

Economic Complexity

L. Pietronero

Dipartimento di Fisica Sapienza, ISC-CNR, Roma and World Bank, Washington

Economic Complexity (EC) is a new field of research that consists in a radically new methodology. It describes economics as evolutionary process of ecosystems made of industrial and financial technologies that are all globally interconnected. The approach is multidisciplinary addressing emerging phenomena in economics from different points of view: analysis of complex systems, scientific methods for systems and the recent developments in Big Data. This approach offers new opportunities to constructively describe technological ecosystems, analyse their structures, understand their internal dynamics, as well as to introduce new metrics. This approach provides a new paradigm for a fundamental economic science based on data and not on ideologies or interpretations, which is becoming a necessary choice in a highly interconnected and globalized world, especially after the great financial and economic crisis of recent years.

Economic Complexity, in addition to a new vision for a data-based scientific approach for fundamental economics, offers a new set of metrics able to quantify the competitiveness of countries, of technological sectors, measuring future development prospects for nations as well as for large companies. Those metrics have already shown to have a major impact for policy makers and for industry applications economics and finance. Over the last year, the World Bank (WB) has extensively tested and adopted this new methodology for its strategic analysis.

A crucial element of our methodology is a radically new approach to the problem of Big Data. Big Data is often associated with "big noise" as well as a subjective ambiguity related to how to structure the data and how to assign them a value that should reflect many arbitrary parameters. In the case of the evaluation of the industrial competitiveness of a country, the required parameters for such an analysis could more than one hundred. A key point approach EC is to go from 100 parameters to zero parameters and obtain results which can be tested in a scientific perspective. This is done by focusing on the data in which the signal to noise ratio is optimal and developing iterative algorithms in the spirit, but other than Google, and optimized to the economic problem in question. In particular the study of a country or a company is not done at the individual level but through the global network in which it is inserted. In this way you get the Fitness of the countries and the Complexity of the products.

The dynamics in the new GDP-Fitness space [1] (opens up to a completely new way for monitoring and forecasting. Then, the taxonomy of products and their evolutionary dynamics is built through machine learning methods. Finally, the same thing is applied to patents and technologies, two elements that open up the possibility of analyzing the core elements of the innovation process.

[1] M. Cristelli, A. Tacchella, L. Pietronero, PLOS One 10(2): e0117174 (2015).

[2] Nature editorial on EC: <http://www.nature.com/news/physicists-make-weather-forecasts-for-economies-1.16963>