
A MATTER OF MINUTES: THE UNEXPECTED SENTIMENT IN FOMC
MEETINGS AND ITS IMPACT ON FED CREDIBILITY

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Abstract

The Federal Reserve (Fed) currently publishes the minutes of each Federal Open Market Committee (FOMC) meeting three weeks after the release of the policy statement, which announces the monetary decision. While the statements outline the reasoning behind policy choices and provide guidance on future monetary policy, the meeting minutes offer detailed insights into the Committee members' views on the economic outlook and policy stance. Following a lexicon-based approach, I first extract the sentiment contained in both documents, where higher (lower) values represent a more hawkish (dovish) stance. Next, I derive an unexpected sentiment component present in the FOMC meetings by orthogonalizing the minutes' sentiment with respect to macroeconomic and financial data, the sentiment of the previous meeting, and the sentiment of the corresponding policy statement. I define this unanticipated component as the Fed's "abnormal" sentiment. By carrying unpriced information, I find that this abnormal sentiment significantly impacts financial markets, reducing daily stock market returns (S&P500) and increasing daily market volatility (VIX) when more hawkish than anticipated. Subsequently, I examine a state-dependent relationship between the Fed's abnormal sentiment and its ability to anchor long-term inflation expectations around a 2% target, conceptualized as its credibility. Specifically, I find that during times of rising medium-term inflation expectations, a hawkish sentiment surprise from the minutes undermines Fed credibility, but enhances it when medium-term expectations are below the target. These findings provide new insights into the effects of FOMC minutes on market expectations and central bank credibility, suggesting that potential revisions in the Fed's communication strategies may be required.

JEL codes: E31, E52, E58, G14

Keywords: FOMC, Meeting minutes, Central bank communication, Sentiment analysis, Central bank credibility

Resumo

Atualmente, a Reserva Federal Americana (Fed) publica as minutas de cada reunião do Federal Open Market Committee (FOMC) três semanas após a divulgação da declaração de política, que anuncia a decisão monetária. Enquanto que as declarações descrevem o raciocínio por trás das decisões de política e fornecem orientações sobre a futura política monetária, as minutas das reuniões oferecem informação detalhada sobre as perspectivas económicas dos participantes e a orientação de política monetária. Através de uma abordagem de dicionário, primeiro identifiquei o sentimento contido em ambos os documentos, onde valores mais altos (baixos) representam uma inclinação mais hawkish (dovish). Em seguida, obtenho uma componente de sentimento inesperado presente nas reuniões do FOMC ao ortogonalizar o sentimento das minutas em relação a dados financeiros e macroeconómicos, o sentimento da reunião anterior e o sentimento da declaração de política correspondente. Eu defino esta componente imprevisível como o sentimento “anormal” da Fed. Por conter informações não precificadas, descubro que este sentimento anormal afeta significativamente os mercados financeiros, reduzindo os retornos diários mercado de ações (S&P500) e aumentando a volatilidade diária do mercado (VIX) quando mais hawkish do que o previsto. Posteriormente, examino uma relação dependente do estado entre o sentimento anormal da Fed e sua capacidade de ancorar as expectativas de inflação de longo prazo em torno de uma meta de 2%, conceptualizado como a sua credibilidade. Especificamente, durante períodos de aumento das expectativas de inflação de médio prazo, uma surpresa de sentimento hawkish nas minutas diminui a credibilidade da Fed, mas aumenta quando as expectativas de médio prazo estão abaixo da meta. Estas descobertas fornecem novas evidências sobre os efeitos das minutas do FOMC nas expectativas dos mercados e na credibilidade do banco central, sugerindo que possíveis revisões nas estratégias de comunicação do Fed podem ser necessárias.

Códigos JEL: E31, E52, E58, G14

Palavras-chave: FOMC, Minutas das reuniões, Comunicação de Banco Central, Análise de sentimento, Credibilidade de Banco Central

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List of Abbreviations

CPI: Consumer Price Index

ECB: European Central Bank

FOMC: Federal Open Market Committee

Fed: Federal Reserve

GDP: Gross Domestic Product

NLP: Natural Language Processing

OLS: Ordinary Least Squares

TIPS: Treasury inflation-protected securities

TVP: Time-varying parameter

U.S.: United States

VAR: Vector Autoregressive

ZLB: Zero Lower Bound

“I think we now understand better how little we understand... about inflation.”

Jerome Powell

[laughs] “That’s not very reassuring.”

Moderator

“No, honestly, this was unpredicted.”

Jerome Powell

ECB Forum on Central Banking – June 29, 2022. Sintra, Portugal.

1. Introduction

Central bank communication is widely recognized as a key monetary policy tool to manage economic expectations. Like many central banks, the Federal Reserve (Fed) has adopted greater transparency to convey its monetary policy stance and economic outlook, particularly by publishing policy statements after every Federal Open Market Committee (FOMC) meeting, and the minutes of the meeting three weeks later. The effectiveness of policy communication in guiding expectations hinges, however, on a critical yet often unchallenged assumption: the credibility of a central bank. Recently, the Fed's ability to effectively manage inflation has come under renewed scrutiny, after Chair Jerome Powell was compelled to abandon the transitory inflation signal in 2021 due to the rapid and sustained increase in price levels. Since words only carry significance when voiced by credible speakers, the Fed is naturally concerned with clear and consistent communication to prevent misinterpretations of monetary policy. But while the policy statements provide a carefully crafted and direct insight into the Fed's monetary stance, the minutes of each FOMC meeting capture the full range of deliberations and assessments made by the members of the Committee. This added information can be both unexpected and divergent from the initial statement, raising an important and so far, unexplored research question: does an unexpected sentiment component in the FOMC meeting minutes influence the Fed's credibility?

In central banking, credibility is generally understood as the trust that the public places in a central bank's commitment and overall ability to achieve its policy objectives. The Fed currently pursues a dual mandate for monetary policy – promoting sustainable maximum employment and low and stable prices. Specifically, it has stated an inflation rate of 2% over the longer run that it considers most consistent with its objectives. Therefore, a typical gauge of Fed credibility in the literature consists of how well-anchored long-term inflation expectations are to the specified target, unaffected by past inflation rates or by transitory economic developments (e.g., Strohsal et al., 2016; Levieuge et al., 2018). While researchers have developed methods to measure central bank credibility through the lens of their inflation-fighting ability, no studies have yet explored the impact that the deliberations made by the members of the Committee, as captured by the FOMC minutes, can have on the Fed's perceived credibility. This is a notable gap in the literature considering the inevitable role that policy communication, particularly through the views of different members, plays in shaping public perception of a central bank.

Following this increased emphasis central banks have placed on public communication (e.g., via press conferences, speeches, or economic forecasts), numerous studies have focused on these different communication tools to extract underlying sentiment measures, a technique known as sentiment analysis. For the Fed, the value of sentiment analysis on FOMC policy statements has already been acknowledged, with sentiment having observed impacts on policy expectations (Hubert & Fabien, 2017) or equity prices (Gardner et al., 2022). Recently, more attention has also been devoted to the FOMC minutes due to their extensive information on the economic and financial outlook, with sentiment affecting stock returns (Gu et al., 2022) or the dollar's valuation (Tadle, 2022). However, research is sparse when it comes to exploring the additional content in the minutes that goes beyond the policy statements and the previous meeting's minutes. Even though the FOMC minutes are released three weeks post-meeting, the fact that they still move financial markets significantly (e.g., Rosa, 2013) suggests that they carry relevant, unexpected information not previously communicated. Understanding the effects of this unanticipated component can deepen our understanding of the influence of central bank communication.

The contribution of this thesis to the literature is threefold. First, I construct a measure for the Fed's "abnormal sentiment," defined as an unexpected sentiment component evident in FOMC meeting discussions. This orthogonalized sentiment surprise is derived from the residuals of a regression on the FOMC minutes' sentiment against a set of macroeconomic and financial data, the sentiment from the preceding meeting minutes, and the corresponding policy statement's sentiment. Thus, this residual variation captures unexpected hawkishness or dovishness from the policymakers' discussions that took place during the meetings. Second, I assess whether the FOMC meeting minutes carry unpriced information relevant to market participants through the Fed's abnormal sentiment. Specifically, I apply an event study methodology around the release day of the minutes to isolate and identify its potential causal effect on stock market returns and financial market volatility. Third, I examine the existence of a state-dependent relationship between the Fed's abnormal sentiment and credibility, contingent on the state of the economy. This relationship is assessed on the release days of the minutes by gauging the anchorage of long-term inflation expectations around a 2% inflation target. This last contribution elucidates how the Fed's policy communication correlates with market confidence in its ability to meet the announced inflation target, while also factoring in the economic context of the communication.

The main findings of this thesis are as follows. First, I find that the sentiment in the FOMC policy statements and minutes is mostly predictable based on a set of variables measured around the FOMC monetary announcements – employment growth, commodity prices evolution, and stock market performance –, as well as the sentiment expressed in the previous document. Notably, for the minutes, all predictors exert a positive and statistically significant influence on sentiment. Second, I find that the unexpected component present in the minutes, captured by the Fed’s abnormal sentiment, provokes market participants to re-evaluate their expectations and beliefs by pricing in this new information even after three weeks of the monetary decision announcement. Specifically, a more hawkish-than-expected sentiment reduces daily returns of the S&P500 and increases daily changes of the VIX. Finally, I find that the effect of the Fed’s abnormal sentiment on credibility depends on whether medium-term inflation expectations are above or below the 2% target. When medium-term expectations exceed the target, a hawkish sentiment surprise from the meeting discussions erodes the Fed’s credibility. Conversely, when medium-term expectations are below the target, a hawkish sentiment surprise now correlates with an increase in credibility, while a dovish sentiment surprise lowers it.

These findings can carry significant implications for the conduct of monetary policy, specifically concerning the communication strategies employed by central banks such as the Fed. The results suggest that presenting a wider range of the Committee members’ views in policy statements or advancing the release of the minutes may be beneficial in terms of reducing the impact of unexpected sentiment shocks. Furthermore, the findings also reveal a double-edged sword for the disclosure of detailed meeting discussions, since they can either bolster or undermine credibility depending on economic conditions. This insight serves as a reminder for central banks to remain vigilant and responsive to market expectations when communicating with the public.

The rest of this thesis is structured as follows. Section 2 reviews the literature and Section 3 describes the empirical methodology. In Section 4, I outline the data employed. Section 5 presents the results and Section 6 discusses policy implications. Finally, Section 7 concludes.

2. Literature review

This section covers three key strands of literature that relate to my dissertation. Firstly, I introduce the evolution and role of central bank communication. Secondly, I delve into the analysis of monetary policy communication via sentiment analysis techniques. Lastly, I examine the definition, measurement, and implications of central bank credibility.

2.1. Evolution and Role of Central bank Communication

Central bank communication plays a pivotal role in shaping market expectations and influencing economic outcomes (Blinder et al., 2008). Over the years, the nature and scope of this communication have undergone significant changes, reflecting the evolving economic landscape and the increasing complexity of monetary policy.

A central bank is a public institution that serves as a nation's primary monetary authority. It manages the currency of a country by controlling the amount of money in circulation. In general terms, central bank communication can be defined as any information provided by the central bank (or its representatives) to the public, including households, businesses, or financial markets (Issing, 2019). This information encompasses those fields in which the central bank has a responsibility or mandate, like the objectives and strategy of monetary policy, or assessments regarding the economic outlook. The instruments of communication have also been the subject of substantial evolution, differing in format (written or verbal), frequency of release, and publication channels. According to Blinder et al. (2022), a central bank's website is the primary source for individuals seeking to understand monetary policy.

Historically, central banks operated under a veil of secrecy, with little to no communication about their policy decisions. For example, during Chairman Alan Greenspan's tenure, market participants would often scrutinize the thickness of his briefcase on FOMC meeting mornings to deduce the Fed's future actions, with a thicker briefcase suggesting his intention to persuade the other members to raise the interest rate target (Gavin & Mandal, 2000). Goodfriend (1986) examines the Fed's arguments for maintaining confidentiality, drawing from court records of the Freedom of Information Act lawsuit against the FOMC in 1975, which ranged from inappropriate market reaction to more difficult interest rate smoothing and undesirable precommitment. Mishkin (2004) defends that central bank transparency is beneficial only if it simplifies communication with the public since the disclosure of too much information (such as the announcement of its objective function) can weaken the

support for a central bank focus on long-run objectives and hinders the communication process. Nonetheless, central banks have placed greater weight on their communications over the years, releasing information on monetary policy that is widely available in the form of policy statements, press conferences, and public speeches, among others.

The evolution towards increasing central bank communication has been driven by a variety of factors, among them the growing recognition of the role of agents' expectations in shaping economic outcomes (Woodford, 2005; Blinder et al., 2008; Blinder et al., 2022). Theoretical models of central bank communication defend that it can be used as a tool of monetary policy for managing market expectations and reducing uncertainty about future decisions (Bernanke, 2004; Issing, 2005). Specifically, when interest rates are constrained by the Zero Lower Bound (ZLB), the capacity of a central bank to impact macroeconomic conditions hinges on its credible communication regarding policy goals and strategies (Eggertsson & Woodford, 2003; Yellen, 2006). Several studies have also focused on the effects of forward guidance, i.e., the central bank's practice of communicating intentions about future monetary policy directions to influence current market expectations (Gertler & Karadi, 2015). Campbell et al. (2012) distinguish between Delphic forward guidance and Odyssean forward guidance: the former is merely predicative and involves providing forecasts of macroeconomic performance and potential policy actions, while the latter involves a public commitment by the central bank to a particular policy path. Campbell et al. (2017) argue that the FOMC's Odyssean guidance after 2011 may have boosted real activity and moved inflation closer to target.

Furthermore, different research regarding the efficacy of central bank communication on the general public documents how it can help anchor inflation expectations. Binder (2017) shows how households' expectations became more anchored after the Fed announced an explicit 2% inflation target in 2012, particularly for more informed consumers. Coibion et al. (2022) find that providing households with simple information about inflation, such as the FOMC's inflation forecast, has significant effects on inflation expectations. The research on central bank communication continues to evolve, with a growing emphasis on its impact on the broader public rather than solely in the financial market's domain (Blinder et al., 2022). However, there remains significant scope for exploration of the effects of policy communication on central bank credibility.

