SPECULATIVE BUBBLE DYNAMICS AND SYSTEMIC RISK IN SHADOW BANKING INSTITUTIONS: EVIDENCE FROM THE UNITED STATES AND EUROPE

Andreea Elena CROICU, PhD Candidate*

Abstract

This study investigates speculative bubble dynamics and systemic risk characteristics among listed shadow banking institutions in the United States and Europe over the period 2010–2026. To examine speculative dynamics, bubble episodes are identified using the Backward Supremum Augmented Dickey–Fuller (BSADF) methodology, while systemic risk is evaluated through a set of market-based indicators, including beta, Value at Risk (VaR), Expected Shortfall (ES), Conditional Value at Risk (CoVaR), Delta CoVaR (ΔCoVaR), and Marginal Expected Shortfall (MES). The results reveal that speculative bubble episodes constitute a recurrent feature of the shadow banking sector in both regions. Bubble activity appears more widespread in the U.S., whereas European institutions exhibit a more heterogeneous pattern, characterised by concentrated speculative episodes affecting fewer firms. Overall, the findings provide comparative evidence on speculative dynamics and systemic risk in two major financial markets and contribute to the growing literature on shadow banking, financial instability, and financial intermediation. The results further support the importance of continuous monitoring of non-bank financial institutions within macroprudential surveillance frameworks.

Keywords: non-bank financial institutions, systemic risk measures, financial stability, comparative assessment

JEL Classification: G01, G12, G15, G21, G23

DOI: https://doi.org/10.65672/fs.2026.2.7

1. Introduction

The growing importance of non-bank financial institutions has attracted increasing attention from both academics and policymakers

---

* *Bucharest University of Economic Studies, Romania; Institute for Economic Forecasting, Romanian Academy. ORCID: https://orcid.org/0009-0009-7377-4553. Corresponding author, e-mail: andreea.croicu@yahoo.com*

due to their potential role in the propagation of financial instability. Shadow banking institutions provide alternative sources of financing outside the traditional banking sector and contribute to financial market development. At the same time, their business models often involve higher leverage, maturity transformation, and complex interconnections with the broader financial system, which may amplify systemic vulnerabilities during periods of market stress (Croicu et al., 2023; Arora & Kashiramka, 2023; Croicu & Călin, 2024; Doruk & Önal, 2026; Zhang et al., 2026)

The global financial crisis highlighted the importance of monitoring risks originating outside the conventional banking sector. Since then, a substantial body of literature has examined the structure, growth, and systemic implications of shadow banking activities, emphasising their potential contribution to financial fragility, contagion mechanisms, and the transmission of market stress across financial institutions (Moreira & Savov, 2017; Pellegrini et al., 2022; Rottner, 2023; Huang et al., 2025; Mashimbye & Fanta, 2026). Despite increasing regulatory attention devoted to these institutions, concerns remain regarding the channels through which shadow banking entities may contribute to the accumulation of systemic vulnerabilities (Călin et al., 2026).

One potential source of instability is the formation of speculative bubbles. Periods characterised by explosive asset price dynamics may encourage excessive risk-taking, leverage expansion, and asset mispricing, thereby increasing the vulnerability of financial institutions and markets. The literature on speculative bubbles has documented the occurrence of such episodes across a wide range of asset classes, including equities, real estate, commodities, and cryptocurrencies (Caraiani et al., 2021; André et al., 2022; Caraiani & Călin, 2024; Iliyasu et al., 2024; Lupu et al., 2024). Methodologically, recent advances in recursive right-tailed unit root testing have significantly improved the identification and dating of speculative episodes in financial markets (Phillips & Yu, 2011; Phillips et al., 2015; Lupu et al., 2026; Fernandez-Perez et al., 2026; Călin & Lupu, 2026).

A related strand of research focuses on the interaction between asset price booms and financial stability. Previous studies suggest that prolonged periods of rapid asset price appreciation may contribute to the accumulation of financial vulnerabilities through leverage expansion, increased interconnectedness, and heightened risk-taking behaviour (Lupu et al., 2025; Dong et al., 2025). Nevertheless, empirical evidence on speculative dynamics within shadow banking institutions remains relatively scarce, particularly in a comparative international setting (Călin et al., 2026; Wang et al., 2026; Wu et al., 2026).

Against this background, this study examines the dynamics of speculative bubbles and the characteristics of systemic risk among listed shadow banking institutions in the United States and Europe. Bubble episodes are identified using the Backward Supremum Augmented Dickey–Fuller (BSADF) methodology, while systemic risk is evaluated through a set of market-based indicators, including beta, Value at Risk (VaR), Expected Shortfall (ES), Conditional Value at Risk (CoVaR), Delta CoVaR (ΔCoVaR), and Marginal Expected Shortfall (MES) (Adrian & Brunnermeier, 2016; Härdle et al., 2016; Acharya et al., 2017; Brownlees & Engle, 2017; Lupu et al., 2021). The analysis provides comparative evidence on the incidence and synchronisation of speculative bubbles as well as on the evolution of systemic risk within the shadow banking sector across the two regions.

