

RISK MANAGEMENT IN THE FIELD OF AGRICULTURAL INSURANCE – CHALLENGES AND EFFICIENCY SOLUTIONS

Summary

This thesis addresses the highly topical issue of managing climate risks in agriculture through risk transfer financial instruments, with a focus on adapting insurance policies to Romania's territorial specificities. The topic is justified by the increasing frequency and intensity of extreme weather events, especially drought, and by the urgent need to strengthen the resilience of farmers and the agricultural sector facing climate change.

The research is structured into five major chapters that follow a coherent, logical progression: from defining theoretical concepts and analysing the European context, to specifically proposing county-level differentiated insurance models for Romania.

Chapter I – Theoretical considerations regarding risk, lays the theoretical groundwork for analysing agricultural risks. A conceptual clarification was made between risk and uncertainty. The paper emphasizes the importance of characterizing risk in terms of hazard, exposure, vulnerability, and expected loss - fundamental elements for evaluating and designing insurance products. A significant contribution of this section is the detailed classification of risks relevant to agriculture: natural (drought, floods, hail), economic (price volatility), financial (limited access to credit), institutional, and social. The analysis showed that pure risks (those considered insurable) are the primary target of financial transfer schemes. It also explored the characteristics of insurable risks (quantifiable, independent, economically significant) and the practical limitations of applying these criteria in agriculture. Chapter I sets **the global context of agricultural risks**, highlighting a general trend of increasingly extreme weather events and growing economic uncertainty, which explains the need for financial innovative protection solutions for farmers.

Based on the analysis under this initial chapter, it can be stated that agricultural risk must be examined within an integrated, multidimensional framework, that accounts not only for the nature and frequency of events, but also for the institutional and economic response capacity. Starting from this data, the research moves forward to practical solutions to optimize protection for farmers facing climate and economic risks.

Chapter II - Mapping pure risks in the agricultural sector at European level, moves from theory to practical application. Starting with a concise overview of the agriculture in Europe as a strategic sector, characterized by structural diversity and high exposure to exogenous risks, the chapter established a rigorous typology of agricultural risks: natural (drought, floods, hail), economic (market volatility), biological (pests, diseases), and institutional (legislative changes, political instability). The focus is rightly placed on pure risks, as events with determinable probability, but with major economic consequences that can be addressed through insurance mechanisms. Also, the analysis concludes that farm size is a key factor influencing insurance behaviour. While large farms tend to be well covered and integrated into risk management systems, small and - to some extent - medium-sized farms remain vulnerable to climate and economic losses. This disparity highlights the need for coherent and tailored public policies to support sustainable and resilient development for all types of farms in the European Union.

A major outcome of this chapter is the development of **a methodology for mapping pure risks**. The methodology included the use of a questionnaire structure into four parts: (1) a focus on identifying the risk transfer framework in the insurance market, (2) identifying the

types of insurable risks, (3) assessing transfer costs based on an optimal structure, and (4) determining the legislative framework regarding premium subsidies provided by EU member states. Risk mapping also revealed disparities in member states responses, with some benefitting from complex insurance schemes (France, Italy, Germany) while others, such as Romania and Bulgaria, have underdeveloped markets.

Thus, this chapter offers a systemic view on pure risks in EU agriculture and provides an analytical framework for subsequent interventions. Risk mapping not only highlights the urgency of developing effective protection instruments but also lays a solid foundation for their territorial calibration. The findings of this chapter will directly underpin the proposed differentiated insurance models developed in the final part of the study.

Chapter III - Risk management in agriculture, plays a crucial role in moving from conceptual analysis and diagnosing risks to developing a functional framework for managing them in the agricultural sector. This chapter describes the risk management integrated process, structured in four stages: identification, assessment, response, and monitoring. The research adapts this general framework to the specific realities of agriculture, analysing in detail production risks (drought, diseases), marketing risks (price volatility), financial risks (credit access), institutional risks (legislative changes), and human resources risks (lack of labour force). Implementing risk reduction strategies at the farm level requires specific risk management tools, which are divided into three categories: **private instruments** (unsubsidized insurance, private mutual funds, forward and futures contracts), **public-private partnership instruments** (subsidized insurance, subsidized mutual funds, income stabilization tools, other financial instruments), and **public instruments** (direct payments, national and central state aid funds). The study shows that only 14 EU member states have explicitly included such support measures in their CAP 2023–2027 strategic plans. However, the degree of actual implementation varies significantly, with Romania - despite being among these states - showing a low degree of tangible application in the field.

This chapter also examines **the evolution of government spending** on risk management in agriculture, emphasizing the importance of public support in reducing farmers' financial burden and encouraging voluntary adoption of insurance products. The introduction of a new CAP framework for 2023–2027 emphasized sustainability and resilience, with increased allocations for environmental measures and adaptation to new requirements. These changes have reshaped spending structures, enhancing both agricultural field efficiency and ability to respond to future challenges.

This part of the research outlines the idea that an effective agricultural risk management system cannot function without a coherent integration of public and private components, with a particular focus on adapting tools to local contexts. Improving farmers' risk awareness and ensuring active involvement by authorities are also essential for developing sustainable support mechanisms. These premises justify the approach taken in the following chapters, which aim to develop concrete models for climate risk transfer through efficient and territorially adapted insurance policies.