2.2. Sentiment Analysis of Central Bank Communication

The evolution of central bank communication has led to an increased volume of information available for analysis. This wealth of data has motivated researchers to devise new methods that can extract meaningful insights from textual data, thus allowing for a deeper understanding of the influence of central bank communication.

Textual analysis is a methodology used to systematically examine and interpret texts, such as written or spoken language, to understand their meaning, context, and potential impact. In the context of central bank communication, textual analysis typically involves examining speeches (e.g., Petropoulos & Siakoulis, 2021), policy decision statements (e.g., Gardner et al., 2022), meeting minutes (e.g., Tadle, 2022), or other forms of policy communication. Sentiment analysis is a specific type of textual analysis that investigates the underlying sentiment (or tone) of a text, which is generally classified as positive, negative, or neutral. Algaba et al. (2020) define sentiment as an entity's attitude towards another, expressed through various channels, with a quantifiable polarity reflecting its direction and intensity. Generally, sentiment analysis can be distinguished between lexicon-based and machine-learning approaches. The former relies on the use of a sentiment lexicon – a collection of words or sequence of words associated with a specific sentiment – to calculate sentiment in a document; the latter consists of a learning algorithm trained on a benchmark dataset with corresponding sentiment values. For central banking research, lexicon-based sentiment analysis methods are generally favored. According to Algaba et al. (2020), these methods tend to be more parsimonious and transparent. Also, the lack of datasets tailored for machine learning algorithms specific to central bank communication likely serves as a deterrent for researchers when opting for machine learning models. Filling this gap with appropriate datasets would greatly benefit the literature.

Still, not all lexicons are also applicable to every economic setting or specific textual structure. In response to the limited suitability of generic lexicons for texts within the finance domain, Loughran and McDonald (2011) develop a financial sentiment dictionary by analyzing 10-Ks and identifying positive and negative words associated with financial outcomes, thus capturing more accurately specialized finance language when measuring sentiment. For central bank communication, some researchers have also adapted and developed new dictionaries tailored for central bank communication (Apel & Grimaldi, 2012; Picault & Renault, 2017; Sharpe et al., 2017; Gardner et al., 2022; Tadle, 2022), while others have

adopted traditional finance-specific lexicons for calculating sentiment (Shapiro & Wilson, 2021; Huang & Kuan, 2021). Other studies employ both traditional and adapted dictionaries to ensure robustness in their analyses (Hubert & Fabien, 2017; Gu et al., 2022).

The literature on sentiment analysis of central bank communication has so far pursued three main goals, with some studies addressing more than one of these objectives: (i) the relationship between sentiment and central banks' objectives (Stekler & Symington, 2016; Shapiro & Wilson, 2021; Huang & Kuan, 2021); (ii) the impact of sentiment on financial markets (Picault & Renault, 2017; Gardner et al., 2022; Gu et al., 2022; Tadle, 2022) (iii) and the predictive power of sentiment on macroeconomic conditions (Apel & Grimaldi, 2012; Hubert & Fabien, 2017; Sharpe et al., 2017). Given the scope of my research, the majority of these studies have concentrated on the Fed's communication, with notable exceptions being Picault and Renault (2017), which focuses on the European Central Bank (ECB), and Apel and Grimaldi (2012), which examines the Swedish central bank.

The first group analyses sentiment in central bank communication to estimate implicit inflation targets or the monetary policy emphasis in different periods. Stekler and Symington (2016) apply a three-part methodology to analyze FOMC meeting minutes from 2006–2010, developing quantitative indexes that reflect the extent of optimism or pessimism on the outlook for the US economy. They find that from 2006 onwards, the FOMC focused extensively on the housing market, and increasingly shifted their attention to financial market volatility from August 2007. Shapiro and Wilson (2021) develop an approach to estimate central bank preferences by analyzing sentiment in policymakers' internal meetings. They calculate a negativity score using the Loughran and McDonald (2011) dictionary and a “human audit” to validate the sentiment measure, which revealed insights into the FOMC's implicit inflation targets. Lastly, Huang and Kuan (2021) develop a method to extract sentiment measures for each of the Fed's policy objectives from the FOMC minutes using an adaptive Bayesian approach for mandate classification. This approach results in mandate-specific sentiment indicators that display distinct patterns during contraction and expansion periods, illustrating the Fed's policy emphasis over time.

The second group comprises studies that investigate the impact of sentiment on stock market volatility, equity price responses, or currency valuations. Picault and Renault (2017) analyze ECB press conferences and argue that their field-specific lexicon-based method predicts monetary decisions effectively and outperforms the dictionaries of Loughran and McDonald

(2011) and Apel and Grimaldi (2012). They report increased European stock market volatility after negative-toned conferences regarding the Eurozone's economic conditions and a stock market increase on announcement day following a hawkish monetary stance in the statements. Gardner et al. (2022) study the impact of FOMC statements on equity prices using a sentiment index derived from textual analysis, which outperforms other macroeconomic variables in predicting price sensitivity to macroeconomic news. Their results align with the perspective that the content of the FOMC statement offers insights beyond asset price information, as these prices may incorporate risk premiums or inadequacies in financial markets' ability to process all available information. Tadle (2022) also evaluates FOMC documents, focusing primarily on the content of the meeting minutes, and finds significant associations between the sentiment indices, fed funds futures rates, and the United States' (U.S.) dollar valuation. His findings highlight the importance of FOMC minutes in guiding market expectations, as the fed funds future rates usually rise following more hawkish minutes, and offer insights on how the release of policy documents, in general, can affect financial markets beyond conventional monetary announcements. Lastly, Gu et al. (2022) also analyze FOMC minutes and show that a measure of tonality influences stock market returns the most during high monetary policy uncertainty periods, thus highlighting the state-dependent effects of the minutes' sentiment. While Tadle (2022) and Gu et al. (2022) both acknowledge the value of sentiment in FOMC minutes for market participants and its influence on asset prices, they overlook its impact on the Fed's credibility in managing inflation expectations. Additionally, they do not directly estimate an unexpected tone component in meeting discussions, beyond the sentiment reflected in policy statements and the previous minutes, to assess its influence on market behavior. In contrast, my research addresses these unexplored aspects, thus significantly departing from these papers.

Lastly, the third group investigates the relationship between central bank communication sentiment and macroeconomic variables or policy expectations, exploring the predictive power of sentiment measures for Gross Domestic Product (GDP) growth, unemployment, interest rate expectations, or future monetary policy decisions. Apel and Grimaldi (2012) were among the first to develop tailored dictionaries specifically designed for sentiment analysis of central bank communication and report the usefulness of sentiment measures derived from central bank meeting minutes for predicting future policy actions. Their results support the idea that sharing information about individual opinions should be a natural and essential part of a central bank communication strategy aimed at making monetary policy

more understandable and predictable. Sharpe et al. (2017) develop a tailored dictionary that is relevant at detecting words related to economic forecasting to construct a measure of optimism and pessimism in the text of Greenbook forecasts published by the Fed. Their findings show that this tonality measure has significant and incremental predictive power for both GDP growth and unemployment up to four quarters ahead. Hubert and Fabien (2017) study the impact of sentiment in FOMC statements on short-term interest rate expectations, using the dictionary of Apel and Grimaldi (2012), but also include results from the Loughran and McDonald (2011) dictionary for a robust assessment. Setting apart from the other studies, they employ a regression model using the central bank tone as the dependent variable to isolate exogenous sentiment shocks. They find that optimistic FOMC statements elevate one-year policy expectations and impact inflation and industrial production, but their effect is state-dependent, influenced by inflation rates, the business cycle, and financial stress. However, they do not focus on the content of the FOMC minutes to derive the same sentiment shock component, while this research derives an unpredictable component considering both policy documents.

One unexplored opportunity in this strand of literature is the separation of sentiment into expected (“normal”) and unexpected (“abnormal”) components. For other contexts, researchers have achieved this decomposition by employing regression models, wherein the dependent variable represents the sentiment measure, and the independent variables consist of a set of factors assumed to explain it based on theoretical and empirical evidence. Huang et al. (2014) offer a prime example of this approach by extracting an “abnormal tone” component from earnings’ press releases. They accomplish this by regressing the sentiment of the press release against a set of available determinants that investors would have access to before the release, such as firm performance and risk factors. The regression residual is interpreted as reflecting managerial strategic choices, which the authors discover to be employed to obscure weak future fundamentals and potentially mislead investors. This idea of “tone management” as the selection of a sentiment level in a qualitative text that does not align with related quantitative information, and its potential implications for the broader economy or the effectiveness of the monetary policy, remains significantly unexplored in the context of the communication between policymakers and the public. The FOMC minutes, by encompassing deliberations on the economic and financial situation by several Committee members, provide a unique case study for this approach. However, they have not been thoroughly examined in the literature under this perspective, which is a gap that I am to fill.

2.3. Central Bank Credibility

The literature on central bank credibility has investigated its importance and effects on macroeconomic equilibrium (e.g., Cukierman and Meltzer, 1986), monetary policy effectiveness (e.g., Leveuge et al., 2018), and financial market stability (e.g., Bicchal, 2022).

Although the literature unanimously agrees that central bank credibility is essential for effective monetary policy, particularly in managing agents' expectations, a precise definition remains elusive (Blinder, 2000). In fact, determining the credibility of a central bank constitutes a largely open question for researchers, as there are no established criteria to provide a definitive answer (Debortoli & Lakdawala, 2016). Central banks have long been at the center of economic research, with their evolution over time marked by shifts toward greater independence, transparency, and accountability. These closely related concepts interact in intricate ways and are widely considered essential factors in enhancing credibility in both the conduct and communication of monetary policy (Bordo & Siklos, 2015).

Independence refers to the extent to which a central bank is free from political influence in making decisions based on its mandate. The most common reasoning behind independent central banks is the need for conducting monetary policy free from political pressure to finance government spending, boost the economy, or reduce unemployment in the short run. Independence allows central banks to make decisions based on their own assessment of economic conditions, rather than political considerations, which helps avoid higher inflation rates and ultimately enhances its credibility (Alesina & Summers, 1993). Transparency is the degree to which a central bank is open and clear in its decision-making processes and policy communications, while accountability refers to the responsibility of a central bank to explain and justify its actions and decisions. By enhancing transparency, central banks enable the public to better understand and anticipate their decisions, which makes them more accountable for their actions, thereby improving the credibility of their strategies and goals (Waller, 2011). For example, Swanson (2006) contends that the increase in Fed transparency (for example, when it began explicitly announcing changes in the federal funds rate target in 1994 or releasing individual votes of Committee members in 2002) led to enhanced financial market forecasting capabilities for the federal funds rate and fewer financial market shocks surrounding FOMC announcements.

Assessing central bank credibility as an independent variable has therefore proven to be a challenging task in the literature, given its subjective and interconnected nature with these

concepts. Blinder (2000) identifies key determinants of credibility based on survey findings from policymakers and economists, who both agreed that it is primarily established first through a track record of honesty – “doing what it says it will do” – and secondly, by a strong aversion to inflation. Interestingly, central banking credibility in the literature has been primarily understood in two ways, which align well with these main factors. Firstly, credibility is tied to a commitment to a policy plan, where it is seen as the ability to resist deviating from the plan in the face of short-term trade-offs (e.g., between inflation and employment) after reaping the benefits of the announcement. This definition was originally developed in the theoretical frameworks by Kydland and Prescott (1977), Barro and Gordon (1983), and Cukierman and Meltzer (1986). Secondly, credibility is associated with the central bank's inflation-fighting ability, which is defined as the degree to which the public trusts the announced inflation target when shaping their inflation expectations. This definition has emerged from the frameworks proposed by Svensson (1993), Croushore and Koot (1994), and Bomfim and Rudebusch (2000).

In terms of developing empirical frameworks to measure central bank credibility, most of the literature has focused on the definition related to inflation-fighting ability rather than the commitment to a policy plan (e.g., Strohsal et al. 2016; Leveuge et al., 2018). This empirical choice in the literature is likely attributed to the fact that measuring credibility through the lens of inflation performance offers a more direct and interpretable approach than assessing the central bank's ability to resist short-term temptations. A notable exception includes the work of Debortoli and Lakdawala (2016), who put forth a regime-switching model to gauge the Fed's credibility. They identify credibility with the Fed's resistance to altering previously established policy courses, thereby balancing short-run gains from managing market expectations against the policy trade-offs. Notably, they pinpoint instances where the Fed likely deviated from its commitments, such as with the appointments of Arthur Burns and Paul Volcker, or the initiation of quantitative easing under Bernanke, thus highlighting periods of reduced credibility.

The literature that adopts the inflation-fighting ability definition explores the role of central banks in shaping the formation and anchoring of inflation expectations among economic agents, with implications for the effectiveness of monetary policy and economic stability. However, as Mendonça and Guimarães e Souza (2009) note, market or survey-based inflation expectations data may sometimes be unavailable or less reliable, especially for emerging

economies. In these situations, the authors argue that reputation-based credibility indices can serve as alternatives. These measures are backward-looking in the sense that they are based on observed performance, i.e., deviations are calculated considering observed inflation instead of expected inflation. They find that for Brazil, higher central bank credibility implies lower variations in interest rates. Demertzis et al. (2012) develop a credibility proxy through a Vector Autoregressive (VAR) approach, understood as the extent to which inflation expectations are anchored in the long run. They assume that credible monetary policy means that long-term inflation expectations are anchored to an implicit target, having a low correlation with actual inflation. They argue that this measure accurately captures historical periods of low credibility levels in the U.S., such as the Great Inflation period from 1968-1980, when the Fed was generally perceived as unable to control inflation. Strohsal et al. (2016) develop a time-varying parameter (TVP) model that indicates the extent to which both past inflation and short-term inflation expectations contributed to long-term inflation expectations de-anchorage from a 2% target in the U.S. (from 2004 until 2014). They contribute to the literature by considering both sources of de-anchoring, i.e., actual and expected inflation, instead of formulating indices based solely on one or the other. They find an almost perfect degree of anchorage except for the period of the financial crisis, suggesting that the credibility of the Fed was challenged in 2008.

