

# Analysis of sentiment in the European Central Bank's social media activity during the Covid-19 pandemic and Ukraine War: A navigating crisis communication

*Análisis del sentimiento en la actividad del Banco Central Europeo en las redes sociales durante la pandemia del Covid-19 y la guerra de Ucrania: una comunicación de crisis navegante*

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### Abstract:

To assess and comprehend the communication strategy used by the European Central Bank (ECB) throughout the Covid-19 pandemic and war in Ukraine, this study considers the crisis communication tactics of the ECB. The study analyses 11,781 tweets from the ECB's official Twitter account using sentiment analysis to look at how the Bank interacts with the public and how it uses adaptive communication strategies in these challenging times. This research innovatively employs the AFINN and NRC sentiment analysis methods to evaluate the ECB's crisis communication. NRC's use of a comprehensive lexicon for emotional identification complements the pre-computed sentiment ratings of AFINN. The ECB's use of positive, clear communication built public trust and underlines sentiment analysis's utility in strategic crisis communication. The study's detailed investigation offers insights for improving crisis communication plans for better public engagement and economic stability.

### Keywords:

European Central Bank; crisis communication; sentiment analysis; social media engagement; public trust.

### Resumen:

*Para evaluar y comprender la estrategia de comunicación utilizada por el Banco Central Europeo (BCE) a lo largo de la pandemia del Covid-19 y la guerra en Ucrania, este estudio examina las tácticas de comunicación de crisis del BCE. El estudio analiza 11.781 tweets de la cuenta oficial de Twitter del BCE utilizando el análisis de sentimientos para observar cómo interactúa el Banco con el público y cómo utiliza estrategias de comunicación adaptativas en estos tiempos difíciles. Esta investigación emplea de forma innovadora los métodos de análisis de sentimientos AFINN y NRC para evaluar la comunicación de crisis del BCE. El uso por parte de NRC de un léxico exhaustivo para la identificación emocional complementa las calificaciones de sentimiento precalculadas de AFINN. El uso por el BCE de una comunicación positiva y clara generó confianza en el público y subraya la utilidad del análisis de sentimientos en la comunicación estratégica de crisis. La investigación detallada del estudio ofrece ideas para mejorar los planes de comunicación de crisis con el fin de mejorar la participación pública y la estabilidad económica.*

### Palabras clave:

*Banco Central Europeo; comunicación de crisis; análisis de sentimientos; participación en redes sociales; confianza pública.*

## 1. Introduction

As we live in the digital age, social media has become an integral part of our lives, drastically reshaping communication dynamics worldwide. Its influence is particularly felt in public communication, where institutions have had to adapt to this fast-paced, interactive communication landscape, particularly in crisis times (Bjola & Zaiotti, 2020). This paper seeks to examine the interplay between sentiment analysis in social media and the public communication of public institutions during crises.

Sentiment analysis, or opinion mining, utilizes computational linguistics, text analysis, and natural language processing to discern and extract subjective information from source materials (Lyu, et al., 2021). When applied to social media, sentiment analysis allows us to capture the pulse of public opinion instantaneously, giving us unprecedented insights into the concerns, fears, and hopes of people, especially during crises (Mee, et al., 2021). Public institutions have begun to realize the importance of effective communication during crises. Traditionally, these institutions would employ “one-way” communication strategies, where they would disseminate information without much scope for public feedback. However, social media has changed the game. The rise of digital diplomacy, characterized by open, dialogic communication with the public, is evident, enabling a more participative public sphere (Bjola & Zaiotti, 2020). This transformation has been particularly crucial in crisis communication, where public sentiment can significantly affect the course of crisis management efforts. Crisis communication refers to the exchange of information between the institution facing a crisis and the stakeholders who can affect or be affected by the crisis outcome (Baba & Nastase-Anysz, 2020). In this regard, social media has emerged as an effective tool for public institutions to manage crises. Through platforms like Twitter and Facebook, these institutions can not only disseminate vital information quickly but also gauge public sentiment towards the crisis and their management efforts (Arroyo Barrigüete, et al., 2022). Such feedback, which can be captured and analysed through sentiment analysis, can be invaluable in fine-tuning the institution’s crisis management strategies. Several scholars have explored different facets of this complex interplay between sentiment analysis, social media, and public communication during crises. However, there are still many aspects of this relationship that remain underexplored. This paper seeks to provide a comprehensive review of the existing literature in this domain, identify gaps in the current understanding, and propose directions for future research. It is essential to underscore that the digital landscape is rapidly evolving. Therefore, while this review strives to be comprehensive, it also recognizes the transient nature of its findings. As new platforms emerge and public institutions find innovative ways to communicate during crises, future research will need to adapt and evolve accordingly. This paper aims to deepen our understanding of how public institutions use social media for crisis communication, the role of sentiment analysis in capturing public opinion during crises, and how these insights can inform and improve crisis management strategies. The ongoing interplay between these elements in our increasingly connected world makes this an exciting and dynamic field of study.

