Review

Interdisciplinary Approaches to Systemic Risk Assessment and Macroeconomic Policy

Yutian (Summer) Cai [1,*]

[1] Department of Economics, Harvard University, Cambridge, Massachusetts, United States
* Correspondence: Yutian (Summer) Cai, Department of Economics, Harvard University, Cambridge, Massachusetts, United States

Abstract: This review paper explores the intersection of macroeconomic policy and systemic risk assessment, focusing on the application of interdisciplinary methodologies to enhance our understanding and management of systemic risk in financial systems. Traditional macroeconomic models often fail to adequately capture the complexities of interconnectedness and feedback loops that characterize systemic risk. Therefore, this paper examines how incorporating insights from network science, behavioral economics, and financial econometrics can improve the effectiveness of macroeconomic policies aimed at mitigating systemic risk. It delves into the historical evolution of systemic risk assessment methodologies, contrasting pre-crisis approaches with those developed in response to the 2008 financial crisis and subsequent events. Core themes include the role of macroprudential policies, stress testing frameworks, and early warning indicators in identifying and managing systemic vulnerabilities. The analysis extends to the implementation challenges of these policies and the inherent trade-offs between maintaining financial stability and promoting economic growth. The review thoroughly examines the emerging applications of agent-based modeling and machine learning techniques for simulating complex financial systems and predicting systemic events. Additionally, it provides critical insights into future research directions, emphasizing the development of more robust systemic risk indicators, the integration of climate risk considerations into macrofinancial models, and the refinement of international coordination mechanisms for addressing cross-border systemic risks. This comprehensive review contributes significantly to understanding how interdisciplinary approaches can enhance macroeconomic policy effectiveness in safeguarding financial stability.

Keywords: systemic risk assessment; macroprudential policy; financial stability; network economics; behavioral finance; stress testing methodology

Received: 08 April 2026
Revised: 25 May 2026
Accepted: 08 June 2026
Published: 11 June 2026

1. Introduction

1.1. Motivation and Scope

The assessment of systemic risk is of utmost importance in the realm of contemporary macroeconomic policy [1, 2]. Systemic risk refers to the potential for a complete collapse of a financial system or market, which can pose substantial threats to the stability of financial systems and the sustainable growth of economies [3]. The propagation of such risks can lead to extensive economic downturns, adversely affecting employment rates, investment levels, and overall societal welfare. This review delves into various interdisciplinary methodologies aimed at assessing and mitigating systemic risk. It scrutinizes approaches that integrate diverse fields such as economics, finance, network science, and computational methods. These approaches are intended to provide a thorough understanding of systemic vulnerabilities and to inform the development of effective policy interventions. The scope of this review includes both theoretical frameworks and empirical applications, with a focus on enhancing the resilience of financial systems to withstand adverse shocks and thereby promote macroeconomic stability.

1.2. Objectives and Structure

This review is dedicated to exploring the rapidly growing intersection of interdisciplinary methodologies in the realm of systemic risk assessment and the design of macroeconomic policies. The primary aim is to synthesize the existing body of literature, emphasizing the strengths and limitations inherent in various approaches that integrate insights from fields such as economics, finance, network science, and computational modeling. The structure of the paper is organized as follows. Section 2 delves into the theoretical foundations of systemic risk, exploring its complex and multifaceted nature, as well as the challenges associated with its measurement [4]. Section 3 provides a review of traditional macroeconomic policy tools, evaluating their effectiveness in mitigating systemic risk through both monetary and fiscal interventions. Section 4 focuses on the application of network analysis to identify systemically important institutions and assess the channels through which contagion may occur. Section 5 investigates the use of agent-based modeling and other computational techniques for simulating macroeconomic scenarios and evaluating policy responses [5]. Finally, Section 6 concludes by summarizing the key findings, identifying existing research gaps, and suggesting potential avenues for future research, with a particular emphasis on integrating diverse methodologies to enhance the robustness and accuracy of systemic risk assessments and policy recommendations.

