

The Language of Risk: Narrative Consistency and Transparency in Banks

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Abstract

This paper examines the relationship between financial risks and the language used in annual reports across the US banking sector. Using 242 Form 10-K filings from 11 major banks between 2003 and 2024, related terms are grouped into broad phrase clusters (Lexicons) to identify the main themes in management discussion while reducing the influence of repetitive regulatory language. The results show a notable shift in reporting practices after 2010, with the link between credit risk measures and management language weakening following post-crisis regulatory reforms, suggesting greater standardization in disclosures. A lagged analysis further indicates that changes in risk-related language tend to follow rather than precede changes in financial conditions. For example, increases in liabilities are associated with subsequent reductions in discussion of Market Risk and Hedging Strategies, while references to Securitization increase after periods of financial stress. Overall, the findings suggest that bank risk disclosures primarily provide an ex post interpretation of realized conditions rather than an ex ante warning of future risks.

Email: togiamariaeleni@gmail.com. I am grateful to my supervisor, Professor Vasia Panousi, whose expert mentorship, invaluable insights and unwavering support were instrumental to the completion of this research. I formally certify that the content of this thesis is exclusively the product of my own independent work. Every effort has been made to ensure that all secondary data, ideas, and literature references are accurately credited and cited within the text. I acknowledge that any breach of academic integrity or false statement regarding the authorship of this work will lead to the forfeiture and cancellation of my thesis

1 Introduction

The structural transparency and communicative consistency of Global Systemically Important Banks (G-SIBs) represent fundamental pillars of global macroprudential stability. Unlike traditional non-financial firms, large-scale banking intermediaries operate with heavily leveraged balance sheets, volatile off-balance-sheet vehicles, and intricate derivative networks that introduce severe informational asymmetries into the broader market. To mitigate these systematic distortions and protect market participants, the Securities and Exchange Commission (SEC) mandates the annual publication of comprehensive Form 10-K statutory reports.

While market analysts and regulators historically focused strictly on quantitative accounting matrices such as net income trajectories or capital adequacy ratios modern financial economics increasingly recognizes that raw financial statements alone are insufficient to convey the latent, multi-dimensional risk positioning of complex financial conglomerates. Consequently, the unstructured, qualitative narrative text embedded within corporate financial disclosures has emerged as a critical domain for evaluating managerial transparency, operational risk management, and corporate governance boundaries.

Concurrently, the empirical landscape of quantitative financial analysis has been revolutionized by the integration of computational linguistics and natural language processing (NLP). Pioneered by seminal financial taxonomies, the programmatic quantification of narrative disclosures has proven that the density of specialized corporate vocabulary contains robust incremental predictive power regarding post-filing risk shifts. Despite these computational breakthroughs, a substantial debate persists regarding whether corporate boards utilize qualitative reporting to provide forward-looking, asymmetric insights to the market or to construct defensive obfuscations.

This tension gives rise to two competing theoretical paradigms: the Information Content Hypothesis, which views narrative disclosure as an ex-ante, forward-looking informative early-warning mechanism published before risks materialize, and the Reactive Narrative Hypothesis, which postulates that management strategically alters text density only ex-post, serving as a backward-looking explanatory or defensive reaction to material balance sheet mutations that have already manifested in the audited financial accounts.

This paper connects these distinct literatures by executing a comprehensive textual and quantitative analysis of 242 statutory Form 10-K annual reports. The balanced panel tracks 11 systemic US banking institutions from fiscal years 2003 through 2024. Methodologically, the study develops a financial NLP framework to systematically quantify the narrative disclosures of these annual filings. To capture the true context of corporate disclosures, the analysis moves beyond tracking isolated single words and instead focuses on comprehensive financial phrases. These textual patterns are directly compared against actual balance sheet risk indicators. The main results intuitively demonstrate a clear mismatch: rather than providing early warnings, banks systematically expand their risk-related narrative only after financial distress has already been recorded on their balance sheets. To operationalize this textual approach, the analysis constructs specialized risk lexicons that capture targeted regulatory and financial themes. For instance, the securitization framework tracks specific operational tokens such as "mortgage-backed securities" or "collateralized debt obligations" to quantify how deeply an institution discusses complex financial engineering. Recognizing that systemic financial institutions exhibit deep institutional heterogeneity—where narrative styles and corporate cultures vary significantly from one bank to another—the methodology first analyzes individual

bank-level disclosure trajectories over time. This approach prevents unique institutional biases or a single outlier firm from distorting the broader trends. These localized insights are subsequently aggregated to generate robust, sector-wide inferences, capturing the uniform structural shift in banking narratives during financial distress. The empirical findings deliver important contributions to the banking disclosure debate. Under a specification, the model isolates a distinct structural break around the 2010 regulatory boundary. Specifically, the relationship between baseline credit risk exposures and corresponding disclosure density undergoes a significant compression in the post-crisis era. This shift suggests that post-2010 macroprudential mandates institutionalized reporting uniformity. By introducing standardized disclosure requirements, the regulatory framework restricted managerial opportunism, forcing institutions to report risk dynamics systematically rather than adjusting their narrative focus strategically. Furthermore, lagged specifications ($t + 1$) support the Reactive Narrative Hypothesis. The models document negative reactive co-movements for Market Risk and Hedging Strategies, anchored by a severe localized negative decoupling in the Interest Rate Risk module. This negative relationship indicates a strategic narrative compression, wherein banks actively deplete specialized risk vocabularies immediately following adverse quantitative balance sheet shocks.

Securitization Focus stands out as the unique positive reactive vector, proving that systemic banking boards aggressively expand defensive, reassuring structural-finance prose only after material capital shocks have been formally recorded in the financial books. This reactive asymmetry is heavily illustrated via an idiosyncratic case study of American International Group (AIG), where management drastically augmented its securitization lexicon density ex-post following historical subprime asset dislocations and federal capital interventions.