Bordo and Siklos (2017) construct a measure of central bank credibility based on the differential between actual inflation and the central bank's target and find that financial crises reduce credibility, but not equally to all central banks, since strong institutional factors can alleviate the impact. Leveuge et al. (2018) present a forward-looking credibility measure designed to address the shortcomings of preceding works, such as Mendonça and Guimarães e Souza (2009) and Bordo and Siklos (2017). Their approach foregoes the use of arbitrary upper and/or lower thresholds, which is the incorporation of tolerance intervals into the credibility indices before inflation starts to impair credibility. The authors also argue for the inclusion of asymmetric effects in assessing credibility, positing that positive inflation deviations pose a greater risk to the de-anchoring of inflation expectations, and hence, to credibility loss, than negative ones. Upon applying this measure to emerging economies that have adopted inflation targeting, they observe that heightened central bank credibility dampens the volatility of short-term interest rates. Conversely, diminished credibility necessitates more assertive monetary interventions to accomplish the same outcomes. Lastly, Bicchal (2022) uses two credibility indicators (one backward and the other forward-looking)

for both emerging and advanced economies and finds that inflation targeting significantly improves credibility, leading to stabilizing effects on interest rates.

Additionally, some studies have set forth alternative approaches to address credibility, seeking to expand the literature in new directions. Lyziak (2016) presents a credibility index based on six key factors – inflation target realization, past inflation performance, transparency, independence, accountability, and public debt – which is applied to nine countries from 1999 to 2007. The author argues that this measure offers the benefits of being time-variant, comparable between countries, and grounded in theoretical foundations. Park (2018) defines credibility as the tendency of private agents to rely on the central bank's announced forecasts (in the case of the Fed, Greenbook, and Survey of Professional Forecasters forecasts) when forming expectations of future variables, other than their forecasts. Gwak (2020) emphasizes the mean-reverting properties of inflation expectations as an indicator of credibility levels, particularly in cases where inflation targets are unknown. Finally, Baker and Lam (2022) focused on the credibility of the Fed's 2021 transitory inflation signal. They constructed a daily sentiment index from a substantial volume of news articles and used a VAR model for analysis. Their findings revealed an escalating skepticism about the transitory nature of inflation up until the term "transitory" was dropped in November 2021.

Upon reviewing the substantial body of literature addressing central bank communication, the application of sentiment analysis techniques to monetary policy documents, and the increasing focus on central bank credibility as a standalone research topic, a unique investigation opportunity emerges. Despite considerable research in these distinct, yet interconnected domains, no study to date, to the best of my knowledge, has systematically linked these three areas. This represents a significant literature gap, particularly given the crucial role communication plays in shaping public perceptions of and trust in central banks (Blinder, 2000; Blinder et al., 2008). The rising acknowledgment and applicability of textual analysis techniques, particularly in the field of economics, further underscore the feasibility and relevance of such a study (Algaba et al., 2020). The motivation for this work thus lies within this context, aiming to bridge this gap and contribute with a novel perspective to the expanding field of central banking studies.

3. Methodology

This section details the methodology adopted in this thesis in four subsections. First, I present the approach to sentiment analysis of the Fed policy communication. Second, I introduce and define the measure of the Fed's abnormal sentiment, which is embedded in the FOMC minutes. Third, I detail how I assess the impact of the Fed's abnormal sentiment on financial markets. Lastly, I examine the potential relationship between Fed credibility and abnormal sentiment.

3.1. Fed Sentiment Analysis

The methodology employed to construct the sentiment score for the FOMC policy statements and minutes is grounded in sentiment analysis techniques commonly used in the central banking communication literature. A lexicon-based approach is utilized, building upon the methodology of Tadle (2022). This subsection starts with the rationale behind using the statements and minutes for the Fed's sentiment analysis. It then proceeds with details on the data gathering and pre-processing stages. After, the sentiment lexicon is presented and lastly, the sentiment calculation methodology is detailed.

3.1.1. Why the Statements and Minutes?

I argue that the FOMC policy statements and the minutes offer an ideal foundation for my analysis due to both their methodological and contextual suitability. From a methodological perspective, the regular publication of these documents at consistent intervals ensures a reliable data source for examination. The language and structure used in the statements and minutes are also very consistent, allowing for accurate comparisons and assessments over time and between documents. In terms of the research focus, I believe that these policy documents are highly relevant for evaluating the perceived credibility of the Fed since they constitute ideal sources for capturing the sentiment concerning the economy: they not only detail the policy decisions made during the meetings but also offer insights and explanations behind these decisions. Moreover, the well-established importance of these documents to financial markets further highlights their suitability for this analysis. For example, Farka and Fleissig (2013) find that FOMC statements have a more significant impact on the volatility of asset prices than surprise interest rate decisions, and Rosa (2013) finds that the release of the FOMC minutes also significantly affect the volatility and trading volume of U.S. asset prices.

On the one hand, the FOMC policy statements serve as concise summaries of the meetings where monetary policy decisions are made, outlining the reasoning behind the policy choices, and providing guidance on the future path of monetary policy. Historically, the FOMC did not release regular statements after its meetings. However, in the early 1990s, the Committee began to recognize the importance of clear communication with the public and financial markets (e.g., Bernanke, 2004). So, from February 1994, the FOMC started to release a post-meeting statement only when policy actions had been taken, and since February 2000, has consistently released statements immediately following each of its eight scheduled meetings per year. These policy statements usually follow a very consistent and structured format. They begin by addressing recent economic developments and trends that have occurred since the last meeting. Next, they emphasize the Fed's dual mandate, which focuses on achieving maximum sustainable employment and maintaining price stability. In the following section, the policy decision made during the meeting is clearly communicated, such as changes to the federal funds rate or adjustments to the central bank's asset purchase program. They also often include information on the expectations regarding the future course of monetary policy, providing insights into the committee's outlook on economic conditions, and offering a glimpse into the committee's decision-making framework. Finally, they conclude with a record of the voting members and respective votes, highlighting the committee's level of consensus concerning the monetary action employed.

On the other hand, the minutes provide a much more comprehensive and detailed account of the meetings when compared to the statements. They offer in-depth insights into the discussions, deliberations, and debates that took place, including the various economic indicators and policy options that were considered by the Committee members. The FOMC has been releasing minutes to the public for many years, with the documents dating back to 1936. However, the release schedule for the minutes has significantly evolved over time, along with its format. Before 2005, the minutes were released 2 days after the subsequent FOMC meeting. This release schedule was revised in December 2004, and since then, the minutes have been published three weeks after each FOMC meeting (approximately 21 days). This change in the release schedule aimed to improve the transparency and timeliness of the central bank's communication, enabling the public and financial markets with crucial information more promptly to allow for more informed decisions and better forecasting capabilities (Danker & Luecke, 2005). The current structure of the FOMC minutes typically includes six key sections. They begin with a Developments in Financial Markets and Open

Market Operations section, covering domestic and global trends and factors affecting money market conditions, such as the Fed's efforts to manage interest rates and liquidity. Following this, the Staff Review of the Economic Situation offers an overview of the current state of the economy, including key indicators such as employment, inflation, and GDP. The Staff Review of the Financial Situation then presents a summary of recent developments in financial markets, including changes in interest rates, credit markets, and the stock market's performance. In the subsequent section, the Staff Economic Outlook provides a forecast for future economic conditions, including GDP growth, employment, and inflation. The Participants' Views on Current Conditions and the Economic Outlook follows, where the FOMC meeting participants share their perspectives on current developments in the economy, frequently referring to inflation, consumer spending, business investment, and the foreign sector. Finally, the Committee Policy Action section contains information about the policy decision, incorporating the members' perspectives on policy. It also records the vote of each member by name, showcasing the level of (dis)agreement within the committee.

3.1.2. Data Gathering and Pre-processing

I collect the text data from the policy statements and minutes that are publicly available on the FOMC's website (FOMC, 2023). The acquisition of this data involved a web scraping process in Python: the uniform URL format for these documents was identified, with placeholders for the specific release dates of the statements and minutes; then, a Python script was executed to open each URL, extract the corresponding text, and save the information for subsequent analysis. The section of the FOMC minutes that recapitulates the previously released statement was excluded from the extraction process, as it constitutes information that was already available to market participants and subjected to sentiment analysis. To maintain consistency in both the intervals between meetings and the format of the documents, the analysis is restricted to the eight scheduled meetings conducted each year. Unscheduled FOMC meetings often occur in response to uncommon economic or financial events (like the 2008 financial crisis or the COVID-19 pandemic) and thus carry a likely negative sentiment. Including these outlier events could skew the results by overemphasizing negative content. Lastly, this decision guarantees that each set of meeting minutes can be accurately associated with the correct policy statement.

To conduct the textual analysis, the open-source Python library spaCy (Honnibal & Montani, 2017) for Natural Language Processing (NLP) tasks was used. After gathering the text data

and before conducting the sentiment analysis, it was essential to clean and pre-process the documents to ensure their suitability for the analysis. The data-cleaning process consisted of the following steps:

1. Sentence Segmentation: Each document was divided into individual sentences to allow for the examination of sentiment at the sentence level;
2. Removal of Punctuation and Numbers: Punctuation marks and numbers were removed from the text to reduce noise;
3. Lowercasing: All text was converted to lowercase, ensuring uniformity in the data, and reducing the risk of misinterpretation due to capitalization differences.

In line with Tadle (2022), I have opted to abstain from certain common pre-processing techniques in text analysis, such as stop word removal, stemming, and lemmatization. This decision was made to preserve the meaning and context of the sentences being analyzed. Stop words are common words such as "and", "the", "in", and "is", which are often removed in text analysis to reduce dimensionality and focus on more informative words. Since removing them can sometimes lead to misinterpretation of the sentiment, they have been retained. Stemming and lemmatization are both techniques used to reduce words to their base or root form. Stemming involves removing suffixes, while lemmatization involves converting a word to its base form according to the language's morphological structure. For example, applying stemming to the word "moderating" yields "moder," while utilizing lemmatization results in "moderate." Although these techniques can be beneficial in certain text analysis tasks by reducing dimensionality, they can also lead to loss of interpretability.

3.1.3. Sentiment Lexicon

Tadle (2022) supplies lists of hawkish and dovish keywords, as well as positive and negative terms, which constitute the basis for determining the sentiment in the FOMC statements and minutes. Hawkish terms indicate an improving economic outlook and rising inflationary pressures, typically suggesting a greater chance of monetary policy tightening. Examples include "inflationary," "investment," and "employment". Conversely, dovish terms pertain to worsening economic conditions and subdued price changes, implying a higher likelihood of monetary policy easing. Examples include "accommodation," "recession," and "unemployment". To accurately capture the underlying sentiment, a context-dependent sentiment analysis is adopted, which considers the relationship between hawkish and dovish keywords and their associated positive and negative terms. Positive terms examples include

"rising," "strength," and "improving," while negative terms examples are "restraining," "weaker," and "low."

Therefore, sentences are classified with a more hawkish sentiment if they contain hawkish keywords associated with positive terms or dovish keywords associated with negative terms, and vice-versa for the dovish sentiment. For instance, if "low" were used as a standalone negative term, the sentence "unemployment has been low" would be incorrectly marked as a dovish (or negative) sentiment, implying a greater tendency toward monetary easing. However, by first identifying the dovish keyword "unemployment", and then considering its association with the negative term "low," the sentence is accurately classified with a hawkish (or positive) sentiment, indicating a higher probability of monetary tightening.

To better reflect the economic conditions and events that occurred during my analysis period, and because the FOMC's wording preference also gradually changes over time, I have made some updates to the dictionary of Tadle (2022). Among these updates, I have also removed the term "securities" from the hawkish keywords list and added it to the dovish keywords list, since when this term is combined with the positive term "increase" it indicates a dovish stance, as it suggests the Fed is increasing the money supply. It is important to mention that the dictionary of keywords and polarized terms employed is also consistent with previous research on central bank communication (e.g., Apel and Grimaldi, 2012; Gardner et al., 2022) ensuring that the analysis is not subject to overfitting due to the use of well-documented, pre-established categories. In addition, I also slightly modify the treatment of negation terms. While maintaining the treatment for the positive terms, I extend the proximity rule for negative terms to be within three words or less of a negation term as well, in line with the idea that negation changes the sentiment of words within a certain proximity.¹

Often, sentences in the documents contain both hawkish and dovish keywords, making it more challenging to accurately capture the underlying tone. Tadle (2022) assumes that these sentences convey sentiments like those with only hawkish keywords. However, in this thesis, I overcome this assumption: when such sentences are encountered, the algorithm first identifies the positive and negative terms in the sentence, and then associates them with the closest hawkish or dovish keyword in terms of the number of words between them.² This results in a more accurate sentence classification that works better at reflecting the intended

¹ The full list of hawkish, dovish, positive, negative and negation words can be consulted in Appendix A.

² Gardner et al. (2022) also implement a similar approach on FOMC statements.

meaning of the text. By following this procedure, hawkish positive terms and dovish negative terms are aggregated into a global “Positive terms” list, and hawkish negative terms and dovish positive terms into a global “Negative terms” list.

3.1.4. Sentiment Calculation

For the sentiment calculation at the sentence level, I first calculate the difference between the number of positive and negative terms identified in each sentence. This way, higher (lower) scores are assigned to sentences with a greater number of positive (negative) terms, since not all sentences are equally perceived in terms of hawkishness or dovishness to market participants.³ Then, I consider the length of each sentence. In lexicon-based methods, this normalization is typically achieved through two methods: (1) dividing the difference by the total number of words (e.g., see Huang & Kuan, 2021; Gu et al., 2022); or (2) dividing only by the total number of positive and negative words (e.g., see Hubert & Fabien, 2017). Method (1) normalizes by total word count, including both sentiment-related and neutral words (with a score of zero indicating absent or neutral sentiment), while method (2) normalizes by only sentiment-related words. The choice between the two methods depends on the research objectives and the text's nature. For the purposes of my work, I use method (1) so that I can also capture sentences with no identified positive or negative words since, in the context of central bank communication, these typically represent a neutral monetary policy stance. Importantly, I only perform the sentiment analysis for sentences that contain hawkish or dovish terms, since only these sentences convey meaningful information for the public and market participants.