Based on the above explanation and argument, there are still many undiscovered facets of the complex interaction between sentiment analysis, social media, and public communication during crises, even though multiple experts have looked at various aspects of it. Although there is an important volume of material discussing the topic, there is still a critical need to discover and fill in knowledge gaps. It is essential to perform an exhaustive evaluation and analysis of the available literature to increase our knowledge in this area. By doing this, we may identify the areas that need more research, illuminate previously unrecognized factors, and eventually advance our comprehension of the way sentiment analysis affects social media involvement and public discourse during crises. This analysis is crucial to developing efficient crisis communication strategies and ensuring prompt and suitable reactions to lessen the negative effects of crises on public perception and attitude.

## 2. Literature review

The digital age has revolutionised crisis communication, fundamentally changing the way information is disseminated and consumed. Social media platforms are now essential channels for government agencies to communicate their crisis management strategies and engage with the public. With immediate access and wide reach, these platforms facilitate real-time updates and foster a two-way dialogue between authorities and citizens. The use of digital communication tools facilitates transparency, speeds up the distribution of information and helps manage public perception during emergency situations.

Extending this digital narrative, the study by Drescher et al. (2023) examines Twitter communication during the early stages of the COVID-19 pandemic. The study shows that while German authorities maintained a more even-handed tone, independent experts favoured a more pessimistic tone, particularly during the more testing periods of the pandemic. This variation in tone illustrates the multiple perspectives and conflicting ideas in the midst of a crisis.

The literature shows the significant involvement of the European Union (EU) and its agencies in social media, which is a fundamental channel for public communication during crises. Müller (2022) highlights the importance of EU agencies in attracting public attention on social media. This is influenced by several factors, including the importance of the news, the longevity of the account and the level of interaction in the communication.

During the pandemic, European leaders showed emotion in their communication, but according to Arroyo Barrigüete et al. (2022), contrary to expectations, there was no significant difference in empathy shown by leaders from countries differently affected by COVID-19. Bunea & Nørbech (2022) analyse the European Commission's strategic communication, which focused on reinforcing its reputation as a responsible policymaker rather than responding to public demand.

Following this line of inquiry, Carvache-Franco et al. (2022) examine the language used on Twitter to discuss crisis and risk. Their findings show that these discussions often focus on key areas such as the economy, health and government, suggesting that social media plays a crucial role in shaping public perceptions and response strategies in times of crisis.

Furthermore, Nisch (2023) offers an analysis of President Zelensky's tweets during the invasion of Ukraine. His findings reveal a consistent positive sentiment and a call for unity and support, demonstrating the power of social media to foster solidarity in the face of adversity.

Hancu-Budui et al (2020) conducted a study on the use of social media by European audit institutions and found that their presence on these platforms effectively promotes public services. However, they also found a lack of strategy for online engagement, particularly in relation to environmental and sustainability messaging.

Building on this theme of digital engagement, MacKay et al. (2022) examined the use of Instagram by Canadian influencers during the pandemic. Their research suggests that while influencers did not make extensive use of Health Belief Model constructs, their posts still managed to generate varying levels of public interaction, demonstrating the nuances of influencer impact during health crises.

Sentiment analysis has been widely used to study public discourse during crises. Lyu et al. (2021) and Monselise et al. (2021) conducted sentiment analysis on discussions related to COVID-19 vaccination, highlighting the public's concerns and changing attitudes towards vaccination. The results showed that there was a general increase in positive sentiment over time,

with trust being the primary emotion. Mee et al. (2021) conducted a sentiment analysis of Brexit discourse among UK MPs, revealing discreet differences in language use across the political spectrum. Kovács et al. (2021) used sentiment analysis to examine public reactions on Twitter to the murder of Ján Kuciak, demonstrating how social media can reveal patterns in public sentiment that correspond to political events and narratives. Vrana et al. (2023) conducted an analysis of EU citizens' Twitter discussions during the energy crisis of 2022-23. They found that fear and sadness predominated, indicating mostly negative sentiments that remained consistent across languages.

By way of comparison, Maghyereh and Abdoh (2022) examined how sentiment affected asset volatility during the financial crisis and the COVID-19 pandemic. Their findings highlight the influential role of public sentiment in financial markets, affecting different types of assets in different ways during times of crisis.

Similarly, Vrana et al. (2023) analysed sentiment in Twitter conversations among EU citizens during the 2022-23 energy crisis. Their work shows a dominant tone of fear and sadness, reflecting widespread public concern about energy prices and political developments, regardless of language barriers.