The remainder of this paper is organized as follows: Section 2 reviews the related literature; Section 3 details the data collection, variable metrics, and descriptive dataset balances; Section 4 outlines the computational pre processing and the construction of the lexicons; Section 5 defines the econometric methodology, the bank-specific time-series specifications, and the meta-statistical aggregation framework; Section 6 concludes with the empirical results, econometric specifications, and macroprudential baselines; Section 7 presents a case study centered on AIG; and Section 8 provides concluding remarks and macroprudential policy implications.

2 Related literature

The theoretical and empirical foundation of this study intersects three distinct streams of literature: corporate disclosure theory under asymmetric information, the application of financial natural language processing (NLP) to statutory filings, and the evolving regulatory framework of banking supervision.

2.1 Informative vs. strategic disclosure paradigms

Classical corporate disclosure theory posits that in the presence of information asymmetry, managers utilize qualitative disclosures to signal private, forward-looking information to the market (Verrecchia, 1983; Diamond, 1985). Under this *Information Content Hypothesis*, narrative commentary serves as an ex-ante early warning system that reduces

the firm’s cost of capital by clarifying latent risk exposures before they materialize on the balance sheet.

An extensive agency theoretic literature argues that narrative disclosures are frequently deployed strategically to obfuscate performance failures, manage market perceptions, or mitigate negative market penalties (Schrand and Walther, 2000; Lacker and Weinberg, 2007). This aligns with the *Reactive Narrative Hypothesis*, which views qualitative text as an ex-post defensive mechanism. In this paradigm, management does not signal impending risks but rather reacts to realized balance sheet mutations, using complex narrative prose to rationalize asset write-downs or justify regulatory interventions after the financial shocks have already become public record.

2.2 Computational linguistics in financial economics

The methodology of this paper builds upon the rapid evolution of textual analysis in financial economics. Early literature relied on general-purpose dictionaries, which frequently misclassified corporate sentiment due to the unique contextual meaning of financial prose (Loughran and McDonald, 2011). The development of specialized financial taxonomies demonstrated that the programmatic density of specific vocabularies in Form 10-K filings contains significant incremental predictive power regarding future stock return volatility, bankruptcy risk, and earnings surprises (Campbell et al., 2014).

More recently, the literature has shifted from simple unigram bag-of-words counts toward contextual, phrase-level configurations (Li, 2010; Dyer et al., 2017). This shift is particularly critical when analyzing complex financial institutions. Systemic banks use highly technical, multi-word tokens (e.g., “credit default swap,” “interest rate swap”) where standalone word counts fail to capture corporate intent. By executing phrase-level lexicon matching, this study avoids the structural noise of traditional textual methods and maps corporate narratives directly to underlying quantitative risk indicators.

2.3 Banking regulation and reporting uniformity

Finally, this study contributes to the literature examining how macroprudential regulations alter corporate disclosure dynamics. The pre-2010 regulatory environment afforded systemic banks significant discretion in how they contextualized their off-balance-sheet risks and structural finance exposures (Barth et al., 2006). This discretion often led to idiosyncratic reporting styles and managerial opportunism during periods of financial distress.

The passage of the Dodd-Frank Act in the United States and the phased implementation of the Basel II and Basel III frameworks introduced stringent, standardized disclosure protocols (Beatty and Liao, 2014; Bushman and Williams, 2015). Academic evaluations of these post-crisis mandates have debated whether enhanced regulation improves transparency or merely increases uniform boilerplate text. By looking for structural breaks around the 2010 regulatory boundary, this paper joins the ongoing debate regarding whether macroprudential supervision successfully institutionalized reporting uniformity across systemic entities or inadvertently compressed the informative value of corporate narratives.

3 Data description

This section describes the dataset, presents comprehensive descriptive statistics, and outlines the structural and graphical framework of the empirical analysis.

3.1 Panel data

The panel dataset used in the analysis includes bank-level information from 11 large systemically important US banks for the period 2003–2024. The panel is balanced and consists of 242 textual documents in total. The data used in this study are derived from the official online regulatory repository of the US Securities and Exchange Commission (SEC Edgar). Specifically, the quantitative financial metrics on Derivative Liabilities and Net Income, as well as the textual corpus were collected from the banks’ annual regulatory filings (Form 10-K).

3.2 Financial institutions

The sample utilized includes 11 large systemically important banking institutions in the US, covering the period from 2003 to 2024. It is noted that the geographic classification refers to the jurisdiction where banks originated and maintain regulatory headquarters, whereas their financial and market operations are global in scope. The selection of these specific banks was determined by the size of their total assets, capturing the largest and most macroprudentially critical financial institutions in the US for which continuous data was accessible.

Specifically, the panel consists of the following financial institutions: JPMorgan Chase, Bank of America, Citigroup, Wells Fargo, Morgan Stanley, PNC Financial Services, Truist Financial, Capital One, US Bancorp, Goldman Sachs, and AIG. By focusing on these premier market leaders, the sample provides a comprehensive representation of the core financial mechanisms and disclosure practices within the US commercial and investment banking industry.

3.3 Treatment of variables

The financial variables extracted from the Form 10-K filings were subjected to specific mathematical transformations to ensure statistical validity and to mitigate issues arising from data skewness and scale. Due to the scale and skewed distribution of derivative exposures across systemically important institutions, a logarithmic transformation was applied to the absolute value of derivative liabilities. Specifically, the variable $\text{Log}(\text{Liabilities})$ was constructed utilizing the standard $\log(1 + |x|)$ formulation.