2. Historical Overview of Systemic Risk Assessment

2.1. Pre-2008 Crisis Approaches

Prior to the financial crisis of 2008, the methodologies employed for assessing systemic risk were predominantly centered on evaluating the vulnerabilities of individual financial institutions and examining macroeconomic aggregates. Although stress testing was utilized during this period, it often lacked a thorough analysis of the financial network as a whole. The focus was primarily on idiosyncratic shocks affecting single entities rather than on the broader interconnectedness that could amplify these shocks [6]. Macroeconomic models of the time tended to treat financial institutions as a uniform sector, which led to a significant oversight of the critical role that interconnectedness plays in exacerbating financial shocks. The limited availability of data regarding interbank exposures further impeded the accurate measurement of systemic risk. Consequently, these approaches largely failed to account for the potential for contagion through intricate financial networks, where distress in one institution could quickly spread throughout the entire system. The emphasis was more on the capital adequacy ratios specific to individual firms, with insufficient attention given to the systemic implications of correlated failures or the feedback loops that could be triggered by declining asset prices and liquidity spirals [5, 7]. The prevailing perspective underestimated the significance of higher-order effects and the non-linear dynamics that are inherent in a highly interconnected financial system (As shown in Table 1).

Table 1. Evolution of Systemic Risk Measurement Approaches

Feature	Pre-2008 Crisis Approach	Post-2008 Crisis Approach (Inferred)
Focus	Individual institution vulnerabilities and macroeconomic aggregates.	Network analysis, contagion pathways, and systemic interconnectedness.
Stress Testing	Idiosyncratic shocks to single entities; limited network analysis.	Comprehensive simulations incorporating network effects, correlated failures, and feedback loops.

Macroeconomic Models	Financial institutions are treated as a homogenous sector.	Model includes heterogeneous institutions and interbank linkages.
Data Availability	Limited data on interbank exposures.	Improved data collection and availability regarding interbank exposures and complex financial instruments (inferred).
Risk Measurement	Focused on firm-specific capital adequacy ratios.	Incorporates systemic risk metrics, such as measures of interconnectedness and potential for contagion.
Contagion Analysis	Largely failed to capture contagion through complex financial networks.	Advanced modeling techniques to understand and quantify contagion risks.
Order Effects	Underestimated the importance of -th order effects. n	Explicit consideration of higher-order effects and non-linear dynamics in financial systems.
Systemic Implications	Less focused on the systemic implications of correlated failures.	Emphasis on systemic risk contributions of individual institutions and the system as a whole.
Liquidity Spirals	Less emphasis on feedback loops driven by asset price declines and liquidity spirals.	Increased focus on modeling and mitigating liquidity spirals and their impact on systemic stability.

2.2. Post-Crisis Developments

The financial crisis of 2008 revealed significant shortcomings in the methods used to assess systemic risk before the crisis occurred. In response to these revelations, substantial efforts were made to develop more comprehensive and effective methodologies. New indicators were introduced, emphasizing the interconnectedness within financial networks. These included measures of financial institution exposures and innovative algorithms like DebtRank, which quantify the systemic impact of financial distress [8, 9]. Stress-testing frameworks were significantly improved to include a wider range of severe and diverse scenarios, moving beyond the limitations of single-factor shocks. Additionally, agent-based models became more popular, as they allow for the simulation of complex interactions and feedback loops within the financial system [6]. Furthermore, regulatory frameworks such as Basel III integrated macroprudential tools, including countercyclical capital buffers, designed to mitigate the accumulation of systemic risk. These developments after the crisis signify a major shift towards a more comprehensive and dynamic approach to assessing systemic risk, reflecting a deeper understanding of the complexities involved.

3. Regulatory Responses and Policy Implications

The global financial crisis acted as a catalyst for substantial regulatory reforms aimed at reducing systemic risk within the financial sector. One of the most significant advancements was the introduction of macroprudential policies [10]. These policies are specifically designed to tackle systemic vulnerabilities that arise due to the interconnected nature of financial institutions and the cyclical tendencies of financial markets. Key measures include countercyclical capital buffers, which are intended to increase the capital requirements for banks during periods of rapid credit expansion, thereby enhancing their ability to absorb potential losses. Additionally, leverage ratio limits have been established to prevent excessive borrowing. Enhanced stress testing requirements have also been implemented, compelling financial institutions to rigorously assess their resilience in the face of adverse economic conditions. The implications of these policies for managing systemic risk are profound, as they contribute to greater financial stability by reducing the probability of widespread institutional failures and mitigating the impact of future financial crises. Nevertheless, there are ongoing challenges in effectively calibrating these policies and addressing any unintended consequences that may arise from their implementation [10].

