

Using input-output stock-flow consistent models to simulate and assess circular economy strategies

Topic: Recent Developments in Stock-Flow Consistent Input-Output Modelling - II

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Abstract. The Circular Economy (CE) paradigm has gained momentum in both academic and industrial circles in the last decade. Despite the intuitive association of a transition towards a CE with a more sustainable society, there has been limited scrutiny about its economic viability. To address this, there is a need for macro- and meso-economic tools to assess the impacts of CE policies on society, the economy, and the ecosystem. The field of ecological macroeconomics can fulfil this need through various promising modelling approaches. However, much work remains to be done. The aim of this article is twofold. Firstly, it provides a short literature review of macro- and meso-economic modelling developments addressing CE issues, focusing on the most widely used approaches and tools. Our review highlights that the engagement of the macro- and meso-economic literature with the CE topic has been, thus far, overly simplistic. On the one hand, most methodological proposals based on computational general equilibrium (CGE) models do not appear adequate to assess the success of CE initiatives, as they lack an explicit description of the structural change required to achieve the transition. Additionally, the more comprehensive literature based on traditional input-output (IO) analysis seems to focus mainly on ex-post assessments or on simple exogenous changes to final demand patterns, rather than providing a dynamic view of the phenomenon. On the other hand, while stock-flow consistent (SFC) models have gained momentum in ecological macroeconomics in the last decade, their main limitation is that they only consider aggregate output, so neglecting the interdependencies between different industries. This is the reason a hybrid approach seems necessary. Secondly, based on the previous point, the article argues that the combination of IO with SFC modelling techniques is one of the most promising methods to simulate, assess, and compare CE strategies. In order to support this, the main features of a simplified IO-SFC model for a capitalist economy are presented and discussed. In such a model, money is endogenously created, production is demand-driven, and the macro-economy is divided into industries that produce goods and services, as well as generating waste and CO2 emissions. Results show that restructuring production and consumption patterns in order to adopt CE-driven practices is not enough to ensure the transition towards a more sustainable economy, as long as production decisions remain driven by private interests.

Keywords: Circular Economy, Stock-Flow Consistent Models, Input-Output Analysis, Waste, Carbon Emissions

JEL Classification: E16, E17, C67, D57

Highlights:

- There has been limited scrutiny about the economic viability of circular economy strategies
- Ecological macro- and meso-economics can provide analytical tools to assess the impacts of circular economy policies on society, the economy, and the ecosystem.
- The article provides a literature review of macro- and meso-economic modelling developments addressing circular economy issues.
- The article argues that the combination of input-output analysis with stock-flow consistent modelling is one of the most promising methods to simulate, assess, and compare circular economy strategies.
- Results show that restructuring production and consumption patterns in order to adopt circular practices is not enough to ensure the transition towards a more sustainable economy, as long as

production decisions remain driven by private interests.

Main research questions:

- What is the economic viability of circular economy practices?
- How can input-output and stock-flow consistent modeling techniques be used to assess the impacts of circular economy policies on society, the economy, and the ecosystem?