

Yet another Approach to Modeling Economic Phenomenon

Ivan Garibay, Christopher Hollander, Ozlem Ozmen, Amit Goel

University of Central Florida, Orlando, FL, USA.

igaribay@ucf.edu, Christopher.Hollander@ucf.edu, ozlem@ucf.edu, amit@agoel.com

Agent-based computational economics (ACE) has increased in popularity over the past few years as a tool to both understand and explain complex economic phenomenon. Econosim is a new ACE model being developed at the University of Central Florida. It differs from many existing ACE models by removing the distinction between firms and households. In Econosim, every economic agent is both a consumer and a producer. This decision results in production and trade becoming the core economic behaviors of every economic agent. In addition, we explicitly represent production knowledge as a set of resource transformation rules that are subject to evolutionary forces. This representation allows population dynamics to alter the technological landscape of the economy and provides a straightforward method of exploring innovation and knowledge driven economic growth.

Each agent in our model, called an *adaptive resource transformer* (ART), lives within an economic ecosystem where individuals are connected by social networks and the actions of an agent can have unintended consequences beyond its nearest neighbors. Econosim is intended to serve as a computational economics laboratory that can be used to verify and explore existing economic ideas and theories, and help inspire and create new ones. It is also intended to serve as a tool for exploring the impact of economic policy by allowing modelers to view the potential consequences of their decisions *in silico*, before they are enacted in the real world. The current model is written in Java, using the MASON toolkit. It is being employed to explore the benefits of entrepreneurial support organizations, such as university incubators, and examine the structure and influence of economic networks.

The modeling approach taken by Econosim draws from the traditional literature on generative models. Economic behaviors and macro-economic phenomenon are emergent properties of simple interactions that occur at the micro level. In the case of Econosim, the micro level is composed of many adaptive resource transformers that interact with one another. Adaptive resource transformers are simple computational agents that have, at their core, a set of transformation rules that specify what an agent is able to consume and produce, and a set of resources used by these rules. These transformation rules define the speciation of the population. Each adaptive resource transformer associates a supply and demand price with each resource it has, and is driven to acquire any and all resources as specified by the inputs of its transformation rules. Resource acquisition is accomplished through trade with neighboring transformers. As an adaptive resource transformer trades with its neighbors, it adjusts the prices that it associates with each resource. When an adaptive resource transformer is unable to acquire any further resources because it has nothing to trade, it dies. This death effect is countered by a birth process that introduces new adaptive resource transformers into the system.

Adaptive resource transformers offer a new approach to abstracting economic agents. They can be programmed to act as purely rationally utility maximizing agents, or enhanced to make use of intelligent or irrational behavior. The core design of each adaptive resource transformer is driven by established theory from biology, economics, and business. The resulting model produces emergent behavior that resembles many well established stylized facts that are found in the existing literature. The reproduction of such stylized facts serves as one important method of model verification and validation.