

Reply to Anonymous Referee report 1, dated Dec 28, 2017 - 09:12

First of all, let me express my gratitude to the referee, who wrote very useful comments. In particular, I appreciated the two final methodological criticisms, which go beyond the task to write the report and aim to be useful from a constructive point of view.

For such a generous behaviour, I decided that I will ask the Editor to add a specific acknowledgement in the final version of the paper.

In what follows, I show (point-by-point) how the paper will be modified in order to take in account all issues raised by the referee. The majority of points are connected to the fact that in the submitted pdf of the paper some references have not been correctly displayed. I apologize for such a “ \LaTeX -mistake” and I hope that my replies can show my original intent.

- 1) I agree that the paper is built by relying on the fact that the reader has some familiarity with the main topic and the methodological approach. Nonetheless, I always tried to refer to related literature explaining all ingredients of the model. Further, I cited my previous paper which is a fundamental basis for the current one. However, I understand it was not enough. In the revised version, I will add needed details: although it is important to maintain the paper within an acceptable length, I will provide a broader model description.
- 2) I divide the reply in two parts.
 - 2.a) Eqn.4 is drawn from existing literature. The reference, unfortunately has not been displayed in the pdf (it appears as [?]). The point will be clearly explained in the revised text. The ref is:
Alfi V., Pietronero L., Zaccaria A., (2008) Minimal agent based model for the origin and self-organization of stylized facts in financial markets. *ArXiv preprint* arXiv:0807.1888.
 - 2.b) A global RV_t variable does not exist. Each trader has her own iRV_t : in eqn.4 the variable RV_t should be iRV_t instead.
- 3) The first missing reference has been indicated in the above point 2). The other references wrongly displayed by [?] in the text are:
P.9: Cont R., (2001) Empirical properties of asset returns: Stylized facts and statistical issues. *Quantitative Finance*, 1, pp. 1-14.
P.10: Zhou J., Liu Y., Zhang X., Gu X., Wang Di., (2017) Uncertain Risk Aversion. *Journal of Intelligent Manufacturing*, 28, pp. 615-624.
P.15: Colasante A., Palestrini A., Russo A., Gallegati M., (2017) Adaptive expectations versus rational expectations: Evidence from the lab. *International Journal of Forecasting*, 33, pp. 988-1006.
P.15: Anufriev M., Hommes C., Makarewicz T., (2013) Learning-To-Forecast with Genetic Algorithms. *Working Paper*.

I infer that without such unfortunate “ \LaTeX -mistakes”, your reading would have been much easier. I apologize for the inconvenient.

- 4) By the expression *informative endowment* I meant the informative set and also the approach itself to information. The relevant distinction between fundamentalists and chartists is based on their approach to the market. Fundamentalists follow an exogenous signal; whereas chartists follow trends. For the sake of brevity, I admit I was too cryptic. I will discuss the point clearly.
- 5) The table will be numbered. The first half of those parameters have been studied in a previous paper. I understand that I should have commented them more adequately. I will do it. The second half of them is being discussed in a forthcoming paper. In the revised version of the paper, I will discuss the main result: i.e. how the variability of such parameters influence the market volatility.
- 6) I think you are right about the “long-range” dependence of the ACF function of absolute value of returns. Also in this case, the missing reference was dramatically important. Although a statistic discussion of the stylized facts goes beyond the scope of the paper, the commented ref of Cont (2001) (given above) will hopefully solve the issue.
- 7) Yes, no problem.
- 8) Once again, the latex compilation was troubling. The ref is:
Silvestre J., (2016) Sovereign default contagion: an agent-based model approach. *Working Paper* WP08/2017/DE/UECE.
- 9) Yes, the sentence will be:
“whereas the risk aversion has, counterintuitively, the opposite effect.”

