

# Referee Report on (MS 2472) "A dynamic theory of economics: What are the market forces?"

January 02, 2018

This brief report aims to comment the paper by Alia Asha Dannenberg, Lukema Oy, Matti Estola (Faculty of Health Sciences, University of Eastern Finland) and Anna Dannenberg (Department of Modern Languages, University of Helsinki). The authors try to replace the *static* neoclassical microeconomic *modeling* with a dynamic one by means of a correct application of the newtonian mechanics to the production and consumption flows.

An economic force acts upon production and consumption flows causing their positive or negative acceleration (second Newton law) and the prices, described as an armonic force, bridge those flows as an equivalent of the walrasian law of demand and supply (third Newton law).

Then, the standard neoclassical walrasian microeconomic modeling is correctly described as a particular case of the newtonian model presented, that is the zero-force case (first Newton law).

The authors implement a dynamic microeconomic model where the economic flows evolve in time. This is a valid contribution, potentially significant, as it implements a dynamic neoclassical walrasian microeconomic model in a correct newtonian representation by means of the classical mechanics.

However, they are implementing an *economic* model, and the underlying economic theory is as important as (if not more important than) the modeling tools and the methodological approach (see Gallegati et al, 2006).

Thus I have some general comments about their contributions.

## Comment 1

In the very beginning of the paper the authors claim: "*the main weakness in the neoclassical theory of economics is its static nature.*" This claim is the core of the entire contribution, but it is critical in a twofold sense.

a) Saying "*neoclassical theory of economics*" is too general. This is true for *microeconomic* neoclassical *models*, but not for macroeconomic Dynamic Stochastic General Equilibrium (DSGE) models; that is, the modern macroeconomic

version of the walrasian General Equilibrium framework, which are not only neoclassical *stricto sensu* (Real Business Cycle models), but also New-Keynesian (NK-DSGE).

Although these macroeconomic models are microfounded by means of the static framework and they are still affected by many critical issues, also "neoclassical" macro economists actually implement dynamic models.

b) "*The main weakness is its static nature*". The authors do not seem to criticize neoclassical walrasian models for their *theoretical* issues but only for their static *modeling* approach. As specified earlier, the authors propose a refinement and a dynamic generalization of the framework implemented by Walras, who himself applied in late XIX century the newtonian mechanics to the economic markets (although as a static restricted case, as authors pointed out). However, they seem to embrace all the *economic* assumptions which have been strongly criticized in the last decades about the "marginalist" walrasian approach: e.g. perfect competition and price-taker firms, consumers' utility function, indirect interctions among agents (e.g. in Mas-Colell et al., 1995 and Varian, 2006).

Thus, I would suggest to better define the aim of the paper in this sense, that is to clarify that the main goal is not the improvement and or a critique of the neoclassical models related to their *economic* implications, but only to propose a dynamic refinement of the walrasian-marginalist microeconomic modeling approach.

For example, Foley (1994) and Foley and Smith (2008) propose a statistical equilibrium model in order to replace the neoclassical idea of relative equilibrium prices and walrasian markets with the classics' intuitions about statistical fluctuations of prices. Also in those contributions, the neoclassical walrasian general equilibrium model represents a special restricted case (that is, with temperature equals zero), but they also attempt to overcome the theoretical issues of neoclassical microeconomics. Of course, also those models still have some critical issues.

## Comment 2

It is not very clear what are the steps forward with respect to the other recent contributions presented by the same authors and to which they refer into this paper (that is, mainly Estola and Dannenberg, 2016 and Estola, 2017). It seems that this is a general presentation of the same framework it has been already presented in those contributions.

## Comment 3

Many recent contributions try to overcome the distinction between microeconomic and macroeconomic modeling because of the so-called "*aggregation problem*", which is a well-known problem having a strong relevance for economists and researchers working on economic modeling. This issue can be managed, for

example, within models in the Complex Adaptive Systems field, mainly Agent-Based Models (either analytic and computational), and in general by means of modeling tools borrowed from disordered systems physics. This is due to the intrinsic nature of the economic systems, and I suspect that this newtonian dynamic refinement of the neoclassical economics could not overcome the aggregation problem (but I am aware that this is not the aim of the authors' contribution).

This comment should be also extended to the way in which the authors represent the interactions among *heterogeneous agents*. These are just indirect interactions through the price system, exactly as in all neoclassical microeconomic models and neoclassical or new-keynesian DSGE macroeconomic models, and not even direct interactions among heterogeneous agents, which allow for the possibility of non-linearities and emergent properties of the economic adaptive system.

## References

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