The study contributes to the existing literature in several ways. First, it extends the growing body of research on speculative bubbles by focusing specifically on shadow banking institutions, a segment of the financial system that has received relatively limited attention in the bubble literature. Second, unlike most existing studies that focus on a single market, it provides a comparative assessment of bubble dynamics and systemic risk characteristics across U.S. and European shadow banking institutions. Third, it documents the degree of synchronisation of speculative episodes across institutions and complements this evidence with a broad set of market-based systemic risk measures. Finally, the findings provide evidence relevant for macroprudential surveillance by highlighting periods of elevated speculative activity and systemic vulnerability within the non-bank financial sector.

The remainder of the paper is organised as follows. Section 2 presents the data and methodology. Section 3 discusses the empirical results. Section 4 concludes.

2. Data and methodology

2.1 Sample selection and data

The empirical analysis focuses on shadow banking institutions identified among the constituents of the S&P 500 and STOXX Europe

600 indices. Restricting the sample to firms included in these benchmark indices ensures high market liquidity, continuous trading activity, and reliable data availability, which are essential for estimating systemic risk measures and speculative bubble indicators.

The identification procedure combines industry classification and firm-level financial characteristics. First, firms belonging to the Financials sector according to the Global Industry Classification Standard (GICS) are considered. Traditional commercial banks, insurance companies, and real estate investment trusts (REITs) are excluded because their business models and regulatory frameworks differ substantially from those typically associated with non-bank financial intermediation.

The analysis retains firms operating in financial services segments commonly linked to market-based finance, including Asset Management and Custody Banks, Consumer Finance, Diversified Financial Services, Investment Banking and Brokerage, and Financial Exchanges and Data. To further distinguish shadow banking institutions from other financial firms, balance-sheet information obtained from Refinitiv Workspace is used to construct indicators of leverage and debt dependence. Financial leverage is measured as the ratio of Total Assets to Total Equity, while debt dependence is proxied by the ratio of Total Debt to Total Assets.

Based on these indicators, a Shadow Banking Score ranging from zero to two is computed. One point is assigned when the Assets-to-Equity ratio exceeds five, and an additional point is assigned when the Debt-to-Assets ratio exceeds 35%. Firms obtaining a score of at least one are classified as shadow banking institutions and retained in the final sample.

Daily closing prices and accounting information are collected from Refinitiv Workspace. To ensure consistency throughout the analysis period, firms with insufficient financial information or incomplete historical series are excluded. The same selection procedure is applied to both Europe and the United States, ensuring methodological comparability across regions.

The final dataset covers the period from 1 January 2010 to 2 February 2026 and includes listed shadow banking institutions from the United States and Europe. This sample provides a suitable framework for examining the relationship between speculative bubble dynamics and systemic risk in the non-bank financial sector.

2.2. Bubble identification

Speculative bubble episodes are identified using the Backward Supremum Augmented Dickey–Fuller (BSADF) test proposed by Phillips, Shi and Yu (2015). The procedure is designed to detect periods of explosive price behaviour by recursively estimating right-tailed unit root regressions over multiple subsamples.

For each firm, the following ADF specification is estimated:

$$\Delta P_t = \alpha + \beta P_{t-1} + \sum_{j=1}^{K} \psi_j \, \Delta P_{t-j} + \varepsilon_t$$

where P_t denotes the asset price series. The null hypothesis of a unit root ($H_0: \beta = 0$) is tested against the alternative of explosive behaviour ($H_1: \beta > 0$).

The BSADF statistic is computed as:

$$BSADF(r_2) = \sup_{r_1 \in [0, r_2 - r_0]} ADF_{r_1}^{r_2}$$

where r_0 denotes the minimum window size, r_1, the starting point, and r_2, the ending point of each recursive subsample. Following Phillips et al. (2015), bubble episodes are identified whenever the BSADF statistic exceeds the corresponding critical value obtained through Monte Carlo simulation.

Based on the dating procedure, three binary indicators are constructed. The first indicator ($BUB_{i,t}$) identifies the presence of a bubble episode. The second ($BMPH_{i,t}$) captures the expansion phase of the bubble, while the third ($BRPH_{i,t}$) identifies the burst phase following the collapse of the speculative episode. A burst event is recorded when the BSADF statistic falls below the critical value after a period of explosive dynamics. These indicators provide a dynamic characterisation of speculative activity and allow the identification of both the emergence and termination of bubble episodes.

2.3. Systemic risk measures

To evaluate the systemic importance and vulnerability of shadow banking institutions, six complementary risk measures are employed: market beta, Value at Risk (VaR), Expected Shortfall (ES), Conditional Value at Risk (CoVaR), Delta CoVaR (ΔCoVaR), and Marginal Expected Shortfall (MES). All indicators are estimated using rolling windows of 252 trading days.

Market beta measures the sensitivity of firm returns to market movements and is computed as:

$$\beta_{i,t} = \frac{\mathrm{Cov}(R_{i,t}, R_{m,t})}{\mathrm{Var}(R_{m,t})}$$

where $R_{i,t}$ represents the return of firm i and $R_{m,t}$ denotes the market return.

