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Global food trade, economic complexity, and their impact on a country's water resources

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The dynamics of economic growth of countries have profound implications for the world's social and environmental status. The economic strength of a country is standardly measured through its Gross Domestic Product (GDP). However, there is no commonly accepted scheme to forecast the growth of the GDP of a country – i.e. to understand the dynamics of economic growth. Recently, a new discipline called Economic Complexity (EC) (Hidalgo & Hausmann, PNAS, 106(26), 10570-10575, 2009) is gaining momentum within this field, where complex-systems methods are used to provide innovative ways to assess the growth potential of a country through data science. Within EC analyses, metrics are provided of the economic competitiveness that countries possess – hence of their potential growth – by analyzing the international trade of goods and products around the globe, focusing in particular on the products each country exports. EC metrics provide a proxy of future economic growth of a country by extracting the productive knowledge (consisting in human and environmental resources, capabilities and finances) that each country owns. These metrics require a simple input, represented by the bipartite network of countries and products exported. Moreover, these measures share a deep relationship with standard centrality metrics, that can help in unveiling features of the underlying network structure (Sciarra et al., Scientific Reports, 9, 15269, 2018). Different EC metrics have been introduced, including (Tacchella et al., Scientific reports, 2, 723, 2012).
We analyze the main differences between these metrics, through the lens of complex network theory, with the aim to understand the capacity of these metrics to serve as proxies not only of economic growth, but also of the potential environmental footprint of each country's economy. We exemplify our approach by considering the impact on water resources (in terms of water footprint) of the production and export of agricultural goods, with a special attention to examine the link between the external water footprint of a country and its economic fitness. Our results show that economic complexity can play a key role to shed light on new facets of the global water resources, revealing interesting relationships between economy and environment, necessary for a better comprehension of climate change dynamics and which may result useful for policy makers.