Uncertainty and Business Cycles: Exogenous Impulse or Endogenous Response?

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Three Big Questions about Uncertainty

Q1: Measurement
How do we construct an empirical proxy for uncertainty?

Q2: Causality
Does uncertainty drive activity? Does activity drive uncertainty? Are they causally linked at all?

Q3: Origins
What is the fundamental source of uncertainty fluctuations? Real economy? Financial system?

This Paper's Contribution
LMN move on from Q1 to Q2 and Q3, in a well motivated and exciting continuation of their agenda.

A Classic Identification Problem

Estimate Reduced Form, Desire Structural IRFs

$$\text{VAR in } X_t = (Y_t, U_t)', \quad \eta_t = Be_t, \quad B = \begin{bmatrix} b_{YY} & b_{YU} \\ b_{UY} & b_{UU} \end{bmatrix}, \quad e_t \sim N(0, I_{2\times 2})$$

4 Parameters, Only 3 Equations

$$\Omega = Var(\eta) = \begin{bmatrix} b_{YY}^2 + b_{YU}^2 & b_{YY}b_{UY} + b_{YU}b_{UU} \\ b_{YY}b_{UY} + b_{YU}b_{UU} & b_{UY}^2 + b_{UU}^2 \end{bmatrix}$$

LMN Approach Is to Use External Moments for Identification

Imagine a series Z with $\mathbb{E}(Ze_U) \neq 0$ but $\mathbb{E}(Ze_Y) = 0$

$$\left.\begin{array}{l} \mathbb{E}(\eta_Y Z) = b_{YU}\mathbb{E}(Ze_U) \\ \mathbb{E}(\eta_U Z) = b_{UU}\mathbb{E}(Ze_U) \end{array}\right\} \rightarrow b_{UU}\mathbb{E}(\eta_Y Z) = b_{YU}\mathbb{E}(\eta_U Z)$$

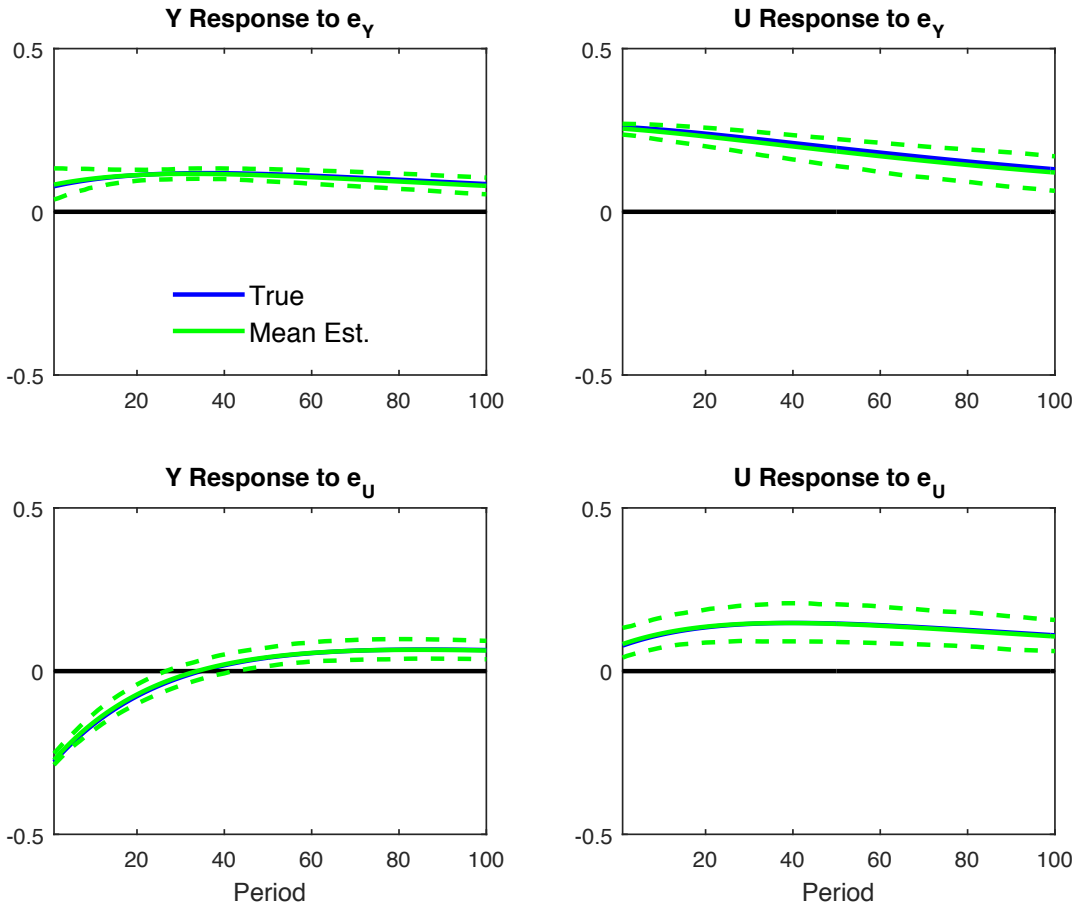
Iteratively Construct the "Instrument" Z

Start with external, *endogenous* series S, e.g.

$$S = b_{SY}e_Y + b_{SU}e_U + b_{SS}e_S$$

1) Guess $e^{(i)} = \{(e_Y, e_U)\}^{(i)}$
2) Cleanse S of $e_Y^{(i)}$ to get $Z^{(i)}$ via projection
3) $B^{(i)}$ identified up to sign normalization
4) Set $e^{(i+1)} = {B^{(i)}}^{-1}\eta$ until convergence

Works Well in Practice



Estimates are mean and 90% intervals of 250 Monte Carlo repetitions. Results in this discussion are based on independent implementation and code, entirely consistent with LMN results. Thanks to LMN for providing their data, code, and advice!

