Increasing interconnectedness and growing complexity of economic and financial systems raise the question of how economic growth and strength should be measured. New economic metrics and economic theories borrow from complexity studies and other disciplines, creating a new paradigm to think about economic development and relations.

Our observations

- Several new institutions want to research the fundamentals of complex, adaptive systems and their behavior, such as the Santa Fe Institute and the Institute of New Economic Thinking. Their aim is to integrate other disciplines, like psychology, physics, computer sciences, biology, anthropology, in the study of economic systems.

- The Atlas of Economic Complexity measures how the knowledge of the society is translated into its production. Complex economies export not only highly complex products, but also a large number of different products. Japan is the most complex economy of the world, followed by Switzerland and Germany.

- New Economic Metrics tries to encode the intangible assets of economic systems, like social capital or the quality of export products, using machine-learning tools. Their approach perceives economic outcomes as the result of adaptive and evolutionary processes, and it develops metrics on the ‘fitness’ of the national economy in the globalized and interconnected world economy.
Connecting the dots

Last week, we noted how the concept of economic complexity helps us understand some of the flaws and limitations of the models used in mainstream economics. Complexity studies in general study the relations and outcomes of systems that consist of many components that interact and adapt to each other, on almost every scale: the universe, societies, the human brain, living cells. The central idea behind complex systems is that their outcomes are difficult to model because of the many and insecure dependencies, relationships, and interactions of the parts that form the whole, hence rendering unstable equilibria and continually changing outcomes. As a result, the understanding of complex systems requires a holistic point of view by seeing how order and stable patterns emerge in these systems, e.g. collective human behavior, diseases, coherent human thought (like philosophy), or even the remarkable stability and order in the observable universe. These complex systems have distinct characteristics that transcend disciplines and objects of study. The first is non-linearity, or the idea that the change in the input is not proportional to the change in the output, like self-reinforcing waves, revolutions, or general relativity. Another key concept is ‘emergence’: properties of larger entities that are not possessed by its smaller organism, like conscious biological life or a piece of art. An idea related to this is ‘spontaneous order’ or ‘self-organization’, where order arises from the behavior of individual parts, which is nonetheless not planned or (centrally) orchestrated. Examples are the evolution of life on earth, behavior on social media platforms, free market economies, or the structure of crystals. Lastly, ‘feedback loops’ is a concept where the output of a system is at the same time the input of a new (causal) process, like in biospheres, electronic engineering, or stock markets. These concepts show that understanding complex systems require a multidisciplinary approach, and that it is practically impossible to model all the possible inputs, relationships, and interdependencies. This paradigm resembles more ‘chaos theory’ than linear and predictable processes, and has a ‘quantum approach’ instead of ‘classical mechanics view’ on phenomena. This paradigm is already fashionable in natural sciences, like astrophysics, (quantum) physics and biology, and is currently introduced in heterodox economics. For understanding the complex nature of economic growth in the globalized and digitized economy, new concepts are needed. For example, when gauging the strength of an economy, we need to look at its ‘resilience’: how well it can overcome shocks and overcome periods of stress, like financial market turbulence, wars, or changing trade patterns. Does an economy generate oscillating dynamics with more unstable equilibria, or does the system have self-regenerating capacity to return to a stable order? Another term is the ‘additivity’ of an economy’s growth capacity: how well it can respond and adapt to changing economic conditions. For example, a research paper on the fitness of the BRIC economies shows that the higher growth paths of China and India can be explained based on the evolution of their industrial and technological complexity compared to the Russian and Brazil economies. Furthermore, the embedded nature of economic systems within other systems and domains, like social or cultural systems, perceives economies as distributed computer networks that consist of information. Economics in this sense is a social learning process, in which output is dependent on the quality of other inputs and information within the system. For example, how well the economy reacts to new developments and whether it has the capacity to benefit from technological innovations, depends on whether an economy has the required types of capital: social, financial, human, or infrastructural.

Implications

- Complex systems require an approach that combine quantitative data research with qualitative human judgement and understanding. In this way, economic complexity studies are the opposite of reductionist paradigms that reduce their object of study to one aspect.

- Understanding economies like distributed network computers provides a new take on the strengths and weaknesses of the economy. For example, it indicates that Japanese export products (which are highly complex) have much to benefit from globalization as the number of economies capable of producing these goods is not long.

- Understanding complex social systems is at odds with a strict concept of rationality, in which we can deduce the principles of behavior or historical outcomes. Therefore, revolutions or technological disruptions require meta-analyses and multidisciplinary research.