4. Macroprudential Policies and Systemic Risk

4.1. Tools of Macroprudential Policy

Macroprudential policies utilize a diverse array of instruments designed to address and mitigate systemic risks by targeting specific vulnerabilities within the financial system. One of the fundamental tools in this regulatory framework is the adjustment of capital requirements, which can be modified in response to changing economic conditions. For instance, countercyclical capital buffers are implemented to compel banks to maintain higher capital reserves during periods of rapid credit expansion [11]. This approach enhances the banks' ability to absorb potential losses when economic conditions deteriorate. Additionally, leverage ratios serve as a critical mechanism by restricting the amount of debt a financial institution can accumulate relative to its equity, thereby curbing excessive risk-taking and preventing undue expansion of balance sheets. In the realm of mortgage lending, loan-to-value (LTV) ratios and debt-to-income (DTI) ratios are employed to limit excessive borrowing by households. These measures are crucial in reducing the risk of housing market bubbles by ensuring that loans are proportionate to the value of the property or the borrower's income [12]. Consequently, they help mitigate potential losses in the event of a downturn in the housing market. The success of these macroprudential tools is contingent upon several factors, including the specific design and implementation of the policies, the prevailing macroeconomic environment, and the level of coordination among regulatory bodies. While empirical studies indicate that macroprudential policies can effectively reduce systemic risk, their impact is not uniform and can vary significantly across different countries and time periods (As shown in Table 2).

Table 2. Macroprudential Policy Tools and Their Impact

Policy Tool	Description	Impact
Countercyclical Capital Buffers	Banks are required to hold more capital during periods of rapid credit growth.	Increases bank resilience to losses during economic downturns.
Leverage Ratios	Limits the amount of debt a financial institution can hold relative to its equity (Debt/Equity < Limit).	Constrains excessive risk-taking by directly limiting balance sheet expansion.
Loan-to-Value (LTV) Ratios	Limits the size of the loan relative to the value of the	Curbs excessive borrowing by households and reduces the risk of

	property (Loan/Value < Limit).	housing bubbles; reduces potential losses in a housing market downturn.
Debt-to-Income (DTI) Ratios	Limits the size of the loan relative to the borrower's income.	Curbs excessive borrowing by households and reduces the risk of housing bubbles; reduces potential losses in a housing market downturn.

4.2. Network Analysis and Systemic Interconnectedness

Network analysis provides a robust framework for comprehending the intricate web of systemic interconnectedness within the financial system [13]. By conceptualizing financial institutions as nodes and their interrelationships as edges, network models unveil complex patterns of exposures and dependencies that are not immediately apparent through traditional analysis. These models enable a shift from conventional, institution-specific risk assessments to a more holistic view of the financial system. This broader perspective allows for a deeper understanding of how individual institutions are interlinked and how their interactions can influence the stability of the entire system [5, 14]. By examining these connections, we can identify potential vulnerabilities and areas where systemic risk may be concentrated, thereby enhancing our ability to manage and mitigate such risks effectively [13, 15].

One significant application of network analysis is in the identification of systemically important financial institutions, often referred to as SIFIs. Centrality measures play a crucial role in this process [16]. For instance, degree centrality assesses the number of direct connections an institution has, while betweenness centrality evaluates the number of shortest paths that pass through a node, indicating its role as an intermediary. Eigenvector centrality, on the other hand, considers the influence of a node's connections. Institutions with high betweenness centrality are particularly noteworthy, as they act as vital intermediaries within the network [17]. The failure of such an institution could severely disrupt the flow of information and potentially trigger a cascade of adverse effects throughout the network, highlighting the importance of monitoring and managing these key nodes to maintain systemic stability [6].

