GHENT UNIVERSITY

ECONOPHYSICS: ECONOMICS, NETWORKS AND COMPLEXITY

Central to the project is the observation that there is an increasing degree of interconnectedness and of complexity in many societal systems. This poses challenges for governance, risk, robustness and resilience. Whereas traditional economics starts from a static world in equilibrium, data-driven complexity economics can deal with a dynamic and interconnected world. Novel interdisciplinary research approaches and educational lines are mandatory to cope with this new reality and address the challenges.

Leading scientists: prof. Koen Schoors (Economics), prof. Jan Ryckebusch (Theoretical Physics)

 # new professorships: 1

Project description

The essential ambition of this project is

1) to develop a new network-based and data-driven methodology for the purpose of drafting and testing new economic theories employing big data sets on economic behavior that are becoming increasingly available, and

2) to integrate these new developments in the research and the teaching of the departments of economics and physics at Ghent University.

The use of network methodology in economics is still in its infancy and many new network methods are developed in physics. By investing in this cooperation between physics and economics, we want to be at the forefront of the emerging scientific development in network-based descriptions of socio-economic systems. Complex networks have been gaining some traction in economics after conquering many other fields of science before, but we are still only at the onset of a new scientific wave. Just as with the other fields where networks gained a foothold, the methodologies of networks are initially put to work to succinctly capture and characterize interaction data. Whether these data refer to trading countries or, to people paying or bank lending, all could benefit from the complex network perspective to uncover the interconnectedness and the high-level features in the studied systems.

One contribution, e.g. developed a network measure to quantify systemic risk in interbank lending networks. A second example of success was the exposure of the core-periphery structure in international trade relationships. There have also been considerable efforts to include networks in theoretical socio-economic models. Network approaches are now appearing in models on economic development, production and systemic risk as well as in game theory.

Next to these purely descriptive and theoretical applications of network theory, network-based explanatory variables are popping up in econometric models too. An agent's behavior is not only a result of the agent's own intrinsic characteristics but also a result of the interaction of the agent with its peers who might or might not have totally different intrinsic characteristics or behavior. Network measures have been developed to capture precisely this, to express the relation of a node to its surroundings. Hence, if economic interactions are represented as a network, network measures can capture and distillate the interaction of an agent with its environment.

Proposed impact

The economic and societal impact of these contributions is very substantial. In the field of financial stability, our team has already contributed with several papers to a better understanding of interbank market stability, which will hopefully help

prevent future financial calamities. We are also working on network based methods that can be applied to detect corruption from an administrative dataset. We are currently applying this on two massive datasets of public procurement and of driver licenses, and we have shown that we can detect cases of corruption in a way based on network statistics. Governments worldwide will be able to apply these methods to their data and in this way fight / avoid corruption in a much more effective way. We our experimenting with a network based method- based models to predict housing prices and credit default, facilitating better risk management in banks. Over and above these specific examples of possible achievements, this generally new approach simply opens a multitude of new research questions that can be addressed by teams of economists and physicists. This will not only help us to better test existing economic theories, but also to develop much needed new theories to forward our economic understanding. Our approach for e.g. introduced a fresh look on trade integration during the last two and a half centuries, which will generate new research in these fields and may be especially useful to understand the consequences of the recent trend of de-globalization. But we are also looking at visa regimes and refugees in a network context and analyzed contagion on dynamic networks of conflict, and liquidity squeezes. Also the spread of social values and civic norms in a population will be studied with the use of network methodologies. Finally we will also supply new sets of interdisciplinary competences that will allow society to fully exploit the welfare enhancing opportunities offered by the innovations of big data and digitalization, hopefully without falling in the pitfalls presented by these opportunities.