

## Executive Summary

### Main Objective:

Modelling uncertainty and spatial effects in time to streamline the analysis and forecasting process, aiming not only to apply existing methodologies but also to develop new econometric tools (CUBT) for analyzing volatile markets and complex economic phenomena.

### Key Activities and Results:

1. **Domain Exploration:** In the initial stage, the specialized literature was reviewed, and empirical analyses were conducted to assess how latent variables such as uncertainty, sentiment, perception, and spatial effects have been addressed in previous research.
2. **Methodological Innovation:**
  - **CUBT (CUB in Time):** A new methodology was developed and validated (through Monte Carlo simulations), extending the CUB model by adding a longitudinal dimension and random effects (heterogeneity – Location–Scale & Location–Shift), enabling the modelling of the evolution of uncertainty, perception, and sentiment over time under non-linearity, while accounting for various chronological specificities (such as autoregressiveness).
  - **TSAR (Threshold Spatial Autoregressive):** Development of a robust methodology for threshold spatial autoregressive models, optimized for large datasets through adaptive LASSO, allowing variable selection and managing parameter heterogeneity.
  - **Discrimination of spatial weighting matrices using an eigenvalue-based approach.**
3. **Empirical Analyses and Applications:** These involved applying the developed methodologies in various areas of financial and economic research to address uncertainty and spatial effects:
  - **Cryptocurrency Market:** Applying SARCH and SGARCH models to the top 100 cryptocurrencies demonstrated contagion effects through non-geographic networks.
  - **Cyber Risk:** Network-based distributional inference highlighted spatial specificities and interconnected vulnerabilities of countries to cyberattacks.
  - **Shadow Economy:** Spatial analysis (Spatial Durbin model) at the EU level revealed the negative impact of tax pressure and significant spillover effects between countries, influencing economic uncertainty.
  - **Sustainable Behavior:** The impact of ESG on volatility or the success of crowdfunding campaigns to reduce uncertainty.
  - **Happiness/Perceptions:** Modeling the effect of financial shocks on perceptions and sentiments – case study on happiness.
  - The developed methodologies will be applied in various financial contexts and beyond.
4. **Dissemination:**
  - Results have been published or are under review in prestigious journals (e.g., *Digital Finance*, *Journal of Risk Finance*, *Journal of The Royal Statistical Society*) and presented at international conferences.

### Conclusion:

Stage 1 successfully established the theoretical foundation and validated the proposed new methodologies, empirically demonstrating that latent variables (uncertainty, sentiment) and spatial interactions are essential for understanding current financial phenomena and beyond. The results obtained will be further developed and utilized in the next stage of the project.