Moreover, network analysis is instrumental in assessing contagion risks within the financial system. By simulating shocks to individual institutions and tracing their propagation through the network, it becomes possible to estimate potential losses to other institutions and the system as a whole [2]. The strength and direction of the links, often represented by exposures such as interbank lending or derivative contracts, are crucial in determining the magnitude of contagion [4]. The loss given default on these exposures is a critical parameter in such simulations [15]. Stress testing scenarios can be meticulously designed to evaluate the resilience of the network under various adverse conditions. These scenarios provide valuable insights that inform macroprudential policies aimed at mitigating systemic risk, ensuring that the financial system remains robust and capable of withstanding potential shocks.

4.3. Behavioral Macroprudential Policy

Behavioral macroprudential policy acknowledges the significant role that psychological biases and heuristics play in influencing financial stability and contributing to systemic risk. Traditional macroprudential models often operate under the assumption that economic actors behave rationally, thereby overlooking the impact of behavioral factors such as herd behavior, overconfidence, and loss aversion [4]. These psychological biases can exacerbate procyclicality within financial markets, resulting in excessive credit growth during economic booms and severe contractions during downturns [4]. For example, during periods of economic expansion, overoptimism can lead to a widespread underestimation of risk and an increase in excessive leverage, which in turn heightens the financial system's vulnerability to unexpected shocks. By understanding these dynamics, policymakers can better anticipate and mitigate potential risks to financial stability.

Interventions that are informed by insights from behavioral economics can effectively mitigate the adverse effects of these biases. One strategic approach involves crafting policies that subtly guide individuals and institutions towards more prudent financial behavior. For instance, mandating that lenders provide clearer and more prominent information regarding the risks associated with complex financial products can help counteract the limitations of bounded rationality [3]. Additionally, the implementation of countercyclical capital buffers, which are automatically activated based on observable indicators of systemic risk such as the credit-to-GDP ratio, can serve to moderate excessive risk-taking during periods of economic expansion. The success of these interventions is contingent upon a comprehensive understanding of the specific biases involved and the context in which they manifest, allowing for more targeted and effective policy measures [15] (As shown in Table 3).

Table 3. Behavioral Biases and Macroprudential Policy

Behavioral Bias	Impact on Financial Stability	Macroprudential Policy Intervention
Herd Behavior	Amplifies procyclicality, leading to excessive risk-taking during booms and panics during busts.	Countercyclical capital buffers triggered by indicators like to dampen excessive risk-taking. $\frac{\text{Credit}}{\text{GDP}}$
Overconfidence	Underestimation of risk, leading to excessive leverage and vulnerability to shocks.	Stress testing to assess the resilience of financial institutions to adverse scenarios, forcing reconsideration of risk assessment.
Loss Aversion	Hesitancy to recognize losses, exacerbating downturns and creating zombie lending.	Early intervention frameworks to address asset quality issues proactively.
Bounded Rationality	Inability to fully process complex information, leading to poor investment decisions.	Clear and salient disclosure requirements for complex financial products to improve understanding of risks.
Overoptimism	Underestimation of future risks and potential losses during economic expansions.	Dynamic provisioning that increase required reserves during boom periods to prepare for potential losses.

5. Stress Testing and Early Warning Indicators

5.1. Evolution of Stress Testing Methodologies

Stress testing methodologies have undergone a remarkable transformation over the years, evolving from basic sensitivity analyses to more advanced and intricate scenario-based simulations. Initially, these methodologies involved subjecting financial institutions to straightforward shocks, such as an increase in interest rates or a decline in asset values [4, 8]. These early sensitivity tests, while relatively easy to implement, often lacked the necessary realism and failed to adequately capture the complex interdependencies and dynamics within the financial system. As a result, they were limited in their ability to provide a comprehensive assessment of financial stability. The evolution of these methodologies reflects a growing recognition of the need for more sophisticated tools that can better account for the multifaceted nature of financial risks and the interconnectedness of global markets.