Lastly, to compute the overall document (statements and minutes) sentiment score, I take the average sentiment of all relevant sentences (N_t). This calculation is done by adding the sentiment score of each sentence (s) and dividing by the total number of analysed sentences (represented by n_d). The formula for the Fed's sentiment (Sentiment), indexed by the document's release day (t), can be seen in equation (1):

$$Sentiment_t = \frac{1}{n_d} * \sum_{s=1}^{N_t} \frac{Positive\ terms_s - Negative\ terms_s}{Total\ words_s} \quad (1)$$

³ Tadde (2022) calculates sentiment by assigning a score of either +1 or -1 to sentences on whether they are hawkish or dovish and have more positive or negative words. He also explores an alternative sentiment calculation wherein the difference between the number of positive and negative modifiers in each document is divided by the total number of words, but disregards the association with the predefined keywords.

For estimations purposes, both sentiment measures have been standardized by transforming them to have a mean of zero and a standard deviation of one. This allows for easier comparison with other similar measures or studies that also standardize the sentiment score and improves the interpretability of the regression coefficients.

Table 1 shows four examples of sentence sentiment scoring taken from the statements. As it becomes clear, the context in which the words appear enables the accurate assignment of sentiment scores. For instance, the term "considerable" in the third sentence was only counted as negative because it was linked to the dovish term "accommodation". Additionally, note how each sentence is lowercase and contains no punctuation marks or numbers, ensuring its suitability for the lexicon-based sentiment analysis.

Table 1 Examples of sentence sentiment scoring

Sentence	Hawkish keywords	Dovish keywords	Positive terms	Negative terms	Score
the federal open market committee voted today to <u>raise</u> its target for the federal funds rate by basis points to percent	['target']	-	['raise']	-	$(1-0)/21 = 0.0476$
recent readings on production and employment though mostly reflecting decisions made before the conclusion of hostilities have proven <u>disappointing</u>	['production', 'employment']	-	-	['disappointing']	$(0-1)/19 = -0.0526$
in these circumstances the committee believes that policy accommodation can be maintained for a <u>considerable</u> period	-	['accommodation']	-	['considerable']	$(0-1)/16 = -0.0625$
<u>gains</u> in employment household spending and business fixed investment have been <u>solid</u> and the unemployment rate has stayed <u>low</u>	['employment', 'spending', 'business', 'investment']	['unemployment']	['gains', 'solid', 'low']	-	$(3-0)/19 = 0.1579$

Notes: Sentences were taken from the FOMC statements (FOMC, 2023). Hawkish and dovish keywords are in bold; positive and negative terms are underscored. Score is calculated by dividing the difference between the number of positive and negative terms with the total number of words in the sentence – see equation (1)

3.2. Fed Sentiment Predictability

Having calculated the Fed's sentiment, I now aim to construct a measure of abnormal sentiment present in the FOMC minutes. An important note is that both the statements and the minutes refer to the same policy decision and assessments, despite the 3-week lag in the minutes' release to the public. Thus, when selecting variables to predict Fed sentiment, the indicators should be those around the days of the policy announcement for the minutes as well, avoiding the mistake of using the time between the minutes' release days.⁴

For the selection of the explanatory variables, I use macroeconomic and financial predictors that are observed prior to the FOMC announcement and were demonstrated in the relevant literature to effectively predict Fed monetary policy surprises (e.g., see Cieslak, 2018; Bauer & Chernov, 2021; Bauer & Swanson, 2022). As Bauer and Swanson (2022) note, these variables are available to financial markets (and the public) before the policy statement's release and share an intuitive and plausible relationship with the Fed's monetary decision-making process. Specifically, the selected variables for this analysis consist of:

- A measure of employment growth: given the Fed's dual mandate of price stability and maximum employment, it is reasonable to include a measure representing job gains or losses in the economy to capture the sentiment of the policy documents;
- A measure of commodity prices evolution: this variable serves as an indicator of inflation trends in the economy, capturing the concern for price stability, a key objective for the Fed, thus likely influencing sentiment in policy documents. Also, commodity prices fluctuations often mirror changes in overall economic conditions, since they are directly influenced by global factors such as supply and demand;
- A measure of stock market performance: while the Fed's consideration for stock market performance when making monetary policy decisions is an interesting debate in the literature (e.g., Kurov et al., 2022), this measure also serves as a proxy for the overall financial environment between FOMC meetings, since it captures market reactions to various factors such as macroeconomic data, corporate performance, and global events.

Furthermore, I include a one-period lagged dependent variable in the regression analysis due to the Fed's practice of employing forward guidance in their policy communication, often

⁴ The release dates of the FOMC statements and minutes since 2000 can be consulted in Appendix B.

indicating the likely course of future policy decisions, and offering insights into future economic developments. By incorporating the lagged sentiment measures, I am accounting for this anticipatory component in the policy documents, which can foster autocorrelation in sentiment. The expectation is that hawkish or dovish stances typically follow similar preceding sentiments, reflective of the continuity often seen in monetary policy. Therefore, I first estimate regression (2) for both documents:

$$Sent_t = \alpha + \beta'X_{t-} + \rho.Sent_{t-1} + \varepsilon_t \quad (2)$$

Here, (t) represents the date of the document release, ($Sent_t$) denotes the standardized sentiment score, (X_{t-}) contains the set of macroeconomic and financial predictors known prior to the monetary announcement, ($Sent_{t-1}$) represents the sentiment of the previous document, and (ε_t) signifies a regression residual. While regression (2) is estimated for both the statements and the minutes, I argue that the latter stands as the most ideal source for extracting a measure of abnormal Fed sentiment.

My definition of abnormal sentiment is in accordance with the relevant literature (notably, Huang et al. 2014), but adapted for the context of central bank communication. As such, it is a measure of sentiment level that does not align with not only the most recent and relevant macroeconomic and financial conditions, but also with the previously communicated sentiment, as well as the sentiment expressed in parallel, yet potentially divergent forms of communication. In the context of the Fed, this last component consists of the possible sentiment duality observed in the minutes when compared to the statements. As previously explained, the sentiment calculation methodology returns a measure in which higher (lower) values correspond to improving (worsening) economic conditions. However, while the statements mainly focus on the reasoning behind the policy choices and its likely future path, the minutes offer the full range of opinions and assessments expressed by the members of the committee, standing as much more valuable sources of information in this respect. As such, to capture the mentioned unexpected sentiment component, I estimate regression (3) of the form:

$$SentMin_t = \alpha + \beta'X_{t-} + \rho.SentMin_{t-1} + \delta.SentStm_t + u_t \quad (3)$$

Here, ($SentMin_t$) and ($SentStm_t$) correspond to the sentiment of the minutes and the statements, respectively. Then, I propose that the residuals (u_t) constitute a measure of the Fed's abnormal sentiment ($AbnSent$), as detailed in equation (4):

$$\hat{u}_t = AbnSent_t = SentMin_t - \hat{\rho}.SentMin_{t-1} - \hat{\delta}.SentStm_t - \hat{\beta}'X_{t-} - \hat{\alpha} \quad (4)$$

A positive abnormal sentiment ($AbnSent_t > 0$) can be interpreted as a hawkish stance that exceeds expectations, considering the overall macroeconomic and financial conditions, the sentiment of the previous meeting minutes, and the tone expressed in the corresponding policy statement. On the other hand, a negative abnormal sentiment ($AbnSent_t < 0$) implies a dovish stance more accommodative than anticipated given the same factors.⁵

3.3. Abnormal Sentiment's Impact on Financial Markets

This subsection details how I assess the influence of the Fed's abnormal sentiment on financial markets. To achieve this, I employ an event study approach, focusing on a narrow time-window during which other factors are less likely to interfere with the observed effects. Event studies have been a common choice in the literature due to their potential of identifying direct causal effects of monetary policy on asset prices (e.g., Bernanke & Kuttner, 2005). Given the already established significance of FOMC minutes for financial markets (e.g., see Rosa, 2013), any variation between the closing figures on the release day and the previous day's close of the minutes can be interpreted as a manifestation of the potential causal impact of the Fed's abnormal sentiment. This methodological choice thus helps to isolate and highlight any financial ramifications of unexpected sentiment deviations in the FOMC meetings.

The validity of the event study approach hinges on a few critical assumptions, namely the absence of reverse causation and the unanticipated nature of the independent variable. I argue that both conditions are confidently met in this study. Firstly, the concerns of reverse causation—the possibility that changes in asset prices could influence the sentiment embedded in the FOMC's minutes—can be dismissed in this case. Indeed, the minutes reflect economic assessments conducted approximately three weeks before their release, making it highly improbable (if not impossible) for asset prices on the day of the release to

⁵ Recall from subsection 3.1.4. that the sentiment analysis is applied exclusively to sentences that contain meaningful information via the hawkish and dovish terms. Therefore, any residual variation captured by equation (4) should still retain its significance for market participants.

retroactively influence these documents' sentiment. Secondly, the abnormal sentiment must be truly unanticipated by market participants, otherwise, the estimated coefficient may be statistically insignificant due to measurement error (Kuttner, 2018; Bauer & Swanson, 2022). My measure of abnormal sentiment, as defined and constructed, fits this criterion. It represents the residuals from a regression that has already accounted for a spectrum of financial and macroeconomic variables, in addition to the potential effects of sentiment from the preceding document and the parallel sentiment from the statement. Consequently, any remaining residual variation captured by this measure can be safely considered as unexpected, and thus, its impact on financial markets should represent a genuine response to an unexpected sentiment surprise. Therefore, the event study regression (5) is estimated:

$$y_t = \alpha + \beta AbnSent_t + \varepsilon_t \quad (5)$$

Here, the dependent variable (y_t) is the percentage log change in the asset value from the closing of the release day of the minutes to the prior day, indexed by (t). The specific indicators considered here – financial market volatility ($\Delta\%VIX$) and stock market performance ($\Delta\%S\&P500$) – are highly responsive to macroeconomic indicators and changes in investor sentiment, making them suitable gauges for capturing the potential impact of the Fed's communication. Given that the abnormal sentiment measure reflects an unexpected deviation from the anticipated sentiment, the sign of the coefficient indicates the market's interpretation of greater-than-expected hawkishness or dovishness. The magnitude of the coefficient (β) would then give a measure of the market's sensitivity to these sentiment surprises. This sensitivity might offer an insight into the level of trust or credibility the market attributes to the Fed's communications. Therefore, this analysis not only delves into the immediate financial market reactions to sentiment surprises but also paves the way for a subsequent investigation into the more enduring implications for the Fed's credibility.

3.4. Fed Credibility and Policy Communication

In this subsection, I implement the TVP model of Strohsal et al. (2016) to explore the evolution of the Fed's credibility. However, the original methodology is adapted to also account for a unique aspect of monetary policy – central bank communication.

A key pillar of monetary policy effectiveness, the credibility of the Fed serves as a critical barometer of policy confidence among market participants. As such, the task of accurately

quantifying this credibility demands a precise and time-sensitive approach. Specifically, I assess the credibility of the Fed in the immediate aftermath of the release of the FOMC minutes. At these junctures, the market's attention is intently drawn to the Fed's messaging, offering a valuable opportunity to capture shifts in credibility perception. This approach contrasts with using end-of-month or quarterly measurements, which are likely to be diluted by extraneous factors unrelated to the Fed's communication. Hence, by focusing on this key communication event, I can get a better understanding of how the Fed's credibility changes over time, and, more importantly, it allows me to see the role of the Fed's abnormal sentiment in this regard. This targeted approach has the potential to shed new light on the influence of monetary policy communication in shaping market expectations.

I thus estimate a TVP model to capture the dynamic nature of the Fed's credibility, i.e., the time-varying degree of long-term inflation expectations anchoring, structured as follows:

$$\pi_{l|t}^e - \pi^T = \theta_{1t} \cdot (\pi_{t-} - \pi^T) + \theta_{2t} \cdot (\pi_{s|t-1}^e - \pi^T) + \beta X_t + u_t \quad (6)$$

$$u_t = c + au_{t-1} + v_t \quad (7)$$

The dependent variable is the de-anchorage of U.S. long-term inflation expectation as measured by breakeven inflation rates ($\pi_{l|t}^e$), on the days when the FOMC minutes are released (t), from the Fed's inflation target (π^T). This de-anchorage serves as a metric for assessing shifts in the Fed's perceived credibility, in line with the prevailing literature that asserts firm anchorage of long-term inflation expectations at the stated target as a hallmark of a credible central bank (e.g., Bomfim & Rudebusch, 2000). The primary independent variables in the model consist of potential de-anchoring factors. These include the most recent inflation de-anchorage readings available before the minutes' release ($\pi_{t-} - \pi^T$) and the previous day's (or most recent data) de-anchorage of short-term inflation expectations ($\pi_{s|t-1}^e - \pi^T$). Also, note that (u_t) allows for serially correlated residuals. The model controls for daily variations in liquidity conditions and risk, represented by (X_t). These variables are instrumental in accounting for factors that can potentially distort the pricing of nominal and inflation-linked bonds. For additional details on the model, see Strohsal et al. (2016).⁶

⁶ I am very grateful to Professors Till Strohsal, Rafi Melnick, and Dieter Nautz for sharing their work files.

Under the assumption of a perfectly credible central bank, long-term inflation expectations should solely depend on the announced inflation target, unaffected by historical inflation ($\theta_{1t}=0$), and short-term expectations ($\theta_{2t}=0$). However, should any of these factors start to significantly influence the formation of long-term expectations, it may indicate that the central bank's credibility is diminishing. This happens as market participants begin to question the central bank's ability to meet its long-term target. Consequently, the time-varying degree of expectations anchoring on the days of the minutes' release serves as a measure of Fed credibility ($FedCred_t$), as expressed in equation (8):

$$FedCred_t = (1 - \theta_{1t} - \theta_{2t}) \quad (8)$$

Note that the credibility of the Fed is said to have been significantly affected when ($FedCred_t < 1$) at the 5% level. Next, I wish to assess how the Fed's policy communication relates to its credibility, as reflected by the ability to anchor long-term inflation expectations. For this, I believe that the measure of abnormal sentiment can have explanatory power.

