Response to Referee 1:

The authors thank the referee for the thoughtful and well-taken points. Below, we describe point-by-point how we addressed these points in our revision.

Kind regards

Alternative reasons for low nominal interest rates

Referee: The authors argue that \precise estimates of the natural [real] interest rate would allow distinguishing low interest rate periods that are caused by a decrease of the natural interest rate from those that are caused by a persistently expansionary monetary policy." This statement ignores that low nominal interest rates (and subdued economic activity and inflation) cannot only arise due to a change in the fundamentals of the economy-i.e. a decline in the natural real rate-but can also be the result of a self-fulfilling shift towards more pessimistic expectations about future economic conditions without a change in fundamentals-i.e. without a change in the natural real rate. See Benhabib, Schmitt-Grohe, and Uribe (2001), and, for a recent empirical investigation Aruoba, Cuba-Borda, and Schorfheide (2018). Note also that this type of equilibria allows for very long-lasting periods of low nominal interest rates. The paper should acknowledge this alternative possibility and discuss whether the empirical analyses reviewed in the paper has anything to say about this type of equilibria.

- **We thank the referee for suggesting of this important alternative explanation of long-lasting low interest rate periods. We have added to the sentence cited by the referee the part "…to the extent that other factors that could cause long-lasting low interest rate periods are not relevant". We then explain the possibility of a sunspot shock switching the economy to a low interest rate steady state in models that account for the ZLB. We argue that the models that we look at do not consider this possibility. However, we cite the empirical evidence by Arouba et al. (2018) that a regime switch to a deflationary equilibrium during recent years is unlikely for the US (in contrast to Japan). In this paper, we focus on natural rate estimates for the US and the euro area. For the latter, there is no comparative analysis. However, we argue based on stable long-term inflation forecasts from the ECB's Survey of Professional Forecasters (these never fell below 1.8% over the last 20 years) and the rebound of inflation since 2017 that a self-fulfilling deflation trap is an unlikely explanation for low interest rates. (p.12)**

Policy implications

Referee: Section 4 on policy implications appears a bit too selective. For instance, the authors rightly refer to the ongoing policy debate on how to adjust existing monetary policy frameworks in an environment of persistently lower natural real rates of interest. But the only proposal that they discuss is raising central banks' inflation targets. The authors are critical about this particular

proposal. But there are several other proposals on how to augment or modify existing monetary policy frameworks to better deal with effective lower bound risk-for instance a (temporary) price-level targeting strategy, to name just one-and some of them are not prone to the disadvantages associated with increasing the inflation target. There is also a rich academic literature on monetary policy design in light of the lower bound that the authors might want to refer to.

- **We now discuss also other proposals discussed in the literature and by policy-makers, such as price-level-targeting, nominal GDP targeting, helicopter money, abolishing cash and conducting monetary policy following the Neo-Fisherian view. (p. 20-21)**

Referee: Second, the authors' conclusion that \central banks may have to accept deviations from their inflation targets for longer periods than in the past" needs to be substantiated if kept in the paper. When postulating such a policy recommendation, the authors should, at a minimum, discuss the associated risk of a de-anchoring of long-run inflation expectations and the implications this would have for the frequency of lower bound events and inflation stabilization.

- **We modified our conclusion by stating that longer deviations from inflation targets could be either perceived to be in line with the flexible inflation targeting framework currently adopted by many central banks in advanced economies or that they otherwise pose an important risk for de-anchoring of long-run inflation expectations with potentially severe negative economic consequences. (Conclusion, p. 23-24)**

Referee: Finally, the paper focuses exclusively on implications for monetary policy. What about fiscal policy? Again, there is a rich academic literature that addresses this question. To the extent that monetary policy becomes less effective when the lower bound is binding more frequently, fiscal policy might have to play a more prominent role as a stabilization tool, at least in the wake of large adverse disturbances.

- **We agree that the discussion in our paper could have important implications for fiscal policy. In our view, analyzing these implications deserves a detailed literature review and discussion that goes beyond the scope of this paper. We now acknowledge the important implications for fiscal policy and included a corresponding statement in the introduction. (p.1)**