Financial Disclosure Quality and Capital Market Information Asymmetry Reduction

Jaxson Morgan

Aubree Foster

Sawyer Brooks

Abstract

This research investigates the nuanced relationship between the quality of corporate financial disclosures and the reduction of information asymmetry in capital markets, proposing a novel methodological framework that diverges from conventional event-study and regression-based approaches. We introduce a multi-dimensional, network-based contagion model that conceptualizes information asymmetry not as a static, firm-specific variable, but as a dynamic, systemic property that propagates through inter-firm informational linkages and investor sentiment networks. Our methodology synthesizes principles from complex systems theory, behavioral finance, and textual analysis of unstructured disclosure data, moving beyond traditional quantitative metrics of disclosure volume or frequency. We formulate and test three primary research questions: First, how do qualitative attributes of narrative disclosures—specifically semantic coherence, forward-looking statement density, and risk discussion granularity—influence the rate of asymmetry decay in a market network? Second, what is the role of disclosure timing heterogeneity across a sector in either amplifying or dampening systemic information asymmetry? Third, can a firm's high-quality disclosure generate positive externalities by reducing asymmetry for peer firms with lower disclosure quality? Our analysis utilizes a unique, hand-collected dataset of annual report narratives from the industrial sector over a fifteen-year period, processed through a bespoke natural language processing pipeline to extract the proposed qualitative dimensions. Results from our network contagion simulations reveal several non-intuitive findings. We demonstrate that the marginal impact of disclosure quality on asymmetry reduction is highly non-linear and contingent on a firm's position within the sectoral information network. Firms acting as 'informational hubs' exert a disproportionately large influence on systemic asymmetry. Furthermore, we identify a critical threshold of semantic coherence in narrative disclosures; beyond this threshold, the contagion of reduced asymmetry accelerates significantly. We also find evidence of strong positive externalities, where high-quality disclosures from market leaders measurably improve the informational environment for laggards, challenging the purely competitive view of disclosure. The paper concludes by outlining the im-

plications of this systemic, network-oriented perspective for regulators aiming to enhance market efficiency and for corporate managers strategizing their communication policies in an interconnected market ecology.

Keywords: Information Asymmetry, Disclosure Quality, Network Theory, Complex Systems, Textual Analysis, Capital Markets, Contagion Model

1 Introduction

The efficient functioning of capital markets is fundamentally predicated on the availability and equitable distribution of information. Information asymmetry, the state where one party in a transaction possesses material knowledge not available to others, represents a persistent friction that distorts pricing, hampers liquidity, and can ultimately lead to market failure. Traditional corporate finance and accounting literature has long posited that high-quality financial disclosure serves as a primary mechanism for mitigating this asymmetry. However, the dominant empirical paradigms for studying this relationship have remained largely confined to linear models examining firm-level outcomes, such as bid-ask spreads or analyst forecast dispersion, following discrete disclosure events. This paper argues that such approaches, while valuable, capture only a fraction of a more complex, systemic reality. Information asymmetry is not merely an attribute of a single firm but a relational and dynamic property that flows through the interconnected web of market participants. A disclosure by one firm does not exist in a vacuum; it alters the informational landscape for its competitors, suppliers, customers, and the entire analyst community. This research seeks to redefine the problem formulation by asking not only if disclosure quality reduces a firm's own information asymmetry, but how it reshapes the entire network of informational dependencies within a market sector. We propose that the process is akin to a contagion, where clarity and transparency can propagate, reducing uncertainty not just at the source but throughout connected nodes. This perspective draws inspiration from epidemiology and network science, fields seldom applied to this accounting context. Our investigation is guided by a core belief that the qualitative

texture of narrative disclosures—the coherence of its story, the candor of its forward-looking statements, the depth of its risk discussions—holds greater power to influence complex investor perceptions and network dynamics than quantitative metrics alone. By constructing a novel methodological framework that models the market as a dynamic network and disclosure quality as a multi-dimensional vector, we aim to uncover previously obscured relationships and non-linear effects that challenge conventional wisdom. This introduction sets the stage for a detailed exploration of our unconventional methodology, the unique dataset we have assembled, the surprising results from our simulations, and the broader implications for theory and practice.

2   Methodology

Our methodological approach represents a deliberate departure from standard econometric techniques, constructing instead a hybrid framework that integrates computational linguistics, network theory, and agent-based simulation. The core innovation is the Conceptual Market Network (CMN), a dynamic, directed graph model where nodes represent firms and edges represent weighted informational influence. Edge weights are not static but are functions of analyst coverage overlap, supply-chain linkages, and product market similarity, derived from historical databases. Information asymmetry is not an exogenous variable but an endogenous state variable for each node, initialized using a composite measure of bid-ask spread, PIN (Probability of Informed Trading) estimates, and analyst forecast divergence. The primary intervention in this system is the annual corporate disclosure, which we characterize along three novel qualitative dimensions extracted via a custom natural language processing (NLP) pipeline applied to the Management Discussion & Analysis (MD&A) section. First, Semantic Coherence Index (SCI) measures the logical flow and connective tissue of the narrative using graph-based representations of text and algorithms to assess conceptual linkage density. Second, Forward-Looking Granularity (FLG) quantifies the specificity and quantitative nature of projections and forecasts, moving beyond simple word counts. Third, Risk Discourse Depth (RDD) evalu-

ates the multidimensionality of risk discussions, distinguishing between generic boilerplate and detailed, scenario-based analyses.

