	Sadness + disgust
Guilt	Joy + fear	Envy	Sadness + anger
Delight	Joy + surprise	Pessimism	Sadness + anticipation
Submission	Trust + fear	Contempt	Disgust + anger
Curiosity	Trust + surprise	Cynicism	Disgust + anticipation
Sentimentality	Trust + sadness	Morbidity	Disgust + joy
Awe	Fear + surprise	Aggression	Anger + anticipation
Despair	Fear + sadness	Pride	Anger + joy
Shame	Fear + disgust	Dominance	Anger + trust
Disappointment	Surprise + sadness	Optimism	Anticipation + joy
Unbelief	Surprise + disgust	Hope	Anticipation + trust
Outrage	Surprise + anger	Anxiety	Anticipation + fear

While polarity sentiment analysis provides a useful broad brush understanding of sentiment, emotion-based sentiment analysis provides a much more detailed, nuanced, and potentially actionable understanding of sentiment

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Materials and Methods: Unveiling Emotions in Financial Markets - Harnessing NLP

ETF	Sector	Companies	Articles
XLE	Energy	Top 10 by holdings	8671
GDX	Gold miners	Top 10 by holdings	1514
XLB	Materials	Top 10 by holdings	25,526
DIA	Industrials	Top 10 by holdings	78,215
XLY	Consumer discretionary	Top 10 by holdings	129,685
XLP	Consumer staples	Top 10 by holdings	36,753
XLV	Health care	Top 10 by holdings	28,607
XLF	Financials	Top 10 by holdings	71,310
XLK	Technology	Top 10 by holdings	109,429
IYZ	Telecommunication	Top 10 by holdings	22,499
XLU	Utilities	Top 10 by holdings	2874
VNQ	Real estate	Top 10 by holdings	1890
			516,973 articles

This methodology not only offers a deeper understanding of market sentiment but also empowers investors to make more informed decisions and predict market trends. Through this approach, we've created a robust tool that blends traditional financial analysis with the emotional pulse of the market.

01 Data Collection

02 Data Cleaning and Preprocessing

03 Sentiment Analysis

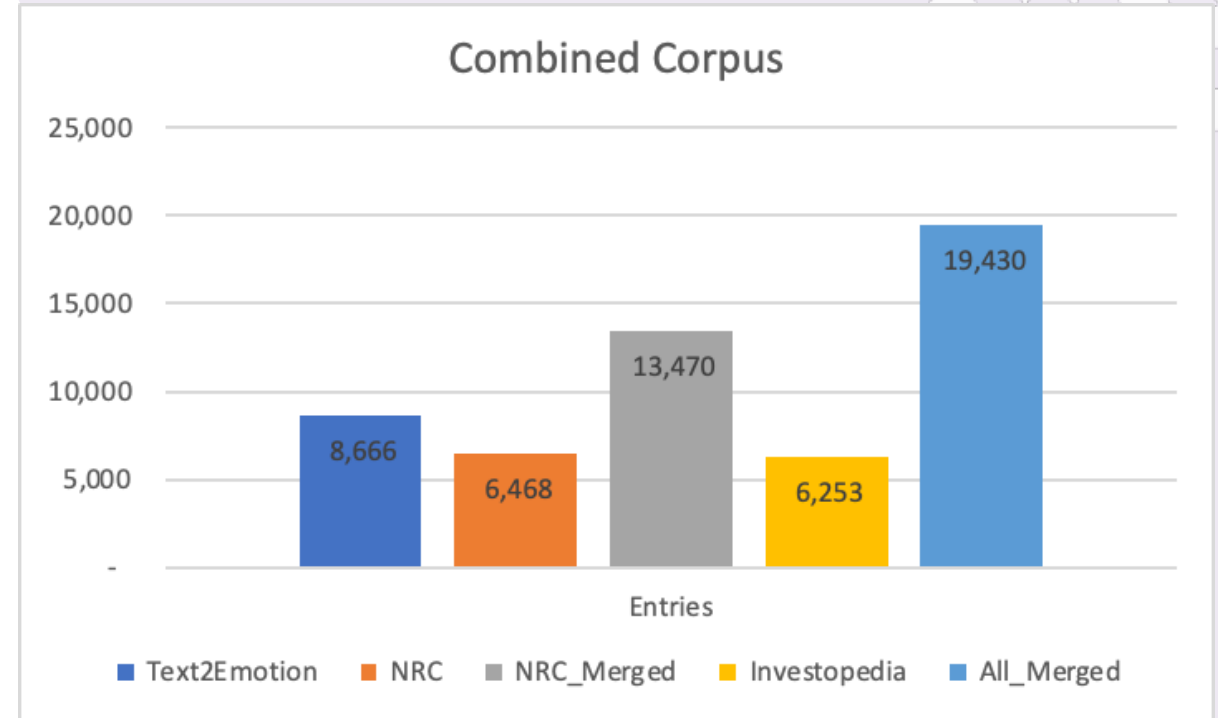**04** Correlation Analysis

05 Visualization and Interpretation

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Expanding Emotion Analysis: "Identifying New Emotions"

FINANCIAL PHRASES TEACHING MACHINES TO READ BETWEEN THE LINES: THE ROLE OF NLP IN DECODING FINANCIAL NEWS.