Comparative studies such as Heidenreich et al. (2020) provide insights into migration discourse on social media, demonstrating the frequent and negative expression of migration issues by political factions on both the extreme left and right. Traber et al. (2020) examine the speeches of prime ministers during economic crises and find an increased shift of blame to external actors when domestic unemployment rises. Tasente (2023) examines the online communication methods used by world leaders during the Ukraine crisis, highlighting the importance of a wide range of communication strategies in effectively engaging global audiences.

The online reputation of global organisations, particularly the EU during the refugee crisis, is analysed by Bjola and Zaiotti (2020), who suggest the need for proactive online reputation management in crisis situations. Yoon and Chung (2020) conducted an evaluation of the European Union's public diplomacy campaigns in Asia by analysing sentiment and semantic networks. Their study found that the EU's social media content was ineffective in generating public engagement, suggesting the need for a more targeted narrative development strategy.

Nastase-Anysz and Baba's (2020) research highlights the response of the public sector during crises and promotes the implementation of relationship marketing principles to strengthen crisis response and communication. In the field of public health, Ali (2021) explores the function of sentiment analysis, particularly in the context of online learning during COVID-19, and proposes methodologies that can help public health officials manage crises.

There is a clear gap in the current literature regarding the implementation of relationship marketing principles for crisis management and communication in the public sector. While there are studies, such as Nastase-Anysz & Baba (2020), that touch on this topic, a more thorough investigation is needed to understand how these principles can be used effectively during crises.

Therefore, social media sentiment analysis is an important asset for understanding and managing public discussions in critical situations. The literature confirms that social media play an important role in the crisis communication of public institutions. However, there is a need for strategic approaches that incorporate relationship marketing principles to improve the effectiveness of crisis communication.

### 3. Research method

To conduct our research, we employed a data centralization approach using the platform Fanpagekarma.com. We extracted a total of 11,781 posts from the official Twitter page of the European Central Bank, spanning from October 28, 2013, to June 2, 2023. Additionally, to identify potential differences in communication strategies, we divided the dataset into three periods:

- Period 1: October 28, 2013, to March 10, 2020: This period can be characterized as one without major geopolitical incidents.
- Period 2: March 11, 2020, to February 23, 2022: This period was marked by the crisis caused by the Covid-19 pandemic.
- Period 3: February 24, 2022, to June 6, 2023: This period was characterized by the crisis generated by the invasion of the Russian army in Ukraine and the ongoing war between the two belligerent parties.

For the analysis of sentiment in online discourse, we utilized RStudio along with the following packages: *tm*, *SentimentAnalysis* and *syuzhet*. We conducted a discourse analysis using two distinct methods: the AFINN method and the NRC method.

When assessing the attitude expressed in the European Central Bank's (ECB) announcement, the usage of the AFINN method and the NRC approach has various advantages and is extremely helpful. First off, the AFINN approach offers a quantitative evaluation of sentiment through its pre-computed sentiment scores, enabling a quick and simple study of the ECB's conversation (Lennox et al., 2020). With the use of this technique, researchers can recognize and follow changes in mood over time, giving them important insights into how well the ECB's communication tactics performed throughout the Covid-19 pandemic and Ukraine war. The NRC technique, on the other hand, enables a more detailed analysis by collecting particular sentiments and emotions expressed in the ECB's tweets thanks to its extensive lexicon (Ali, 2021). Researchers can determine the underlying emotions driving the ECB's communication during crises thanks to this method's qualitative knowledge of the feelings stated. The study provides a greater knowledge of the ECB's adaptable communication strategies as well as the effects of particular emotional appeals on public involvement and trust by utilizing the NRC approach. The combination of the AFINN method and the NRC approach provides a thorough and in-depth analysis of sentiment in ECB communication. This combination offers insights into public opinion and response and enables a more detailed assessment of the efficiency of the ECB's crisis communication initiatives. The application of these two techniques improves the sentiment analysis' overall accuracy and dependability, allowing researchers to reach solid findings and influence how the ECB and other institutions dealing with similar crises would communicate in the future.

**AFINN Method:** The AFINN method is a widely used lexicon-based approach for sentiment analysis. It assigns a pre-defined sentiment score to each word in a text based on its emotional connotation. The AFINN lexicon consists of a list of words, each associated with a sentiment score ranging from -5 to +5, where negative scores indicate negative sentiment, and positive scores indicate positive sentiment. In our research, we applied the AFINN method using the *SentimentAnalysis* package in RStudio. The package calculates the sentiment score for each post by summing up the individual sentiment scores of the words present in the post. The resulting sentiment scores can be categorized as positive, negative, or neutral based on a predefined threshold.

**NRC Method:** The NRC (National Research Council) method is another lexicon-based approach for sentiment analysis. It focuses on the identification of emotions and sentiment expressed in text. The NRC lexicon consists of a comprehensive set of words associated with specific emotion categories, such as joy, anger, fear, sadness, and more.