Drawing upon the literature review, transparent, consistent, and anticipated central bank communication can help to enhance a central bank's credibility. As Blinder (2000) asserts, credibility is built on a foundation of aligning actions with words, emphasizing the significance of both the content of communication and subsequent policy implementation. Consequently, if market participants can accurately predict the sentiment conveyed in the Fed's communications, they are more likely to trust the Fed's capacity to guide long-term inflation, as this consistency between communication and actions generates confidence. However, a surprise in the Fed's expressed sentiment, which is captured by the abnormal sentiment, might indicate a divergence between market expectations and the Fed's actual monetary policy posture. Furthermore, the repercussions of such discrepancy are likely context-dependent, as the effects of unexpected hawkish or dovish sentiment would vary according to the prevailing economic conditions. To capture this economic context, I believe that market-based medium-term inflation expectations, as opposed to short-term, offer a more stable representation of the market's view of the trajectory of the economy. Short-term expectations are more susceptible to immediate economic news or events, which may not necessarily reflect longer-term economic trends. For example, temporary supply shocks or unexpected financial market fluctuations can trigger immediate changes in short-term expectations but do not always alter the broader economic outlook. Hence, being less

influenced by short-term noise, medium-term expectations are better at reflecting the economy's overall state.

As an example, consider a scenario where rising aggregate demand is fuelling inflation expectations. In response, the FOMC's policy statement acknowledges the necessity for price vigilance but stops short of advocating monetary tightening. Nevertheless, the minutes from the policy meeting (released three weeks later) reveal a considerably higher level of inflation concern among the members of the Committee than suggested by the initial policy statement and the previous meetings' discussion or expected based on overall observable macroeconomic conditions. This discordance in policy sentiment between the two forms of communication and the expectations of economic agents could prompt market participants to question the Fed's authentic monetary policy stance, potentially undermining future policy communications and hence its credibility. Such dynamics call for a model that integrates both the unexpected changes in sentiment and the prevailing state of the economy. Building upon this interpretation, I estimate regression (9) as follows:

$$FedCred_t = c + \lambda_1 \cdot (D_1 \cdot AbnSent_t) + \lambda_2 \cdot (D_2 \cdot AbnSent_t) + \beta X_t + \varepsilon_t \quad (9)$$

Where (D_1) and (D_2) are dummy variables defined as:

$$\begin{cases} D_1 = 1 \text{ if medium-term inflation expectations at } t \text{ are above the target} \\ D_1 = 0 \text{ if medium-term inflation expectations at } t \text{ are below the target} \end{cases} \quad (10)$$

$$\begin{cases} D_2 = 1 \text{ if medium-term inflation expectations at } t \text{ are below the target} \\ D_2 = 0 \text{ if medium-term inflation expectations at } t \text{ are above the target} \end{cases} \quad (11)$$

So, the dummy variable (D_1) is equal to 1 when medium-term inflation expectations are above the inflation target on the minutes' release days, while the dummy variable (D_2) is equal to 1 when they are below the target. By following this specification, the parameters (λ_1) and (λ_2) in regression (9) capture the state-dependent effects of the Fed's abnormal sentiment on credibility. If $(\lambda_1 < 0)$, it suggests that when inflation expectations are high, an unanticipated hawkish sentiment from the FOMC meeting discussions is associated with a decrease in credibility. If $(\lambda_2 > 0)$, it implies that in a low inflation environment, a hawkish surprise in sentiment increases the Fed's credibility. Lastly, the vector (X_t) incorporates the same daily control variables of equation (6).

4. Data

In this section, I outline the dataset employed in this research, which includes text data retrieved from the Fed policy documents, macroeconomic and financial variables measured around FOMC announcements, and measures of U.S. financial market inflation expectations. Additionally, the measures of Fed sentiment and credibility are presented.

4.1. Statements and Minutes

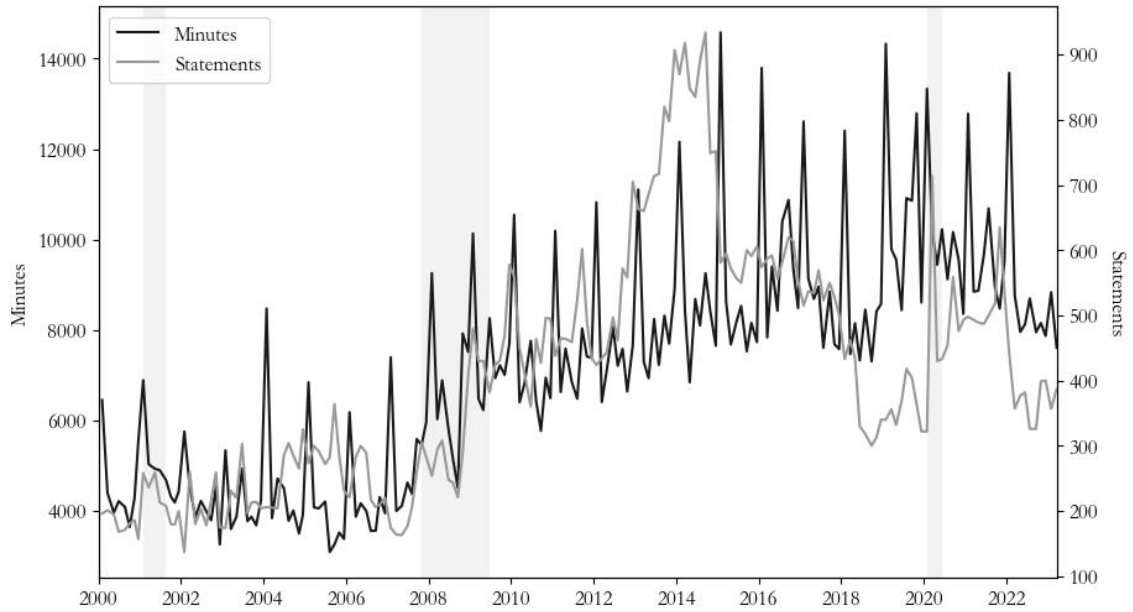
Table 2 contains some descriptive statistics regarding the length of the FOMC statements and minutes (2000M02–2023M03). According to the table, the minutes (with an average of 242 sentences) are considerably more detailed than the statements (which average 15 sentences). This contrast in length is consistent with the distinct purposes of these documents previously detailed. Moreover, the minutes display a much higher variability in the number of sentences (expressed by the standard deviation), further reflecting the more extensive and diverse nature of the topics addressed in the minutes than in the statements. Figure 1 shows the word count evolution for both documents side-by-side by monetary announcement. The overall upward trend, particularly for the FOMC minutes, indicates that the Fed's communication has become more extensive and informative over time, demonstrating the increasing commitment to transparency by the central bank. Note that, after reaching a peak word count on the September 2014 statement, the length of the statements has gradually decreased, except for the March 2020 meeting that was due to the onset of the COVID-19 recession. During the ZLB period from 2009 to 2015, the average statement length was at its highest with approximately 583 words, which potentially shows an increased reliance on communication during this period.

Table 2 Sentence Length Statistics: Statements and Minutes

	Statements	Minutes
Observations	186	186
Mean	15 sentences	242 sentences
Minimum	5 sentences	114 sentences
Maximum	29 sentences	471 sentences
Standard Deviation	5.7	81.3

Notes: Self elaboration based on FOMC (2023).

Figure 1 Word count evolution of Statements and Minutes



Notes: Self elaboration based on FOMC (2023). Shaded gray regions indicate U.S. recessions.

After applying the data pre-processing steps outlined in the methodology section, a total of 2.382 sentences (62.823 words) from the statements and 27.131 sentences (792.419 words) from the minutes were retained for the sentiment analysis. As mentioned earlier, these sentences feature either a hawkish or dovish term, or both, excluding sentences that do not convey significant information for the sentiment calculation; for example, in the case of the statements, this typically excludes the final section listing the voting members.⁷

4.2. Inflation Expectations

To assess the evolution of inflation expectations in the U.S. economy, I follow the established literature and use break-even inflation rates sourced from Gürkaynak, Sack, et al. (2010). Treasury inflation-protected securities (TIPS) have become a valuable resource for gauging expected inflation since the break-even inflation rates derived from the yields of TIPS and nominal bonds with equal maturities offer insights into these expectations. However, as Strohsal et al. (2016) note, to guarantee the availability of enough index-linked bonds to estimate real yield curves, I start my sample from 2004 onwards. Specifically, I use one-year forward rates ending ten years ahead for long-term expectations (BKEVEN1F9),

⁷ Words clouds for the most common hawkish and dovish terms can be consulted in Appendix C.

ending 5 years ahead for medium-term expectations (BKEVEN1F4), and ending three years ahead for short-term inflation expectations (BKEVEN1F2).⁸ The availability of these rates at a high frequency, as opposed to survey-based measures such as the University of Michigan Inflation Expectations or the Survey of Consumer Expectations at a monthly frequency, and the Survey of Professional Forecasters at a quarterly frequency, enables a targeted analysis only on the days relevant for my analysis. I gather the rates for the release days of the FOMC minutes (using the next available day if data is absent) and the rates for the day preceding each release (employing the most recent rate available if data is lacking). Inflation is measured as the most recent annual log change of the Consumer Price Index (CPI) available before the minutes' release. I assume a 2% constant inflation target during my sample period. In January 2012, the Fed explicitly announced an inflation target of 2% (FOMC, 2012), viewed as a rate low enough to not significantly distort economic decisions, but high enough to provide a buffer against the risk of deflation and allow for sufficient room for real interest rate adjustments. As stated in the announcement, clearly communicating this goal helps to keep longer-term inflation expectations firmly anchored. However, even before this announcement, it was generally agreed that the Fed had an implicit inflation target of 2% after 1995, due to the stabilization of inflation expectations around this target and because it had become an international standard among other central banks (Bullard, 2012).

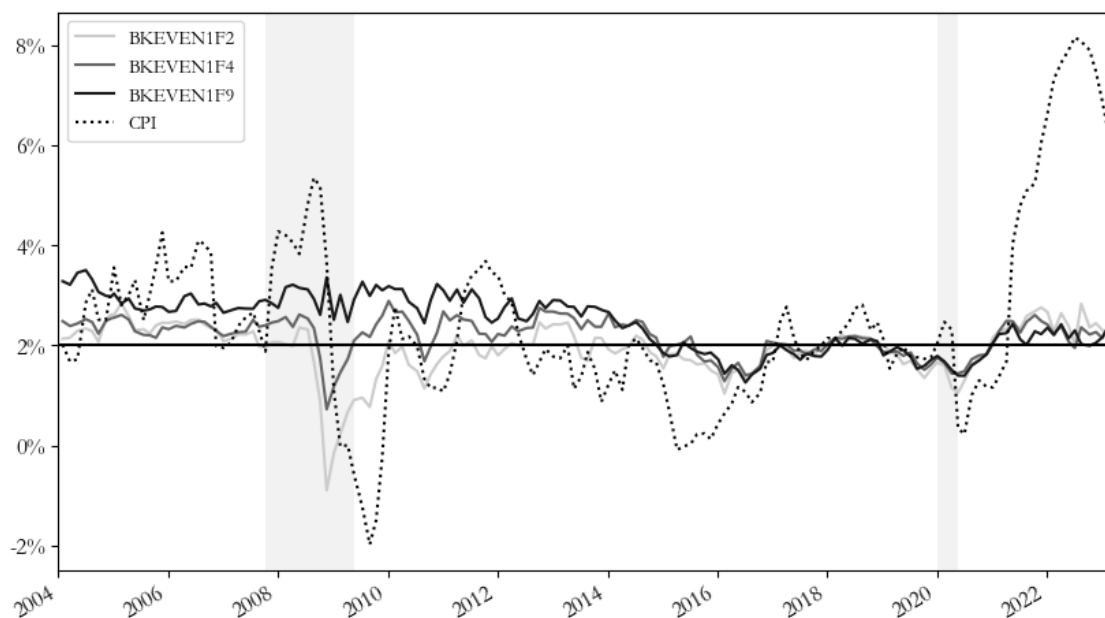
Gürkaynak, Swanson, et al. (2010) highlight that employing forward rates instead of yields circumvents direct influence from short-term developments, thus allowing for a more precise examination of inflation expectations at any given horizon. Furthermore, the market for U.S. government securities near the 10-year horizon is very liquid (thus reducing the impact of the liquidity premium) and sufficiently far out, which makes it difficult to attribute movements in the forward inflation compensation at this horizon to transitory responses of the economy to a shock. This strengthens the appropriateness of the 10-year forward breakeven rate as an indicator for long-term inflation expectations. Nevertheless, these measures can be inevitably affected by risk and liquidity premiums, so it is essential to control for these factors at a daily frequency as well. So, following Strohsal et al. (2016), I include as daily control variables the CBOE stock option price volatility index (VIX), the spread between Moody's Seasoned AAA Corporate Bond and 10-Year Treasury Constant Maturity

⁸ Gürkaynak, Sack, et al. (2010) do not directly provide the one-year forward rate ending three years ahead, but it can be calculated from the 2-year (BKEVEN02) and 3-year (BKEVEN03) breakeven rates as (3BKEVEN03-2BKEVEN02).

(AAA10Y), and the daily news-based U.S. economic policy uncertainty index (PolUnc) from Baker et al. (2016), all taken from the FRED database.

Figure 2 presents deviations of short, medium, and long-term inflation expectations, as well as actual inflation, from the 2% target, observed from the release dates of the minutes since 2004. After the 2008 Global Financial Crisis, short and medium-term expectations turned negative, seemingly influenced by the negative CPI in 2009. However, long-term expectations managed to stay above zero, as well as the target. A shift occurred in January 2015 when long-term inflation expectations descended below the 2% target, hitting a sample period low in July 2016. This shift coincided with the Fed's decision in December 2015 to raise interest rates, marking the first hike in nearly a decade, thus signaling an end to the ZLB period, and indicating a lean towards monetary tightening. Lastly, the sharp ascent of the CPI following the COVID-19 recession is noteworthy, reflective of supply-demand imbalances, an exceptionally accommodative monetary policy during this phase, and unforeseen events such as Russia's invasion of Ukraine. From 2021 onward, both short, medium, and long-term inflation expectations have stayed slightly above the 2% mark.

Figure 2 Deviation of actual and expected inflation from 2% target by minutes' release



Notes: Self elaboration based on the break-even rates calculated by Gürkaynak, Sack, et al. (2010). Shaded gray regions indicate U.S. recessions.