- The Text2Emotion corpus was expanded with the addition of the NRC dataset, increasing the understood vocabulary from 8,666 to 13,470 words and aligning them with Plutchik's emotions.

- In analyzing financial articles, the same emotion was deduced for 5,702 articles as compared to the original algorithm, while 551 articles **revealed different emotions.**

- The new algorithm also accounts for **mixed emotions** when two emotions represent over 50% of the emotional state.

- Several financial phrases were found to have **different emotional associations** with the improved algorithm. For example, twelve financial phrases associated with 'trust' instead of 'joy', three financial phrases associated with 'surprise' instead of 'joy', and one financial phrase associated with mixed emotions 'sadness' and 'fear' (despair) instead of 'joy'.

- The financial dictionary also contained phrases, necessitating an adjustment to the algorithm to **include partial key searches** and lookahead into the sentence for phrases.

Combined Corpus

Entries	Value
Text2Emotion	8,666
NRC	6,468
NRC_Merged	13,470
Investopedia	6,253
All_Merged	19,430

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Sector Analysis: "Emotional Trends in Different Sectors"

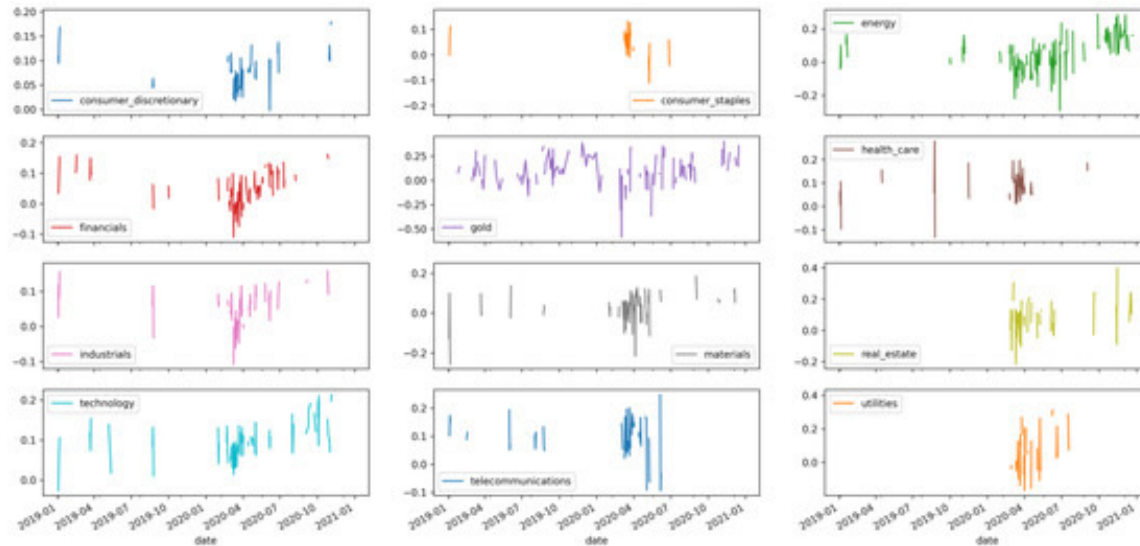## DIFFERENT SECTORS, DIFFERENT EMOTIONS: HOW EMOTIONAL TRENDS VARY ACROSS SECTORS.

Table 4. Correlation between sectors.

Sector	Correlation	Correlation	Correlation	Correlation	Correlation
Cons. disc.	1	0.55	0.61	0.58	0.56
Cons. stap.	0.55	1	0.5	0.38	0.44
Financials	0.61	0.5	1	0.63	0.56
Industrials	0.58	0.38	0.63	1	0.57
Technology	0.56	0.44	0.56	0.57	1
	Cons. disc.	Cons. stap.	Financials	Industrials	Technology

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Correlation Findings: "Emotion Sentiment and Market Movement"

IT'S ALL CONNECTED: HOW EMOTIONS REVEAL HIDDEN RELATIONSHIPS BETWEEN COMPANIES.

- A co-occurrence news graph was analyzed, showing correlations between companies in technology, consumer discretionary, consumer staples, and financial sectors.

