From trigger agents to planning agents: making a simple economy asynchronous

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Abstract

Why complex agents? This simple question has marked the development of agent-based simulation, a discipline that is under the pull of two divergent forces: on one hand, by the developments of agent platforms, that propose intelligent, logic-based agents, where a substantial part of the complexity resides in the agent; and on the other hand, by the needs of parameter and mechanism exploration, that favors simple agents in order to deal with the explosion of the search space. In this work, we aim to compare the usage of complex and simple agents by replicating a simple agent-based simulation in a language that supports complex, plan-based agents.

We began by locating some of the simplest agent-based economical model available in the literature, models aimed to represent fundamental economical issues as labour price, value of money, sustainability and crises. Our search produced a small number of simple agent-based models. The common features of those seem to be the presence of

- households/workers, as the point of consumption and the source of work;
- firms, where work is transformed in goods
- money that is used to mediate from work to consumption
- and finally, to ease coordination problems, banks, sometimes in an abstract, non-individual representation.

The references examined include Boyle (2013), Bargili et al. (2008) and Gaffeo et al. (2012). We finally selected this last work because of its simplicity. Our first aim, thus, was that of obtaining a qualitative replication of the chosen model, whose main result was that the economic macro equilibrium implied by the basic neoclassical macroeconomic model can be, at least in some cases, deducted by a simple agent-based model without the assumption of a Walrasian auctioneer. The model exhibits also an interesting range of non-equilibruim feature, allowing for occasional crises caused by lack of coordination and positive feedbacks. We thus set off to create a BDI-based (Jason) implementation of the Gaffer et al (2012) model.

In the first part of the paper, we will list the technical challenges that we met and the proposed solution, especially for what concerned the synchronization of the model. The description of the chosen model made clear how it had been implemented in a synchronized, step-wise way, as it is customary for models implemented, for example, in NetLogo. In the economy as represented in Gaffeo et al (2012), production and sales were respectively simultaneous and sequenced just after each other.

We decided instead to remove any reference to simultaneous behavior, apart from an external calendar that imposed a financial report at the end of one simulated year. This way, firms and workers can start production and find a job at any time, modifying both the theoretical equilibrium to be reached and the feedback cycles that underlie crises and catastrophes. In the last part of the paper, we report our findings in this directions, showing how simple but plausible mechanism modifications influence stability and sustainability of the model.

References

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