To implement the NRC method, we utilized the *syuzhet* package in RStudio. The package allows us to identify the dominant emotion category for each post by matching the words in the text with the emotion categories in the NRC lexicon. By counting the occurrences of words associated with each emotion category, we obtain a quantitative representation of the emotional content of the posts.

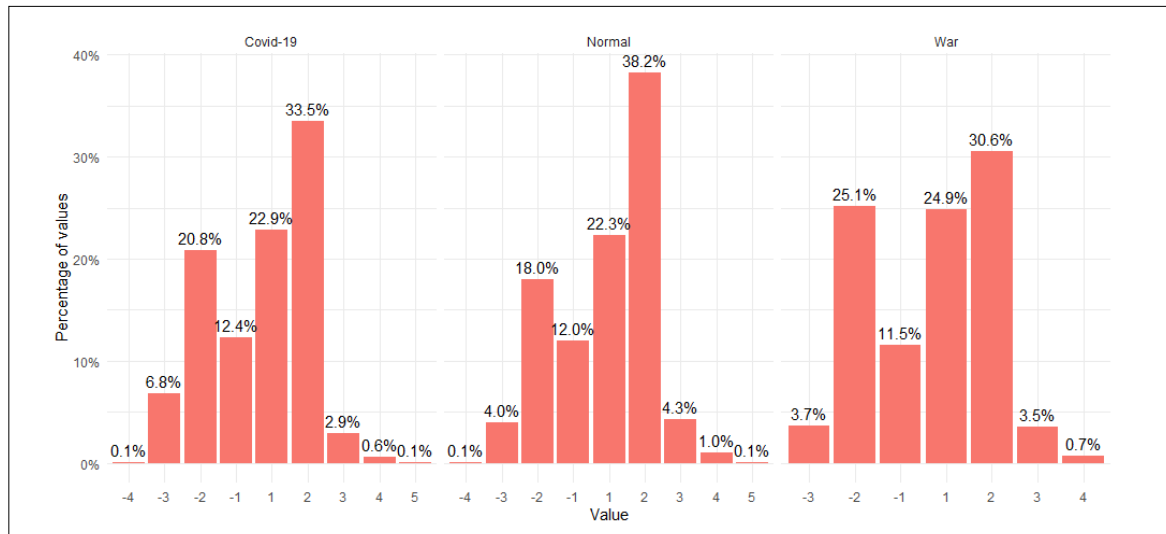
By applying both the AFINN and NRC methods, we aimed to gain a comprehensive understanding of the sentiment and emotional characteristics of the Twitter posts from the European Central Bank during the specified time periods. These methods provide valuable insights into the evolving communication strategies and public sentiment in response to different geopolitical events and crises.

## 4. Results

### 4.1. Sentiment Analysis

The European Central Bank's (ECB) public discourse has always been a crucial determinant of market sentiment and economic trends. The ECB has been utilizing Twitter as a key tool to disseminate its policy messages and decisions. This report provides a comprehensive analysis of the ECB's public discourse on Twitter from October 28, 2013, to March 10, 2020, using the AFINN method, which evaluates emotions on a scale from -5 to +5, with -5 representing strongly negative words and +5 representing strongly positive words.

**Figure 1. AFINN sentiment analysis**



Source: own elaboration

During the analysed period, the ECB's Twitter messages were primarily comprised of words with positive connotations, accounting for 65.9% of the discourse. This positive tone was distributed as follows: +1 = 22.3%, +2 = 38.2%, +3 = 4.3%, +4 = 1%, and +5 = 0.1%. Conversely, the negative component constituted 34.1% of the discourse, with -1 = 12%, -2 = 18%, -3 = 4%, and -4 = 0.1%.

This data suggest that the ECB used a predominantly positive vocabulary, perhaps to inspire confidence, stability, and optimism, critical elements in central banking communication. The high percentage of moderately positive words (+2) might be linked to messages reassuring markets about the adequacy of monetary policy measures, the robustness of the Eurozone economy, or the soundness of financial institutions.

