Climate Change Impacts on the Affordability and Market Penetration of Flood Insurance across Europe

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Introduction

Increasing riverine flood risk, as a result of climate change, can cause flood insurance premiums to rise. As a result, insurance can become unaffordable and households may not insure, increasing the financial vulnerability to flood risk. The extent of these issues depends on flood insurance systems in place, which can differ considerably between countries in Europe. There are strengths and weaknesses to the various strategies, however, some aspects may be better able to cope with climate change. In this study we assess to what extent flood insurance becomes unaffordable and uptake of coverage declines as a result of climate change for several stylized insurance systems in Europe. Besides being affected by locally changing flood risk, we assess to what extent insurance premiums can be influenced by remote climate change through the international reinsurance mechanism

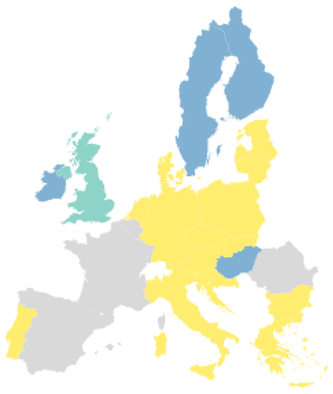

Figure 1: *Stylized flood insurance systems in Europe.*

- *A voluntary system is characterized by risk-based premiums, voluntary uptake, and private insurers and reinsurers.*
- *A semi-voluntary system is similar except that uptake is connected to mortgage or general home insurance.*
- *The solidarity system maintains equal premiums for all and mandatory uptake.*
- *The public-private-partnership (PPP) has partial risk-based premiums, mandatory uptake, private insurance and public reinsurance.*

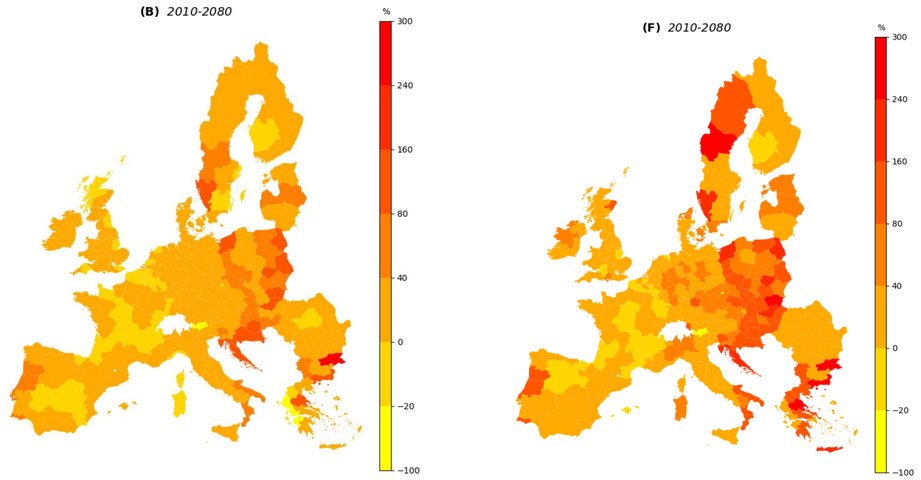

Figure 2: *Growth of unaffordability of flood insurance in the period 2010-2080 under existing national insurance systems. Here, growth is the percentage increase of the share of the population for whom flood insurance is unaffordable. Two flood-risk scenarios are shown where (A) is RCP2.6 with SSP1, and (B) is RCP8.5 with SSP3.*

Modeling approach

Flood insurance unaffordability and uptake are projected using the "*Dynamic Integrated Flood Insurance*" (DIFI) model. Flood damage and socio-economic development data is gathered from the GLOFRIS model, which is used to determine premiums for various insurance arrangements. Included insurance systems vary in terms of purchase obligation, risk-dependency, risk-sharing mechanism and reinsurance provision. Unaffordability is projected using household income distributions on a national level, where it is defined as causing household income to fall below 60% of disposable income. Insurance uptake is modelled taking into account affordability and subjective risk perceptions. The model is run for all households in 1/100yr floodplains, and results are aggregated on a NUTS2 level.

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Remote climate change

We assess the impact of natural disasters that occur outside the EU by adjusting the private reinsurer's risk aversion parameter. Evidence suggests that large natural disasters, or multiple disasters in close succession, can deplete reinsurers' capital stocks, which can cause a "hard" capital market. The high demand for capital by reinsurers after such large disasters causes the price of capital to increase. Reinsurers respond by adjusting premiums charged to insurers worldwide, who can respond by raising premiums to households, which causes the financial impact of these disasters to occur outside of the area experiencing direct damage. Due to increasing frequency and severity of natural disasters caused by climate change, reinsurers are likely to experience a "hard" capital market more often.