The limitations inherent in these early methods catalyzed the development of more comprehensive scenario-based stress tests. These advanced methodologies involve the construction of hypothetical yet plausible macroeconomic and financial scenarios, such as a severe economic downturn or a global health crisis, to assess their potential impact on the solvency and liquidity of financial institutions. By incorporating multiple risk factors and feedback loops, these scenarios provide a more holistic and nuanced view of potential vulnerabilities within the financial system [6, 17]. This approach allows for a deeper understanding of how various stressors might interact and compound, offering valuable insights into the resilience of financial institutions under adverse conditions. The shift towards scenario-based stress testing represents a significant advancement in the ability to anticipate and mitigate potential financial crises.

Nevertheless, the design and implementation of effective stress tests are fraught with numerous challenges. One of the primary challenges is the design of scenarios, which requires a careful balance between realism and severity [3, 6]. Scenarios must be severe enough to uncover vulnerabilities but also plausible enough to be credible to stakeholders. Additionally, model risk presents a significant challenge, as the accuracy of stress test results is heavily dependent on the models used to simulate the impact of the scenarios. The availability and quality of data pose further hurdles, particularly in emerging markets and for complex financial instruments, where data may be sparse or unreliable. Moreover, the computational demands associated with conducting large-scale stress tests can be substantial, necessitating significant investments in both technological infrastructure and specialized expertise. These challenges underscore the complexity of stress testing as a tool for financial risk management.

5.2. Financial Econometrics for Early Warning Systems

Financial econometrics serves as an essential and robust toolkit for the development of early warning systems designed to detect and predict systemic risk within financial markets. These systems utilize advanced statistical models to uncover patterns and anomalies in financial data that often precede economic crises [8]. Among the most commonly used models are logit and probit models, which are employed to estimate the likelihood of a crisis occurring based on a comprehensive set of macroeconomic and financial indicators. In these models, the dependent variable typically signifies the occurrence of a crisis within a specified time frame, while the independent variables encompass a range of factors such as credit growth, fluctuations in asset prices, and levels of external debt. By analyzing these variables, financial econometrics can provide valuable insights into potential vulnerabilities within the financial system, thereby enhancing the ability to anticipate and mitigate the impact of future crises.

In addition to binary choice models, signal extraction methods are widely utilized in the field. These approaches concentrate on identifying leading indicators that surpass predefined thresholds, thereby signaling an increased level of risk. Time series models, such as Vector Autoregressions, are particularly effective in capturing the dynamic interrelationships among various financial variables [15]. This capability allows for the detection of feedback loops and contagion effects, which are critical in understanding the propagation of financial disturbances. Moreover, the integration of machine learning techniques, including neural networks and support vector machines, is becoming increasingly prevalent [9]. These advanced methods enhance the accuracy and robustness of early warning systems by identifying complex, non-linear relationships within the data. The effectiveness of these models is typically assessed using performance metrics such as the area under the receiver operating characteristic curve and the rates of Type I and Type II errors, ensuring that the systems are both reliable and efficient in predicting potential financial crises [14].

5.3. Integrating Macroeconomic and Financial Data

Integrating macroeconomic and financial data is essential for conducting robust stress testing and developing effective early warning systems. Traditional methodologies often handle these domains in isolation, overlooking the significant feedback loops that exist between the real economy and the financial sector [2, 12]. A thorough assessment necessitates an understanding that macroeconomic shocks can permeate the financial system, thereby amplifying their effects on economic activities. Conversely, financial instability can initiate or worsen macroeconomic downturns [10, 14]. By recognizing these interdependencies, analysts can better predict and mitigate potential risks. This integrated approach ensures that both macroeconomic and financial factors are considered in tandem, providing a more comprehensive understanding of systemic vulnerabilities and enhancing the resilience of economic frameworks.

Incorporating financial variables such as asset prices, credit spreads, and bank capital ratios into macroeconomic models enables a more accurate depiction of economic dynamics. Similarly, stress testing exercises must account for the impact of adverse macroeconomic scenarios on the solvency and liquidity of financial institutions. This involves modeling the sensitivity of bank balance sheets to fluctuations in key macroeconomic variables like GDP growth, inflation, and interest rates [2]. Additionally, early warning systems are enhanced by integrating both macroeconomic indicators, such as unemployment and inflation, and financial market signals, like volatility indices and credit growth. This comprehensive approach provides a more holistic view of systemic risk. The primary challenge lies in effectively capturing the complex and often non-linear interactions between these diverse data sets, which requires sophisticated modeling techniques and a deep understanding of economic interrelations (As shown in Table 4).

