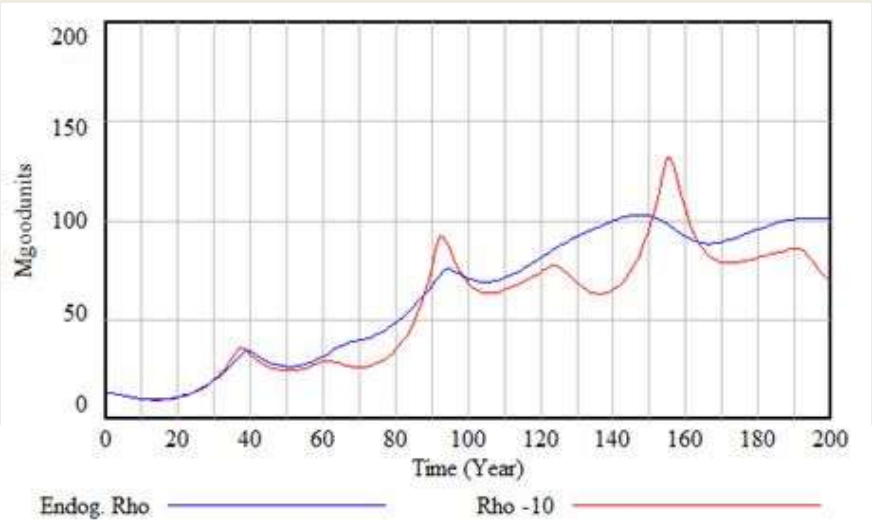
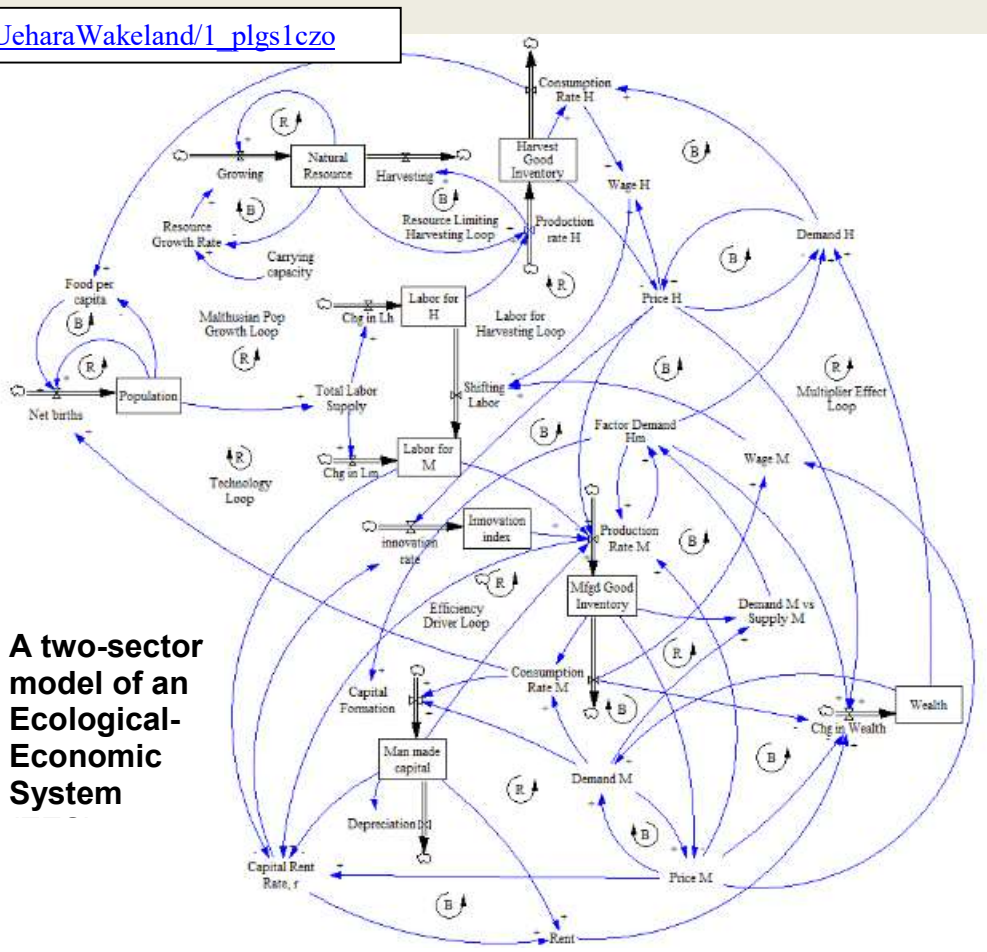
ECOLOGICAL ECONOMICS SYSTEM (EES) MODELLING