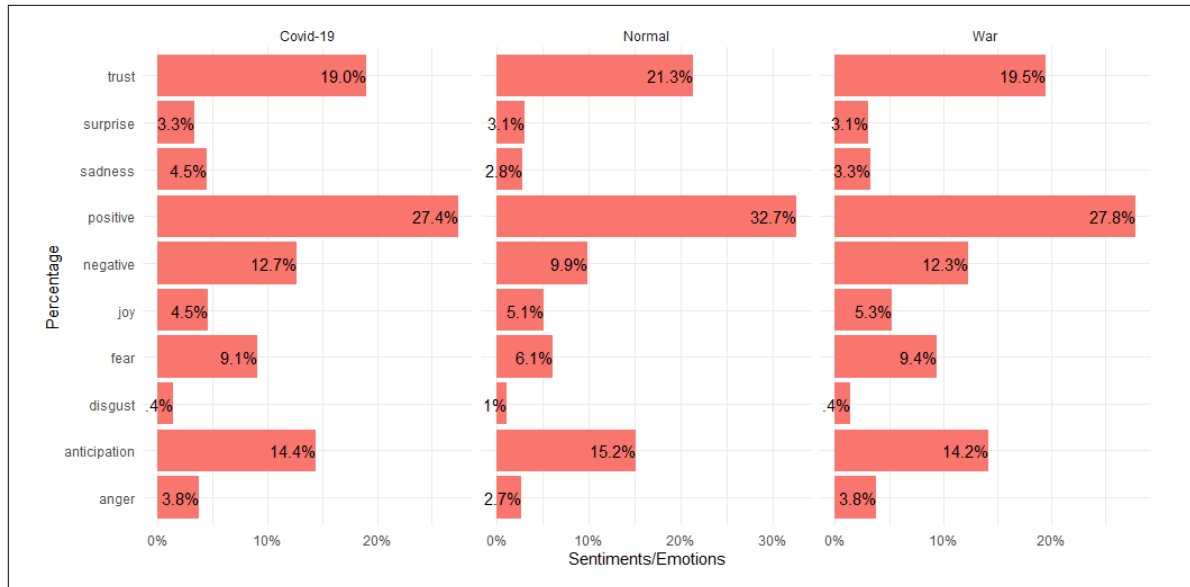
During the COVID-19 period, a notable shift occurred. The ECB's discourse skewed towards positive words at 60% (+1 = 22.9%, +2 = 33.5%, +3 = 2.9%, +4 = 0.6%, +5 = 0.1%), while negative words increased to 40% (-1 = 12.4%, -2 = 20.8%, -3 = 6.8%, -4 = 0.1%). This shift could reflect the ECB's response to the pandemic-induced economic crisis. The increase in negative words may correspond to references to economic risks, uncertainties, or downturns. Meanwhile, the maintained positivity could represent efforts to reassure markets and citizens, emphasizing the ECB's commitment to utilizing its toolkit to mitigate the pandemic's economic impact.

In the Ukrainian war period, the ECB's communication slightly readjusted, focusing on positive words by 59.7% (+1 = 24.9%, +2 = 30.6%, +3 = 3.5%, +4 = 0.7%), and negative words by 40.3% (-1 = 11.5%, -2 = 25.1%, -3 = 3.7%). This adjustment suggests that while the ECB acknowledged geopolitical and economic risks (-2 words), it also continually stressed resilience, stability, and effective policy response (+1 and +2 words).

In conclusion, the ECB's Twitter discourse exhibits a predominantly positive tone across different periods, possibly reflecting a strategic communication to foster confidence and optimism amid uncertainty. Despite the variations during crisis periods, a resilient positive tone is maintained, suggesting a commitment to reassure markets about the ECB's ability to respond effectively to crises.

This discourse analysis is invaluable for understanding the ECB's communication strategy and market sentiment trends. The AFINN method's emotional scoring offers insights into the ECB's tone during different periods, providing a window into the central bank's communication efforts and potentially forecasting economic policy direction. It demonstrates how central banks can leverage social media platforms for effective communication and public engagement, essential in today's digitized world.



**Figure 2. NRC sentiment analysis**

Source: own elaboration

Analysing the sentiment of a public institution's discourse, particularly on social media platforms such as Twitter, can provide deep insights into its communication strategy and its engagement with its stakeholders. The discourse of the European Central Bank (ECB) from October 28, 2013, to March 10, 2022, as analysed using the NRC sentiment analysis method, provides an illustrative example of how sentiment analysis can be used to examine an institution's communication strategy during various periods, including the Covid-19 pandemic and the war in Ukraine.

The overall sentiment of the ECB's discourse over the specified period, as deduced from the data provided, appears to be largely positive. The ECB used words generating positive sentiment in 32.7% of its discourse, while words generating negative sentiment only made up 9.9% of its discourse. This preponderance of positive sentiment words suggests a communication strategy focused on maintaining an optimistic tone, possibly to build trust, encourage confidence, and instil a sense of stability among its stakeholders. This strategy aligns with the ECB's role as a leading financial institution responsible for maintaining financial stability in the Eurozone.

When it comes to the emotions generated by the words used in the ECB's discourse, the majority of the words generated feelings of trust (21.3%) and anticipation (15.2%). This suggests a strategic effort on the part of the ECB to build credibility among its stakeholders and create an expectation of positive outcomes. Furthermore, the presence of fear (6.1%), while not dominating, suggests the ECB's awareness of potential threats and challenges. The use of such words may reflect the ECB's efforts to communicate the severity of certain situations and the importance of the measures taken in response.