4.3. Macroeconomic and Financial Variables

The set of variables gathered in line with the FOMC announcements, meant to encapsulate the broader economic conditions concurrent with each policy communication, are calculated as follows (Bauer & Swanson, 2022):

- Employment growth (EMPG): the log change in the total nonfarm payroll employment from one year earlier to the most recent release before the FOMC announcement, obtained from the FRED database;
- Commodity prices evolution (BCOM): the log change in the Bloomberg Commodity Spot Price index from three months before the FOMC announcement to the day before the FOMC announcement, taken from Refinitiv;
- Stock market performance (S&P500): the log change in the S&P500 closing stock price index from 65 trading days before the FOMC announcement to the day before the FOMC announcement, taken from Refinitiv.

4.4. Fed Credibility Evolution

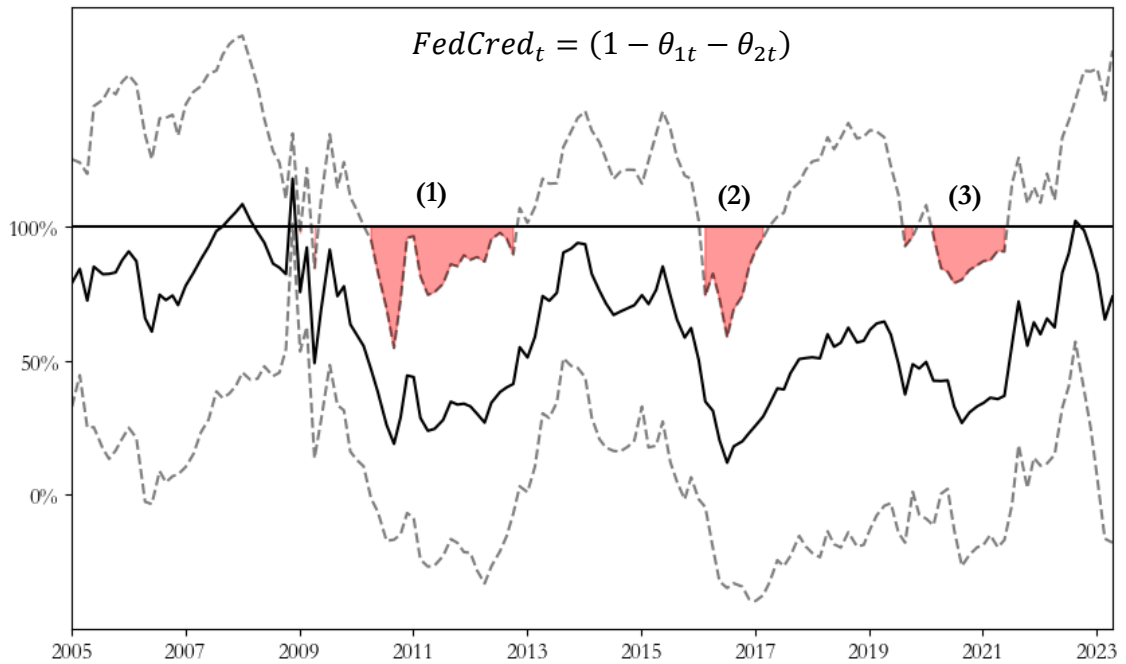
Figure 3 shows the smoothed time-varying (percentage) estimate of the anchoring parameter obtained from equation (8) in subsection 3.4. It shows 3 periods of low Fed credibility:

- (1) April 2010 – October 2012: During this period, the Fed, under Chair Bernanke, was primarily focused on the financial crisis recovery. Following the conclusion of the first round of Quantitative Easing (QE1) in March 2010, the Fed initiated QE2 (November 2010 - June 2011). To further stimulate economic activity, the Fed also launched "Operation Twist" in September 2011, shifting its Treasury holdings from short to long-term. The Fed stated in August 2011 that near-zero short-term rates would persist "at least through mid-2013," but was then revised to late 2014. This period also saw the 2011 U.S. debt ceiling crisis, the first-ever U.S. credit downgrade by Standard & Poor's, and the escalation of the European debt crisis;
- (2) February 2016 – February 2017: Throughout this period, the Fed, under Chair Janet Yellen, began its gradual approach to normalizing monetary policy post-QE3 (which ended in October 2014). The first rate hike post-financial crisis occurred in December 2015, followed by a year's pause due to economic uncertainties such as China's economic slowdown, Brexit concerns, and the U.S. presidential election, which contributed to heightened financial market volatility. Another rate hike was

not seen until December 2016. During this period, longer-term U.S. inflation expectations were particularly low, returning to the 2% target in February 2017 (see Figure 2);

- (3) February 2020 – May 2021: This period was marked by the COVID-19 pandemic, which triggered a global economic downturn. Under Chair Powell, the Fed took a broad array of actions to limit the economic and financial damage, like lowering its target for the federal funds rate in March 2020 to a range of 0-0.25%, providing forward guidance on the future path of interest rates, resuming its assets purchase program, and other exceptionally accommodative measures. By the end of 2021, CPI inflation was well above 2% (see Figure 2). The Fed began tapering the pace of asset purchases in November 2021 and raising rates in March 2022.

Figure 3 Anchoring-percentage of U.S. Long-term Inflation Expectations



Notes: The Figure shows the estimated (percentage) anchoring parameter obtained from equation (8) as the solid black line, and the 95% confidence interval as the dashed gray lines. Periods when the upper confidence band crosses below 100% are filled in red.

These three periods of diminished Fed credibility are relatively novel in the literature, due to the employment of the methodology of Strohsal et al. (2016) specifically on the release days of the FOMC minutes. In the period (1), the combination of persistent economic fragility and the Fed's mix of unconventional policy measures may have fuelled uncertainty over its ability to steer the economy effectively. During the period (2), the delay in anticipated rate

hikes and an uneven transition towards normalizing monetary policy might have suggested an unclear or undecided monetary stance by the Fed. Finally, in period (3), the rise in inflation, coupled with the Fed's seemingly high tolerance for it, likely heightened inflation expectations, which may have contributed to the de-anchoring of longer-term expectations from the 2% target. The initial narrative of transitory inflation was only abandoned in November 2021, which may have helped the Fed regain its inflation-fighting credibility afterward (Baker & Lam, 2022). Table 3 shows the average and minimum credibility levels for the three periods. Period (1) was the longest period of low credibility, while Period (2) was the most serious, albeit more short-lived.

Table 3 Periods of Fed Credibility Loss

Fed Credibility loss	Average credibility	Minimum credibility
(1) 2010M04–2012M10	33%	19% at 2010M08
(2) 2016M02–2017M02	24%	12% at 2016M07
(3) 2020M02–2021M05	36%	26% at 2020M08

Notes: Fed credibility loss periods represent times when the anchoring parameter $(1 - \theta_{1t} - \theta_{2t})$ is significantly below one at the 5%-level.

Considering the entire sample period, the average degree of anchoring for long-term inflation expectations stands at 60%. This indicates that long-term expectations have primarily been uninfluenced by short-term expectations and actual inflation, albeit far from perfect anchorage. Considering only instances when the anchoring parameter significantly falls below one, the average degree of anchorage is 78%, which can be interpreted as a more approximate reflection of the Fed's average credibility throughout the sample period (2004M01–2023M04). The notion that the Fed is to some extent credible, but not perfectly credible, has already been documented in the literature (e.g., Debortoli & Lakdawala, 2016).

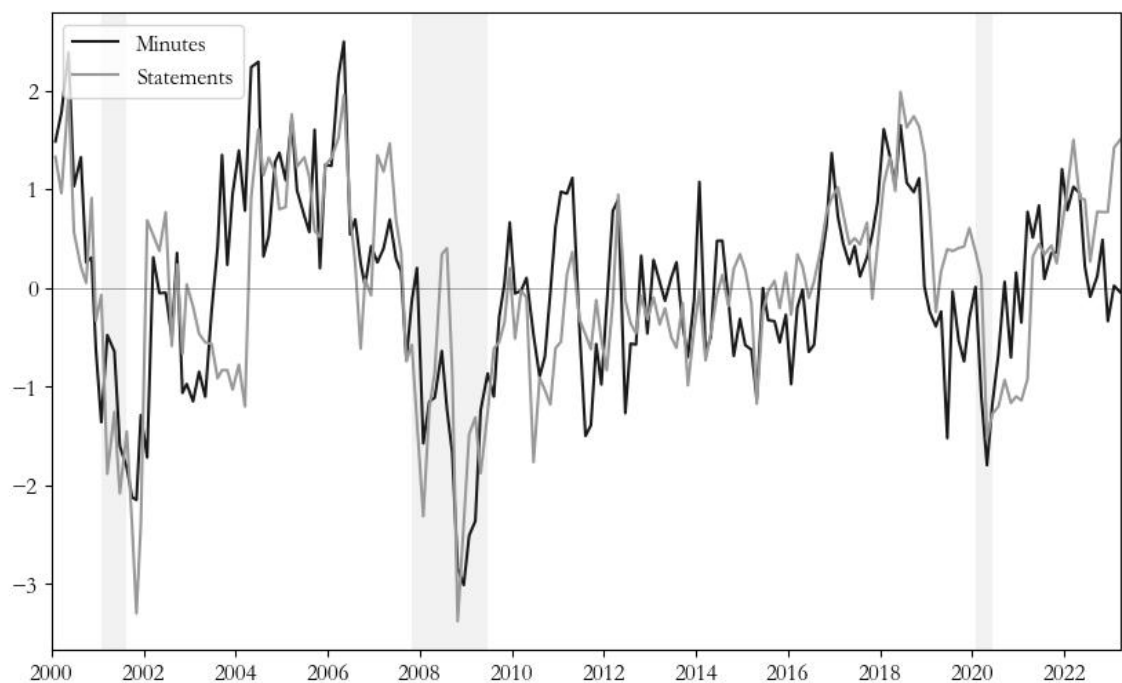
4.5. Fed Sentiment Evolution

Figure 4 plots the sentiment trajectory of the FOMC's statements and minutes by monetary meeting, offering an insight into the Fed's policy tilt over time.

At the beginning of 2000, sentiment scores were primarily positive, suggesting hawkish communication. However, following the 2001 economic recession and the September 11 terrorist attacks, sentiment turned dovish as the Fed aimed to mitigate the economic impact by lowering interest rates. Between May 2004 and August 2007, sentiment scores were

predominantly positive, reflecting a period of hawkish communication as the Fed raised interest rates in response to the expanding economy. This period ended in September 2007, when sentiment turned negative due to the onset of the Global Financial Crisis. From then until the end of 2011, sentiment remained mostly dovish as the Fed implemented largely accommodative monetary policy to support the economy during the recession. Between 2012 and 2016, sentiment scores fluctuated around neutral territory, likely reflecting the ZLB period and the increased reliance on unconventional monetary policy tools. Starting in 2016, sentiment scores gradually increased, reaching a historical maximum for the statements in June 2018. This increasingly hawkish communication can be attributed to the strengthening economy, allowing the Fed to normalize monetary policy by raising rates again. However, from June 2018, sentiment gradually decreased, although remaining mostly positive, until March 2020 when they dipped into negative territory due to the COVID-19 pandemic. The Fed adopted a dovish communication stance approximately one year until March 2021. From this meeting onwards, sentiment scores returned to positive territory and began to increase as the economy reopened, suggesting that the Fed shifted to a more hawkish communication even though it only first raised interest rates one year later, at the March 2022 meeting. This trend persisted until the latest data in March 2023 for the statements, indicating the continued focus on managing elevated price levels, while the minutes currently stand at neutral territory.

Figure 4 Fed Sentiment Evolution: Statements and Minutes



Notes: The figure shows the standardized results obtained for the Fed's sentiment from equation (1). Shaded gray regions indicate U.S. recessions.

5. Results

In this section, the findings from the empirical analysis are presented. First, I show the results regarding the predictability of the Fed's sentiment. Second, I highlight the significance and implications of the Fed's abnormal sentiment on financial markets. Finally, I explore the results from the relationship between Fed's abnormal sentiment and credibility.

5.1. Fed Sentiment Predictors

Table 4 presents the estimates for the regression models specified in equations (2) and (3) in subsection 3.2. Columns (1) and (2) show the estimates for the model specified in equation (2) for the sentiment in the statements and minutes, respectively. Column (3) presents the estimates for the model specified in equation (3). The results in Table 4 serve a dual purpose: firstly, it elucidates the influence of the selected macroeconomic and financial indicators on the sentiment expressed in the statements and minutes – columns (1) and (2); secondly, it allows for the extraction of the Fed's abnormal sentiment measure – column (3).

Table 4 Fed's Sentiment Predictive Regressions

	Statements (1)	Minutes (2)	Minutes (3)
SentStm_t			0.361*** (0.065)
BCOM	1.470** (0.725)	1.937*** (0.528)	1.842*** (0.489)
EMPG	0.049*** (0.016)	0.044*** (0.016)	0.005 (0.015)
S&P500	1.164 (0.821)	3.216*** (0.699)	2.802*** (0.621)
Sent_{t-1}	0.724*** (0.059)	0.606*** (0.059)	0.425*** (0.062)
Constant	-0.049 (0.055)	-0.097** (0.049)	-0.074* (0.044)
Adj. R²	0.67	0.67	0.73
Sample	2003M12–2023M03	2004M01–2023M04	2004M01–2023M04
Observations	155	155	155

Notes: The table shows the results from estimating regression (2) in the first two columns, and the results from estimating regression (3) in the third column. Standard errors are given in parenthesis; *, **, and *** indicate significance at the 10%, 5% and 1%-level, respectively. The regressions are estimated using Ordinary Least Squares (OLS) and employ heteroskedasticity-consistent (Huber-White) standard errors.

In column (1), I highlight three important results. First, both commodity prices and employment growth exert a considerable and positive influence on the sentiment conveyed in the Fed's statements. Second, the coefficient on the S&P500 index is not statistically significant, implying that stock market performance may not be a robust determinant of sentiment in the statements. Third, the sentiment from the preceding statement exhibits significant persistence, highlighting the tendency for consecutive statements to maintain a similar policy tone. These findings suggest that when commodity prices are rising, and employment growth is strong – both frequently linked to high inflation – the tone of the statements tends to reflect a more hawkish monetary policy stance. Interestingly, these two factors seem to effectively mirror the Fed's dual mandate, underscoring the simultaneous focus on employment levels and price levels when crafting the policy statements. Moreover, the sentiment's persistence in the statements indicates a degree of consistency in the Fed's policy communication over time.