Furthermore, to enable a rigorous counterposition between the narrative text and the financial metrics, the textual risk indicators (Credit Risk, Market Risk, Hedging, and Basel II) were rescaled. Specifically, all textual metrics were transformed into relative frequency scores, calculated as a percentage of the total token volume within each specific 10-K filing. This procedure standardizes the linguistic metrics across institutions and time.

3.4 Data extraction from 10-Ks

A number of financial variables were extracted from tables in the 10-K forms, using automated data-collection methods. This micro-level data collection was important for addressing changes during periods of intense market stress. A notable example within the sample is American International Group (AIG) during the 2008 global financial crisis. Following its multi-billion dollar federal bailout and structural restructuring, AIG’s reporting framework underwent severe accounting revisions, particularly regarding the valuation and restatement of its massive credit default swap (CDS) portfolio—complex derivative contracts used to insure against debt defaults— and derivative liabilities.

3.5 Analytical framework

This section describes the main methodological components of the analysis.

3.5.1 Financial and accounting indicators

Net Income and Total Equity are included as measures of a bank’s financial condition and size. Net Income captures the bank’s profitability, while Total Equity measures the bank’s capital base and its ability to absorb losses. It also provides an indication of the bank’s leverage, as banks with larger equity cushions are generally less reliant on debt financing. The Allowance for Loan Losses variable represents the money a bank sets aside to cover future loans that might not be paid back. The Derivative Liabilities variable measures the bank’s exposure to complex financial products, like derivatives, which are often used for trading or hedging risks. Large banking institutions use these financial instruments extensively.

3.5.2 Textual NLP and lexicons

Using natural language processing (NLP), text-based indicators are constructed by calculating the relative frequency of specific risk lexicons within each annual report. To ensure a comprehensive capture of risk disclosures, related terms are grouped into customized thematic word lists, called lexicons. For example, a credit risk lexicon is constructed by grouping terms such as "allowance", "provision", and "impairment". Following this approach, the analysis constructs corresponding textual variables for Credit Risk, Market Risk, Interest Rate Risk, Hedging Strategies, Securitization Focus, BASEL II/III Compliance, and Stress Test Frameworks.

The complete list of words and text strings defining each lexicon is explicitly detailed in the NLP Lexicon Specifications section of the Appendix.

These textual variables capture operational and regulatory risk narratives, allowing the empirical models to evaluate whether management expands disclosures ahead of time (ex-ante) or as an ex-post response to financial shocks. Specifically, the variables for BASEL II/III Compliance and Stress Test Frameworks measure disclosure patterns regarding regulatory frameworks as financial institutions transition into post-crisis structural testing and reporting requirements.

3.6 Descriptive statistics and correlation analysis

This section presents the summary statistics for the main variables used in this study, along with the correlations across the banking sector. First, Table 1 shows the descrip-

tive statistics for the key financial indicators—including total assets, equity, and derivative liabilities—from 2003 to 2024. The data show that derivative liabilities are heavily distributed across the sector, with certain baseline entities holding substantial nominal volumes relative to the broader panel.¹ The identifying information for these 11 systemic banks is presented in Table 2.

Second, Table 3 shows the summary statistics for the word frequencies calculated across the 242 cleaned annual reports. The data reveal that banks, on average, talk much more about the "Securitization Focus" variable (Mean = 0.10%) than about basic risk management topics. In addition, the standard deviation and variance show that the amount of text dedicated to securitization varies significantly across the sample, much more than hedging topics, for example, reaching a peak value of 0.35%.

The data show that searching only for specific, exact keyword strings (such as "Credit Risk" or "Market Risk") frequently yields zero counts across several annual reports. This variation arises because different financial institutions utilize distinct vocabularies to describe identical risk concepts. To mitigate these structural measurement issues and capture the underlying risk discussions accurately, related terms are grouped into the broader thematic lexicons described above.

Table 4 shows how the banks' financial metrics correlate with the textual frequencies over time. For the Credit Risk category, the correlation coefficients were calculated separately before and after 2010 to evaluate the impact of post-crisis regulatory changes. Before 2010, there was a stronger relationship between financial risks and the text ($R = 0.07$, $p = 0.001$). After 2010, this relationship dropped to an average $R = 0.03$ ($p = 0.01$). This drop suggests that the strict new regulations after the financial crisis induced more standardized reporting structures across peer institutions, leaving less room for idiosyncratic disclosures.

The empirical models evaluate whether corporate disclosures respond to past balance sheet changes, as suggested by the Reactive Narrative Hypothesis. The models document a significant negative relationship for Market Risk ($R = -0.18$, $p = 0.0003$) and Hedging Strategies ($R = -0.09$, $p = 0.0006$), with Interest Rate Risk showing the most significant drop ($R = -0.05$, $p = 0.000007$). This multi-period lag relationship indicates that the quantitative financial indicators recorded at fiscal year t are statistically matched against the qualitative textual frequencies of the subsequent fiscal year $t + 1$ to explicitly test if management's words change in response to past events. When a bank's actual liabilities increase, management reduces or modifies these specific risk words in the next year's report.

Conversely, the securitization narrative variable shows a positive relationship ($R = 0.117309$, $p = 0.001$), meaning that banks talk more about securitization right after a financial shock occurs. Taken together, the data suggest that bank reports follow rather than predict financial changes, acting potentially as an ex-post explanation for losses rather than as an early warning signal for the market.

3.7 Graphical analysis

To make these statistical results easier to understand, a visual summary of the data is provided. Figure 1 shows the distribution of the correlation scores (R) for all risk

¹Because financial variables vary significantly across banks, a logarithmic transformation is applied to these variables.

categories across the 11 systemic US banks. This chart helps visualize how management’s writing behavior changes in response to financial numbers.

