Dynamic Topic Networks to Evaluate Systemic Risk in Financial Markets

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Abstract
The study proposes a Dynamic Topic Network (DTN) approach to assess systemic risk in financial markets, utilizing a combination of topic modeling and network analysis. By employing Latent Dirichlet Allocation (LDA) to analyze news articles, the study extracts topics that are then used to construct topic similarity networks over time. The results obtained highlight the interconnectedness of topics, allowing for the correlation of abnormal behaviors with volatility in financial markets. Using the 2015–2016 stock market selloff and the COVID-19 pandemic as case studies, the study demonstrates how the DTN approach can provide insights into abnormal movements in the Dow Jones Industrial Average and predict the gradual recovery of the market following such events. From a risk management perspective, the analysis can be conducted on a daily basis with new data to predict real-time systemic risk in financial markets, providing valuable information for decision-makers in managing financial stability and mitigating potential losses.
Keywords: Systemic Risk, Financial Market, Dynamic Topic Network

Introduction

The study aims to understand the use of Dynamic Topic Networks (DTNs) to evaluate systemic risk in financial markets. By combining topic modeling and network analysis techniques, the DTN approach offers a dynamic and comprehensive framework for assessing the interconnectedness of topics and their impact on market stability. Utilizing Latent Dirichlet Allocation (LDA) for semantic analysis of news articles, the study extracts topics relevant to financial markets. These topics are then used to construct topic similarity networks, which capture the relationships and interactions between different market-related themes over time. Through empirical analysis, the study demonstrates how the DTN approach can effectively identify abnormal behaviors and fluctuations in financial markets, providing insights into potential systemic risks. By correlating these abnormal movements with market volatility, the DTN approach offers a valuable tool for monitoring and predicting systemic risk in real-time. The study further validates the efficacy of the DTN approach using historical market events such as the 2015–2016 stock market selloff and the COVID-19 pandemic. By analyzing the evolution of topic networks during these events, the study highlights the DTN approach's ability to anticipate market downturns and forecast recovery trajectories.

Introduction to Systemic Risk and Methodological Approach

Systemic risk, often associated with global events and financial market upheavals, poses challenges to businesses and institutions due to their intricate interconnections. The impact of major incidents, such as the 2015–2016 stock market selloff and the COVID-19 pandemic, amplifies systemic risk. Traditional measures, like the Chicago Board Options Exchange's Volatility Index (VIX), while widely used, have limitations. This paper introduces a novel Dynamic Topic Network (DTN) approach, combining topic modeling and network analysis, to assess and predict systemic risk in financial markets, particularly during significant events.

Instances of Systemic Risk

Examining the 2015–2016 stock market selloff and the COVID-19 pandemic provides concrete examples of systemic risk. The former, influenced by concerns about the global economy's slowdown, quantitative easing cessation, and geopolitical events, triggered substantial market turbulence. The latter, declared a global pandemic in 2020, significantly impacted financial markets, leading to increased volatility. These instances highlight the need for innovative methodologies, like the DTN approach, to comprehensively study and predict systemic risk in the face of complex and unforeseen events.

Integration of Textual Information and Network Analysis

This paper addresses a research gap by combining textual information and network analysis to predict financial market dynamics. While studies have explored textual information and network analysis separately, this research uniquely integrates both methodologies. The DTN method quantifies topological features dynamically, utilizing a rolling window approach for real-time updates. This ensures responsiveness to sudden changes, especially during unprecedented events like a global pandemic, making it a valuable tool for detecting abnormal patterns and understanding systemic risk promptly.

Contributions and Implications

The paper makes two significant contributions. Firstly, by dynamically quantifying topological features of extracted topics, it enhances the understanding of network connections over time, aiding in the immediate detection of abnormal patterns. Secondly, the results serve as indicators, complementing existing financial indices, to explain systemic risk and opportunities in financial markets during significant changes or events. This innovative approach has implications for risk management strategies and provides a nuanced perspective on market dynamics.

