

Economic Dynamics: Two Years from Completion

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Abstract

Jay Forrester was working on two paper collection projects in the last years of his life. The first was Social Dynamics, which was published by the System Dynamics Society in 2019. The second was Economic Dynamics, which is going to be a model based collection. This work in progress described what needs to be done on the models that Jay was working with to bring Economic Dynamics to fruition. Ultimately, the hope is to also publish it as an electronic book.

Background

I first heard about the National Model in a letter from Merwan Engineer, a college friend who had met Peter Senge at a Futurist conference and was sure that this was a project I would want to know about. The year was 1983. I was at McGill University as a Special Student studying Math and Physics because I felt that Economics, which I had gotten my undergraduate degree in, had somehow missed the mark. In retrospect, I was right about missing the mark, but in the wrong direction. I had already applied to the Economics Department at MIT, but after getting Merwan's letter also applied to the Sloan School.

Once I got there, I went to Jay Forrester and asked him if I could work on the National Model project. He said no. I asked again after I had taken a course in System Dynamics. The answer was still no. But, still more coursework later when I asked again, he said yes. And thus begins my relationship with the National Model project.

In 2019 the System Dynamics Society published the electronic collection Social Dynamics (<https://collections.systemdynamics.org/jwf/social-dynamics>) in phone friendly book form. This is one of two projects that Jay had launched with a small group of people led by Roberta Spencer. The other was Economic Dynamics, and for that he wanted a model. This work in progress report is on bringing that model from where Jay left it, to the point it can reproduce the figures in the content of the Economic Dynamics collection.

Problem Statement

The goal of this work is to take a model that has been used in many variations over many years, largely in Dynamo, then later in Vensim, with cryptic variable names and no diagrams into a form that is accessible and can be parameterized to produce the important behavior modes discovered over the course of its development. That model represents an economy, and the behavior modes of interest relate to employment, GDP, interest rates and other economic measures.

Problem Approach

The first step is to bring the model into a form that can be worked with, creating usable variable names and stock and flow representation consistent with modern model development approaches. Most of this process can, and has been, automated.

The next step is to adjust the model for readability and transparency to the extent possible. This is a challenge because the model has a number of somewhat difficult constructions. Most important among these is a common set of equations for representing the household and production sectors. Breaking those out and adjusting the structure layout requires lots of editing by hand.

When the model is, for lack of a better word, organized, the work of getting it to behave well gets underway. This is work that is similar to the development of a model to replicate behavior modes for which there are multiple targets. Time consuming, and not guaranteed to succeed, but at least well tested.

Finally the model and its results need to be packaged. This will be done using an interface to make it easy to switch parameterizations for the different behavior modes. The goal is clearly to have those parameterizations be as similar as possible, but whether that is possible remains to be seen.

Progress to Date

I have brought the model into a modern form with reasonably good structural organization. This was done using a combination of the XMUTIL toolkit to translate the model from Vensim and change the variable names to be readable, and the new automated stock and flow diagram generation capabilities of Stella.

I now need to begin the work of adjusting the organization to make the model easier to deal with. This will almost certainly be done in conjunction with experimentation around model behavior. There are still improvements to the toolset that are underway to make this task (and model reorganization in general) easier.

References

The ultimate publication draws on D-Memos, papers, and book chapters published by Jay Forrester. These were selected by Jay as representative of his work in Economic Dynamics, but may not all be included as copyright permissions need to be obtained for many. All of this content is available; it is only the organization, and the linkage to a working model, that will be unique.