

Identification and measurement of systemic threats to the insurance sector resulting from climate risk in the light of sustainable development policy: new tools based on Machine Learning.

The 2030 Agenda for Sustainable Development, adopted by all 193 ONZ member states, contains 17 goals, including five areas: people, planet, prosperity, peace, and partnership. The goals cover a wide range of challenges such as poverty, hunger, health, education, gender equality, climate change, sustainable development, peace, and social justice. In the presented project, we consider the issue of climate change. Since the agreement in 2019, the European Commission has been implementing an economic growth strategy, thanks to which Europe is to become climate neutral by 2050. Therefore, subsequent legislative changes supporting the implementation of the sustainable development goals pose a big challenge to the insurance sector, especially due to the lack of developed market practice. To better understand the impact of climate change on the insurance sector, we are establishing quantitative tools that allow the identification, description and measurement of systemic risk in the insurance sector resulting from climate risk.

In this project, we analyze the physical climate risk context of catastrophe risk in order to determine the resulting risks across the insurance sector. The context of interconnections in the sector and the channels of transmission of potential undesirable financial events and their effects are important for the entire insurance system. We focus on establishing the network of relationships between insurers and the impact of climate risk on this structure of relationships. We propose new hybrid constructions of dependency networks in which we combine mathematical, econometric and statistical tools with machine learning methods.

The goal of this project consists in:

1. Identifying key mechanisms that should be included in the effective tools for early identification, assessment, and measure of systemic risk in the insurance sector in the light of the climate risk.
2. Developing new methods of network construction allowing the analysis of various aspects of systemic risk in the insurance sector in the context of climate risk. Checking if global, strictly and quasi-local network measures of constructed networks can be used as predictors of a given aspect of systemic risk.
3. Developing new hybrid methods allowing to analyze the dynamics of the structure of the connections' network of systemic risk in the insurance sector, combining statistical and econometric tools with tools of network modeling and predictive analysis.

The following hypotheses are made:

1. Global, strictly, and quasi-local network measures of constructed networks can be used as predictors of systemic risk in the context of climate risk.
2. The use of a hybrid approach improves both the explanatory and predictive power of models used to analyze the dynamics of the structure of the network of connections and systemic risk in the insurance sector and facilitates the identification of factors affecting the possibility of a system event and the assessment of its financial effects.
3. The application of the hybrid approach provides decision makers responsible for macroprudential policy with more information needed to monitor the growth and quantitative assessment of systemic risk in the light of climate risk in the insurance sector than the methods used so far.

Carrying out the research related to the above objectives will allow to:

1. Provide specific proposals of new methods of modeling and forecasting the network structure and systemic risk in the insurance sector resulting from climate risk
2. Identify insurance companies with a similar level of systemic importance because of the climate risk.
3. Formulate appropriate recommendations for shaping macro-prudential policy.