These three dimensions form a Disclosure Quality Vector (DQV) for each firm-year observation. The contagion process is governed by a set of differential equations modeling the flow of 'informational clarity' from a disclosing firm to its neighbors in the CMN. The rate of flow is modulated by the strength of the connecting edge and the components of the DQV, with SCI acting as a primary amplifier. Crucially, the model incorporates a non-linear sigmoidal response function, positing that the assimilation of complex narrative information by the market has diminishing returns at low quality and accelerating returns after a threshold of coherence and granularity is passed. We also model a temporal dimension, where the sequence of disclosures within a fiscal season creates waves of clarity propagation. The system is implemented as a computational simulation in a dedicated environment, allowing us to run thousands of iterations with randomized initial conditions and network structures to test robustness. Our empirical dataset covers 120 industrial firms from 1990 to 2004, providing a rich panel for both calibrating the model's parameters and validating its outputs against observed market microstructure data. This methodology allows us to pose counterfactual scenarios—such as what the systemic asymmetry would have been if a key firm's disclosure quality were altered—that are impossible to examine with traditional observational data alone.

3   Results

The execution of our network contagion model yielded a series of findings that underscore the complexity and non-linearity of the relationship between disclosure quality and market-wide information asymmetry. A primary result is the identification and empirical validation of the non-linear threshold effect. The impact of a firm's Semantic Coherence Index (SCI) on the subsequent reduction of its own node-specific asymmetry, and more importantly on the asymmetry of its first-degree neighbors in the Conceptual Market Network, displayed a pronounced sigmoidal shape. Below an SCI threshold (calibrated

at approximately 0.65 on our normalized scale), improvements in narrative coherence yielded minimal incremental benefits. However, once a firm's disclosure crossed this threshold, the marginal reduction in both local and network asymmetry increased dramatically. This suggests that markets effectively 'tune out' poorly structured narratives, but engage deeply with coherent ones, processing not just the facts but the underlying story, which then radiates through the network.

Secondly, the analysis confirmed the pivotal role of network position. Firms centrally located in the CMN—those with high betweenness centrality due to being covered by a wide array of analysts or operating in diversified segments—acted as super-spreaders of informational clarity. A high-quality disclosure from such a hub firm produced a reduction in systemic asymmetry that was, on average, 3.2 times greater than an identical disclosure from a peripheral firm. This result highlights that the social and analytical structure of the market itself is a critical moderator of disclosure effectiveness. Furthermore, we observed strong evidence of positive externalities. In simulations where a high-centrality, high-disclosure-quality firm was artificially 'silenced,' the asymmetry levels of its connected peers, including those with poor disclosure practices, rose significantly. This provides compelling model-based evidence that transparent firms create a public good of market clarity that benefits even their less transparent competitors.

A third key finding relates to the timing of disclosures. Heterogeneous disclosure dates within a sector, contrary to some expectations of creating a continuous information flow, were found under our model to amplify short-term network volatility in asymmetry. A clustered release pattern, while creating a concentrated informational event, led to a faster and more stable decay of systemic asymmetry post-cluster. The dynamic interplay between the DQV dimensions was also revealing. A high SCI amplified the positive effects of strong Forward-Looking Granularity (FLG), but could not compensate for a complete absence of FLG. Risk Discourse Depth (RDD) showed a more independent, stabilizing effect, particularly reducing asymmetry spikes during periods of sector-wide stress. Validation exercises, where the final simulated asymmetry states of the network were compared against realized measures of market friction (like aggregate bid-ask spreads

for the sector portfolio), showed a significantly stronger correlation than traditional firm-level linear regression models, supporting the explanatory power of our network-based approach.

4   Conclusion

This research has endeavored to reframe the classical inquiry into financial disclosure and market efficiency through the lens of complexity and interconnection. By conceptualizing the capital market as a dynamic information network and modeling disclosure quality as a multi-faceted contagion agent, we have uncovered insights that remain opaque to traditional methodological frameworks. Our most significant contribution is the demonstration that the value of high-quality disclosure is not confined to the disclosing entity but propagates through the market's fabric, creating positive externalities that enhance the informational environment for all participants. This challenges the purely proprietary, strategic view of disclosure and argues for its role as a systemic stabilizer. The identification of non-linear thresholds, particularly for narrative coherence, offers practical guidance: marginal improvements to poorly structured communications may be futile, but a concerted effort to cross the coherence threshold can yield disproportionate benefits for the firm and its network.

The findings on network centrality underscore that the market's attention structure is a form of capital. Firms occupying central informational positions bear a greater responsibility for market efficiency, as their communications have outsized impacts. For regulators, our study suggests that policies encouraging disclosure quality, particularly along the narrative dimensions we identify, may be more effective for reducing systemic information asymmetry than policies merely mandating more frequent or voluminous disclosure. Encouraging clustered reporting periods within sectors might also promote more efficient information digestion by the market network. While our model is computationally intensive and relies on specific calibrations, it provides a proof-of-concept for a more systemic analysis of accounting information. Future research could extend this network

approach to other forms of disclosure, such as conference calls or social media communications, and explore international differences in network topology. In conclusion, by stepping away from the atomistic, linear models of the past, this paper offers a novel vision of the capital market as a complex adaptive system where the quality of corporate storytelling actively shapes the very landscape of shared knowledge and economic trust.

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