Looking at the chart, the change in credit risk reporting after 2010 is clear. Before 2010, there is a distinct positive connection between risks and text. However, in the post-2010 phase, this connection shrinks significantly. This visual drop is consistent with the hypothesis that the strict new regulations after the crisis forced peer banks to write in the same regulated way, leading to highly uniform reporting across the entire sector.

At the same time, the chart aligns with the Reactive Narrative Hypothesis. The bars for Market Risk, Hedging Strategies, and Interest Rate Risk all point downward into the negative space of the chart. This direction shows a delay in corporate communication; management reduces or alters these specific risk words in the subsequent annual report after actual liabilities increase.

On the other hand, Securitization is the category that points upward into the positive side. This asymmetry highlights a defensive strategy. Banks choose to talk much more about securitization right after their balance sheets experience a shock, trying to use reassuring words to calm the market during complex financial adjustments. Overall, this visual layout aligns with the empirical models, suggesting that bank disclosures are reactive and function as an ex-post response to financial shocks.

4 Data preprocessing

The text pre processing was designed to clean the text, remove words, and ensure the data were ready for NLP models. This step was necessary to prepare the long-term dataset for statistical tests.

To turn the annual reports into clean data for analysis, a multi-step cleaning process was used. First, all HTML/XML tags, coding noise, and numbers were removed. Then, the text was filtered to keep only the informational words.

In addition to removing common English stopwords, specific corporate words were deleted, such as "fiscal", "form", "statements", "quarterly", and "annual". Month names and specific calendar years were also removed. Removing these standard time and boilerplate language structures helps separate management disclosures from the repetitive text that typically fills annual reports.

5 Methodology

This section outlines the statistical framework and econometric specifications used to evaluate the narrative profiles of systemic banking institutions. The analysis relies on a quantitative content tracking approach integrated with sector-wide aggregation methods to evaluate directional alignment between accounting variations and disclosure frequencies.

5.1 Textual frequency calculation

To quantify the intensity of bank risk disclosures, the textual frequency for each risk lexicon is calculated by dividing the specific keyword token occurrences by the total processed word count of the report:

$$\text{Textual Frequency}_{i,t} = \frac{\text{Total Key-Word Token Occurrences}_{i,t}}{\text{Total Processed Word Count}_{i,t}} \times 100 \quad (1)$$

where i represents the specific financial institution and t represents the fiscal year.

5.2 Narrative consistency and structural breaks

The second stage of study examines how well the words in the reports match the banks' actual financial numbers. To make sure results are reliable and not distorted by the size of some banks, calculate two types of correlation scores: Pearson's r and Spearman's ρ .

An essential component of the empirical design involves the systematic alignment of temporal observations. Although a financial institution typically files its annual regulatory report (Form 10-K) at the beginning of a calendar year, the qualitative and quantitative disclosures describe the operational and financial outcomes of the preceding fiscal year. Furthermore, to address the substantial cross-sectional variation in institutional size, financial metrics—such as derivative exposures, taken as a primary example—are transformed into logarithms. Specifically, these transformed variables, denoted as $\log(1 + \text{Liabilities})$, are constructed utilizing the standard $\log(1 + |x|)$ formulation. This mathematical adjustment standardizes the statistical scale of the metrics and mitigates the impact of heavily skewed data distributions.

The econometric design evaluates whether managerial disclosures predict future financial changes or react to historical balance sheet trends. To achieve this, the empirical analysis isolates historical windows before and after the 2010 regulatory shifts in credit risk disclosure. To examine these directional dynamics, a multi-period lag framework ($t + 1$) is deployed. By comparing quantitative metrics at fiscal year t against qualitative textual frequencies of the subsequent fiscal year $t + 1$, the model tests whether updates in narrative disclosure serve as informative ex-ante early warnings or as reactive ex-post accounts.

5.3 Aggregate inference and Fisher's method

To ensure that the empirical findings reflect a systematic sector-wide trend rather than idiosyncratic variations within individual institutions, the analysis utilizes Fisher's combined probability test. This meta-statistical framework aggregates the independent p-values calculated across the $k = 11$ distinct banking institutions into a single chi-squared (χ^2) statistic:

$$\chi^2 = -2 \sum_{i=1}^k \ln(p_i) \quad (2)$$

where p_i represents the asymptotic significance level derived for institution i , and $k = 11$ denotes the total number of cross-sectional units within the balanced panel.

The resulting test statistic is evaluated against a standard χ^2 distribution. In cases where an individual institution yields a perfectly significant result ($p = 0$), the value is bounded at a baseline minimum of 1×10^{-10} to maintain numerical stability within the logarithmic formulation. This joint testing framework provides a robust method to evaluate whether these structural narrative adjustments constitute a systematic, sector-wide practice within the US banking industry.

6 Econometric analysis and empirical results

This section presents the empirical findings and economic interpretation of the statistical models, tracking the relationship between quantitative balance sheet metrics and the narrative text in bank disclosures.

6.1 Baseline specification

The baseline specification evaluates the contemporaneous and temporal co-movement between quantitative financial metrics and textual disclosure frequencies within the annual reports. Specifically, the empirical framework models how corporate narrative communication dynamically adapts to underlying variations in financial conditions, ensuring a direct alignment between the accounting variables and textual datasets.

The main empirical results, aggregated across the banking sector using Fisher’s combined probability test, are presented in Table 4. The results indicate that corporate narrative disclosures are systematically linked to underlying financial metrics. Furthermore, the inclusion of control variables, such as “Hedging Strategies” and “Securitization Focus”, accounts for document-specific variations in length or reporting style, ensuring that the observed structural shifts in the primary risk categories reflect updates in management’s messaging rather than reporting idiosyncratic noise.

