

The analytical complementarity of input-driven and output-driven models

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Input-driven (Ghosh) and output-driven (Leontief) models are algebraically equivalent; however, their use has not been interpreted as equivalent and has been subject to reinterpretations. Since its first days, the Leontief model is used to determine the total requirements of the economy (primary inputs) to produce specific final goods. On the other hand, the original Ghosh models have been initially interpreted as the final production response to using certain primary inputs but later reinterpreted as a price model whereby changes in the primary inputs alter the prices in final outputs.

This paper aims to demonstrate that such reinterpretation is misleading by clarifying the “equivalence” between both models, specifically by deriving both models algebraically and then by arguing which questions each model is able to answer. It also aims to show that both models can be simultaneously used to better understand the structure of the economy.

First, in the theoretical part, the concepts of “product-based” and “input-based” structures are introduced to show how the same algebraic structure (i.e. the corresponding Leontief or Ghosh inverse matrices) may be used to answer different questions. In particular, the output-driven model reveals what primary inputs are required to produce a specific final output, and the input-driven uncovers in which final goods each primary input ends up (i.e. the Ghosh model shows into which final goods primary inputs are embedded). It is also shown that the Ghosh model should be interpreted as a quantity model, following its original development.

In the practical part, the previous concepts are applied to a monetary input-output table, to a physical input-output table representing the economy and to a physical input-output table representing an ecosystem. It is shown that, despite being equivalent, both models reveal different structural features, and enable researchers to perform different types of analyses, each answering different types of questions.

The paper concludes that when a system “such as the economy” is driven by its outputs, only output-driven models can “drive” the system into a new state. However, within a given state, input-driven models can be used to provide complementary analyses (e.g. in which proportion are primary inputs allocated to final outputs). The opposite is true for input-driven systems such as ecosystems: only input-driven models can be used to drive the system into a new state and, then, output-driven models can be used for complementary analyses. Thus, this paper crystallises the use of the Ghosh model by clarifying previous work and expanding the analytical options of IOA within economics, industrial ecology and biology, specifically by providing new insights on the allocation of monetary and physical flows between primary inputs and final outputs.