- Notable **company pairs** across different sectors were identified, such as Target-Apple, Tesla-Apple, Amazon-Nvidia, Amazon-JP Morgan, etc.

- When considering significant **market events** of ±2% or greater, a moderate correlation (above 60%) was observed across sectors, aligning with the co-occurrence news network.

- Despite lower correlation when compared against daily market price alone, the pairs **Amazon-JPMorgan**, **Amazon-Citigroup**, **Boeing-Microsoft**, and **Boeing-Amazon** showed **moderate correlation** on significant market days.

- Over 60% of the market events confirmed this moderate correlation, indicating a more accurate and effective analysis of **market sentiment and investor behavior**, and suggesting improved financial risk management potential.
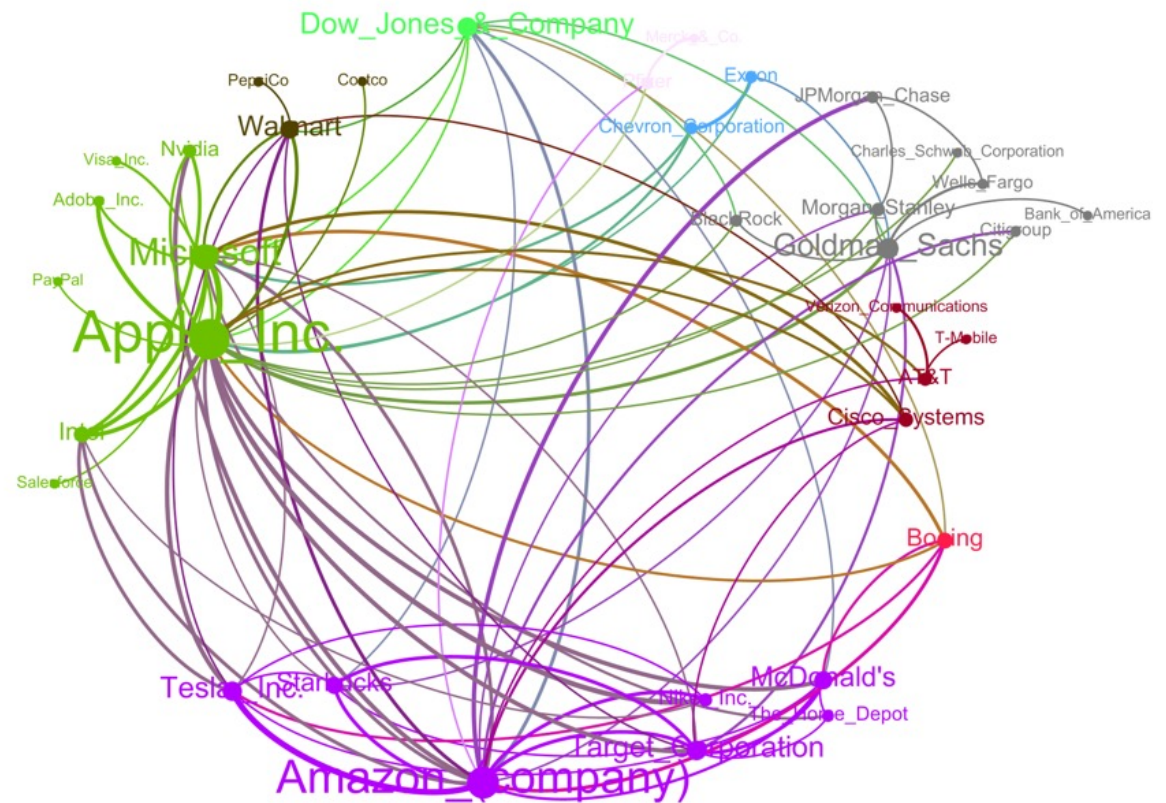
Emotionomics: Shaping the Future of Financial Risk Management

Investing with emotions: the surprising role of sentiment analysis in shaping investment strategies.

Our approach reveals connections between companies within and across sectors, and

Anticipate market trends based on the emotional pulse of financial news and move closer to a comprehensive understanding of macro forces and their impact on market events

Uncovering the Emotional Spectrum in Financial News

Predicting Market Movements with Emotional Co-occurrence Networks

Beyond Sentiment Analysis: 30 Distinct Emotions to Guide Investment Strategies

Emotion-driven Intelligence: A Game-Changer for Financial Risk Management

Harnessing the Power of Emotionomics for Precise Market Predictions

The Future of Financial Market Analysis and Prediction

Predicting the future with emotions: the surprising power of sentiment analysis in financial markets.

> In the complex landscape of financial markets, news sentiment stands as an important signal for driving better temporal predictions. Understanding the impact of financial news and investor sentiment is crucial; it not only helps us anticipate market movements but also allows us to manage risk more effectively.

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