During the Covid-19 period, there was a slight decrease in the proportion of positive sentiment words (27.4%) and an increase in the proportion of negative sentiment words (12.7%) in the ECB's discourse. This could be a reflection of the severe challenges posed by the pandemic, with the negative sentiments likely reflecting the economic uncertainties and disruptions caused by the pandemic. However, the fact that positive sentiment words still outweighed negative sentiment words indicates the ECB's ongoing commitment to maintaining an overall positive tone in its communication.

Emotions generated during this period showed a decrease in trust and anticipation, but an increase in fear. This likely mirrors the anxiety and uncertainties prevalent during the pandemic. Interestingly, the proportion of sadness (4.5%) equalled that of joy, possibly reflecting the dichotomy of the period - on one hand, the sadness stemming from the loss and disruption caused by the pandemic, and on the other, the joy possibly related to solidarity, resilience, and hope for recovery.

During Ukraine war period, the proportion of positive sentiment words in the ECB's discourse slightly increased to 27.8%, while negative sentiment words increased marginally to 12.3%. The slight increase in positive sentiment words may represent an attempt by the ECB to maintain positivity and stability in the face of a new crisis.

In terms of emotions, trust remained the most generated emotion, albeit at a slightly higher level than during the Covid-19 period. This could suggest that, despite the new crisis, the ECB remained committed to maintaining trust with its stakeholders. Fear, however, decreased significantly to 3.3%, while joy increased to 5.3%. This could indicate that despite the ongoing crisis, the ECB was projecting a reduced sense of fear and promoting more positivity in its communication.

Thus, the sentiment analysis of the ECB's Twitter discourse shows how the institution adapted its communication strategy to different periods, reflecting the prevailing circumstances and its role as a stabilizing force in the European financial system. Despite the crises, the ECB maintained an overall positive sentiment in its discourse, perhaps aiming to inspire confidence, trust, and stability among its stakeholders. This analysis highlights the potential of sentiment analysis as a tool for understanding public institutions' communication strategies and their attempts to engage with their stakeholders.

#### 4.2. Topics analysis

**Period 1:** The present investigation examines the public communication of the European Central Bank (ECB) via its Twitter account during the period from October 28, 2013 to March 10, 2020, a time that can be characterized by an absence of major geopolitical disturbances. This analysis identified several thematic focuses from the bank's tweets during this time.

- 1. Cryptocurrencies and Digital Currencies:** Several tweets focus on cryptocurrencies like Bitcoin, pointing out their volatile and speculative nature. They also acknowledge the potential for a central bank digital currency. The ECB emphasizes a need for stable coins and a balance between privacy and anti-money laundering measures in any potential central bank digital currency.
- 2. Leadership Transition:** The change of leadership from Mario Draghi to Christine Lagarde as ECB President is covered. Both leaders express their views on monetary and fiscal policy and the role of the ECB in various contexts. For instance, Lagarde emphasizes climate change, while Draghi focuses on issues like the impact of negative interest rates on the pension industry.

3. **Monetary Policy and Financial Stability:** The tweets consistently mention the ECB's monetary policy decisions, with changes in interest rates and the asset purchase program. Draghi specifically discusses the importance of fiscal policy and the need for certain countries to implement reforms for sustainable growth.
4. **The Euro:** Several tweets refer to the strength and popularity of the euro, with Draghi affirming its irreversibility. The ECB also celebrates the euro's 20th anniversary and releases new euro banknotes.
5. **Engagement with Public:** The ECB actively encourages public interaction, inviting questions and thoughts via hashtags and sharing ECB-related humour. The #ECBYouthDialogue and #ECBListens portals are mentioned as platforms for dialogue.
6. **Climate Change:** Lagarde highlights the role of central banks in fighting climate change, endorsing the EU Green Deal, and addressing environmental sustainability's role in price stability.
7. **Banking Supervision and Regulation:** The ECB confirms maintaining the Emergency Liquidity Assistance to Greek banks and addresses the need to complete the banking union. It also welcomes Andrea Enria as the new Chair of the ECB Supervisory Board.
8. **Outreach and Communication:** The ECB shares behind-the-scenes glimpses, live links to press conferences, and interactive events like competitions. It also acknowledges technical issues with their Twitter account and celebrates reaching certain follower milestones.

**Period 2:** The period spanning from March 11, 2020, to February 23, 2022, was a time of profound challenges, changes, and adaptations, triggered primarily by the COVID-19 pandemic. This paper aims to analyse how the European Central Bank (ECB) communicated these developments on its Twitter channel during this period. The study focuses on a series of key topics addressed by the ECB, which reveal the bank's strategy and response to the crisis, as well as its vision for the future.