WITH A FOCUS ON ENDOGENOUS INNOVATION AND RESILIENCE

6m video about poster https://media.pdx.edu/media/ISDC2020PosterNagaseUeharaWakeland/1_plgs1czo



Dynamics of man-made capital input

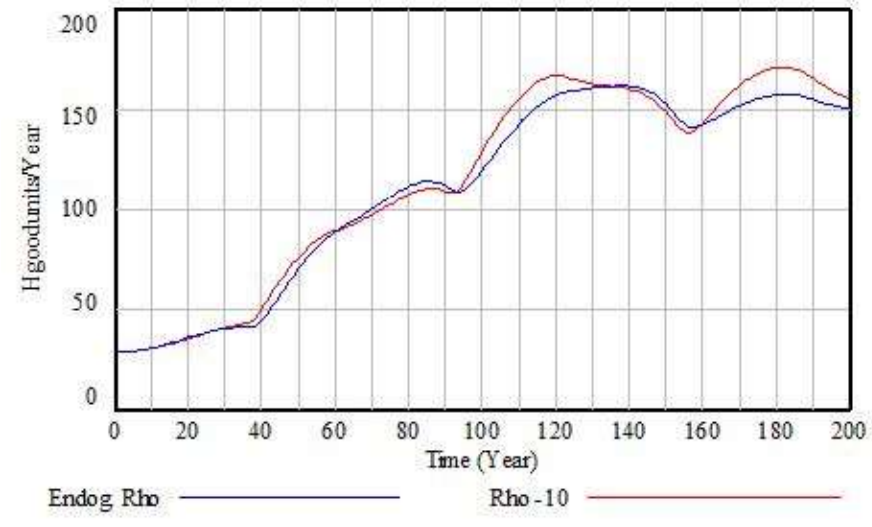


A two-sector model of an Ecological-Economic System

A sneak peak of the stabilizing effect of endogenizing innovation

Our paper presents many diagrams of our simulation results. Here, we present just a few. The diagrams above and below depict the dynamics of the two types of productive inputs in our EES, 'natural resource' and 'man-made capital'.

- **Red curves** show the dynamics without innovation (the substitutability parameter is kept constant).
- **Blue curves** show the dynamics with endogenous innovation.
- Both diagrams demonstrate the smoothing effects of endogenous innovation.
- This 'smoothing out' effect is consistent with the way innovation is modelled in the system; every time the relative scarcity of either of the two inputs increases, the substitutability between them in production improves.



Dynamics of natural resource input

Should the market price signal help to stabilize the EES? Of course.

BY NAGASE, UEHARA, AND WAKELAND, FOR SDS CONFERENCE, BERGEN, NORWAY, JULY 2020

Q1: What is an ecological economic system (EES)?
A1: An EES is a way we can look at the world we live in, a system consisting of an economy (constructed and maintained by human) and an ecosystem (nature) that ultimately determines the sustainability of the whole system.

Q2: What sort of an 'economy' is depicted by the model?
A2: A very simplified one, consisting of two types of agents: 'producers' and 'households.' The former produces goods to be consumed by the latter, and the latter provides a productive input (called 'labour') to the former, in a typical manner of a circular flow diagram of an economy.

Q3: How about the 'ecosystem'?
A3: It is depicted as the source of a renewable but depletable productive input (called 'natural resource stock').

What about other known functions of an ecosystem for our well-being? Let us explain later (see **Q5** & **A5**).

Q4: What do we mean by innovation?
A4: Innovation refers specifically to an increase in productivity of inputs. Why is it so narrowly defined? Because we are interested in studying whether, as we extract natural resources from the ecosystem, the economy can be sustained by accumulating man-made capital (a stock of durable inputs that generate a flow of productive services over a period) as substitute inputs.

Q5: How does SD come into play?
A5: SD is extremely useful! Even our very simple model is too complex to be solved mathematically for analytic solutions. SD let us study the transitional dynamics of the system, without requiring instantaneous period-by-period equilibria, or a long-term steady state. Even still, the model is already complex enough. So for now, other features of the ecosystem such as receiving byproducts/pollutants from the economy and providing vital life support systems are not modelled.

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