

Referee comments on “Debt, deleveraging and business cycles. An agent-based perspective”

This paper makes a worthy contribution to both understanding the role of debt in business cycles and the development of heterogeneous multi-agent modelling in economics, and on those grounds is worthy of publication. However it is also more a work in progress than a completed research agenda—it indicates what can be done with this approach, rather than being the final word. Therefore there are numerous choices made in the modelling that I would be more critical of, were it being presented as a completed project.

Chief here are the use of a Cobb-Douglas production function, the homogeneous treatment of households, and the simplistic modelling of the production of capital goods. I hope these will all be addressed in future iterations of this model—though I am happy to see the paper published without amendments on these points.

The use of a Cobb-Douglas Production Function

Cobb-Douglas production functions are the standard fare of Neoclassical economic models. This is not a recommendation! Decades ago, Anwar Shaikh demonstrated that a Cobb-Douglas function in which the exponents sum to one is not a production function, but a nonlinear mapping of the income identity “GDP = Wages + Profits” under conditions of relatively stable income shares. It should not be used by non-neoclassical economists (or neoclassical ones for that matter!) (Anwar Shaikh, 1974).

Homogeneous treatment of households

I may have read the paper wrongly, but it appears that households are treated as homogeneously receiving both wages, profits and interest payments:

Households are simultaneously taking the roles of workers, consumers and financial market traders. Households’ total monthly income is made by both labor and capital income.

Some dubious assumptions are used as a consequence of this excessive aggregation:

Profits of investment good producer are distributed in equal shares among all households. Put differently, it is assumed that all households own equal shares of capital goods producers and that shares are not traded in the market.

This homogeneous treatment makes it impossible to consider income distribution dynamics in this model, when surely these are crucial to the actual behaviour of a capitalist economy. Graziani’s arguments against lumping firms and banks together should also be extended to separating rentier households from capitalist ones—let alone capitalists from workers. (Augusto Graziani, 2003, 1989)

Simplistic modelling of the production of capital goods

I am concerned at the treatment of capital goods firms as being simpler than consumer goods producers:

Contrary to consumption goods producers, capital goods producers do not have production inventories as well as financing needs because of the job production process and the variable production factors employed. Capital goods producers can be represented as stylized agents with both real and financial inputs and output. Conversely, consumption goods produces are much more complex agents...

In fact, capital goods production in a multi-commodity world is arguably far more complex than consumer goods production, since many capital goods are needed to produce a given capital good while a given consumer good may need very few other consumer goods to be produced. The intra-sectoral linkages in capital goods, in other words, are much stronger than those in consumer goods. This is therefore a reason to use a more complex vision of capital goods production, rather than a simpler one.

Appropriateness of multi-agent modelling

The authors make a strong claim for agent-based modelling:

We argue that the agent-based approach is better suited to deal with a realistic view of the economy, and is able to take into account the complex pattern of interactions in the credit markets, like networks topologies, credit rationing, bankruptcy waves and information cascade effects, which are very important issues the causes and the unfolding of debt-induced recessions.

While I agree heterogeneous multi-agent models are necessary to examine network effects, the agent-based approach to generating systemic data that qualitatively simulates what we see in real world macroeconomic data faces the challenge of emergence. That is, we know the macroeconomic data: unemployment, profit rates, inflation, etc. We do not know the individual behaviours, or the interactions between individuals, which caused these: the former are emergent properties of the latter. It may therefore be very difficult to work out what agent behaviours and interactions are needed to generate the macro data we actually see.

By over-emphasising the agent-based approach, non-neoclassical authors may be committing the same fallacy that afflicts neoclassical economics, of “strong reductionism”—with the only advantage being that researchers in this area are not trying to generate equilibrium outcomes. However they are still working on the presumption that “macroeconomics is applied microeconomics”, and that macro phenomena are best generated by aggregating micro behaviours.

The fallacy of Strong Reductionism has long been realised as such in the physical sciences (P. W. Anderson, 1972). Citing Anderson:

The main fallacy in this kind of thinking is that the reductionist hypothesis does not by any means imply a “constructionist” one: The ability to reduce everything to simple fundamental laws does not imply the ability to start from those laws and reconstruct

the universe. In fact, the more the elementary particle physicists tell us about the nature of the fundamental laws the less relevance they seem to have to the very real problems of the rest of science, much less to those of society. (Anderson 1972 , p. 393)

Therefore I would suggest amending the following statement cited from this paper at the beginning of this section:

We argue that the agent-based approach is **well** suited to deal with a realistic view of the economy, and is **better** able to take into account the complex pattern of interactions in the credit markets, like networks topologies, credit rationing, bankruptcy waves and information cascade effects, which are very important issues the causes and the unfolding of debt-induced recessions.

Linguistic amendments

A research topic that has been to a large extent ignored in previous work in agent-based computational economics

Should be

This is a research topic that has been to a large extent ignored in previous work in agent-based computational economics

Conversely, consumption goods **produces**

Should be

Conversely, consumption goods **producers**

Firms ask loans to the banking system in order to finance their production plans and to fulfill their payments commitments, i.e., taxes, dividends, interests, and loan repayments

Should be

Firms ask **for** loans **from** the banking system in order to finance their production plans and to fulfill their payments commitments, i.e., taxes, dividends, interests, and loan repayments

During this period, the firm tries to **rise** new capital in the financial market in order to increase its liquidity

Should be

During this period, the firm tries to **raise** new capital in the financial market in order to increase its liquidity

Anderson, P. W. 1972. "More Is Different." *Science*, 177(4047), 393-96.

Graziani, Augusto. 2003. *The Monetary Theory of Production*. Cambridge, UK: Cambridge University Press.

_____. 1989. "The Theory of the Monetary Circuit." *Thames Papers in Political Economy*, Spring, 1-26.

Shaikh, Anwar. 1974. "Laws of Production and Laws of Algebra: The Humbug Production Function." *Review of Economics and Statistics*, 56(1), 115-20.