1. **Pandemic Response & Monetary Policy:** The ECB has been taking comprehensive measures in response to the economic fallout from the COVID-19 pandemic, including the €750 billion Pandemic Emergency Purchase Programme (PEPP) and the provision of temporary collateral easing measures. These initiatives aim to ensure liquidity and stability in the financial markets and to support the euro area economies. The bank has also implemented negative interest rates as a tool to stimulate lending and boost the economy. These policies are explained and defended by President Lagarde in various posts, in response to criticism and questions from the public.
2. **Digital Euro & Cryptocurrency:** The ECB has embarked on a project to explore the potential of a digital euro. The discussions and updates regarding this topic suggest that the bank sees potential benefits in a digital currency, such as universal acceptance and a risk-free means of payment. The bank also notes that a digital euro would complement physical cash rather than replace it. The ECB also discusses cryptocurrencies like Bitcoin, but with a degree of caution, highlighting their potential risks.

- 3. Sustainable Finance & Climate Change:** The ECB shows a significant commitment to addressing climate change and promoting sustainable finance, as shown by the establishment of a climate change center and the acceptance of sustainability-linked bonds as collateral. The bank also shows its commitment to a carbon-neutral economy and proposes the creation of a green capital markets union.
- 4. Inclusion & Diversity:** Several posts highlight the ECB's commitment to fostering diversity and inclusion within its own ranks and in the broader economic field. Examples include setting gender targets, empowering women in economics and leadership positions, and announcing a Women in Economics Scholarship.
- 5. Euro Area Expansion & Collaboration:** The ECB shares updates about Bulgaria and Croatia's progress towards adopting the euro and joining the banking union, reflecting the ongoing integration and expansion of the euro area. The ECB also actively participates in international conferences, engaging in discussions with other central bank leaders.
- 6. Public Engagement & Transparency:** The ECB shows a commitment to engaging with the public and being transparent about its policies and strategies. This is reflected in posts like the #ECBListens event, live press conferences and panel discussions, Q&A sessions with board members, and President Lagarde's participation in online events and Twitter.
- 7. The Future of the Euro:** The ECB marks the 20th anniversary of the euro and emphasizes its importance in European identity and culture. At the same time, the bank explores new technologies and developments, such as digital currencies, that could shape the future of the euro.

**Period 3:** The period stretching from February 24, 2022, to June 6, 2023, was deeply marked by geopolitical tensions, in particular the crisis caused by the Russian invasion of Ukraine and the ensuing war between the two parties. This paper seeks to analyse the discourse of the European Central Bank (ECB) as reflected in its Twitter posts during this turbulent era. Eight central themes were identified in the ECB's posts, each reflecting the bank's response to the crisis, as well as broader trends in its policies and communication strategies.

- 1. Inflation and Interest Rates:** Numerous tweets highlight the ECB's commitment to returning inflation to its target of 2%. This includes tweets on Valentine's Day and in multiple other instances, indicating ECB's decision to raise interest rates to tame inflation. ECB President Christine Lagarde emphasizes on multiple occasions the importance of combating inflation and delivering price stability. There are also updates on monetary policy decisions, including interest rate hikes and the intention to continue raising rates until inflation returns to its 2% target. Furthermore, the ECB holds discussions with civil society representatives to address concerns about inflation and explain the actions being taken to combat it.
- 2. Cryptoassets and Digital Euro:** ECB's tweets show a keen interest in the crypto industry and a potential digital euro. There's mention of Bitcoin's stabilization and the need for regulation and taxation in the crypto industry, treating unbacked digital asset trading as gambling activities. The possibility of introducing a digital euro to protect people's freedom to pay is also considered. Concerns are expressed regarding the riskiness of crypto-assets and their potential impact on financial stability. Updates are provided on the progress and development of the potential digital euro.

3. **Women's Equity:** On Valentine's Day and International Women's Day, the ECB emphasizes the need for equity in supporting women's success and calls for embracing equity by providing women with the necessary support.
4. **Climate Change:** The ECB adopts coordinated measures to incorporate climate change considerations in corporate bond purchases, collateral framework, disclosure requirements, and risk management. ECB officials, including President Christine Lagarde, speak about addressing climate change in monetary policy operations.
5. **Euro Area and EU Membership:** The ECB welcomes Croatia as its 20th member of the euro area. Also, it highlights strong support for the euro among the population and the importance of keeping central bank money at the heart of the financial system.
6. **Financial Stability and Banking Sector:** ECB President Christine Lagarde underscores the resilience of the euro area banking sector and the ECB's ability to provide liquidity support when needed. Central bank action is coordinated to enhance the provision of US dollar liquidity.
7. **Brexit:** The ECB discusses the impact of Brexit on the UK economy, focusing on the negative effects on labour supply and trade.
8. **Annual Accounts and Economic Growth:** The ECB announces its annual accounts, highlighting the growth of its balance sheet and the impact of rising interest rates. It also presents economic growth outlooks for the euro area and discusses inflation trends and projections.