Turning to column (2), where the sentiment in the minutes is considered, we observe similar dynamics. Both commodity prices and employment growth continue to have a significant positive impact but are now accompanied by the performance of the S&P500 index, which becomes statistically significant. This newfound significance suggests that market performance weighs more heavily on the deliberations and discussions during policy meetings, as captured in the minutes than in the crafting of the policy statement itself. This result can be associated with the Committee's closer consideration of wider economic and financial implications and long-term trends during their meetings that are not captured in the statements due to their concise nature. Furthermore, just as with the statements, a considerable degree of sentiment persistence is observed.

Cumulatively, the results from columns (1) and (2) highlight that sentiment in the FOMC's statements and minutes not only is predictable, with the model's explanatory power amounting to approximately 70% (adjusted R-squared) but that it is also intrinsically tied to key macroeconomic and financial indicators measured around monetary announcements and previous FOMC communication. It also indicates that the sentiment analysis methodology described in Section 3 is effectively capturing changes in the Fed's policy tilt over time, illustrating its potential applicability across different research objectives.

With the inclusion of the sentiment from the corresponding policy statement in column (3), the results show some subtle changes in the dynamics that underlie the

sentiment in the minutes. The influence of employment growth becomes statistically insignificant, suggesting that the sentiment expressed in the statement may encapsulate labor market conditions more effectively, displacing the direct influence that employment growth had on the sentiment in the minutes when considered in isolation. Nevertheless, commodity prices, stock market performance, and the sentiment from the previous minutes retain their statistical significance. Importantly, the corresponding policy statement holds a significant and positive relationship with the sentiment in the minutes. This result suggests that FOMC statements can set market participants' expectations about the sentiment likely to be reflected in the upcoming release of the minutes: more hawkish statements tend to be followed by more hawkish minutes, and vice-versa. This is why the inclusion of this variable is so important to capture a truly unexpected sentiment in the minutes, obtained from the regression residuals, which I refer to as the Fed's abnormal sentiment – see equation (4). These residuals serve as an orthogonal measure, independent of the observed macroeconomic and financial data preceding the announcement, the prior FOMC meeting's sentiment, and the sentiment in the post-meeting policy statement. Hence, higher (lower) values of the Fed's abnormal sentiment indicate a more hawkish (dovish) tone than expected given these factors. By isolating and quantifying these unanticipated sentiment deviations for each FOMC meeting, we can investigate their potential impact on financial markets.

5.2. Market Impact of Abnormal Sentiment

Table 5 presents the estimates for the regression model specified in equation (5) in subsection 3.3. This model delves into the effects of the Fed's abnormal sentiment on financial markets, following the event study methodology previously described.

Table 5 Market Responses to Fed's Abnormal Sentiment

	$\Delta\%S\&P500$	$\Delta\%VIX$
	(1)	(2)
AbnSent	-0.411** (0.183)	2.21** (1.008)
Constant	0.043 (0.087)	-0.792* (0.473)
Adj. R²	0.03	0.03
Sample	2004M01–2023M04	2004M01–2023M04
Observations	155	155

Notes: The table shows the results from estimating regression (5). Standard errors are given in parenthesis; *, **, and *** indicate significance at the 10%, 5% and 1%-level, respectively. The regressions are estimated using OLS and employ heteroskedasticity-consistent (Huber-White) standard errors.

Column (1) presents the results for the S&P500 daily returns and shows a statistically significant and negative coefficient for the abnormal sentiment measure. This result suggests that when the Fed's minutes express a more hawkish sentiment than expected (i.e., a hawkish surprise), there is an associated decline in the S&P500 index daily returns. Market participants could interpret this unexpected hawkishness as an indication of forthcoming monetary policy tightening, leading to subdued expectations of corporate profits and, in turn, a decrease in stock returns. This finding is in line with current economic literature regarding monetary policy surprises. Studies such as Jarociński and Karadi (2020) and Bauer and Swanson (2022) confirm that unexpected hawkish monetary policy surprises on FOMC monetary announcements lead to a decrease in the S&P500. As Jarociński and Karadi (2020) explain, both the expected increase in the discount rate and the decline in expected future dividends (caused by the negative economic outlook from the policy tightening) can contribute to a lower stock market valuation. Also, Bernanke and Kuttner (2005) report an increase in equity prices following unanticipated Fed monetary easing.

Turning to column (2), we find a positive relationship between the Fed's abnormal sentiment and the daily change in the VIX index, meaning that greater-hawkishness-than-anticipated in the minutes corresponds with a rise in the VIX. Known as the "fear gauge," this index reflects market expectations of future volatility. Hence, a daily surge in the VIX can signify heightened market uncertainty, which may arise from investors discerning potential economic and financial instability of future policy shifts from the unexpected hawkishness. This result is again in line with prevailing economic literature. Bomfim (2003) finds how a surprise increase in the target federal funds rate significantly increases stock market volatility when compared to the day before the FOMC meeting, with positive surprises (i.e., higher-than-anticipated values of the target) having a larger effect than negative ones. Building upon this reasoning, the observed increase in the VIX in column (2) can be tied to the unexpected component of the abnormal sentiment measure. This component unveils fresh information that was not previously incorporated into asset prices, triggering market participants to assimilate this new information, hence causing market volatility.⁹

It is important to reinforce that the novelty of my results lies in the way I construct the measure of monetary policy surprise. The abnormal sentiment measure is based on the

⁹ In fact, estimating equation (5) using the standard sentiment measure (SentMin) as the explanatory variable does not yield statistically significant results, reinforcing the role of the unexpected component in shaping market participants' response.

unexpected sentiment component embedded in the FOMC meeting minutes, as opposed to deriving monetary surprises from financial market's fluctuation on the days of the monetary decision. For example, Bauer and Swanson (2022) use the first principal component of the changes in the first four quarterly Eurodollar futures contracts, and Jarociński and Karadi (2020) analyze high-frequency co-movement of interest rates and stock prices. Therefore, it reflects a direct insight into the FOMC's deliberations that were not previously captured by financial markets. The economic and statistical significance of these results suggests at least two key insights: first, that sentiment analysis can be a useful tool to derive signals of unexpected hawkishness or dovishness, highlighting the market's active engagement with and response to the tone in the Fed's communication; and second, the minutes of the FOMC meetings can serve as a crucial Fed communication tool for financial markets, conveying substantial information that extends beyond previous communication.

5.3. Effect of Abnormal Sentiment on Fed Credibility

Table 6 shows the results from estimating regression model (9) specified in subsection 3.4.¹⁰

Table 6 Fed Credibility and Abnormal Sentiment

<i>FedCred</i>	
D₁.AbnSent	-0.121*** (0.042)
D₂.AbnSent	0.198*** (0.062)
Control Variables:	
VIX	0.012** (0.005)
PolUnc	-0.001*** (0.000)
AAA10Y	-0.192** (0.088)
Constant	0.788*** (0.085)
Adj. R²	0.25
Sample	2004M01–2023M04
Observations	155

Notes: The table shows the results from estimating regression (9), where $D_1=1$ when $BKEVEN1F4>2$ and $D_2=1$ when $BKEVEN1F4<2$. Standard errors are given in parenthesis; *, **, and *** indicate significance at the 10%, 5% and 1%-level, respectively. The regression is estimated using OLS and employs Newey-West heteroskedasticity and autocorrelation consistent standard errors with automatic bandwidth selection.

¹⁰ The results from the TVP model can be consulted in Appendix D.

According to Table 6, the effect of abnormal sentiment on the Fed's credibility, as gauged by the time-varying anchoring degree of long-term inflation expectations on the release days of the minutes, is in fact contingent on the state of medium-term inflation expectations.

In a lower-inflation environment ($D_1=0, D_2=1$), the results show a positive relationship between the Fed's abnormal sentiment and credibility. Specifically, a hawkish surprise from FOMC policy meetings increases the Fed's perceived credibility, while a dovish surprise reduces it. When medium-term inflation expectations are below 2%, a surprisingly hawkish tone in the minutes might be interpreted as a positive sign about current and future economic conditions. This can reinforce the market's trust in the Fed's ability to achieve its long-term target, hence strengthening its overall credibility. Conversely, a dovish surprise, indicating a higher concern about unemployment than expected, might suggest a weaker economic state than initially believed by market participants. This perspective might cast doubt on the Fed's capacity to fulfill its dual mandate, as it implies a need for prolonged accommodative policies to sufficiently stimulate the economy.

When medium-term inflation expectations exceed the Fed's target ($D_1=1, D_2=0$), the effect of the abnormal sentiment shifts. Unlike in a lower-inflation environment, a hawkish surprise now undermines the Fed's credibility, while a dovish surprise increases it. In a higher-inflation context, an unexpectedly hawkish tone may suggest to market participants that the FOMC is more concerned about inflation than what was previously transmitted in the policy statements or discussed in the previous meeting. This unforeseen hawkish sentiment could trigger worries that inflation has not been adequately addressed, thereby impairing the Fed's credibility. Conversely, a dovish surprise in this scenario implies that the Committee perceives inflationary pressures to be easing. Market participants may interpret this unexpected dovish tone as an indication that concerns over inflation are diminishing and that the FOMC anticipates a return to the inflation target soon, thus enhancing the Fed's credibility by reassuring markets of its effective inflation management.

In essence, these results highlight that the FOMC minutes play a pivotal role in the Fed's credibility. They convey crucial, unexpected content beyond previous policy communication that affects the market's perception of effective monetary policy. Importantly, their influence varies with the state of the economy – they are not considered in isolation, but as a dynamic communication tool that shapes the Fed's image amidst shifting economic conditions.

6. Monetary Policy Implications

This section discusses the broader implications for monetary policy derived from my findings. I concentrate on three primary areas: the implications of both predictable and unexpected sentiment components in Fed communication; enhancing policy information release strategies; and preserving central bank credibility in diverse economic states.

The predictability of sentiment in the FOMC's policy statements and meeting minutes, influenced by key macroeconomic and financial indicators around monetary announcements and past communication, underscores the role of central bank communication in guiding market expectations. Notably, the predictive power of employment growth, commodity prices, and stock market performance reveals that these documents can provide valuable information on current economic and financial conditions. The significance of these variables suggests that the Fed carefully devises its communication content, aligning sentiment with the prevailing macroeconomic context. Additionally, the sizable prediction value of lagged sentiment further emphasizes the Fed's commitment to consistency and predictability in its communication. This effort can help minimize unexpected sentiment shifts, which could trigger undesired market reactions. For market participants, this predictability can become a valuable tool, since it enables them to anticipate the central bank's sentiment, fostering more informed decisions and enhancing market efficiency.

However, the unexpected sentiment component in policy communication – the Fed's abnormal sentiment – wields a significant influence on financial markets. Specifically, more hawkish-than-anticipated minutes are associated with a reduction in the S&P500 daily returns and a daily increase in the VIX. These effects mean that unanticipated shifts in sentiment can provoke considerable market perturbations by altering market behavior. These findings carry implications for both financial markets and the Fed. First, market participants should exercise caution around the release of the minutes, particularly by preparing for potential volatility and the erosion of the value of their equity holdings. This awareness could entail hedging and risk mitigation strategies, or conservative positioning in advance of the minutes' release, especially when economic or financial conditions suggest the possibility of a hawkish surprise. Second, these insights offer a chance for the Fed to better understand the implications of its communication. The sharp market responses indicate that even minor unexpected shifts in sentiment from the minutes could move markets significantly. While the Fed does not target specific market outcomes, understanding these dynamics is crucial

to ensuring its communication does not inadvertently introduce excessive volatility. Therefore, central banks should factor these effects into their communication strategies, aiming to mitigate unexpected sentiment shocks to avoid undesirable market turbulence.

The observed influence of unexpected sentiment also suggests a possible need for strategic optimization in the information released by central banks such as the Fed. I argue that this optimization could manifest in two ways: refining the clarity of policy statements and/or reassessing the timing of the minutes' release. Firstly, a shift from the traditional individualistic communication strategy in the statements to a more collective one might be beneficial. Here, the central bank could consider presenting a broader spectrum of the Committee members' views within the policy statements. This comprehensive disclosure could help align market expectations more closely with the content of the forthcoming minutes, thereby reducing the impact of unexpected sentiment shocks when the minutes are unveiled. Secondly, reassessing the timing of the minutes' release could also mitigate market disruptions caused by unexpected sentiment. Currently, the FOMC minutes are released three weeks after the policy statement. Advancing this release would provide market participants with access to the detailed information sooner, allowing for earlier adjustments to their expectations. Consequently, the surprise impact of the newly disclosed information may be less significant, further promoting market stability.

Finally, the influence of unexpected sentiment on central bank credibility highlights the dynamic relationship between central bank communication and perceived trustworthiness. This thesis provides novel empirical evidence of this link. It corroborates theoretical literature on the subject (e.g., see Blinder et al., 2008), yet it is the first to delve directly into the impact of the Fed's policy communication sentiment on its credibility. The impact of unexpected sentiment on credibility was found to be state-dependent, contingent upon the level of medium-term inflation expectations (below or above the 2% threshold). This indicates that the effects of communication on credibility are not static, but rather evolve with economic conditions. Therefore, these findings underline the need for central banks to remain vigilant and adapt their communication strategy according to market expectations to retain credibility. This could involve practicing greater transparency in different periods by acknowledging divergent views within the committee or potential policy uncertainties. This level of openness helps mitigate any potential loss of credibility, preserving the effectiveness of monetary policy.

7. Conclusion

In this thesis, the relationship between Fed policy communication and its perceived credibility was examined. This examination was grounded in the increasing emphasis on central bank communication as a key monetary policy tool to manage agents' expectations.

The primary findings from this research indicate that the sentiment expressed in the FOMC policy statements and meeting minutes is mostly predictable, based on macroeconomic and financial conditions measured around monetary announcements and previous communication. However, it was found that an unexpected sentiment component present in the meeting minutes affects financial markets significantly, with a more hawkish-than-anticipated sentiment negatively impacting stock market daily returns and increasing daily market volatility. The most crucial insight in this thesis is the state-dependent relationship shared by the Fed's abnormal sentiment and credibility. Notably, when medium-term inflation expectations exceed the 2% target, an unexpected hawkish sentiment from the meeting minutes leads to a de-anchorage in long-term inflation expectations, but when medium-term expectations are below the target, a hawkish surprise enhances credibility.