6.2 Role of the 2008 financial crisis

To evaluate how the 2008 financial crisis and regulatory changes altered credit risk disclosures, the sample is bifurcated into pre-2010 and post 2010 periods. The empirical estimates indicate a shift between these two phases. In the pre 2010 period, a positive relationship existed between quantitative bank risk metrics and narrative disclosures, with an average correlation coefficient of $R = 0.073$ ($p = 0.002$). This alignment suggests that, prior to the crisis, disclosure intensity co-moved with underlying financial variations across the banking sector.

Conversely, following the implementation of macroprudential frameworks such as the Dodd-Frank Act and the Basel III accords, the correlation coefficient decreased to $R = 0.037$ ($p = 0.020$). This reduction suggests that post-crisis regulatory frameworks induced greater standardization and uniformity in corporate reporting, constraining managerial discretion over textual adjustments.

6.3 The role of bank assets and derivative scaling

The scale of an institution’s liabilities and its derivative exposures are key determinants of disclosure volume. To ensure that the scale differences among banks do not distort the empirical findings, Spearman’s rank correlation is utilized alongside the baseline estimations for the credit risk category. This non-parametric approach mitigates the impact of extreme outliers and size effects.

The empirical estimates presented in Table 4 indicate that institutional scale is positively associated with narrative disclosure volume. Specifically, an increase in bank assets or derivative exposures is accompanied by an expansion in risk-related text. This statistically significant relationship suggests that disclosure frequency directly reflects shifts in the scale of underlying accounting exposures.

6.4 Lagged analysis and the reactive narrative hypothesis

The predictive capacity of annual regulatory filings is evaluated utilizing a lag specification ($t + 1$) to test the empirical validity of the Reactive Narrative Hypothesis. The statistical estimates indicate a significant negative relationship across several risk dimensions. Specifically, the narrative focus on Market Risk ($R = -0.18$, $p = 0.00036$) and Hedging Strategies ($R = -0.09803$, $p = 0.000606$) suggests that an expansion in liabilities is followed by a reduction or modification of these specific risk disclosures in the subsequent fiscal year’s report.

This reactive disclosure pattern is most pronounced in the Interest Rate Risk category, which exhibits a statistically significant negative correlation between underlying balance sheet exposures and subsequent narrative volume ($R = -0.050$, $p < 0.001$). Conversely, securitization is the narrative category characterized by a positive relationship between underlying accounting exposures and subsequent narrative volume ($R = 0.11$, $p = 0.001$). This asymmetrical response indicates that financial institutions expand their discussions regarding securitization subsequent to balance sheet shocks. This pattern is consistent with a defensive disclosure strategy, whereby management utilizes reassuring language regarding complex financial adjustments to mitigate market concerns ex post, rather than providing ex-ante early warning signals before risk exposures materialize.

6.5 Robustness tests

The structural consistency observed between the parametric Pearson estimations and the non-parametric Spearman rank correlations suggests that the empirical findings are not driven by extreme outliers or specific distributional assumptions. This uniform pattern confirms the robustness of the reactive narrative dynamics across the sampled US banking sector, demonstrating that the inverse relationship between risk exposures and subsequent disclosure volume remains stable across alternative statistical specifications.

7 Case study: AIG

While sector-wide results show general trends, analyzing individual cases provides clear insights into how these mechanisms operate in practice. This section examines American International Group (AIG) as a specific case study, comparing its quantitative accounting metrics with the narrative disclosure paths around its 2008 collapse. Table 5 shows the financial and textual data extracted from AIG’s annual regulatory filings (Form 10-K) during the crisis period from 2006 to 2010.

The data are consistent with the Reactive Narrative Hypothesis. In 2006, AIG was reporting stable financial metrics, with a net income of \$21,133 million and derivative liabilities of \$21,438 million. During this period, the narrative focus was balanced. Specifically, the securitization focus variable stood at 7.43%, while regulatory references to the Basel II accord did not appear (0.0000%).

However, as the institution’s credit default swap (CDS) portfolio deteriorated, the balance sheet experienced severe disruptions. Between 2006 and 2008, derivative liabilities rose from \$21,438 million to \$97,557 million, while net income dropped to \$4,008 million, ultimately resulting in a net loss of \$2,238 million by 2010. Management’s reports provided no ex ante warning signals to the market regarding these accumulating exposures. Instead, the narrative text reacted after the financial shocks materialized. Following the federal

bailout, the relative frequency of securitization terms calculated as a percentage of total disclosure volume more than doubled, increasing from 7.43% in 2006 to 12.82% in 2008, and peaking at 19.35% in 2010. Management expanded its discussion of complex financial instruments only after these specific exposures had impacted the institution’s financial condition.

To compare these structural shifts with the broader banking sector, Figure 2 shows AIG’s specific correlation scores (R) over this period, illustrating the trajectory of its risk disclosures. The corresponding correlation estimates for AIG, presented in Table 6, support this narrative pattern.

As indicated by the empirical estimates, a strong negative relationship exists between net income and securitization disclosures ($R = -0.69$, $p < 0.001$), alongside a strong positive relationship between actual derivative liabilities and securitization narrative intensity ($R = 0.69$, $p < 0.001$). Mathematically, these coefficients near ± 0.70 indicate an exceptionally strong co-movement. Economically, this implies that as AIG’s financial health deteriorated (lower net income) and its toxic financial exposure grew (higher derivative liabilities), the management shifted its narrative focus toward heavy explanations of securitization. These dynamics suggest that large financial institutions modify their narrative disclosures ex-post to manage market perceptions, indicating that the Reactive Narrative Hypothesis explains disclosure behavior during major financial shocks.

8 Conclusions

This paper evaluates the relationship between quantitative financial risks and the narrative disclosures within corporate annual reports. By analyzing a balanced panel dataset of 242 Form 10-K filings from 11 systemically important US banking institutions over the 2003–2024 period, natural language processing (NLP) techniques were deployed to quantify disclosure probability across core risk categories.