## 5. Discussion

Between 2013 and early 2020, the European Central Bank (ECB) seemed to welcome the growing impact of digitalisation on monetary policy and financial stability. This was underlined by its research into digital currencies. This period was also marked by a smooth leadership transition and the launch of the digital euro initiative. This development reflects the impact of the digital age on crisis communication strategies, as government agencies increasingly use social media to disseminate valuable information and promote public engagement. This phenomenon has also been identified by Müller (2022). The ECB's involvement in these areas illustrates a broader institutional appreciation of social media as an important channel for policy communication and public debate.

In the second period, from March 2020 to February 2022, the ECB shifted its focus in response to the unforeseen demands of the COVID-19 pandemic. The themes of sustainable finance and digital currency become more prominent, in line with the ECB's commitment to inclusivity and adaptability in times of global economic disruption. The Bank's strategic communication during this period is consistent with the findings of Arroyo Barrigüete et al. (20-22), who analysed the emotional content of European leaders' communication. Their findings suggest that although the pandemic evoked an emotional response, the level of empathy conveyed did not have a direct correlation with the severity of the impact of the pandemic.

The third period, spanning February 2022 to June 2023, is underscored by the ECB's communication amidst the geopolitical tensions triggered by the crisis in Ukraine. Here, the ECB's strategic communication efforts, which were geared towards

addressing inflationary pressures and ensuring financial stability, appear to align with Tasente's (2023) insights on the various communication strategies deployed during geopolitical disturbances. The ECB's consistent emphasis on digital currencies and sustainable finance during this tumultuous period further suggests an institution attempting to maintain a trajectory of modernization and responsiveness amid a landscape of profound uncertainty.

Throughout these intervals, the ECB's utilization of Twitter to maintain a predominantly positive communicative stance, even in the face of crises, exemplifies the central bank's understanding of the critical role that sentiment plays in public perception and confidence. This approach mirrors academic findings on sentiment analysis, such as those by Lyu et al. (2021), which underscore the importance of tone in shaping public discourse during crises.

Moreover, the ECB's strategic communication tactics, as derived from sentiment and thematic analysis, offer a nuanced reflection of the evolving landscape of crisis communication in the digital age. The ECB's efforts are emblematic of an institution that not only adapts to changing circumstances but does so in a sophisticated dialogue with the public, balancing its operational transparency with the strategic imperatives of relationship marketing. In doing so, the ECB's communication activities are in line with the academic discourse that emphasises the need for strategic, empathetic and adaptive communication to manage public sentiment and maintain economic stability in times of crisis.

## 6. Conclusions

A study of the European Central Bank's (ECB) Twitter activity over almost a decade illustrates the importance of lexical accuracy and sentiment in managing public debate on sensitive economic issues. As an institution responsible for Europe's monetary policy, fiscal rules and inflation, the consequences of its communicative preferences go beyond the dissemination of information and affect economic perceptions and balances.

The data show that the ECB is adept at managing market sentiment, which has a significant impact on public opinion and market dynamics. The institution adopts a positive tone in its communication, which is a deliberate strategy to ensure public confidence and market stability. The consistent optimism is part of a broader strategic objective to instil confidence in the institution's ability to manage changing economic conditions.

However, the research also acknowledges the ECB's ability to adjust its tone in response to the severity of the economic turmoil. There is a marked increase in the use of cautious and serious language in times of crisis, suggesting a measured strategy that balances optimism with the hard facts of economic hardship.

The ECB's precision in addressing complex economic issues deserves recognition. The institution's discourse is characterised by clarity and purpose, which is evident in all its communications. Such meticulousness serves to clarify policy choices, manage public expectations and strengthen confidence in the ECB's policy orientations.

Moreover, an analysis of the topics addressed in the ECB's tweets reveals a strategic alignment with the ever-changing economic scenarios. This adaptability in the ECB's narrative strategy highlights its ability to respond effectively to emerging challenges while remaining relevant to its audience.

The ECB's commendable approach to public engagement, as evidenced by its enthusiasm for open dialogue, sets a benchmark for others to follow. This interactive approach not only strengthens the link between policymakers and the public, but also demonstrates the institution's commitment to transparency and accountability. Its implementation can serve as a benchmark for similar institutions grappling with the complexities of communication in today's digital age.

In conclusion, the analysis of the ECB's Twitter discourse highlights the importance of word choice and sentiment in the public communication of a European institution dealing with sensitive economic issues. It underlines the need to maintain a positive tone in order to inspire confidence and optimism, while reflecting the reality of economic conditions during crises.

The study illustrates the importance of clear, deliberate communication on complex economic issues and the value of adaptability, public engagement, and transparency in institutional communication strategies. The ECB's approach to communication provides valuable lessons for other public institutions and contributes to a broader understanding of the role of sentiment analysis in evaluating and guiding institutional communication strategies. The findings offer a solid foundation for further research into the impact of communication strategies on market sentiment and economic stability.

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## 8. Specific contributions of each author

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Data collection and analysis	Tănase Tasente
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## 9. Conflict of interest

The authors declare that there is no conflict of interest contained in this article.

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