

## RESEARCH BRIEF

## How to anticipate the impact of a massive cyber attack ?

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As part of their work within the Joint Research Initiative «Cyber-Insurance: actuarial modeling» (Axa GRM - Ensae Paris - Sorbonne University) Caroline Hillairet and Olivier Lopez are trying to define a general framework for designing accumulation scenarios that can be used to anticipate the impact of a massive cyber-attack on a portfolio insurance. This methodology can help insurance companies to design their strategies to face such cyberattacks. Also, the Covid 19 crisis of these past few months has shown us the interest of designing accumulation scenarios.

The growing cyber threat is encouraging companies to take out insurance policies to complete their arsenal of protection. Recently, efforts have been made to quantify risk with a traditional frequency severity approach, as in Eling and Loperfido (2017), Forrest et al. (2016), Farkas et al. (2019) or Bessy-Roland et al. (2020). However, significant uncertainty about the real value of the coverage remains and a global portfolio failure would be able to break the principle of mutualization at the heart of the insurance business. This type of crisis is called the «accumulation scenario», see Eling and Schnell (2016). The particular nature of the services included in typical cyber-contracts generally consists of a combination of financial repairs and the rapid intervention of teams of experts to help the policyholder restart his business. Circumscribing the crisis through this assistance is a portion of the total cost. If a large number of policyholders are simultaneously victims of an attack, saturation of this response capacity may occur. Depending on the situation, this can lead to an increase in the cost of intervention per insured, or to the impossibility of honoring the contract (due to a lack of resources that can be mobilized). Hillairet and Lopez propose a way to quantify the probability and the cost of such saturation based on a given response capacity of the insurer and the policyholder. The main part of their approach consists in mixing the effect on the portfolio, the response strategy and epidemiological models to describe the strength of the attack at the global level, Gaussian approximation theory is used to simulate the impact of the attack on a large insurance portfolio.

The approach designed by Hillairet and Lopez is based on compartmental SIR models, but can also be adapted to any other type of infection and generalized to any other type of model to describe the chronology and strength of the attack. The article is organized according to the modeling of a cyber event and its result on a portfolio. Then, the authors use Gaussian approximation theory to estimate the evolution of these episodes for large portfolios to derive deviation limits that help quantify the probability of saturation of the response. Finally, Hillairet and Lopez propose a Wannacry-type scenario to discuss the impact of the response of the insurance company and policyholders through simulation studies.

At the moment there is a lack of public data to clearly identify the precise response times during massive cyber attacks. Further modifications could be made to enrich it, as data collection grows with the attacks, the models should also become clearer in the future.

## References

Original title of the article: Propagation of cyber incidents in an insurance portfolio: counting processes combined with compartmental epidemiological models.

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