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Network analysis of food risks and crises in the global seafood market

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Over the last decades we have been assisting to the sharp increase in global interchanges of goods, services, ideas and cultures, in a process known as globalization. This is on-going process acting at the global scale and one of it's the major aspects is the development of international trades for primary goods such as energy, raw materials and food. Demand and consumption of those commodities are then dependent from a large set of interactions, which involves multiple actors in different part of the world. Hence, changes in some local market or area can have cascading effects on other distant markets with global effects and dynamics that will depend on the complexity of the global network.

This can often give rise to price volatility for some of these commodities in specific markets thus generating effects on the societies exposed to such fluctuations. In particular, over the last 10 years there has been a sharp increase in price volatility of several food products that are traded at international level and among those seafood products appear to be the most volatile. Moreover, it is also expected that the global food system will come under strong pressure from the combined effects of several fundamental factors, including population growth, energy, land demand and climate change To match the supply and demand of food products and then to guarantee food security is therefore important to assess how trades and prices can respond to those pressures and identify resilience and stability of the global food trade network.

To describe some of those dynamics we consider a minimal model for the global seafood market, which is described by a set of producers (e.g., fishery), distributed consumers and set of global suppliers that are able to trade and distribute the commodity over the global market network. Different markets are linked in the network and we consider cost related to production, distribution and consumption of the seafood. Each actor in the network will have different goal functions that they will try to maximize, but their best strategy will depend from the strategies of the other players. We use then a game theoretical approach to establish the equilibrium on the network, which is the set of strategies that maximize the gain for all players.