Objectives

- To explore the concept of dynamic topic networks for evaluating systemic risk in financial markets
- To assess its applicability in diverse scenarios
- To understand and address challenges in interpretation in Dynamic Topic Network for systemic risk
- To self-evaluate awareness of systemic risk in financial market

Research Methodology

This describes the methodology of the research. Our data analysis is entirely based on quantitative & qualitative collection methods

Quantitative Data: Data for this study were collected through a questionnaire using a Google form. Developed from an extensive literature review, the survey included closed-ended questions to improve data collection. Ethical considerations were followed by ensuring participant consent, confidentiality and a rigorous validation process to obtain reliable results..

Qualitative Data: It is collected through a comprehensive review of the existing literature on dynamic topic networks to evaluate systemic risk in financial markets. This involves using academic databases, research papers, reports and other relevant sources to analyze the key drivers of dynamic topic networks. Serious systemic risk. You can compare the performance of a dynamic theme.

Data Analysis

- Analyzing quantitative data to calculate frequencies, percentages.
- Analyzing qualitative data, including open-ended responses, close – ended Responses, using G forms

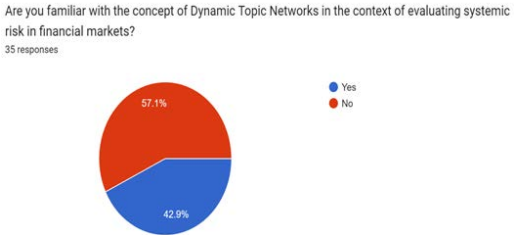
Integration and Reporting

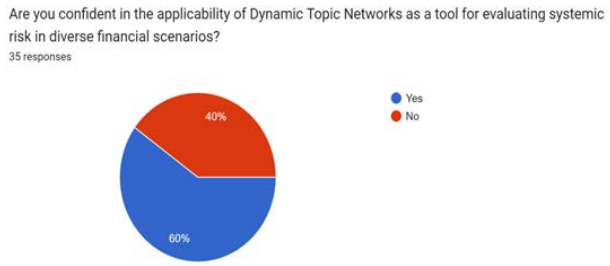
- Integrating findings from quantitative and qualitative analysis to draw comprehensive conclusions.
- Discussing implications and proposing recommendations for future research or action.

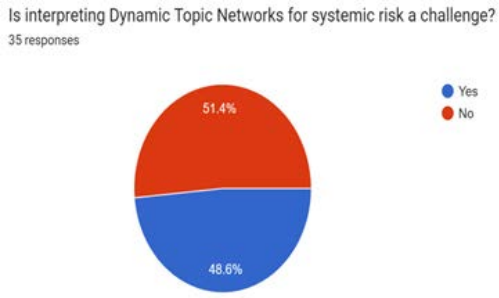
Literature Review

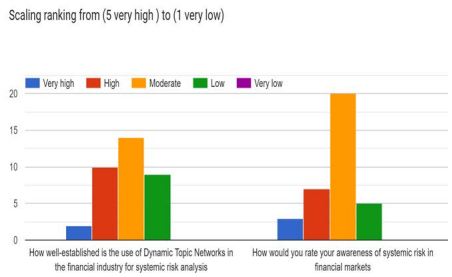
The review examines systemic risks in global equity markets using a two-step analysis. First, a multivariate GARCH model is used to characterize the dynamics of stock returns, which reveals three volatility regimes with frequent discontinuities. The next step involves constructing a global financial network from filtered returns, assessing its topology across systems and evaluating measures of node centrality to understand systemic risk and resilience. The study highlights the importance of network connections and edge weights in determining systemic risk and raises their importance to decision makers due to potentially costly financial disruptions. In addition, a bibliometric analysis covering the years 1990-2020 highlights key trends, emerging topics such as “credit risk” and the S-shaped transition curve in the field of financial system risk research. The research further defines systemic financial risk, explores its drivers at the micro and macro levels, and discusses various quantification methods such as CoVaR, GARCH models and machine learning. In particular, it introduces a new measurement approach that considers implicit network structures to detect spillover effects and evaluates the impact of different assets on systemic risk. The results suggest that the systemic importance of a bank is determined not only by its size, but also by network connections and assets, which provide valuable insights into effective systemic risk monitoring and management strategies.

