Response to Referee 2

Thank you for commenting on our paper and for your suggestions. The following remarks reply to your comments and suggestions in the order in which they appear in your report (quotations from your report are shown in italic).

2. ***General Critique***

- *There is a research question raised in the beginning: where does the puzzling empirical fact from?*
  A potential solution for this puzzle is presented. It is also discussed clearly why DSGE models without the mentioned extensions have problems explaining the empirical finding. In my view this is good scientific practice.
  I suggest to accept the paper after some revisions. I outline these in detail below.

  Thank you for your comments.

3. ***Major Critique***

- *The introduction is far too long. During the introduction I read through a lot of information that is given again in detail later on. It should be a short introduction into the topic. But here it is a mini article that includes Empirics, Literature review, Modeling results and so on in too high detail.*

  Some informations appear even twice in the introduction (e.g. that there is a literature where house prices are defined as collateral).

  I suggest to shrink the introduction down to one page (at most one and a half). All Information that doesn't find its place in the introduction any more should be put into the later sections.

  In the new version, I will shorten the introduction part as suggested.

- *Abstract: "Agents are endowed with heterogeneous shocks, and rationally extract information from market activities. Since agents are confused by changes in average private signals about future fundamentals, the model generates an amplified effect of technology shocks on house prices, which accounts for the disconnect between house prices and the discounted sum of future rents."*
  These sentences are not understandable here:

- *“endowed with shocks” sounds strange, maybe “subject to ..”*
- *from what market activity do they draw information? Isn't this important to the model?*
- *“agents are confused” sounds very strange and unscientific here. Should be more precise.*
- *“the disconnect” has not been mentioned before. Which disconnect?*
- *“information heterogeneity” about what? In which respect is the information heterogeneous?*

In the new version, I will changes the words as suggested:

- “endowed with shocks” will be replaced by “subject to..”
- Agents draw information from the pricing signals, including their wages, interest rates, housing prices, etc. Yes, the information extraction process is important to generate the main results.
- Will revise the words.
- Will revise the words.
- Will revise the words.

• *The author is sometimes talking about agents being “confused” or “rationally confused” sometimes there are simply “rational” or “noisy rational”. It is not clear to me if this means all the same and what. There seems to be a literature on this rational confusion. Which I am not aware of. Please add this to your literature review.*
Additionally but closely related: There is a literature on bounded rationality in macroeconomics,
e.g.:
  - *Paul Grauwe, 2011. "Animal spirits and monetary policy," Economic Theory, Springer; Society for the Advancement of Economic Theory (SAET), vol. 47(2), pages 423-457, June*
  - *Lengnick, Matthias & Wohltmann, Hans-Werner, 2016. "Optimal monetary policy in a new Keynesian model with animal spirits and financial markets," Journal of Economic Dynamics and Control, Elsevier, vol. 64(C), pages 148-165.*

  Please relate your work to this literature. That would make it easier for the reader to understand what your work is about (and what not).

  In the new version, I will add the literature review on rational confusion and also the references as suggested.

• *P. 3: “The reason why standard real macroeconomic models have difficulty in explaining the lead-lag relationship is because nonresidential capital produces market consumption*

and investment goods, whereas residential capital produces only home consumption goods (e.g. Fisher, 2007). The asymmetry in how many goods to substitute away from residential capital provides a strong incentive to substitute away from residential capital toward nonresidential capital after a productivity shock."
I don't understand that passage. e.g. what are "real macroeconomic models"?
The sentence is to complicate. Please use a simpler way of putting it.

Here, "real macroeconomic models" should be "real business cycle models." In the new version, I will rewrite the sentence as suggested.

- *Analysis around table 2: Please define the variables clearly. What does "residential investment" exactly mean?*
  I also think that the presentation of the results in the table is very cumbersome. Couldn't you present the results more nicely? Maybe the figure in the end of this document (from Walsh, 2010, Monetary Theory and Policy) is an inspiration.
  E.g. "In other developed countries, there is no clear order among the second moments except Finland, which also shares this feature to some extent." This is something not directly visible from the table.

  In the new version, I will explain what "residential investment" means. Also, I will follow the style in Walsh (2010) to re-present the results in Table 2.

