Money Creation and Financial Instability: An Agent-Based Credit Network Approach
Answer to Referee Report 3

Referee: The paper presents an interesting agent based model in which households and firms are connected in a network endogenously generated by their behavioural rules. The model is extremely simple but nevertheless is able to capture the role of interbank lending in creating a financially fragile macroeconomic environment. The paper is skilfully written. The introduction well frames the present contribution within the agent based literature and the model is effectively presented. It is also effective in stressing the relevance of microfoundation in the SFC approach.

We are happy that the referee supports our paper. All of his suggestions are constructive and we hope to meet the expectations of the referee in the upcoming revised version. In this letter we will reply in detail to each of the points raised.

Referee: The simplicity of the model is at the same time its beauty and its limit. Some assumptions are clearly unrealistic and limit the ability of the model of identifying policy measures to stabilise the financial system (as for example the absence of an interest rate). One way to overcome this limit would be transform one of the (many) stochastic variables into parameters that can be influenced by the policy maker (for example the duration of loans).

This interferes with points raised by referee 1 and 2. Referee 1 wants us to change our assumptions more towards the post keynesian endogenous money approach, *"so that banks can obtain cash from the Central bank"*. At the same time referee 2 wants us to analyze the creation of instability in a more systematic and formal way. E.g. how does it depend on the model's parameters?

We want to offer the following way to reconcile these different suggestions:
First of all, we keep our simple baseline simulations (with and without an interbank market) because we think that it is important to present ACE SCF models to a general audience using simple models (this opinion is also shared by referee 2). We perform some analyses in the determinants of (in)stability. E.g. (1) which role does the existence of systemic banks play for (in)stability, (2) how often do total breakdowns occur, (3) should large banks be more strictly regulated than small ones, ...

Then, we add a new section at the end of our paper in which we introduce save assets (e.g. AAA-bonds). In order to get high powered money, banks could make use of RePo operations with the central bank. In this way we can make the banks and central bank less passive and also move into the direction of the "endogenous approach". We control the amount of save assets exogenously to be able to meet the request of referee 2 and 3. We have an instrument (the endowment with save assets) "*that can be influenced by the policy maker*"(referee 3) and changed to analyze its influence on the system's instability (referee 2).
For compensation in the number of pages, we shorten the first chapters by spending less time criticizing the mainstream.

Computationally, these changes bring us already (despite the model's simplicity) to a computational boundary. The necessary simulations are so elaborate that they would take more than one week on a standard desktop computer. We are currently trying to make use of a high-performance Linux-Cluster by parallelizing the simulations on 40-50 cores at the same time. On a technical level the necessary steps are already very involved and it will certainly take us some time to do the necessary programming and simulation work.

Referee: Other assumptions may leave the impression that the results necessarily come from the ad-hoc setting (as for example the neutrality to risk implicit in the borrowing behaviour of households and banks). I completely agree with the authors that also in mainstream models the foundational assumptions are ad-hoc. But, as proposers of non-orthodox approaches, we are somehow condemned to show that we can do better. In this respect the author may want to confront their approach with the one in Ussher (A Speculative Futures Market with Zero-Intelligence, Eastern Economic Journal, 2008) with which it shares some features.

We agree with the referee 3 (and 2) that we've stressed the simple (textbook) money multiplier approach and its convergence to the theoretical equilibrium too much. In this respect, the impression might arise that the convergence is a result of the ad-hoc setting which, indeed, seems to be contrary to our criticism of mainstream models. We will handle that in a revised version of the paper. What we can say is that, from our point of view, we've done better than mainstream models concerning the modeling of financial instability as well as the fact, that the interbank market is stabilizing in good times and destabilizing in bad times. These features of our model aren't introduced in an ad-hoc way through the assumptions.

Furthermore, using ZI agents may generally lead to somewhat unrealistic and ad-hoc model assumptions but it isn't the aim to create a model that beats mainstream models on all areas. This became clear, in particular, while studying the excellent proposed paper of referee 3. In this context, we interpret the comment as an invocation to shorten the criticism of mainstream models and, instead, to emphasize why we've used ZI agents since it is an appropriate tool to "isolate the effect of market rules on market outcomes" (according to *Gode et al.*, 2004 as well as *Ussher*, 2008). This is also in line with referee 2. Furthermore, agent-based models with ZI agents can rather be seen as a benchmark of market outcomes without the influence of agents' response to new information and formation of expectations.

Of course, we will reformulate the corresponding parts in the revised version to meet the referees legitimate criticism.

Referee: A final remark about the use of the term "endogenous money". The post-Keynesian literature, within which the SFC approach has been developed, refers to endogenous money (and credit) as the generation of deposits that is driven by the demand for credit. In other words, in that approach the supply of credit is infinitely elastic at the current interest rate and it is the demand by the borrowers that actually defines the credit market (see for example: Lavoie, Endogenous Money in a Coherent Stock-Flow Framework, Levy Institute working paper 325). In the paper at hand the mechanism is still supply driven (textbook approach in the authors' words). In this sense the reference to Minsky and Godley and Lavoie is not appropriate in my opinion.

We are aware that our paper might produce confusion about the expression "endogenous money". With endogenous, we mean that the private (banking) sector creates part of the aggregate M1 by granting credits to the households. Instead of just calculating the equilibrium outcome of this aggregate we let it grow by an interactive process. Money is therefore a result of the behavioral interactions, insofar it is endogenous. We have to point out more clearly that money is not yet endogenous as it is in the "endogenous approach to money" found in the Post Keynesian literature to avoid confusion. This point was also raised by referee 1.