Firm-level tail risk is measured using Value at Risk (VaR), defined as the 5% empirical quantile of the return distribution:

$$VaR_{i,t}^{0.05} = -Q_{0.05}(R_{i,t})$$

Expected Shortfall (ES) extends VaR by measuring the average loss conditional on exceeding the VaR threshold:

$$ES_{i,t}^{0.05} = -E(R_{i,t} \mid R_{i,t} \leq -VaR_{i,t}^{0.05})$$

To capture the systemic dimension of risk, the analysis employs the CoVaR framework developed by Adrian and Brunnermeier (2016). CoVaR measures the Value at Risk of the financial system conditional on institution $i$being in distress:

$$CoVaR_{i,t}^{0.05} = VaR_{t}^{0.05}(R_m \mid R_i = VaR_{i,t}^{0.05})$$

CoVaR is estimated using quantile regression:

$$R_{m,t} = \alpha_i^{0.05} + \beta_i^{0.05} R_{i,t} + \varepsilon_t$$

and calculated as:

$$CoVaR_{i,t}^{0.05} = \hat{\alpha}_i^{0.05} + \hat{\beta}_i^{0.05} VaR_{i,t}^{0.05}$$

The marginal contribution of an institution to systemic risk is measured through Delta CoVaR:

$$\Delta CoVaR_{i,t} = CoVaR_{i,t}^{distress} - CoVaR_{i,t}^{normal}$$

which can be expressed as:

$$\Delta CoVaR_{i,t} = \hat{\beta}_i^{0.05}\left(VaR_{i,t}^{0.05} - Median(R_i)\right)$$

Finally, systemic vulnerability is assessed through Marginal Expected Shortfall (MES), defined as the expected loss of a firm conditional on severe market stress:

$$MES_{i,t}^{0.05} = E\left(R_{i,t} \mid R_{m,t} \leq -VaR_{m,t}^{0.05}\right)$$

MES captures the extent to which individual institutions are exposed to extreme market downturns and complements CoVaR-based measures that focus on systemic contribution. Taken together, these indicators provide a comprehensive assessment of both firm-level and system-wide dimensions of financial risk.

3. Results

Figure 1 presents the evolution of speculative bubble episodes among listed shadow banking institutions in the United States and Europe. Bubble states are identified using the BSADF procedure and classified into normal, boom, bubble, and burst phases.

Several patterns emerge. First, bubble episodes are recurrent across both regions, indicating that speculative dynamics represent a persistent feature of the shadow banking sector rather than isolated events. In the U.S. sample, bubble activity appears more widespread, with a larger number of firms exhibiting prolonged periods of speculative behaviour. Several institutions spent a substantial proportion of the sample period in bubble states, suggesting that speculative dynamics were not confined to a small subset of firms.

Second, the European sample exhibits greater heterogeneity. While some institutions experience only sporadic bubble episodes, others display extended periods of speculative activity. This pattern suggests that bubble dynamics in Europe are more concentrated at the firm level, whereas the U.S. market exhibits a broader diffusion of speculative behaviour across institutions.

Third, bubble activity appears particularly pronounced during the period spanning approximately 2017–2021, with additional episodes observed in the post-2022 period. The clustering of bubble episodes across multiple firms suggests the presence of common market conditions that favoured the emergence of speculative dynamics within the shadow banking sector.

Figure 1
Bubble timelines of shadow banking institutions in the United States and Europe

Notes: Bubble states are identified using the BSADF methodology. Panel A reports U.S. shadow banking institutions (S&P 500), while Panel B reports European shadow banking institutions (STOXX Europe 600). Colors denote normal, boom, bubble, and burst states. Percentages indicate the share of observations classified as bubble periods for each firm. Sample period: 2010–2026

Source: Author's own work

Finally, the figure provides limited evidence of highly synchronized burst episodes affecting a large share of institutions simultaneously. Although individual firms experience bubble collapses, sector-wide burst events appear relatively uncommon, indicating that speculative episodes often unfold asynchronously across institutions.

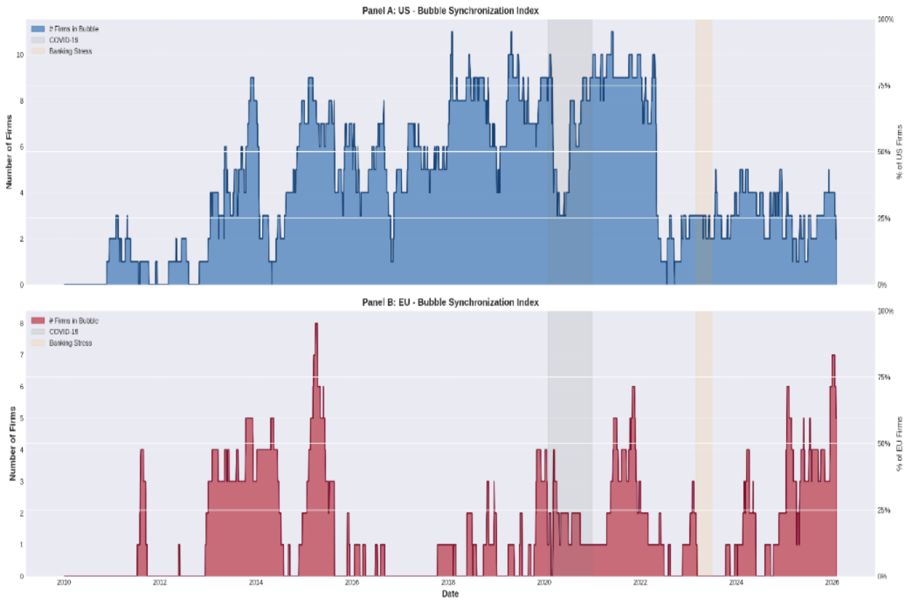
Overall, the results suggest that speculative dynamics constitute a recurrent feature of both U.S. and European shadow banking institutions, although the extent and distribution of bubble activity differ across regions.