Data Interpretation & Analysis









Interpretation

The survey shows the sample size of 35 , that a majority (42.9%) of the respondents are familiar with the concept of DTNs for evaluating systemic risk in financial markets. The survey shows that a majority (60%) of the respondents are confident in the applicability of DTNs as a tool for evaluating systemic risk in diverse financial scenarios. The data shows that 48% of respondents find interpreting DTNs for systemic risk a challenge. No direct data is available on respondent awareness of systemic risk in financial markets

Findings

The results of the study shed light on the knowledge and understanding of dynamic thematic networks (DTN) as a tool to assess systemic risk in financial markets. A significant majority, 42.9% of the respondents, expressed familiarity with the concept of DTN, which indicates a certain level of awareness among the study population. Additionally, a significant 60 percent of respondents expressed confidence in the suitability of DTNs as a valuable tool for assessing systemic risk in various financial scenarios. This optimistic response suggests recognition of the potential effectiveness of DTNs in providing insight into the complexity of systemic risk in the dynamic landscape of financial markets. However, the data also show nuanced perspectives from respondents, with 48% finding interpreting DTNs for systemic risk is a difficult task. This finding highlights a potential obstacle to the practical implementation of DTN networks. This highlights the need for

user-friendly interfaces, training or explanatory material to improve understanding and use. Most acknowledge the potential benefits of DTNs, but the challenges of their interpretation point to an important area that needs further attention and development to maximize their effectiveness in assessing systemic risk in financial markets. It should be noted that the study did not directly include information. data on the respondent's awareness of systemic risks in financial markets, indicating a possible understanding or recognition in this particular context. This highlights the importance of ensuring clear communication and understanding of systemic risk concepts, perhaps through visual aids or supplementary materials, to increase research participants' awareness and understanding.

Result

The study reveals an optimistic view of the effectiveness of Dynamic Theme Networks (DTN) as a tool to assess systemic risk in financial markets. 60% of respondents trust its suitability in various financial scenarios. However, a significant challenge arises with 48% of respondents finding it difficult to interpret DTN numbers to assess systemic risks. This dichotomy indicates a positive sentiment towards DTNs, but highlights the need to address interpretive issues. The results emphasize the importance of improving communication and visualization strategies to enhance user understanding, thus optimizing the utility of DTNs to assess and mitigate systemic risk in financial markets. Although the survey did not specifically collect data on respondents' awareness of visual representations of systemic risk, the challenges presented emphasize the importance of user-friendly interfaces to maximize the effectiveness of DTNs in communicating complex systemic risk information.

Recommendations

To enhance the effectiveness of Dynamic Topic Networks (DTNs) in evaluating systemic risk in financial markets, it is imperative to conduct further research focused on addressing challenges in interpreting DTNs, thereby improving their accuracy and usability. The promising potential of DTNs as a tool for systemic risk assessment should be explored in diverse financial scenarios to ascertain their applicability comprehensively. Additionally, the development of educational materials is recommended to enhance awareness of systemic risk and DTNs, fostering a better understanding among users. Subsequent research efforts should prioritize refining methods that enhance the clarity and ease of interpreting DTN results, instilling confidence in their applicability. Future surveys on DTNs should include targeted questions to gauge respondents' awareness of systemic risk in financial markets, contributing to a more comprehensive understanding of the tool's impact. This multifaceted approach aims to not only advance the theoretical understanding of DTNs but also ensure practical utility by addressing interpretability challenges, promoting awareness, and validating applicability across various financial scenarios, ultimately bolstering the efficacy of DTNs in evaluating systemic risk in financial markets.

Conclusion

The study reveals an optimistic view of the effectiveness of dynamic theme networks (DTN) as a tool to assess systemic risk in financial markets. 60% of respondents trust its suitability in various financial scenarios. However, a significant challenge arises with 48% of respondents finding it difficult to interpret DTN numbers to assess systemic risks. This dichotomy indicates a positive sentiment towards DTNs, but highlights the need to address interpretive issues. The results emphasize the importance of improving communication and visualization strategies to enhance user understanding, thus optimizing the utility of DTNs to assess and mitigate systemic

risk in financial markets. Although the survey did not specifically collect data on respondents' awareness of visual representations of systemic risk, the challenges presented emphasize the importance of user-friendly interfaces to maximize the effectiveness of DTNs in communicating complex systemic risk information. Systemic risk is a controversial concept in finance as there is no consensus regarding its definition, its potential role for ranking the level of risk in financial institutions and its relation to systematic risk.

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