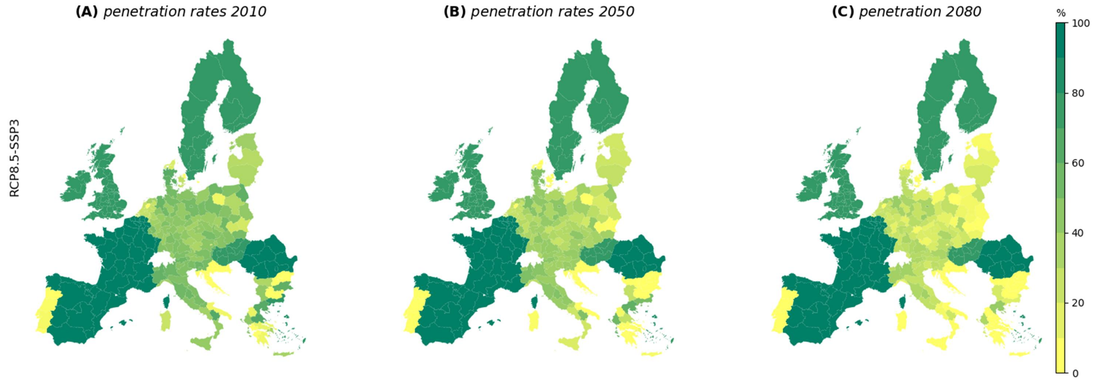

Figure 3: *Flood insurance penetration rates in 2010, 2050 and 2080, under RCP8.5-SSP3. This scenario shows the largest reduction of insurance uptake due to low income growth of households. Countries where insurance is mandatory, or connected to mortgage or real estate insurance, are shown to have fixed penetration rates above 80%.*

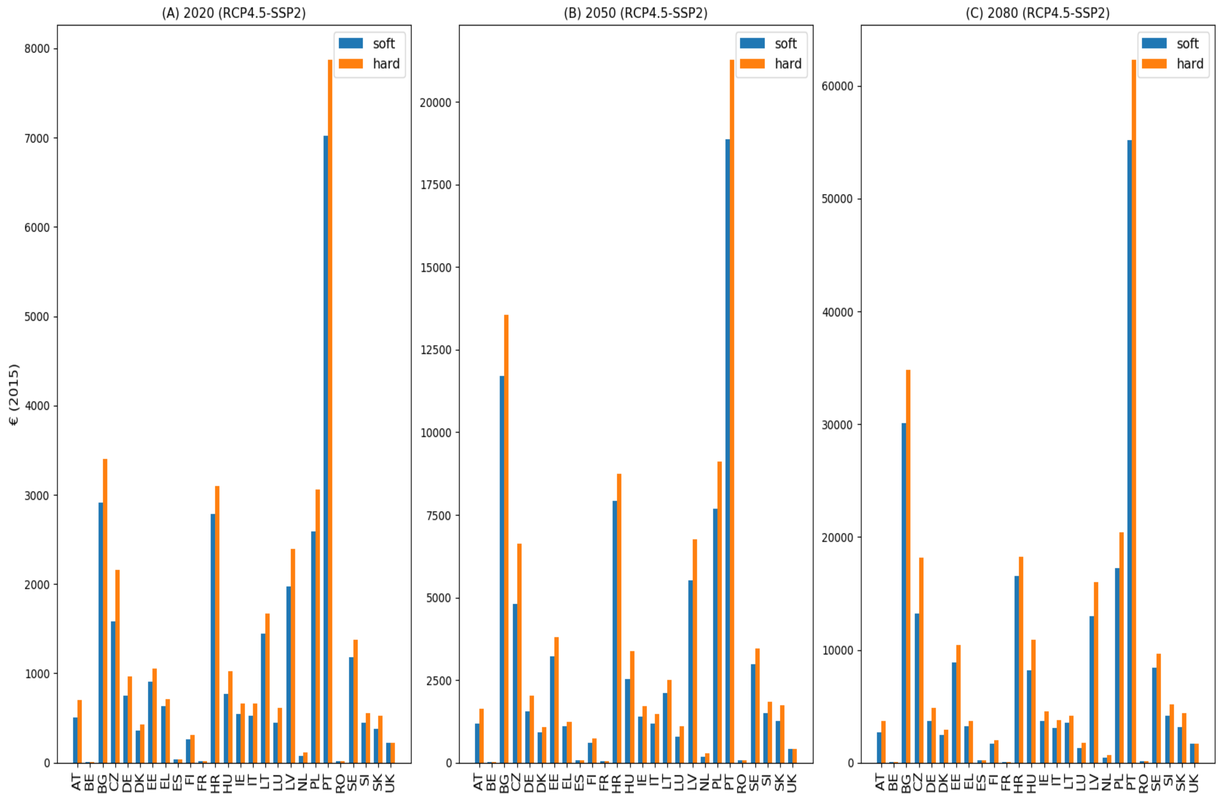

Figure 4: *Average annual premiums in 2015 Euros, projected for hard and soft capital market conditions in EU countries, for 3 periods (2020-2050-2080), under RCP4.5-SSP2 (Tesselaar et al., 2020). The shown premiums are for stylized insurance systems as shown in Figure 1. It can be seen that for countries where reinsurance is obtained on the private market (voluntary and semi-voluntary systems) a hard capital market for reinsurance leads to considerably higher premiums.*

Results

- We project an increase in the extend of unaffordability of insurance towards 2080 for all flood risk scenarios. Countries with solidarity-based systems are most successful at limiting the growth of unaffordability. Highest levels of unaffordability growth are seen in Eastern European regions.
- Insurance uptake declines for countries where it is optional. Figure 3 shows penetration rates under RCP8.5-SSP3, where we observe the highest decline in insurance uptake as a result of high increasing flood risk and low income growth for households. The decline in uptake is highest in Eastern European regions, which is in line with projected climate- and economic developments in that region.
- Insurance premiums are subject to volatility on capital markets through global reinsurance. Because of this flood insurance may become unaffordable in European countries due to natural catastrophes occurring outside this region.

Cited material:

Tesselaar, M., Botzen, W.J.W., Aerts, J.C.J.H., 2020. Impacts of climate change and remote natural catastrophes on EU flood insurance markets: An analysis of soft and hard reinsurance markets for flood coverage. Atmosphere (Basel).

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