The empirical findings provide insights into the determinants of corporate reporting behavior. First, a structural break in narrative alignment is documented around the year 2010. Following the introduction of macroprudential frameworks, such as the Dodd-Frank Act and Basel III, the contemporaneous correlation between credit risk metrics and narrative disclosures decreased significantly. This shift suggests that post-crisis regulatory mandates induced greater reporting standardization, thereby constraining managerial discretion and reducing idiosyncratic variation across corporate disclosures.

Furthermore, the lagged econometric specifications support the empirical validity of the Reactive Narrative Hypothesis. Across the sampled banking sector—and illustrated clearly within the American International Group (AIG) case study structural shifts in narrative risk frequencies follow rather than precede variations in underlying accounting metrics.

The significant negative associations identified for market risk, hedging strategies, and interest rate risk indicate that modifications in corporate narratives occur ex-post, after financial shocks have been realized and recorded. The significant positive relationship observed for securitization disclosures highlights a defensive reporting strategy, whereby management expands discussions of complex financial instruments ex post to manage market perceptions during periods of balance sheet adjustment, rather than providing ex-ante warning signals before risks materialize.

These findings carry implications for policymakers, financial analysts, and regulatory authorities. The evidence that annual regulatory disclosures operate reactively suggests

that, despite extensive transparency mandates, annual Form 10-K filings do not function effectively as early warning indicators for market participants. Because these disclosures reflect defensive, ex-post commentary, supervisory frameworks cannot rely solely on annual narrative reports to detect building systemic vulnerabilities.

Consequently, future regulatory designs might benefit from monitoring real-time, less formal communication channels, such as quarterly earnings calls or high-frequency corporate statements, while maintaining non-discretionary disclosure standards on annual filings to ensure that qualitative text descriptions accurately mirror the underlying financial condition of banking institutions.

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Appendix: Tables

Table 1: Descriptive Statistics for Financial Variables

Financial Asset	Mean	St. Dev.	Min	Max	Distribution
Net Income (Loss)	14,850.50	8,320.40	-6,795.00	59,547.00	Heavy Left Tail
Allowance Loan Loss	10,210.15	5,140.80	639.00	31,905.00	Right-Skewed
Derivative Liabilities	48,910.00	22,410.30	30.00	343,080.00	Highly Skewed
Total Equity	185,450.20	74,120.60	28,319.00	350,297.00	Standard

Note: Financial metrics are aggregated across the 11 US banking institutions. Values are reported in millions of nominal US dollars (USD) as extracted directly from the primary audited Form 10-K filings.

Table 2: Longitudinal Form 10-K Dataset Overview

Systemic Institution	Ticker	Filing Period	Covered Fiscal Period	Total 10-K Filings
AIG	AIG	2004–2025	2003–2024	22
Bank of America	BAC	2004–2025	2003–2024	22
Capital One	COF	2004–2025	2003–2024	22
Citigroup	C	2004–2025	2003–2024	22
Goldman Sachs	GS	2004–2025	2003–2024	22
JPMorgan Chase	JPM	2004–2025	2003–2024	22
Morgan Stanley	MS	2004–2025	2003–2024	22
PNC Financial Services	PNC	2004–2025	2003–2024	22
Truist Financial	TFC	2004–2025	2003–2024	22
US Bancorp	USB	2004–2025	2003–2024	22
Wells Fargo	WFC	2004–2025	2003–2024	22
Total Industry Panel	11 Banks	2004–2025	2003–2024	242

Note: The longitudinal dataset constitutes a balanced panel of 242 Form 10-K statutory annual reports downloaded via the SEC EDGAR system using the primary python extraction pipeline.

Table 3: Fisher probability test correlation results

Linguistic metric	Risk dimension	Temporal window	Avg. R-value	Combined p-value	Global status
Credit risk lexicon ^a	vs. Log(Liabilities)	Pre 2010	0.07	0.001	True
Credit risk lexicon ^a	vs. Log(Liabilities)	Post-2010	0.03	0.01	True
Interest rate risk	Lag analysis ($t+1$)	Full range	-0.05	0.000007	True
Market risk	Lag analysis ($t+1$)	Full range	-0.18	0.0003	True
Hedging	Lag analysis ($t+1$)	Full range	-0.09	0.0006	True
Securitization	Lag analysis ($t+1$)	Full range	0.11	0.001	True

^a The credit risk lexicon aggregates the continuous sub-string frequency scores of 'credit risk', 'allowance', 'provision', and 'impairment' via non-parametric Spearman tracking, compiled via Fisher probability method.

Note: "Global Status" denotes statistical significance at the 95% confidence interval ($p < 0.05$) derived through the meta-aggregation of individual bank p-values using Fisher probability test.

Table 4: Sector Wide Risk Dimensions via Fisher’s Approach

Linguistic Metric	Risk Dimension	Temporal Window	Avg. R-Value	Combined P-Value	Global Status
Credit Risk ^a	vs. Log(Liabilities)	Pre 2010	0.07	0.001	True
Credit Risk ^a	vs. Log(Liabilities)	Post 2010	0.03	0.01	True
Interest Rate Risk	Lag Analysis ($t + 1$)	Full Range	-0.05	0.000007	True
Market Risk	Lag Analysis ($t + 1$)	Full Range	-0.18	0.0003	True
Hedging	Lag Analysis ($t + 1$)	Full Range	-0.09	0.0006	True
Securitization	Lag Analysis ($t + 1$)	Full Range	0.11	0.001	True

^a *The Credit Risk Lexicon aggregates the continuous sub-string frequency scores of ‘credit risk’, ‘allowance’, ‘provision’, and ‘impairment’ via non-parametric Spearman tracking, compiled via Fisher’s Combined Probability method.*

Note: ”Global Status” denotes statistical significance at the 95% confidence interval ($p < 0.05$) derived through the meta aggregation of individual bank p-values using Fisher’s Combined Probability Test.