Table 4. Key Macroeconomic and Financial Variables for Systemic Risk Assessment

Category	Variable	Description	Relevance to Systemic Risk
Macroeconomic Indicators	GDP Growth (g)	Percentage change in Gross Domestic Product.	A decline in can lead to increased loan defaults and reduced profitability for financial institutions. g
	Inflation (π)	Rate at which the general level of prices for goods and services is rising.	High can erode the real value of assets and savings, impacting financial stability. Unexpected inflation can also squeeze bank margins. π
	Interest Rates (r)	Cost of borrowing money.	Changes in affect borrowing costs, asset valuations, and the profitability of financial institutions. r
	Unemployment Rate	Percentage of the labor force that is unemployed.	High unemployment can lead to mortgage defaults and reduced consumer spending, impacting the financial sector.
Financial Market Signals	Asset Prices	Prices of stocks, bonds, and real estate.	Sharp declines in asset prices can lead to wealth destruction, reduced investment, and financial instability.

Credit Spreads	Difference in yield between corporate bonds and risk-free government bonds.	Wider spreads indicate increased risk aversion and potential funding problems for corporations, which can impact banks.
Bank Capital Ratios	Ratio of a bank's capital to its risk-weighted assets.	Low capital ratios indicate that a bank is more vulnerable to losses and less able to absorb shocks.
Volatility Indices (e.g., VIX)	Measure of market volatility.	High volatility can trigger risk-off behavior and amplify market movements, potentially leading to financial crises.
Credit Growth	Rate of increase in lending.	Rapid credit growth can fuel asset bubbles and increase systemic risk when lending standards are relaxed.

6. Comparison, Challenges and Limitations

6.1. Comparison of Methodologies

The methodologies under discussion present unique strategies for assessing systemic risk, each with its own strengths and challenges. Agent-based modeling is particularly adept at capturing complex behaviors that emerge from interactions at the micro-level. However, this approach is often burdened by significant computational demands and uncertainties in parameter settings, which can lead to model risk if the agents are not accurately calibrated. On the other hand, network analysis is proficient in pinpointing key institutions within a system and identifying potential channels for contagion. Despite this, it faces difficulties in integrating nonlinear dynamics and feedback loops, which can result in an underestimation of risk during periods of crisis [6]. Macroprudential stress testing offers a broad, top-down perspective, yet its dependence on historical data and predefined scenarios may cause it to miss unexpected risks, thereby introducing model risk if calculations are not precise. Each of these methodologies inherently carries model risk due to the simplifying assumptions and data constraints they rely on, highlighting the importance of thorough validation and the complementary use of different approaches to achieve a more robust assessment.

6.2. Challenges and Limitations

Implementing interdisciplinary methodologies for assessing systemic risk involves navigating a multitude of challenges. One of the primary obstacles is the availability of data, which is particularly problematic when seeking detailed, real-time information across various sectors [16]. This lack of data can impede the development of accurate models [3]. Additionally, when integrating different approaches, model uncertainty becomes more pronounced, necessitating rigorous validation and sensitivity analysis to ensure reliability. The complexity of systemic risk itself, characterized by non-linear interactions and feedback loops, further complicates accurate modeling efforts. Effective policy coordination is essential across different regulatory bodies and jurisdictions, yet this is often obstructed by conflicting mandates and information asymmetries. Moreover, the computational demands of sophisticated interdisciplinary models can be significant, potentially limiting their practical use [1]. Finally, converting model outputs into actionable policy recommendations requires a nuanced understanding of political and economic constraints, which adds another layer of complexity to the process.

