Identifying Financial Actors Exposed to Tipping Points

Keywords: ecological tipping points, financial risks, financial networks, multilayer network, cascading effect

Extended Abstract

Ecosystems around the world are showing symptoms of resilience loss [1]. With them there is an increasing risk of critical transitions or regime shifts: large, abrupt and difficult to reverse changes in the function and structure of ecosystems. When regime shifts occur they often impact the flow of benefits that people get from nature, and with them the ability of companies, cities or nations to satisfy human basic needs. Here we ask who is exposed to ecological regime shift risk, and by being exposed, who has the agency or power to intervene and perhaps avoid tipping points?

To answer this question we match companies whose activities imply the use or extraction of natural resources in places vulnerable to regime shifts. Then, for publicly listed companies we reconstruct social networks of companies ownership and investments. The networks serve to identify financial actors exposed to ecological tipping points through several investments or regions of the world. The multilayer network can be centred around companies, shareholders, investors, or countries. Clustering at different levels of aggregation allow us to identify actors with disproportional risk exposure, but also companies, investors or countries who could make a difference in mitigating risk.

As an example, Fig 1 shows a preliminary analysis of financial actors exposed to the risk of emergent zoonotic diseases (such as covid) [2]. Vanguard Group Inc, Bedrock Inc, and Dimensional Holdings Inc are the most central actors in the shareholders network, financial institutions with high exposure include banks, financial and insurance companies, as well as corporations. International regulation could address companies and investors according to regions of origin or countries of exploitation. We are currently replicating the zoonotic disease example with an analysis of fishing industries in marine ecosystems, and mining companies in terrestrial ones.

References

[1] Rocha, J. C. (2022). Ecosystems are showing symptoms of resilience loss. Environmental Research Letters, 17(6), 065013.
[2] Galaz. V., J. Rocha, P.A. Sanchez García, T. Roukny, P. Søgaard Jørgensen, A. Dauriach and A. Golland. 2022. Beijer Discussion Paper 277: Financial dimensions of global zoonotic disease risks. Beijer Discussion Paper Series.

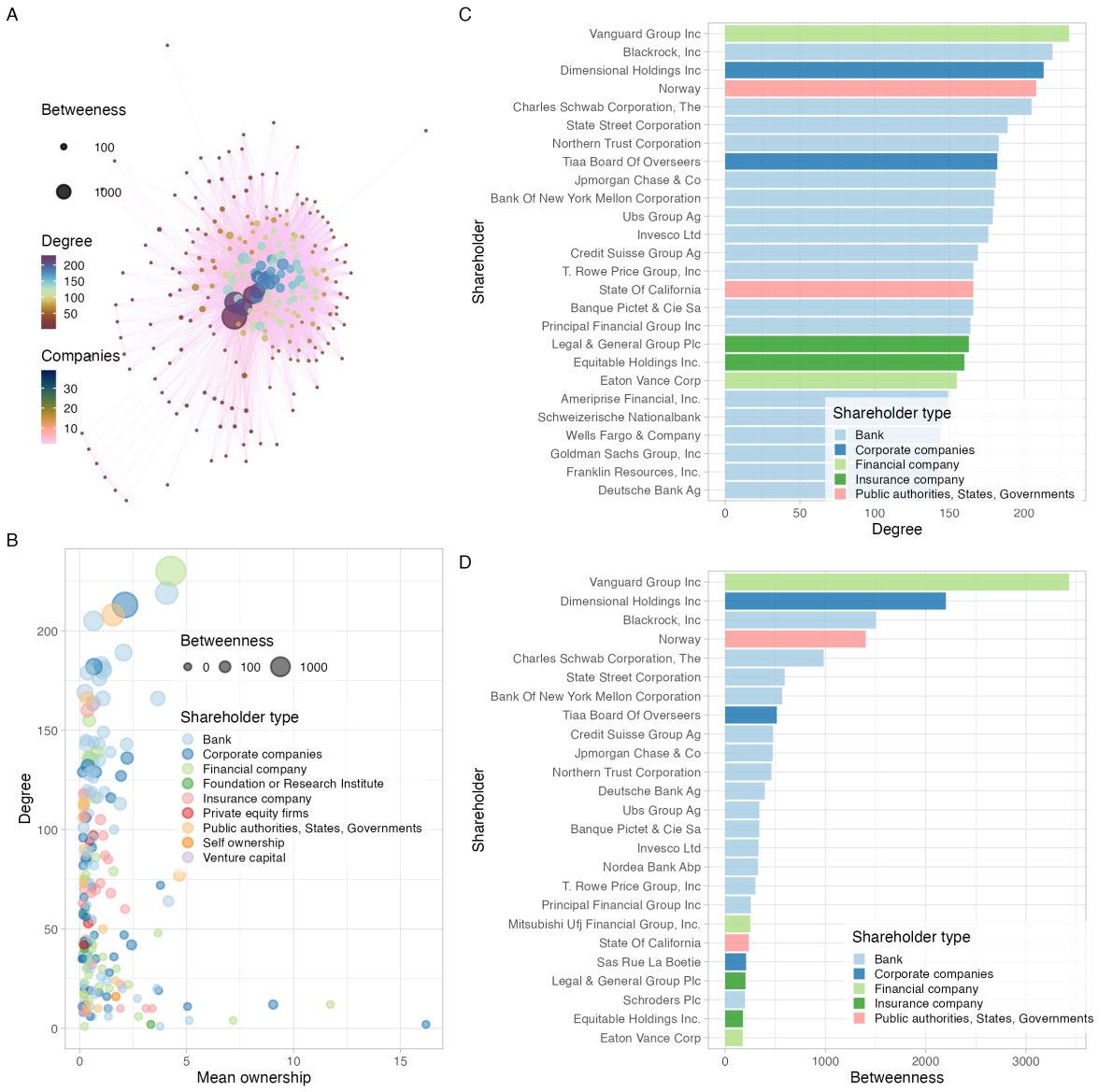

Figure 1. **Financial actors exposed to the risk of emergent zoonotic diseases.** A network projection of companies ownership (A) shows that a few companies have investments in large proportions of the network, yet their ownership share is relatively low. Investors play different roles, but actors with high exposure tend to be financial companies, banks or corporate companies (B). Top shareholders are ranked by degree (C) and betweenness (D).