- *Table 3: The 0.06 seams relatively high for a p-value. The argument in the text "residential investment Granger causes nonresidential investment" might be too strong. The table is also a bit confusing. Could it be sorted in some order? Those counties with highest p values at the top or so, …?*

  The p-value for the null hypothesis that residential investment Granger causes nonresidential investment is 0.006 for Canada instead of 0.06. In the new version, I will sort the countries by p-values as suggested to make the results more reader-friendly.

- *In the section "The Basic Model" when discussing the assumptions, please make clear, why you are making them:*
  - *which of the assumptions are original in your model?*
  - *why assuming islands? This is not intuitive. How does that look like in standard DSGE with housing sectors?*
  - *why assuming different firms. What exactly do they produce? How does that look like in standard DSGE with housing sectors?*

I made the assumptions following the standard literature. In the new version, I will add words to explain:

- What assumptions in my paper differ from the standard DSGE model with housing sectors;
- The assumption of the islands resembles that in reality agents make economic decisions locally. For instance, firms/households make their production/consumption decisions based on their local information. The standard DSGE model with housing sectors assumes agents have full information about the economy. For instance, households can fully understand if the increase of housing prices is due to productivity, population, inflation, etc. Obviously, the assumption of heterogeneous information is closer to the reality.
- I use different firms to represent that firms have heterogeneous information in realty. The firms produce representative goods (after transfer to money). The standard DSGE with housing sectors assumes firm has full information about the economy and produce representative goods.

- *P. 26: "For instance, the model predicts that the forecast errors of output are positively correlated with the business cycle in response to TFP shocks with a correlation of 0.052, since firms are partially informed about the shocks and agents' expectations of output tend to underreact."*
  Is it possible to give an example for that? E.g. in a booms agents expect output to be …

  In the new version, I will add an example to explain the intuition as suggested.

- *P. 27: Between "… such a hump." and "To check the robustness …":*
  Could you add some sentence explaining the results of the two paragraphs above? What is the take away message of your VAR analyses?

  In the new version, I will add some words to explain the discrepancy between the simulated data and the empirical data. The VAR analyses is to help readers have a better understanding of the theoretical results that expectation errors did play a role in our economy.

4. Minor Critique

- *Abstract: Close correlated to the business cycle*
  To explain this fact

  In the new version, I will revise the words.

- *P.1: "In response to the recession" sounds a bit strange here.*
  "Consumption, but fail(s) in explaining"

  In the new version, I will revise the words.

- *P.2: "with the business cycle and their correlation with U.S. GDP is"*
  → with the business cycle, i.e. their correlation with U.S. GDP is

  In the new version, I will revise the words.

- *P.2: "has a difficulty in predicting house prices having a higher volatility than output." I think the word "predicting" is misplaced here. It sounds as if you want to predict how house prices are developing in the future. But this argument is not about prediction; it is about replicating empirical facts.*
  → same problem on page 21 and 26

  In the new version, I will revise the words.

- *P.3: "an improvement in TFP has an amplified effect on house prices3."*
  the effect is amplified, ok! But what is the effect? I don't understand the meaning of this sentence.

  In the new version, I will explain what are the amplification effect and the intuition why housing prices increased more under heterogeneous information than under full information in response to TFP shocks.

- **P.5: La'O (2010), who …**

  In the new version, I will revise the words.

- *P. 6: from ~~the~~ survey data*

  In the new version, I will revise the words.

- *P. 6: "the disconnect between house prices and ..."*
  I think this should be correctly called "the disconnection"

In the new version, I will revise the words.

- *P. 6: "the sum of the after-tax equivalent-risk opportunity cost of capital and the expectation of future house prices appreciation excluding maintenance cost."*
  This expression is too complicate.

  In the new version, I will revise the words.

- *P. 8: "an interesting thing is … in the Europe" This is not a very nice formulation.*

  In the new version, I will revise the words.

- *P. 9: "that nonresidential investment does not Granger cause"*
  Is the "not" really correct?

  In the new version, I will use "fail to Granger cause" instead of "does not Granger cause" as in the lecture notes by Dr. Eric Zivot at University of Washington (Page 26, https://faculty.washington.edu/ezivot/econ584/notes/multivariatetimeseries.pdf).

- *P. 12: "constant-to-scale technology" constant RETURNS to scale?*

  In the new version, I will revise the words.

- *P. 17: "general model" general equilibrium model?*

  It should be "general equilibrium model". In the new version, I will revise the words.

- *P. 27: I think the references to figure 5 and 6 are not correct here.*

  They should be Figure 6 and 7. In the new version, I will revise the words.