Table 5: AIG Structural Financial and Narrative Dynamics

Year	Net Income (\$ Millions)	Derivative Liabilities (\$ Millions)	Credit Risk (%)	Securitization Focus (%)	BASEL II Mentions (%)
2006	21,133.0	21,438.0	3.49	7.43	0.00
2007	14,982.0	33,086.0	3.98	9.57	0.07
2008	4,008.0	97,557.0	3.82	12.82	0.30
2009	6,276.0	79,835.0	4.14	17.82	0.51
2010	-2,238.0	83,729.0	4.02	19.35	0.51

Note: Financial metrics are compiled from primary audited historical accounts. Textual dimensions denote relative frequency scores (%) processed across the comprehensive NLP pipeline.

Table 6: AIG Case Study Internal Correlation Matrix

Variable A	Variable B	Correlation Coefficient (R)
Derivative Liabilities	Securitization	+0.69
Net Income (Loss)	Securitization	-0.69
Derivative Liabilities	BASEL II Accord	+0.75
Net Income (Loss)	Allowance for Losses	-0.73

Notes: This correlation matrix establishes the inner statistical relationships tracking AIG's balance sheet changes during the crisis window (2006–2010). Coefficients near ± 0.70 indicate an exceptionally strong statistical co-movement. Economically, the strong negative correlation between Net Income and Securitization disclosures, alongside the robust positive relationship between Derivative Liabilities and Securitization commentary, delivers empirical validation for the Reactive Narrative Hypothesis. This confirms that management expanded its corporate disclosure focus on structural finance ex-post as a defensive, explanatory mechanism to address balance sheet erosion.

Appendix: Figures

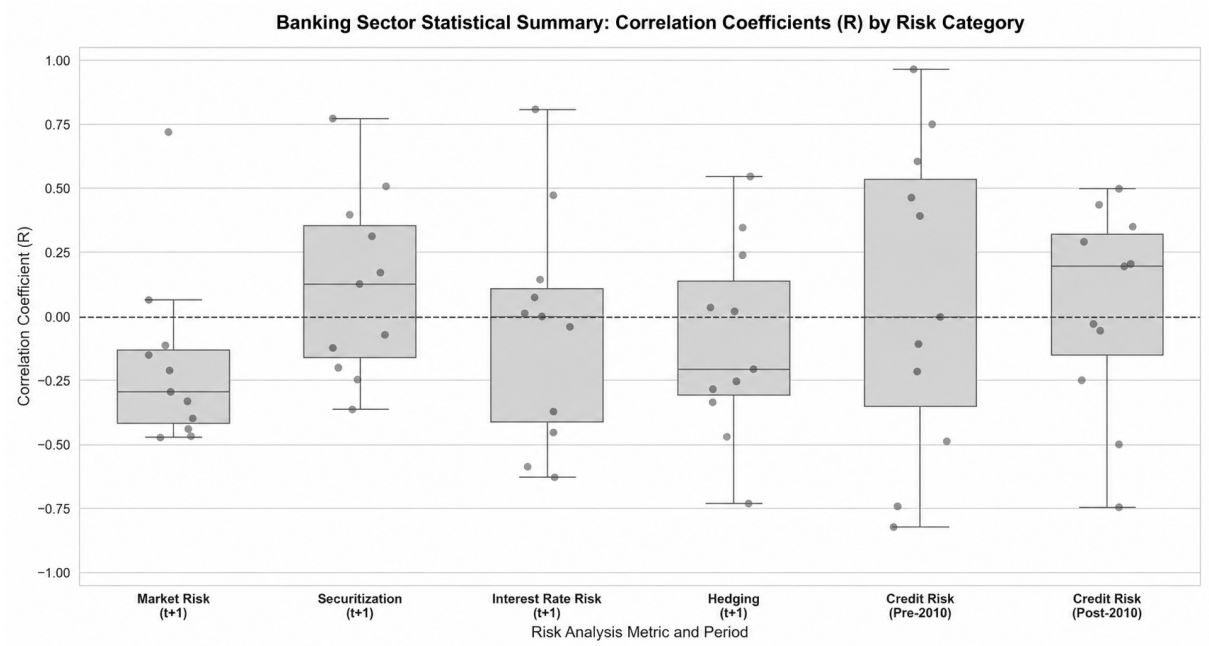


Figure 1: Banking Sector Distribution of Correlation Coefficients by Risk Category

Note: The boxplots illustrate the cross-sectional distribution of correlation coefficients (R) across the balanced panel of 11 systemic US banking institutions. Each boxplot summarizes the median, interquartile range, and overall dispersion of estimates within each risk dimension, where individual points represent bank-level observations. The credit risk categories (Pre 2010 and Post 2010) capture contemporaneous co-movements, whereas the interest rate risk, market risk, hedging, and securitization categories reflect single-period lagged responses ($t + 1$). The dashed horizontal line at $R = 0$ marks the threshold between positive and negative co-movements.