7. Future Perspectives

7.1. Emerging Research Directions

Emerging research directions in systemic risk assessment are increasingly utilizing advanced methodologies such as agent-based modeling, machine learning, and artificial intelligence [5, 16]. Agent-based modeling provides a bottom-up approach that simulates complex interactions within financial networks, effectively capturing emergent systemic risks that may not be apparent through traditional methods. Machine learning and artificial intelligence techniques, including sophisticated deep learning algorithms, are capable of analyzing extensive datasets to identify early warning signals and predict potential contagion pathways. These innovative methods enhance stress-testing frameworks by incorporating more realistic behavioral assumptions and identifying vulnerabilities that conventional models might overlook. Additionally, ongoing research is delving into the application of artificial intelligence for automated risk monitoring and real-time systemic risk assessment. This could potentially lead to more proactive and effective risk management strategies, ensuring a robust financial system. The variable represented by [[MATH_EQ_026]] could play a significant role in the development of future models, offering new insights and enhancing predictive accuracy.

7.2. Integrating Climate Risk and Sustainability

Integrating climate risk and sustainability into macrofinancial models is essential for conducting precise assessments of systemic risk. Climate change presents substantial threats to financial stability and economic growth through both physical risks, such as extreme weather events that can adversely affect asset values, and transition risks, which include policy changes that may impact carbon-intensive industries [8, 16]. These risks have the potential to spread throughout the financial system, possibly leading to systemic crises. Future research should prioritize the development of advanced models that effectively capture the complex, non-linear, and feedback effects of climate change on macroeconomic variables, including GDP growth, inflation, and interest rates. Additionally, the integration of sustainability metrics, such as Environmental, Social, and Governance (ESG) factors, into risk assessments can offer a more holistic perspective on the resilience of the financial system [9]. This comprehensive approach is vital for understanding and mitigating the multifaceted impacts of climate change on global economic stability.

7.3. International Coordination and Policy Implications

International coordination plays a crucial role in addressing and mitigating cross-border systemic risks, which necessitates the enhancement of information sharing and the development of collaborative stress-testing frameworks. Recent studies have underscored the interconnected nature of financial institutions and markets, drawing attention to the potential for contagion effects that can transcend national boundaries [7]. The implications for policy are significant, as they include the need for the establishment of globally consistent regulatory standards. These standards are particularly important in areas such as capital adequacy and liquidity requirements for financial institutions deemed systemically important. Additionally, macroprudential policies should be harmonized to prevent regulatory arbitrage and to ensure that risk management is effective on a global scale [9]. Future research endeavors should aim to quantify the advantages of international cooperation, focusing on how such collaboration can lead to a reduction in systemic risk and an enhancement of global financial stability [15]. This could be achieved by employing metrics such as the systemic risk index to provide a more comprehensive understanding of these dynamics.

8. Conclusion

8.1. Summary of Key Findings

This review underscores the critical role of interdisciplinary methodologies in effectively assessing systemic risk and informing macroeconomic policy. Our analysis reveals that traditional, siloed approaches often fail to capture the complex interactions between financial markets, the real economy, and policy interventions. Integrating insights from economics, finance, network science, and behavioral science provides a more holistic understanding of systemic vulnerabilities. Specifically, network analysis helps identify systemically important institutions and contagion channels, while behavioral models shed light on the role of various psychological and market dynamics in amplifying systemic risk. Furthermore, our findings suggest that macroeconomic policies designed without considering these interdisciplinary perspectives may inadvertently exacerbate systemic instability, leading to suboptimal outcomes for economic growth and financial stability. The implications of these findings are profound, suggesting that policymakers must adopt a more integrated approach to economic management. This involves not only recognizing the interconnectedness of different economic sectors but also understanding the behavioral underpinnings that drive market participants. Future research should focus on developing more sophisticated models that can simulate the complex feedback loops present in the global economy. Additionally, there is a need for empirical studies that validate these models in real-world scenarios, ensuring their practical applicability. By advancing our understanding of systemic risk through interdisciplinary research, we can better equip policymakers to design interventions that enhance economic resilience and stability.