Chapter IV - Impact of climate change on the agricultural insurance market in Europe, has a dual purpose: assessing the increasingly evident impact of climate change on agricultural production in Europe and evaluating the insurance market's response to these challenges. The research demonstrates that agriculture is one of the most vulnerable sectors to climate change, facing increasingly intense and frequent physical risks - particularly drought, floods, extreme temperatures, and weather events such as hailstorms and severe storms.

Through the methodology for **analysing extreme climate phenomena** (based on time-series analysis, moving averages, and the identification of years with extreme losses), the study identified a clear correlation between the growing frequency of extreme weather events and the recorded agricultural losses. Thus, during 2013–2023, there were several critical years (2013,

2017, 2019, 2021, and 2023) with significant per-hectare losses that would have severely affected farm profitability without protection mechanisms. The crossing of moving averages in 2013 signalled the intensification of recent extreme climate events, while the 2019 crossing confirmed these phenomena have become a lasting trend, systematically affecting the European economy.

Evaluating the agricultural insurance market from Europe reveals a strong polarisation: in Western countries (France, Italy, Germany, Spain), insurance systems are well developed, integrated into agricultural policies, and benefit from substantial public support. In contrast, in Central and Eastern European countries (Romania, Bulgaria, Slovakia), the penetration rate of insurance products is low, with coverage being fragmented and often ineffective.

An important finding of this chapter is that premiums in the “Fire and other property damage” category and total direct insurance premiums have seen accelerated growth since 2015. Fire and property damage premiums grew by 30.8% over eight years. This steady rise has been supported by a greater awareness of climate risks and the need for protection against natural disasters such as fire, floods, and severe storms. As for total direct insurance premiums, their value increased by 53.3%. This trend reflects a growing interest in insurance products as a response to climate change.

In the last part of this chapter, we analysed **the correlation between the evolution of climate phenomena and the development of the insurance market**. This correlation confirms the working hypothesis of the thesis: where climate risks are recurrent and systemically hazardous, the insurance market tends to respond-either by expanding the range of available products or through direct public interventions (subsidies, mutual funds, government reinsurance). It was observed that the segment covering heatwaves, cold spells, droughts, and wildfires has a significant impact on agriculture, as evidenced by the correlation results supporting this idea. The one-year lag correlation coefficient for this segment (0.4201) is the highest among all analysed categories, suggesting that these extreme events most strongly influence variations in fire and property damage insurance premiums. This stronger correlation can be explained by the fact that heatwaves, droughts, and frost directly affect agricultural production through crop losses, soil degradation, and reduced water resources.

Based on these results, we can state that agricultural insurance can no longer be regarded merely as optional products but must be integrated into a national and European strategy for climate change adaptation. A passive approach to these risks leads to structural economic losses, whereas the development of proactive solutions - such as index-based products or public-private partnerships - represents the key to future resilience for farmers from Europe. These conclusions provide the necessary foundation for formulating the operational proposals presented in the final chapter.

Chapter V - Optimizing the risk management process in the agricultural sector through insurance, constitutes the essential applied part of the thesis, integrating both the theoretical and empirical findings of the previous chapters and concrete proposals for optimizing climate risk management mechanisms in agriculture - especially within the Romanian context. Focused on agricultural insurance instruments, with particular emphasis on production index-based policies (Yield Index Insurance – YII), this chapter makes an original contribution by developing county-level differentiated models tailored to territorial risk profiles.

A significant contribution of this chapter lies in the detailed comparison of different types of insurance policies: indemnity-based, climate index-based (e.g., NDVI), and yield index-based. It is argued that **the Yield Index Insurance model is the most suitable for Romania**, given the predominance of drought risk and the feasibility of aggregating production data at the county level.

In the central section of this chapter, a detailed analysis was conducted on corn crop in Romania, which will serve as a reference for risk modelling. Based on data from the 2007–2024 period, counties were categorized by risk level - high (e.g., Constanța, Vrancea, Buzău), medium (e.g., Călărași, Teleorman, Olt), and low (e.g., Bihor, Mureș, Brăila) - according to the frequency and severity of losses. Based on these findings, a differentiated scheme of Yield Index Insurance policies was proposed, tailored to each county. The policies feature deductibles ranging from 10% to 45%, maximum compensation limits between 45% and 55%, and final costs between 0.64% and 3.29% after subsidy application. Table 32 of the thesis details the insured values per hectare, gross and net premiums, and the optimal cost-to-coverage ratio by county. The results demonstrate the economic viability of the proposed schemes, especially when combined with public support, and provide a concrete and scalable model for both policymakers and insurers. The chapter also highlights the need for public-private partnerships and investments in digitalization for risk assessment, thereby facilitating the development of a modern agricultural insurance system.

Thus, this final chapter confirms the thesis's hypotheses and offers a strategic, practical vision for developing a modern and effective agricultural insurance system in Romania. Through its detailed proposals, the work goes beyond theoretical analysis, positioning itself as a practical guide for reforming the agricultural insurance market facing increasingly frequent climate risks.

In sum, the thesis demonstrates that **managing climate risks in agriculture must be territorially differentiated, economically sustainable, and institutionally integrated**. Through its theoretical foundation, empirical analysis, and proposals for insurance-based protection instruments, this thesis provides a *reference model for developing an agricultural insurance system capable of protecting farmers against increasingly frequent climate changes and contributing to the economic stability of Romania's agricultural sector*.