

The Influence of Climate Change on Insurance Sustainability: Evidence from Spanish Agricultural Insurance

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As extreme weather events become more frequent, climate change-related risk is emerging as a major concern for insurers due to its impact on insured losses and its potential threat to business sustainability [1]. Building on the North American Actuarial Climate IndexTM(ACI), this research develops and applies a nested framework of actuarial climate indices for the Iberian Peninsula - particularly Spain - that includes the Iberian Actuarial Climate Index (IACI), the Spanish Actuarial Climate Index (SACI), and the Provincial Spanish Actuarial Climate Index (pSACI) [2, 3]. Through a comprehensive analysis of hail-storm impacts in Spain's wine-grape sector, using claims data from 1990 to 2022, we use advanced statistical methods - including regression, quantile regression, generalized linear mixed models (GLMMs), and linear quantile mixed models (LQMMs)—to quantify how incremental increases in these climate indices correlate with higher claim frequencies and more severe losses. Notably, extreme losses (e.g., at the 99th percentile) escalate disproportionately, underscoring the importance of tail-risk-sensitive approaches. Our findings highlight significant regional variability, particularly at the provincial level, and underscore the need for climate-responsive underwriting strategies and Solvency II-compliant risk measures [4, 5]. By offering a province-level monetization of climate change effects on insurance premiums and solvency capital requirements (SCR), this research provides actionable insights for product design, asset-liability management, and regulatory compliance. Overall, these results advocate for the transition from conventional mean-based risk models to adaptive, tail-focused methodologies, positioning scalable climate indices as crucial tools for 21st-century risk governance in the insurance industry.

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