Figure 2 reports the Bubble Synchronization Index, defined as the number of shadow banking institutions simultaneously classified in a bubble state. The indicator provides an aggregate measure of speculative co-movement and allows the identification of periods characterized by widespread speculative activity within the sector.

The U.S. sample exhibits a prolonged period of elevated synchronization between approximately 2016 and 2021. During several episodes, between eight and eleven institutions are simultaneously classified as being in a bubble state, indicating a substantial degree of speculative co-movement across the shadow banking sector. Following a marked decline during 2022, synchronisation remains present but at considerably lower levels, with most observations involving fewer than five institutions.

Figure 2

Bubble synchronisation index in U.S. and European shadow banking institutions



Notes: The figure reports the number of institutions simultaneously classified in a bubble state according to the BSADF procedure. Panel A presents U.S. shadow banking institutions, while Panel B presents European shadow banking institutions. The secondary axis reports the percentage of firms in a bubble state relative to the total number of institutions in each sample. Shaded areas indicate the COVID-19 period and the 2023 banking stress episode.

Source: Author's own work

The European sample displays a more episodic pattern. Peaks of synchronisation are observed around 2013–2015, 2019–2021, and again during the most recent years of the sample. Although the number of firms is smaller than in the U.S. sample, several periods exhibit a high proportion of institutions simultaneously experiencing bubble conditions, suggesting that speculative dynamics can become highly concentrated at the sectoral level.

A comparison of the two regions reveals important differences. Bubble synchronisation in the United States appears more persistent over time, whereas Europe is characterised by shorter but more pronounced synchronisation episodes. Despite these differences, both markets exhibit recurrent periods during which a substantial share of shadow banking institutions simultaneously experience speculative dynamics.

Overall, the results suggest that bubble episodes are not purely firm-specific phenomena. Instead, speculative behaviour frequently emerges in a synchronised manner across multiple institutions, supporting the existence of common drivers of bubble formation within the shadow banking sector.

Figure 3 presents the evolution of six systemic risk indicators for U.S. shadow banking institutions, including market beta, Value at Risk (VaR), Expected Shortfall (ES), Conditional Value at Risk (CoVaR), Delta CoVaR (ΔCoVaR), and Marginal Expected Shortfall (MES). For each measure, the figure reports the cross-sectional mean together with the minimum–maximum range across firms.

Several common patterns emerge across all indicators. First, systemic risk remains relatively stable during most of the sample period, although substantial heterogeneity is observed across institutions. This heterogeneity is reflected in the wide dispersion bands visible in all panels, suggesting that risk exposures differ considerably across shadow banking entities.

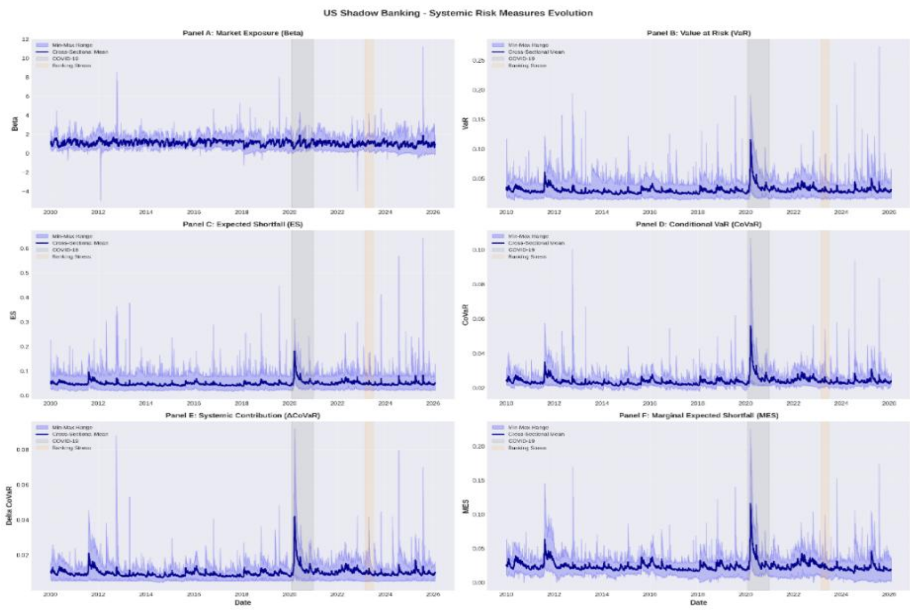
Second, all risk measures exhibit a pronounced spike during the COVID-19 market turmoil of 2020. The increase is particularly visible for VaR, ES, CoVaR, ΔCoVaR, and MES, indicating a simultaneous deterioration in firm-level risk, systemic contribution, and vulnerability to market-wide stress. The synchronised response across all indicators highlights the sensitivity of shadow banking institutions to severe market disruptions.