8.2. Concluding Remarks and Policy Recommendations

Systemic risk assessment remains a complex challenge, demanding continuous refinement of interdisciplinary methodologies. Current models often struggle to fully capture the dynamic interplay between macroeconomic policies and financial vulnerabilities. To enhance financial stability, we recommend proactive macroprudential policies, including countercyclical capital buffers and loan-to-value restrictions, calibrated based on real-time systemic risk indicators. Furthermore, improved data sharing and enhanced regulatory coordination across jurisdictions are crucial. Central banks should incorporate systemic risk considerations into their monetary policy frameworks, acknowledging the potential for unintended consequences of low interest rate environments on risk-taking behavior. Investing in research to better understand the propagation of shocks through the financial system, particularly those originating from non-bank financial institutions, is also paramount for building economic resilience against future crises. Future research should delve deeper into the mechanisms of shock transmission and the role of emerging financial technologies in altering risk landscapes. By fostering a collaborative international approach and leveraging technological advancements, we can develop more robust frameworks for predicting and mitigating systemic risks, ultimately safeguarding global economic stability.

References

1. M. Hellwig, "Systemic Risk, Macro Shocks, and Macro-prudential Policy," MaxPlanck Institute for Research on Collective Goods, Bonn, 2018.
2. Z. He and A. Krishnamurthy, "A macroeconomic framework for quantifying systemic risk," National Bureau of Economic Research, Working Paper No. w19885, 2014.
3. G. Ahmad, M. S. Rizwan, and D. Ashraf, "Systemic risk and macroeconomic forecasting: A globally applicable copula-based approach," Journal of Forecasting, vol. 40, no. 8, pp. 1420-1443, 2021.
4. G. De Nicolò and M. Lucchetta, "Systemic risks and the macroeconomy," National Bureau of Economic Research, Working Paper No. w16998, 2011.
5. J. Frait and Z. Komárková, "Financial stability, systemic risk and macroprudential policy," Financial Stability Report, 2011, pp. 96-111.
6. T. Cenesizoglu and D. Ibrushi, "Predicting systematic risk with macroeconomic and financial variables," Journal of Financial Research, vol. 43, no. 3, pp. 649-673, 2020.

7. T. G. Andersen, T. Bollerslev, F. X. Diebold, and J. Wu, "A framework for exploring the macroeconomic determinants of systematic risk," American Economic Review, vol. 95, no. 2, pp. 398-404, 2005.
8. M. Rizan, M. Z. Salim, S. Mukhtar, and K. Daly, "Macroeconomics of systemic risk: transmission channels and technical integration," Risks, vol. 10, no. 9, p. 174, 2022.
9. B. Lojak, "Essays in Financial Macroeconomics: Corporate Debt, Systemic Risk and Macrofinancial Stability," Doctoral dissertation, Otto-Friedrich-Universität Bamberg, Fakultät Sozial-und Wirtschaftswissenschaften, 2020.
10. I. I. Tomuleasa, "Macroprudential policy and systemic risk: An overview," Procedia Economics and Finance, vol. 20, pp. 645-653, 2015.
11. S. Chavleishvili, S. Fahr, M. Kremer, S. Manganelli, and B. Schwaab, "A risk management perspective on macroprudential policy," 2021.
12. A. Blundell-Wignall and C. Roulet, "Macro-prudential policy, bank systemic risk and capital controls," OECD Journal: Financial Market Trends, vol. 2013, no. 2, pp. 7-28, 2014.
13. A. M. Andries, F. Melnic, and S. Nistor, "Effects of macroprudential policy on systemic risk and bank risk taking," Czech Journal of Economics and Finance, Forthcoming, 2017.
14. Y. Lu and Y. Wang, "Macroprudential policies, national culture, and bank systemic risk: A cross-country comparison," Finance Research Letters, vol. 58, p. 104295, 2023.
15. X. Freixas, L. Laeven, and J. L. Peydró, "Systemic risk, crises, and macroprudential regulation," MIT Press, 2015.
16. B. Arnold, C. Borio, L. Ellis, and F. Moshirian, "Systemic risk, macroprudential policy frameworks, monitoring financial systems and the evolution of capital adequacy," Journal of Banking & Finance, vol. 36, no. 12, pp. 3125-3132, 2012.
17. V. Pacelli and M. M. Povia, "Macro-Prudential Policies to Mitigate Systemic Risk: An International Overview," Systemic Risk and Complex Networks in Modern Financial Systems, pp. 73-92, 2024.