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Estimating the real effects of uncertainty shocks at the Zero Lower Bound☆

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ABSTRACT

We employ a parsimonious nonlinear Interacted-VAR to examine whether the real effects of uncertainty shocks are greater when the economy is at the Zero Lower Bound. We find the contractionary effects of uncertainty shocks to be statistically larger when the ZLB is binding, with differences that are economically important. Our results are shown not to be driven by the contemporaneous occurrence of the Great Recession and high financial stress, and to be robust to different ways of modeling unconventional monetary policy. These findings lend support to recent theoretical contributions on the interaction between uncertainty shocks and the stance of monetary policy.

1. Introduction

Uncertainty is widely recognized as one of the drivers of the Great Recession and the subsequent slow recovery. Recent empirical studies show that when an unexpected increase in uncertainty realizes, a contraction in real activity typically follows. Theoretically, uncertainty can depress real activity via "real option" effects, which affect investment in presence of nonconvex adjustment costs, and "precautionary savings" effects, which influence consumption if agents are risk averse. (Bloom, 2014) offers a survey of the recent empirical and theoretical literature.

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Unsurprisingly, fluctuations in uncertainty represent a major concern for policymakers.[1] Given its recessionary effects, an increase in uncertainty naturally calls for a cut in the policy rate. In December 2008, however, the U.S. federal funds rate hit the zero lower bound and remained there for seven years. Table 1 documents correlations between different business cycle indicators (real GDP, investment, and consumption, all expressed in quarterly growth rates) and two proxies of financial uncertainty. The first one is the VIX, which is a measure of implied volatility of stock market returns over the next 30 days commonly used in literature. The second one is the financial uncertainty index recently proposed by Ludvigson et al. (2016), which is constructed via a factor approach to forecast errors related to a large number of financial U.S. series.[2] The correlations are computed for two different phases of the U.S. post-WWII economic history, i.e., "Normal times", in which the federal funds rate was unconstrained, and "Zero Lower Bound" (ZLB henceforth), in which the federal funds rate hit its lower bound and stayed at its bottom value.[3] A clear fact arises. The negative correlation between these business cycle indicators and uncertainty doubled – in the case of the VIX, tripled – since the end of 2008. These correlations are in line with the predictions coming from the theoretical contributions by Johannsen (2014), Fernández-Villaverde et al. (2015), Nakata (2017), and Basu and Bundick (2017). These papers employ calibrated New Keynesian general equilibrium models and show that uncertainty shocks generate a much larger and persistent drop in real activity when monetary policy is constrained by the ZLB.

In spite of the obvious relevance of this issue from a policy and theoretical standpoint, no empirical analysis explicitly modeling the nonlinearity related to the real effects of uncertainty shocks due to the ZLB has been proposed so far.[4] This paper addresses this issue by estimating a nonlinear Interacted-VAR (I-VAR) with post-WWII quarterly U.S. data. The I-VAR is particularly appealing to address our research question because it enables us to model the interaction between uncertainty and monetary policy in a parsimonious fashion. A parsimonious approach is desirable here given the limited amount of observations belonging to the ZLB state in the post-WWII U.S. sample. Our baseline I-VAR models measures of real activity (real GDP, consumption, investment), prices (the GDP deflator), the federal funds rate, and the VIX.[5] The model is nonlinear because it augments an otherwise standard linear VAR with an interaction term featuring the VIX, which enables us to identify uncertainty shocks, and the federal funds rate, which identifies the two states we aim at modeling, i.e., normal times and the ZLB. Crucially, the federal funds rate and the VIX are endogenously modeled in our analysis. We account for this endogeneity by computing nonlinear Generalized Impulse Response Functions (GIRFs) as in Koop et al. (1996) and Kilian and Vigfusson (2011).

Our main results can be summarized as follows. First, in line with most empirical contributions on the real effects of uncertainty shocks, we find that heightened uncertainty induces a contraction in real activity. In particular, consumption, investment, and output display a temporary negative response to an unexpected increase in uncertainty. This holds true in both states of the economy, a finding suggesting that uncertainty should be a concern for policymakers also in times when conventional monetary policy is unconstrained. Second, and specifically related to our research question, we find clear-cut evidence in favor of stronger real effects of uncertainty shocks in presence of the ZLB. According to our empirical model, the peak negative response of investment at the ZLB to a jump in uncertainty is about 3% larger relative to the one estimated in normal times, and 37% larger in cumulative terms over a five-year span, while the cumulative relative loss in output and consumption is about 12% and 13% larger, respectively. Third, using alternative interaction terms involving indicators of the business cycle and measures of financial stress, we show that our empirical findings are not driven by the occurrence of the Great Recession or the increase in credit spreads during the ZLB phase. Fourth, exercises dealing with a counterfactual systematic monetary policy during Normal times confirm that the monetary policy stance is likely to be the main driver of the stronger recessionary effects generated by uncertainty shocks during the ZLB. Fifth, we show that the different response of real activity to an uncertainty shock in the two regimes is robust to the employment of various proxies for unconventional monetary policy. Our Appendix shows that our results are also robust to the employment of Ludvigson et al.'s (2016) novel index of financial uncertainty and to the inclusion in our otherwise baseline model of a number of financial and real variables (measures of financial stress, stock prices, house prices, private and public debt).

[1] In an interview to *The Economist* released in the midst of the Great Financial Crisis on January 29, 2009, Olivier Blanchard, Economic Counsellor and Director of the Research Department of the IMF, stated: *"Uncertainty is largely behind the dramatic collapse in demand. Given the uncertainty, why build a new plant, or introduce a new product now? Better to pause until the smoke clears."*

[2] Ludvigson et al. (2016) find financial uncertainty to be an exogenous driver of the U.S. business cycle. This finding justifies our focus on measures of financial uncertainty. However, our Appendix shows that the stylized fact documented in Table 1 is robust to the employment of the measure of uncertainty based on the distribution of the forecast errors of real GDP proposed by Rossi and Sekhposyan (2015), the macroeconomic uncertainty index constructed by Jurado et al. (2015), and the economic policy uncertainty index constructed by Baker et al. (2016). For a similar evidence, see Plante et al. (2017).

[3] Throughout the paper, we will label as "Normal times" the post-WWII period up to 2008Q3, and "ZLB" the period 2008Q4–2015Q4. This is consistent with the fact that the Federal Reserve set its target federal funds rate to the 0–25 basis points range in December 2008.

[4] Johannsen (2014), Nodari (2014), Caggiano et al. (2014), Fernández-Villaverde et al. (2015), Basu and Bundick (2017) engage in VAR investigations dealing with impulse responses estimated over different samples including or excluding the ZLB. As shown in Section 4, our investigation enables us to link the different impulse responses we find in the two scrutinized regimes to the ZLB, and to exclude competing explanations such as the contemporaneous occurrence of the Great Recession or heightened financial stress.

[5] Our analysis does not separately identify macroeconomic effects due to movements in uncertainty *per se* and effects due to movements in risk. Bekaert et al. (2013) empirically discriminate between the two and find the business cycle effects triggered by movements in the VIX to be mainly due to variations in uncertainty.