Third, risk levels decline substantially following the pandemic shock but do not fully return to pre-2020 levels. Several indicators, particularly ΔCoVaR and MES, display recurrent increases during the post-2022 period, suggesting the persistence of systemic vulnerabilities despite the absence of a shock comparable to that observed during the pandemic.

Finally, the large distance between the cross-sectional mean and the upper bound of the distribution indicates that a small number of institutions periodically account for disproportionately high levels of systemic risk. This finding suggests that systemic vulnerabilities within the shadow banking sector are unevenly distributed and may become concentrated in specific institutions during periods of market stress.

Figure 3

Evolution of systemic risk measures in U.S. shadow banking institutions



Notes: The figure reports the evolution of six systemic risk measures estimated using 252-day rolling windows: market beta (Panel A), Value at Risk (VaR, Panel B), Expected Shortfall (ES, Panel C), Conditional Value at Risk (CoVaR, Panel D), Delta CoVaR (ΔCoVaR, Panel E), and Marginal Expected Shortfall (MES, Panel F). The dark line represents the cross-sectional mean, while the shaded area indicates the minimum–maximum range across firms. Shaded vertical bands denote the COVID-19 period and the 2023 banking stress episode.

Source: Author's own work

Overall, the results indicate that U.S. shadow banking institutions exhibit relatively moderate average risk levels during normal periods, but their contribution to systemic risk increases substantially during episodes of financial stress. The evidence further suggests that systemic vulnerabilities remain present in the post-pandemic period, although at levels considerably below those observed during the 2020 shock.

Figure 4 presents the evolution of the same systemic risk indicators for European shadow banking institutions. Similar to the U.S. sample, the figure reports the cross-sectional mean together with the minimum–maximum range across firms.

Several findings emerge. First, the overall dynamics of systemic risk in Europe broadly mirror those observed in the United States. All indicators display a pronounced increase during the COVID-19 shock of 2020, reflecting a simultaneous deterioration in market risk, tail risk, systemic contribution, and vulnerability to market-wide stress. The consistency of this response across measures suggests that the pandemic represented the most severe systemic event during the sample period.

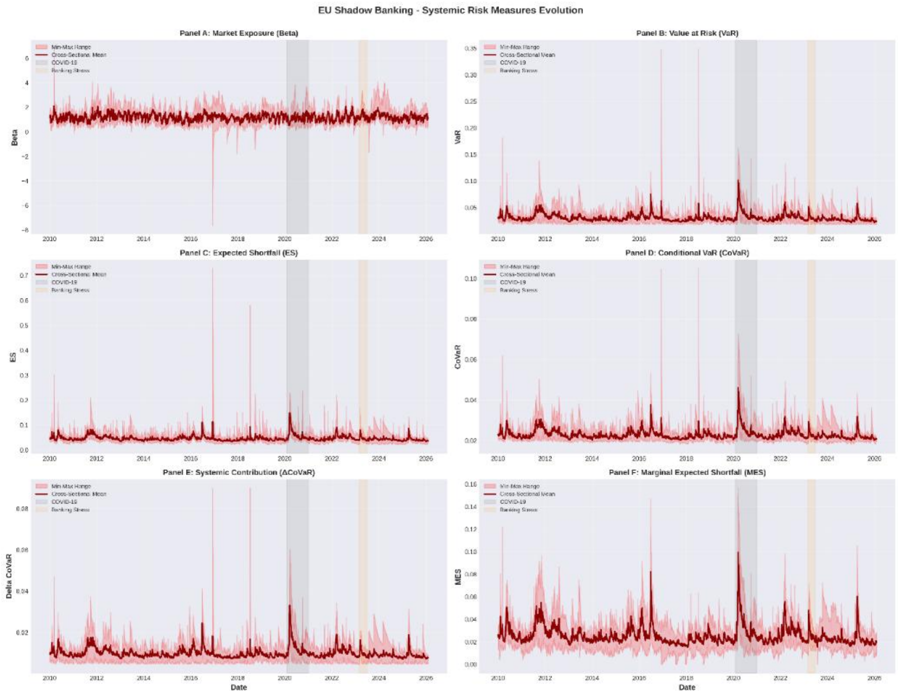
Second, average risk levels remain relatively stable during normal market conditions. The cross-sectional means of VaR, ES, CoVaR, ΔCoVaR, and MES fluctuate within narrow ranges for most of the sample, indicating that systemic risk remains moderate outside major stress episodes. At the same time, the wide minimum–maximum bands reveal substantial heterogeneity across institutions, with individual firms periodically exhibiting considerably higher risk levels than the sectoral average.

Third, several indicators show renewed increases following 2022, particularly for ΔCoVaR and MES. Although these increases remain well below the levels observed during the pandemic, they suggest that systemic vulnerabilities did not disappear following the normalisation of market conditions and continue to re-emerge periodically within the European shadow banking sector.

A comparison with the U.S. sample reveals broadly similar patterns but somewhat lower average volatility and narrower cross-sectional dispersion during normal periods. Nevertheless, stress episodes generate risk responses of comparable magnitude, indicating that European shadow banking institutions remain vulnerable to severe market disruptions despite exhibiting more moderate dynamics during tranquil periods.

