

Macroscale Modeling Linking Energy and Debt: A Missing Linkage

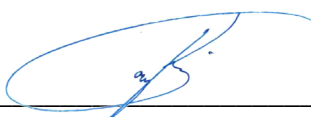
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ABSTRACT

What if we realized that the fundamental economic framework of models that are meant to guide a low-carbon energy transition prevents them from actually answering the question they are supposed to answer? Instead of assuming a series of energy investments, and then estimating the economic impacts from those choices, they actually do the exact opposite. They assume economic growth, and then make a series of investments to meet emissions targets without actually factoring in how the energy systems themselves feedback to economic growth. The research here would be to try to understand how energy/resource extraction are linked with long-term economic outcomes, specifically addressing the idea of accumulation of debt in the economy. Many economic models implicitly assume that energy resources are not constraints on the economy. These energy-related constraints have to be introduced if we are to effectively understand long-term debt and natural resource interactions. Same is also true with various biophysical models which do not consider economic parameters like debt, employment and wages etc. while modeling population growth and resources in the system.

The research objective seeks to develop a consistent merged model combining both a biophysical and an economic model to describe the industrial transition to our contemporary macroeconomic situation. The research approach would be to integrate macro-scale system dynamics models of money, debt, and employment (specifically the Goodwin and Minsky models of (Keen, 1995 & Keen, 2013)) with system dynamics models of biophysical quantities (specifically population and natural resources such as in (Meadows et al., 1972, Meadows et al., 1974, Motesharrei et al., 2014)). The proposed research concept is critical to link biophysical modeling concepts with those economic models that specifically include the link of debt to employment and economic growth.

This type of modeling is anticipated to help answer important questions for a low-carbon transition for example how does the rate of investment in “energy” feedback to growth of population, economic output, and debt and also how does the capital structure (e.g. fixed costs vs. variable costs) of fossil and renewable energy systems relate to and affect economic outcomes.



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