The main goal of the project is to develop novel and impactful quantitative methods that allow a coherent and unified measurement of market risk and financial position performance, ensure adequate risk aversion specification, and maintain efficient size of the underlying capital reserves. The project is split to three tasks related to the development of integrated and economically coherent approaches to modeling in finance, analysis of microstructural and statistical risk factor dynamics aspects, and long-run risk-sensitive objective criteria together with their applications to finance and economy.

To achieve this goal, we plan to use novel research techniques as well as advanced statistical and econometric tools developed in our previous research that proved to provide new insight into market risk, risk measure theory, and portfolio optimization in both econometric and financial contexts. This relates e.g. to the statistical risk unbiasedness definition, axiomatic approach to time-consistency, dynamic acceptability and performance quantification methods, various robust statistics methods, or usage of recurrence neural networks for risk quantification. We plan to apply those concepts to multiple subproblems investigating statistical properties of the underlying risk factor, economic risk unbiasedness implications, optimal portfolio selection procedures, risk factor dynamic discrimination and parameter identification using robust statistics, long-memory dynamic and multidimensional heavy-tail risk factor models, time-consistency of risk-sensitive models, specific reinforced learning optimization schemes for long-run stochastic control problems, and long-run risk-sensitive equilibria.

The relevance and importance of the stated research goals is versatile. First, while the popularity of integrated approaches to market risk modeling is constantly increasing, e.g. due to application of machine learning methods in finance, many proposed methodologies lack proper analysis of the interactions behind their financial, econometric, and mathematical aspects which leads to non-quantified risks. Second, the usage of non-coherent risk quantification models in the financial or insurance sector could be devastating as it impacts many strategically important areas linked to, e.g., *Risk-Weighted Asset* (RWA) determination or systemic risk allocation. Third, there are multiple inherent - yet not well studied - interactions between model design, estimation, calibration, and backtesting that are not well encoded in the models. These interactions are often cemented via specific economic or financial market microstructures or regulatory policies, which require a coherent approach that is not focused solely on the mathematical part of the methodology. For example, this can refer to the relation between capital model design and its regulatory backtesting performance that eventually impacts the actual RWA-induced reserve. Fourth, the need for methodological updates and refinements of market risk and capital models is being constantly emphasized by financial institutions, academic community, as well as regulatory bodies. Finally, to justify the importance of the stated research agenda, we recall that many researchers state that one of the core reasons behind the 2007-2008 subprime crisis was due to the misunderstanding of the Gaussian copula-based *Collateralized Debt Obligation* (CDO) pricing model which underestimated the probability of joint defaults; this is exactly a type of modeling issue that might have been avoided if economic features within the model were investigated more closely either by the regulator or financial institutions.

The project output should allow the creation of comprehensive quantitative methods that enable efficient and coherent measurement of market risk, proper determination of capital buffer, or correct risk-aversion specification. The potential impact of this project is very broad as the methodologies in scope of this project refer to all – not necessarily financial – frameworks, whose aim is to analyze or quantify market risk. In the financial framework, this includes models used within *Internal Model Approach* that are linked to *Expected Shortfall*, *Default Risk Charge* or *Non-Modellable Risk Factors*. In a wider context, this also refers to areas linked to risk quantification, econometric noise modeling, as well as general stochastic control optimality frameworks. Although the research agenda is interdisciplinary, our core focus is on finance and econometric models that produce capital reserves that are later converted to RWA and used for financial reporting. As stated in the research goal, we plan to develop integrated and economically coherent approaches to modeling in finance in multiple areas, analyse microstructural and statistical risk factor dynamics, and long-run risk-sensitive objective criterions together with their applications to finance and economy.