Figure 4

Evolution of systemic risk measures in European shadow banking institutions



Notes: The figure reports the evolution of six systemic risk measures estimated using 252-day rolling windows: market beta (Panel A), Value at Risk (VaR, Panel B), Expected Shortfall (ES, Panel C), Conditional Value at Risk (CoVaR, Panel D), Delta CoVaR (ΔCoVaR, Panel E), and Marginal Expected Shortfall (MES, Panel F). The solid line represents the cross-sectional mean, while the shaded area indicates the minimum–maximum range across firms. Shaded vertical bands denote the COVID-19 period and the 2023 banking stress episode.

Source: Author's own work

Overall, the results suggest that systemic risk within the European shadow banking sector is generally contained during normal market conditions but increases sharply during periods of financial stress. The persistence of elevated risk measures in the post-2022 period further indicates that systemic vulnerabilities remain present despite the absence of a shock comparable to that experienced in 2020.

Tables 1 and 2 report the descriptive statistics of the systemic risk measures for U.S. and European shadow banking institutions, respectively. Overall, the results reveal broadly similar risk profiles across the two regions, although notable differences emerge in the indicators' distributional characteristics.

Table 1

Descriptive statistics of systemic risk measures: U.S. shadow banking institutions

Measure	Mean	Median	Std	Min	Max	Skew	Kurt
Beta	1.0940	1.0607	0.5313	-4.9272	11.2160	0.62	4.41
VaR	0.0302	0.0276	0.0125	0.0133	0.2732	3.01	22.33
ES	0.0493	0.0419	0.0242	0.0174	0.6429	2.52	21.93
CoVaR	0.0238	0.0229	0.0038	0.0180	0.1070	5.79	66.69
Delta CoVaR	0.0099	0.0090	0.0042	0.0044	0.0918	4.67	46.90
MES	0.0239	0.0228	0.0125	0.0000	0.2254	2.95	22.87

Notes: This table reports descriptive statistics for the systemic risk measures used in the analysis. The sample covers U.S. shadow banking institutions over the period 2010–2026.

Source: Author’s own work

Table 2

Descriptive statistics of systemic risk measures: European shadow banking institutions

Measure	Mean	Median	Std	Min	Max	Skew	Kurt
Beta	1.1898	1.1460	0.4908	-7.6031	6.7719	0.48	6.98
VaR	0.0308	0.0281	0.0112	0.0170	0.3492	4.60	62.06
ES	0.0467	0.0435	0.0175	0.0212	0.7284	6.49	145.63
CoVaR	0.0229	0.0220	0.0036	0.0179	0.1050	4.01	38.09
Delta CoVaR	0.0099	0.0092	0.0040	0.0045	0.0900	3.11	25.36
MES	0.0255	0.0231	0.0117	0.0000	0.1567	2.39	11.45

Notes: This table reports descriptive statistics for the systemic risk measures used in the analysis. The sample covers European shadow banking institutions over the period 2010–2026.

Source: Author’s own work

Market beta exhibits average values above one in both samples, with mean coefficients of 1.094 for the United States and 1.190 for Europe. These results suggest that shadow banking institutions tend to amplify overall market movements rather than simply track them. While average beta values are relatively comparable across regions, the distribution is characterised by substantial dispersion, as reflected by extreme minimum and maximum values. The European sample exhibits a slightly higher average market exposure, whereas the U.S. sample displays a wider positive range, reaching values above 11 during periods of elevated market stress.

The tail-risk measures also display similar average levels across regions. Mean VaR equals 0.0302 in the United States and 0.0308 in Europe, while mean ES reaches 0.0493 and 0.0467, respectively. Despite these similarities in central tendency, the distributions are strongly non-normal. Both VaR and ES exhibit pronounced positive skewness and exceptionally high kurtosis values, indicating the presence of extreme tail events and occasional periods of severe risk accumulation. Notably, the European sample displays substantially higher skewness and kurtosis for both measures, suggesting a greater concentration of extreme observations despite comparable average risk levels.

Similar patterns are observed for the systemic risk indicators. Mean CoVaR values remain relatively stable across regions, amounting to 0.0238 in the United States and 0.0229 in Europe. Likewise, the average contribution to systemic risk measured by ΔCoVaR is virtually identical in both samples (0.0099). However, both indicators exhibit substantial positive skewness and excess kurtosis, implying that systemic risk contributions are not evenly distributed over time but become concentrated during relatively rare stress episodes.

The results for MES provide additional evidence regarding the vulnerability of shadow banking institutions to severe market downturns. Average MES values are slightly higher in Europe (0.0255) than in the United States (0.0239), suggesting marginally greater exposure to systemic market stress. Nevertheless, both samples display considerable dispersion and non-normality, reflecting the episodic nature of systemic losses during adverse market conditions.

Taken together, the descriptive statistics indicate that U.S. and European shadow banking institutions share broadly comparable average levels of market, tail, and systemic risk. At the same time, the pronounced skewness and kurtosis observed across most indicators highlight the importance of extreme events in shaping the risk profile of the sector. These findings are consistent with the view that systemic vulnerabilities in shadow banking are characterised less by persistently elevated risk levels and more by the occasional emergence of severe stress episodes capable of generating disproportionately large losses and systemic spillovers.