Before concluding, let me give a tentative reply to two criticisms. I would like to be clear on one point: what follows is not a couple of complete replies. The referee raised two very substantial questions (although the first one is even more radical than the second) and it is not possible to reply here as they both deserve. There exist entire books, fascinating and challenging, which address proper replies. I refer to the vast literature about complexity in economics, which presents crucial contributions that compare micro-founded macro models with the new frontiers reached by the adoption of agent based models in macroeconomics. I could never report here all the required refs. To say it in a couple of lines - and it is a very bad exercise - following the methodological line joining Keynes and Minsky, consider the contributions of (at least) Akerlof, Delli Gatti, Gallegati, Hommes, Kirman, Leijonhufvud, Lux, Tesfatsion, and many more...

- 1) As a macroeconomist, I assume the idea that complex systems are totally incompatible with the perspective “which variable is causing what”. Just to give my view, Macroeconomics is more a matter of statistics than of analytics. Indeed, the great advantage of agent based simulations is that results emerge spontaneously from the model and are not the consequence of specific ingredients. The policy strength is that the behavioral root of the model allows the analyst to check the impact of specific factors. I can be more explicit on this, in the revision of the paper, by showing (very briefly) partial results obtained in my previous study (see references of the paper).

In some parts of the model, a bounded (small) noise is used to differentiate individual behaviours. No DSGE-like shocks hit the dynamics: there is not an equilibrium “sometimes perturbed” here. Diversity and differentiation among individuals are obtained by heterogeneity in behavioural rules and informative sets. Nothing is deterministically decided a priori. A couple of examples:

- expectations of traders belonging to the same category are differentiated by means of a noise (σ_F for fundamentalists and σ_C for chartists) bounded within a small interval, $[-1, 1]$;
- parameters μ and z rule the sensitivity of each market participant to, respectively, the price unbalance (difference between best bid and best ask) and the book unbalance (the market pressure - i.e. the number of bid orders vs the number of ask orders).

Values of such parameters are kept fixed, once chosen within small intervals, and allow to differentiate individual positions. Results emerge from the true interaction among traders and from the consequent negotiations, not from the parameters.

Conclusively, let me say that my idea was not “to solve” the model. The basic rationale is to show the complex dynamics of a complex system and to check whether the individual ability to learn from past errors and the individual risk aversion can influence the aggregate dynamics. I questioned the role played by individual features of people (which affect their interaction) on the aggregate dynamics, NOT the role played by each individual on it, which (in my opinion) does not even exist.

- 2) In several other papers (some with coauthors) I have shown many possible settings for the fundamental value (i.e., fixed, variable, equal for everybody, differently perceived by each traders,...). My point is that what really matters is that it remains exogenous. In the revised version of the paper, where I will embed partial results from the previous paper (as I said previously), the link between the variability of the fundamental value and the volatility of markets will be clear (referring both to the general fundamental value and to the heterogeneity of individual perceptions of different traders). Let me say, finally, that I do not see problematic that FV_t varies as a random walk. Different contributions in literature hold both the “random walk” and the “non-random walk” hypotheses. Possibly, an acceptable way to see the point is the following one (similar to Biondo A.E., Pluchino A., Rapisarda A., (2017), Informative Contagion Dynamics in a Multilayer Network Model of Financial Markets. *Italian Economic Journal*, vol.3, 343-366):

The fundamental value is an exogenous variable, whose dynamics is set by

$$FV_t = FV_{t-1} + \mathbb{D}_t$$

where \mathbb{D}_t is a random variable [...] simplistically assumed in such a way to represent the *yield* of the asset (which is assumed to follow a random walk). This very simplified perspective suggests to interpret it as the dividend value, which could be either positive or negative (in case of profits or losses, respectively). Each fundamentalist has her individual perception, possibly imperfect [...]

I hope that such a more detailed explanation, for the revised version of the paper, can (at least partly) satisfy the criticism.

Conclusively, I would express my sincere appreciation for the proposed exciting inputs, but I cannot go further than this (here). The anonymous referee knows my name: I would be delighted to continue such a discussion, detailedly and, I am sure, fruitfully.