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TITLE: A NETWORK VIEW OF INPUT-OUTPUT ECONOMY: COMPLEXITY AND RESILIENCE

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ABSTRACT:

Given that a sustainable system must be resilient to internal and external challenges, resilience is a necessary condition of sustainability. The world's economic growth has long been criticized for the unsustainable way of consuming energy and resources. However, it cannot be denied that the world's economy, especially some major countries, is paradoxically resilient given its history which is full of successful growth and depressed crisis. Therefore, understanding the resilience of economic systems is essential for re-design and re-construct the current Earth system for resilience in general, given that the economic system integrating human, built, and natural systems is a typical case of complex Earth systems. On the other hand, owing to the historical accumulation of economic statistics, data are adequate to conduct quantitative studies for this purpose. In order to understand resilience of economic systems, it is necessary to investigate its complexity because essentially resilience is an emergent property of the economic system due to complex interactions among heterogeneous agents (economic sectors for example). One of the most common ways to study systems' complexity is complex networks which represent the system as interconnections among agents. Given that each system in the form of networks can also be mathematically represented by an adjacency matrix, it is possible to make an analogy between network topology and the input-output (IO) structure of an economy. In particular, the U.S. economy is chosen as a case to study its complexity and resilience given its economic, political, geographical, and environmental importance in the world. In the IO network, sectors can be regarded as nodes while economic flows connecting these sectors can be seen as links. The nodes and links are distinguishable in the light of economic outputs and flows' strength, respectively, which brings more complexity to the IO network given that the literature in complex network has been primarily concentrated on simpler networks whose nodes and links are homogeneous. Given the fact that the U.S. IO accounts are complex enough with around 500 sectors and are available for decades back to 1960s, it is possible to obtain meaningful information regarding complexity and resilience by investigating the IO network in the context of complex networks.