4. Conclusions

This study examined speculative bubble dynamics and systemic risk characteristics in listed shadow banking institutions from the United States and Europe over the period 2010–2026. Using the BSADF methodology, the analysis identified bubble episodes at the firm level and investigated their synchronisation across institutions. In addition, systemic risk was evaluated through a set of complementary market-based measures, including beta, Value at Risk (VaR), Expected Shortfall (ES), Conditional Value at Risk (CoVaR), Delta CoVaR (ΔCoVaR), and Marginal Expected Shortfall (MES).

The results indicate that speculative bubble episodes constitute a recurrent feature of the shadow banking sector in both regions. Bubble activity is more widespread among U.S. institutions, whereas European institutions exhibit a more heterogeneous pattern characterized by periods of concentrated speculative activity affecting a smaller number of firms. Despite these differences, both markets experienced prolonged episodes of bubble formation, particularly during periods associated with favourable financial conditions and elevated market valuations.

The synchronisation analysis further reveals that bubble episodes frequently emerge simultaneously across multiple institutions. Although the intensity and persistence of synchronisation differ between the United States and Europe, both regions display recurrent periods in which a substantial share of shadow banking entities are simultaneously classified as being in a bubble state. These findings suggest that speculative dynamics are not exclusively firm-specific phenomena but may reflect broader market conditions affecting the sector as a whole.

The analysis of systemic risk measures highlights the importance of extreme events in shaping the risk profile of shadow banking institutions. All risk indicators exhibit pronounced increases during the COVID-19 market disruption, confirming the vulnerability of non-bank financial intermediaries to severe market stress. While risk levels declined following the pandemic shock, several indicators continued to display episodic increases during the post-2022 period, suggesting that systemic vulnerabilities remain present despite the absence of a crisis comparable to that experienced in 2020.

A comparison between the two regions reveals broadly similar average levels of market, tail, and systemic risk. However, the distributional properties of the indicators indicate that risk is characterized by substantial heterogeneity and occasional extreme observations. The high levels of skewness and kurtosis observed across most measures suggest that systemic risk in shadow banking is driven primarily by relatively rare but severe stress episodes rather than by persistently elevated risk conditions.

Overall, the findings contribute to the growing literature on shadow banking by providing comparative evidence on speculative dynamics and systemic risk in two major financial markets. From a policy perspective, the results support the continued monitoring of non-bank financial institutions as potential sources of financial instability, particularly during periods characterized by elevated market exuberance and heightened risk-taking.

Several limitations should be acknowledged. The analysis focuses exclusively on listed shadow banking institutions and relies on market-based measures of systemic risk. Future research may extend the analysis to broader segments of the non-bank financial sector, investigate the determinants of bubble synchronization, and explore more directly the relationship between speculative episodes and systemic risk transmission mechanisms.

References

1. Acharya, V.V., Pedersen, L.H., Philippon, T., & Richardson, M. (2017). Measuring systemic risk. *The Review of Financial Studies, 30*(1), pp. 2–47. https://doi.org/10.1093/rfs/hhw088
2. Adrian, T., & Brunnermeier, M.K. (2016). CoVaR. *American Economic Review, 106*(7), pp. 1705–1741. https://doi.org/10.1257/aer.20120555
3. André, C., Caraiani, P., Călin, A.C., & Gupta, R. (2022). Can monetary policy lean against housing bubbles? *Economic Modelling, 110*, 105801. https://doi.org/10.1016/j.econmod.2022.105801
4. Arora, D., & Kashiramka, S. (2023). Are shadow banks a threat to the financial stability of EMEs? *China Accounting and Finance Review, 25*(4), pp. 488–512. https://doi.org/10.1108/CAFR-09-2022-0133
5. Brownlees, C., & Engle, R. F. (2017). SRISK: A conditional capital shortfall measure of systemic risk. *The Review of Financial Studies, 30*(1), pp. 48–79. https://doi.org/10.1093/rfs/hhw060
6. Călin, A.C., & Lupu, R. (2026). Tracing exuberance: Multi-model evidence of bubble episodes in the Bucharest stock market.

International Journal of Emerging Markets. Advance online publication. https://doi.org/10.1108/IJOEM-12-2025-2934