These findings carry considerable implications. Firstly, they highlight that investors and market participants are responsive to unexpected shifts in policy communication, reflecting this in their financial decisions. Secondly, it suggests that the Fed and other central banks that publish any form of policy meetings discussions may need to revise their communication strategies, potentially through a more comprehensive representation of central bankers' views in policy statements, or by adjusting the timing of the minutes' release. Importantly, to maintain credibility, central banks must pay close attention to prevailing economic conditions and adapt their communication accordingly. While these findings contribute significantly to the literature, they also point toward new avenues for future research. Advanced sentiment analysis techniques or other textual extraction tools could be employed for a more nuanced understanding of central banking communication. Moreover, extending this analysis to other forms of Fed policy documents, or examining similar dynamics in different central banks, would enrich the field further.

In conclusion, what the Fed says – and does not say – matters. This thesis has reaffirmed the importance of strategic central bank communication through a new perspective on the dynamic relationship between FOMC policy documents and market expectations. Whether the Fed's policy communication increases credibility or not, it is a matter of minutes.

8. References

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9. Appendix

Appendix A: Dictionary of keywords and polarized terms

Hawkish Keywords:	"business", "businesses", "demand", "economic", "economy", "employment", " job ", "energy", "equities", "equity", "expansion", "financial", "growth", "housing", "income", "indicators", "inflation", " cpi ", " pce ", "inflationary", "investment", "investments", "labor", "manufacturing", "outlook", "output", "price", "prices", "production", "recovery", "resource", "slack", "spending", "target", "toll", "wage", "wages"
Dovish Keywords:	"accommodation", " accommodative ", "devastation", "downturn", "recession", "unemployment", " uncertainty ", " securities "
Positive Terms:	"abating", "accelerated", "add", "advance", "advanced", "augmented", "balanced", "better", "bolsters", "boom", "booming", "boost", "boosted", "eased", "elevated", "elevating", "expand", "expanding", "expansionary", "extend", "extended", "fast", "faster", "firmer", "gains", "growing", "heightened", "high", "higher", "improved", "improvement", "improving", "increase", "increased", "increases", "increasing", "more", "raise", "rapid", "rebounded", "recovering", "rise", "risen", "rising", "robust", "rose", "significant", "solid", "sooner", "spike", "spikes", "spiking", "stable", "strength", "strengthen", "strengthened", "strengthens", "strong", "stronger", "supportive", "up", "upside", "upswing", "uptick", " considerable "
Negative Terms:	"adverse", "back", "below", "constrained", "contract", "contracting", "contraction", "cooling", "correction", "dampen", "damping", "decelerated", "decline", "declined", "declines", "declining", "decrease", "decreases", "decreasing", "deepening", "depressed", "deteriorated", "deterioration", "diminished", "disappointing", "dislocation", "disruptions", "down", "downbeat", "downside", "drop", "dropping", "ebbed", "erosion", "fade", "faded", "fading", "fall", "fallen", "falling", "fell", "insufficient", "less", "limit", "low", "lower", "moderated", "moderating", "moderation", "reduce", "reduced", "reduction", "reluctant", "removed", "restrain", "restrained", "restraining", "restraint", "resumption", "reversed", "slack", "slow", "slowed", "slower", "slowing", "slowly", "sluggish", "sluggishness", "slumped", "soft", "softened", "softening", "stimulate", "strained", "strains", "stress", "subdued", "tragic", "turmoil", "underutilization", "volatile", "vulnerable", "wary", "weak", "weakened", "weaker", "weakness", " loss ", " hardship ", " muted "
Negation Terms:	"fail", "less", "never", "no", "not", "opposed", "unlikely"

Notes: Adapted from Tadle (2022). Updates to the lists are marked as bold.

Appendix B: Release dates of FOMC Statements and Minutes

Statements	Minutes	Statements	Minutes	Statements	Minutes	Statements	Minutes	Statements	Minutes
02/02/2000	23/03/2000	14/12/2004	04/01/2005	04/11/2009	24/11/2009	17/09/2014	08/10/2014	31/07/2019	21/08/2019
21/03/2000	18/05/2000	02/02/2005	23/02/2005	16/12/2009	06/01/2010	29/10/2014	19/11/2014	18/09/2019	09/10/2019
16/05/2000	29/06/2000	22/03/2005	12/04/2005	27/01/2010	17/02/2010	17/12/2014	07/01/2015	30/10/2019	20/11/2019
28/06/2000	24/08/2000	03/05/2005	24/05/2005	16/03/2010	06/04/2010	28/01/2015	18/02/2015	11/12/2019	03/01/2020
22/08/2000	05/10/2000	30/06/2005	21/07/2005	28/04/2010	19/05/2010	18/03/2015	08/04/2015	29/01/2020	19/02/2020
03/10/2000	16/11/2000	09/08/2005	30/08/2005	23/06/2010	14/07/2010	29/04/2015	20/05/2015	15/03/2020	08/04/2020
15/11/2000	21/12/2000	20/09/2005	11/10/2005	10/08/2010	31/08/2010	17/06/2015	08/07/2015	29/04/2020	20/05/2020
19/12/2000	01/02/2001	01/11/2005	22/11/2005	21/09/2010	12/10/2010	29/07/2015	19/08/2015	10/06/2020	01/07/2020
31/01/2001	22/03/2001	13/12/2005	03/01/2006	03/11/2010	23/11/2010	17/09/2015	08/10/2015	29/07/2020	19/08/2020
20/03/2001	17/05/2001	31/01/2006	21/02/2006	14/12/2010	04/01/2011	28/10/2015	18/11/2015	16/09/2020	07/10/2020
15/05/2001	28/06/2001	28/03/2006	18/04/2006	26/01/2011	16/02/2011	16/12/2015	06/01/2016	05/11/2020	25/11/2020
27/06/2001	23/08/2001	10/05/2006	31/05/2006	15/03/2011	05/04/2011	27/01/2016	17/02/2016	16/12/2020	06/01/2021
21/08/2001	04/10/2001	29/06/2006	20/07/2006	27/04/2011	18/05/2011	16/03/2016	06/04/2016	27/01/2021	17/02/2021
02/10/2001	08/11/2001	08/08/2006	29/08/2006	22/06/2011	12/07/2011	27/04/2016	18/05/2016	17/03/2021	07/04/2021
06/11/2001	13/12/2001	20/09/2006	11/10/2006	09/08/2011	30/08/2011	15/06/2016	06/07/2016	28/04/2021	19/05/2021
11/12/2001	31/01/2002	25/10/2006	15/11/2006	21/09/2011	12/10/2011	27/07/2016	17/08/2016	16/06/2021	07/07/2021
30/01/2002	21/03/2002	12/12/2006	03/01/2007	02/11/2011	22/11/2011	21/09/2016	12/10/2016	28/07/2021	18/08/2021
19/03/2002	09/05/2002	31/01/2007	21/02/2007	13/12/2011	03/01/2012	02/11/2016	23/11/2016	22/09/2021	13/10/2021
07/05/2002	27/06/2002	21/03/2007	11/04/2007	25/01/2012	15/02/2012	14/12/2016	04/01/2017	03/11/2021	24/11/2021
26/06/2002	15/08/2002	09/05/2007	30/05/2007	13/03/2012	03/04/2012	01/02/2017	22/02/2017	15/12/2021	05/01/2022
13/08/2002	26/09/2002	28/06/2007	19/07/2007	25/04/2012	16/05/2012	15/03/2017	05/04/2017	26/01/2022	16/02/2022
24/09/2002	07/11/2002	07/08/2007	28/08/2007	20/06/2012	11/07/2012	03/05/2017	24/05/2017	16/03/2022	06/04/2022
06/11/2002	12/12/2002	18/09/2007	09/10/2007	01/08/2012	22/08/2012	14/06/2017	05/07/2017	04/05/2022	25/05/2022
10/12/2002	30/01/2003	31/10/2007	20/11/2007	13/09/2012	04/10/2012	26/07/2017	16/08/2017	15/06/2022	06/07/2022
29/01/2003	20/03/2003	11/12/2007	02/01/2008	24/10/2012	14/11/2012	20/09/2017	11/10/2017	27/07/2022	17/08/2022
18/03/2003	08/05/2003	30/01/2008	20/02/2008	12/12/2012	03/01/2013	01/11/2017	22/11/2017	21/09/2022	12/10/2022
06/05/2003	26/06/2003	18/03/2008	08/04/2008	30/01/2013	20/02/2013	13/12/2017	03/01/2018	02/11/2022	23/11/2022
25/06/2003	14/08/2003	30/04/2008	21/05/2008	20/03/2013	10/04/2013	31/01/2018	21/02/2018	14/12/2022	04/01/2023
12/08/2003	18/09/2003	25/06/2008	16/07/2008	01/05/2013	22/05/2013	21/03/2018	11/04/2018	01/02/2023	22/02/2023
16/09/2003	30/10/2003	05/08/2008	26/08/2008	19/06/2013	10/07/2013	02/05/2018	23/05/2018	22/03/2023	12/04/2023
28/10/2003	11/12/2003	16/09/2008	07/10/2008	31/07/2013	21/08/2013	13/06/2018	05/07/2018		
09/12/2003	29/01/2004	29/10/2008	19/11/2008	18/09/2013	09/10/2013	01/08/2018	22/08/2018		
28/01/2004	18/03/2004	16/12/2008	06/01/2009	30/10/2013	20/11/2013	26/09/2018	17/10/2018		
16/03/2004	06/05/2004	28/01/2009	18/02/2009	18/12/2013	08/01/2014	08/11/2018	29/11/2018		
04/05/2004	01/07/2004	18/03/2009	08/04/2009	29/01/2014	19/02/2014	19/12/2018	09/01/2019		
30/06/2004	12/08/2004	29/04/2009	20/05/2009	19/03/2014	09/04/2014	30/01/2019	20/02/2019		
10/08/2004	23/09/2004	24/06/2009	15/07/2009	30/04/2014	21/05/2014	20/03/2019	10/04/2019		
21/09/2004	11/11/2004	12/08/2009	02/09/2009	18/06/2014	09/07/2014	01/05/2019	22/05/2019		
10/11/2004	16/12/2004	23/09/2009	14/10/2009	30/07/2014	20/08/2014	19/06/2019	10/07/2019		

Notes: Self elaboration based on FOMC (2023). Unscheduled FOMC meetings are not considered.

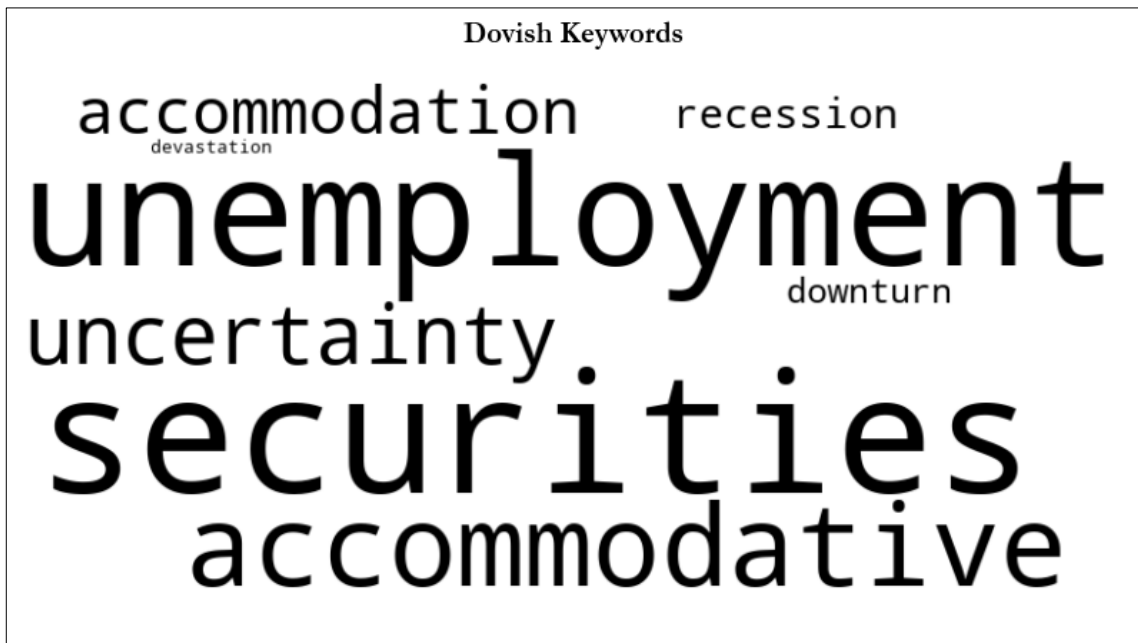
Appendix C: Word Cloud of hawkish and dovish keywords

C.1. Statements



Notes: Self elaboration based on FOMC (2023). The word clouds were developed for the hawkish and dovish terms shown in Appendix A that appear in the FOMC statements from 2000M02–2023M03. The size of a word in each word cloud is proportional to the number of times it is used.

C.2. Minutes



Notes: Self elaboration based on FOMC (2023). The word clouds were developed for the hawkish and dovish terms shown in Appendix A that appear in the FOMC minutes from 2000M03–2023M04. The size of a word in each word cloud is proportional to the number of times it is used.

Appendix D: Results from TVP Model

Long-term Expectations De-anchorage	
$\sigma_{\varepsilon_1}^2$	-6.895*** (0.678)
$\sigma_{\varepsilon_2}^2$	-3.334*** (0.351)
$\sigma_{\varepsilon_v}^2$	-4.290*** (0.169)
c	-0.001 (0.013)
a	0.966*** (0.024)

Notes: The table shows the results for model (6). The coefficients represent the estimated variances of the time-varying de-anchoring factors ($\sigma_{\varepsilon_1}^2, \sigma_{\varepsilon_2}^2$ for θ_{1t}, θ_{2t} , respectively) and the disturbances of the model ($\sigma_{\varepsilon_v}^2$). Standard errors are given in parenthesis; *, **, and *** indicate significance at the 10%, 5% and 1%-level, respectively. Variance parameters are in exponential form to ensure positive variances ($\exp(\sigma_{\varepsilon_1}^2), \exp(\sigma_{\varepsilon_2}^2), \exp(\sigma_{\varepsilon_v}^2)$). Results for the control variables are not shown.