

The referee has raised a number of points and we have used them to improve the paper. They are quoted in bold font to distinguish them from our response that follows.

1. **“What is the equilibrium state in an economic system? The linear response theory is constructed on the basis of an equilibrium state. Nobody doubts existence of such a state for physical systems excluding those very unstable with chaotic nature; the physical equilibrium states are well defined. I understand your equilibrium state is an economic situation in absence of demand. But this is not acceptable to me, because I think demand plays a critical role in establishing any economic system, otherwise nobody can have motivation to work. In other words, I assume that an economic system responds to demand in a highly non-linear manner or even shows unstable behavior against applied demand if the demand-free state is adopted as an equilibrium state.”**

This is a very deep question indeed. The objection to the notion of an absence of demand is indeed correct: demand does exist in equilibrium. It is the absence of a demand *shock* that characterizes this equilibrium. We have changed the manuscript accordingly.

2. **“Should the causality be satisfied in the linear response relations (2) and (14)? Dynamics of physical systems certainly is constrained by the causality relation. But I wonder if the causality is still a valid constraint in formulating the economic linear response theory. Since economic agents are intellectual in contrast to physical particles, they may determine their behaviors thinking about future.”**

The question of causality that you refer to is a central issue in the “specification problem” of macroeconomics. In Eq. (2) we are simply presenting the current state of macroeconomic theory. I don’t know that anyone really knows how causality works here: it seems to run in the demand→output direction (well, is assumed so in economic theory), but the output→demand direction is another story. Our point is that if one accepts that something like Eq. (2) then there is a much better way of representing this using linear response theory [e.g. Eq. (14)]. The advantage of using something like Eq. (14) is that one might be able to actually test whether the causality you refer to is, in fact, correct. With Eq. (2) there is really no hope as one can always fit observations with a sufficient number of lags. The goal of our paper was, compared to your question, comparatively modest: given the current accepted causality of macroeconomics can one do better than the representative agent to include heterogeneity in the aggregation problem and if so how? The answer are (i) yes and (ii) with linear response theory.

Whether causality is a valid constraint for intelligent agents is a fascinating question that is simultaneously beyond the scope of our paper (we assume it to be valid in keeping with current economic theory) and central to the validity of our paper: a bit of paradox indeed. This paradox that you have identified is precisely why we considered

this approach. Current econometric analysis is does not provide the structure needed to formulate the question you pose or provide the framework needed to begin to resolve the question. Our hope it that by casting current macroeconomic analysis in a proper formalism the validity (or lack thereof) can be addressed.

3. **“Is there any relationship between hierarchical dynamics and superstatistics? Hierarchical dynamics is a very attractive idea to address complicated economic phenomena. Very recently it has been empirically confirmed that labor productivity has a distribution with power-law tail in the efficient side. An idea of superstatistics was borrowed from physics to account for the power-law behavior. Please refer to the following papers:<http://arxiv.org/abs/0809.3541>
<http://www.economics-ejournal.org/economics/discussionpapers/2008-42> Superstatistics emphasizes spatial and temporal inhomogeneity in physical conditions such as temperature and density. In the above- mentioned papers, it is assumed that heterogeneity in economic temperature arising from fluctuating demand. Could you say anything about possible relationship between hierarchical dynamics and superstatistics?”**

This is a very intriguing line of inquiry and we will see if there is anything we can say at this point.