7. Călin, A.C., Lupu, R., Croicu, A.E., & Topa, R.A. (2026). Bubbles and the Pro-Cyclicality of Systemic Risk Measures in Shadow Banking. *Journal of Risk and Financial Management*, *19*(4), 242. https://doi.org/10.3390/jrfm19040242
8. Caraiani, P., & Călin, A.C. (2024). The comovement of bubbles' responses to monetary policy shocks. *The North American Journal of Economics and Finance, 74*, 102244. https://doi.org/10.1016/j.najef.2024.102244
9. Caraiani, P., Călin, A.C., & Gupta, R. (2021). Monetary policy and bubbles in US REITs. *International Review of Finance, 21*(2), pp. 675–687. https://doi.org/10.1111/irfi.12284
10. Croicu, A.-E., & Călin, A.C. (2024). Reconceptualizing stability: Dynamics of shadow banking in financial markets. In Proceedings of the International Conference on Business Excellence (Vol. 18, No. 1, pp. 1385–1397). https://doi.org/10.2478/picbe-2024-0125
11. Croicu, A.-E., Iancu, L.A., & Rogojan, L.C. (2023). A review on the impact of shadow banking on financial markets prudential regulation. In Proceedings of the International Conference on Business Excellence (Vol. 17, No. 1, pp. 1596–1602). https://doi.org/10.2478/picbe-2023-0143
12. Dong, F., Mei, D., & Xiao, Z. (2025). Asset bubbles and financial frictions in small open economies. *Journal of International Money and Finance, 150*, 103230. https://doi.org/10.1016/j.jimonfin.2024.103230
13. Doruk, Ö.T., & Önal, Y.B. (2026). Lurking mechanism: Shadow banking and macroeconomic instability. *Economic Systems*. Advance online publication. https://doi.org/10.1016/j.ecosys.2026.101107
14. Fernandez-Perez, A., Gómez-Puig, M., & Sosvilla-Rivero, S. (2026). Policy to mitigate the price explosiveness in Madrid and Barcelona's real estate markets. *Journal of Policy Modeling*. Advance online publication. https://doi.org/10.1016/j.jpolmod.2026.107068
15. Härdle, W.K., Wang, W., & Yu, L. (2016). TENET: Tail-event driven network risk. *Journal of Econometrics, 192*(2), pp. 499–513. https://doi.org/10.1016/j.jeconom.2016.02.013
16. Huang, M., Jiang, H., & Zhang, S. (2025). Nonlinear effects of shadow banking on banks' systemic risk. *Pacific-Basin Finance Journal, 93*, Article 102869. https://doi.org/10.1016/j.pacfin.2025.102869
17. Iliyasu, J., Mamman, S.O., Abubakar, A.B., & Sanusi, A.R. (2024). Effects of adverse geopolitical risk on price bubbles contagion from European natural gas prices to international energy prices. *Journal of*

Economic Studies, 52(3), pp. 605–619. https://doi.org/10.1108/JES-03-2024-0131

18. Lupu, R., Călin, A.C., Dumitrescu, D.G., & Lupu, I. (2025). Introducing a novel fragility index for assessing financial stability amid asset bubble episodes. *The North American Journal of Economics and Finance, 75*, 102291. https://doi.org/10.1016/j.najef.2025.102291
19. Lupu, R., Călin, A.C., Dumitrescu, D.G., Popovici, O.C., & Khurshid, A. (2026). Unravelling systemic risk dynamics amid financial asset bubbles in times of enhanced volatility. *Amfiteatru Economic, 28*(71), pp. 328–344. https://doi.org/10.24818/EA/2026/71/328
20. Lupu, R., Călin, A.C., Lupu, I., Iancu, L.A., & Croicu, A.E. (2024). Bubble or not? A time series classification problem using machine learning. *Romanian Journal of Economic Forecasting, 27*(1), pp. 5–22.
21. Lupu, R., Călin, A.C., Zeldea, C.G., & Lupu, I. (2021). Systemic risk spillovers in the European energy sector. *Energies, 14*(19), 6410. https://doi.org/10.3390/en14196410
22. Mashimbye, L., & Fanta, A.B. (2026). Shadow banking and systemic risk in South Africa: Does size matter? *The Journal of Risk Finance, 27*(3), pp. 458–473. https://doi.org/10.1108/JRF-01-2025-0049
23. Moreira, A., & Savov, A. (2017). The macroeconomics of shadow banking. *Journal of Finance, 72*(6), pp. 2381–2432. https://doi.org/10.1111/jofi.12530
24. Pellegrini, C.B., Cincinelli, P., Meoli, M., & Urga, G. (2022a). The contribution of (shadow) banks and real estate to systemic risk in China. *Journal of Financial Stability, 60*, Article 101018. https://doi.org/10.1016/j.jfs.2022.101018
25. Phillips, P.C.B., & Yu, J. (2011). Dating the timeline of financial bubbles during the subprime crisis. *Quantitative Economics, 2*(3), pp. 455–491. https://doi.org/10.3982/QE82
26. Phillips, P.C.B., Shi, S., & Yu, J. (2015). Testing for multiple bubbles: Historical episodes of exuberance and collapse in the S&P 500. *International Economic Review, 56*(4), pp. 1043–1078. https://doi.org/10.1111/iere.12132
27. Rottner, M. (2023). Financial crises and shadow banks: A quantitative analysis. *Journal of Monetary Economics, 139*, pp. 74–92. https://doi.org/10.1016/j.jmoneco.2023.06.006
28. Wang, C., Zhang, W., & Meng, Y. (2026). Reassessing non-financial firms' shadow banking in the Chinese stock market: From re-lending to cash-liquidity allocation. *International Review of Economics & Finance, 108*, 105241. https://doi.org/10.1016/j.iref.2026.105241

29. Wu, H., Liu, X., & Tan, W. (2026). Spillover effect of shadow banking business governance: A perspective on audit pricing decisions. *International Review of Financial Analysis, 109*, 104816. https://doi.org/10.1016/j.irfa.2025.104816
30. Zhang, S., Miao, W., & Xu, H. (2026). Shadow banking coordinated supervision and systemic risk control: Empirical evidence from the New Asset Management Regulation. *Pacific-Basin Finance Journal,* 97, 103103. https://doi.org/10.1016/j.pacfin.2026.103103