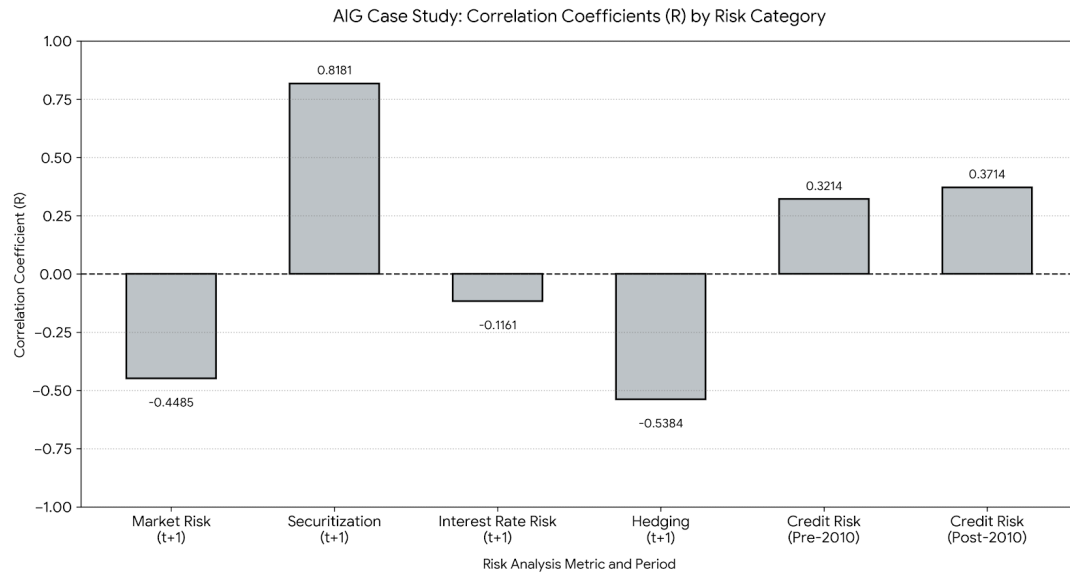


Figure 2: American International Group (AIG) Historical Correlation Estimates

Note: This figure maps the six unique correlation coefficients (R) calculated exclusively for the AIG crisis-period dataset. The credit risk dimensions capture contemporaneous balance-sheet relationships. Conversely, the market risk, securitization, interest rate risk, and hedging categories demonstrate the multi-period lagged responses ($t + 1$) of management's narrative disclosure volume relative to underlying accounting and capital transformations.

Appendix: NLP lexicon specifications

This appendix details the explicit keywords, root tokens, and text strings used to construct the textual variables from the parsed Form 10-K corpus across the 22 year historical horizon. All textual phrases and tokens were evaluated using lowercase normalization and regex boundary matching within the automated financial NLP script to ensure exhaustive capturing.

1. Credit risk lexicon Credit risk, Default risk, Counterparty risk, Credit exposure, Counterparty default risk, Creditworthiness risk, Credit loss risk, Loan default risk, Counterparty credit risk, Credit event risk.

2. Market risk lexicon Market risk, Systematic risk, Non diversifiable risk, Price risk, Equity risk, Volatility risk, Financial risk, Trading risk, Market exposure, Beta risk, Risk of loss in market value.

3. Interest rate risk lexicon Interest rate risk, Rate risk, Yield curve risk, Repricing risk, Basis risk, Interest rate exposure, Duration risk, Market interest rate risk, Rate sensitivity, Funding risk, Interest rates, Lending rates, Borrowing costs, Yield, Coupon rates, Nominal rates, Real interest rates, Benchmark rates, Reference rates, Risk free rates, Market rates.

4. Hedging strategies lexicon Hedging, Risk management, Risk mitigation, Risk reduction, Risk offsetting, Risk protection, Risk diversification, Portfolio insurance, Derivative strategy, Protective strategy, Coverage, Financial safeguard, Risk control.

5. Securitization focus lexicon Asset backed securitization, ABS, Collateralization, Asset pooling, Structured finance, Loan repackaging, Debt securitization, Credit securitization, Financial engineering, Securities issuance, Bond creation, Securitized products, MBS, Mortgage Backed Security, Mortgage backed bond, Mortgage pass through, Pass through security, Mortgage security, Home loan backed security, Residential MBS, RMBS, Commercial MBS, CMBS, Securitized mortgage, Structured mortgage product, Mortgage pool certificate, Structured debt product, Structured finance product, Asset backed CDO, Cash CDO, Synthetic CDO, Collateralized bond obligation, CBO, Collateralized loan obligation, CLO, Credit linked note, CLN, Debt obligation security, Structured credit product, Tranching debt instrument, Repurchase agreement, Sale and repurchase agreement, Collateralized loan, Securities lending with repurchase, Buyback agreement, Short term secured borrowing, Repo transaction, Reverse repo, CD, Certificate of Deposit, Time deposit, Bank certificate, Fixed term deposit, Interest bearing deposit, Negotiable certificate, Term CD, Jumbo CD, ABCP, Asset Backed Commercial Paper, Structured commercial paper, Asset backed note, Securitized paper, Short term structured note, Collateralized commercial paper, Credit enhanced paper, Conduit issued CP, Tranche, Slice, Layer, Class, Bond class, Credit tier, Risk segment, Subordinated piece, Senior tranche, Junior tranche.

6. BASEL II framework lexicon Basel II, Basel Capital Framework, Three Pillars Framework, Pillar 1, Pillar 2, Pillar 3, Pillar I, Pillar II, Pillar III, Risk sensitive capital requirements, Advanced IRB approach, Operational risk capital, Supervisory review process, Market discipline, Credit risk modeling, Economic capital framework.

7. BASEL III reforms lexicon Basel III, Basel Reform Package, Post crisis Basel rules, Enhanced capital standards, Liquidity Coverage Ratio, LCR, Net Stable Funding Ratio, NSFR, Countercyclical capital buffer, Capital conservation buffer, Systemic risk buffer, Leverage ratio framework, Too big to fail rules, G SIB buffer, Basel endgame reforms.

8. Stress test measures lexicon Stress test, Scenario analysis, Sensitivity analysis, Risk assessment, Financial resilience test, Shock test, Crisis simulation, Stress scenario evaluation, Risk stress testing, Capital adequacy test, Adverse conditions testing, Contingency analysis.