Identification Isn't Free

An Exclusion Restriction

- External S used to construct Z must not belong in the VAR.
- Shock e_S must not affect activity or uncertainty, so $\mathbb{E}(\eta e_S) = 0$.
- LMN summarize this issue nicely on p10.

What Can Go Wrong?

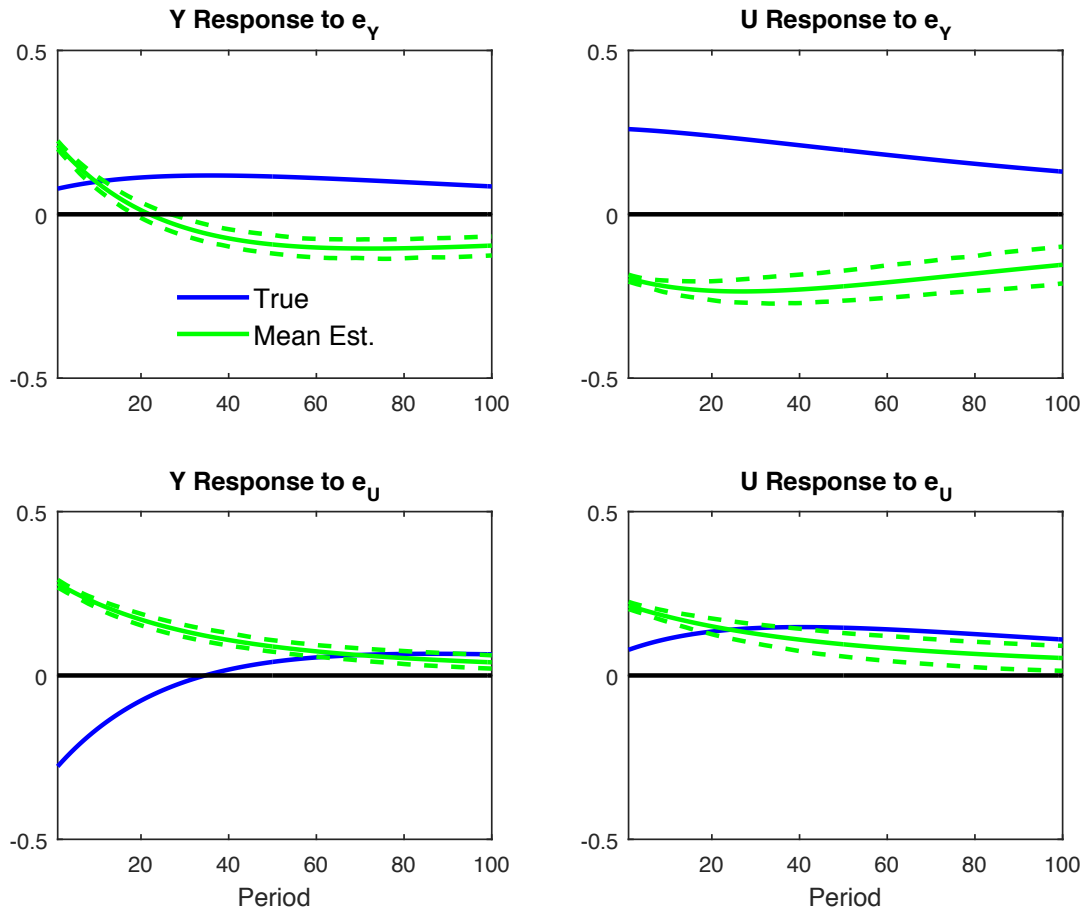
- If $\mathbb{E}(\eta e_S) \neq 0$, then $b_{UU}\mathbb{E}(\eta_Y Z) = b_{YU}\mathbb{E}(\eta_U Z)$ fails.
- Back to standard unidentified SVAR case.
- Approach may fail to recover IRFs.
- Identified shocks may be contaminated by endogeneity from e_S.

An Inherently Economic – Not Econometric – Assumption

- S equal to stock returns in LMN.

No other shocks reflected in stock returns, other than "activity" or "uncertainty" shocks, may also affect activity or uncertainty.

Exclusion Restriction Violation



Estimates are mean and 90% intervals of 250 Monte Carlo repetitions. Allowed shock to S to enter positively in contemporaneous Y and U equations of the VAR.

Basu & Bundick (2015)
Demand & Uncertainty

New Keynesian DSGE model

Two Shocks

Demand: level shock to discount rate

Uncertainty: shock to volatility of demand shocks

Household-Side Demand Mechanism

$$\text{Uncertainty} \rightarrow \left(\begin{array}{c} \text{Precautionary savings,} \\ \text{labor supply} \end{array} \right) \rightarrow \text{Recession}$$

Measurement

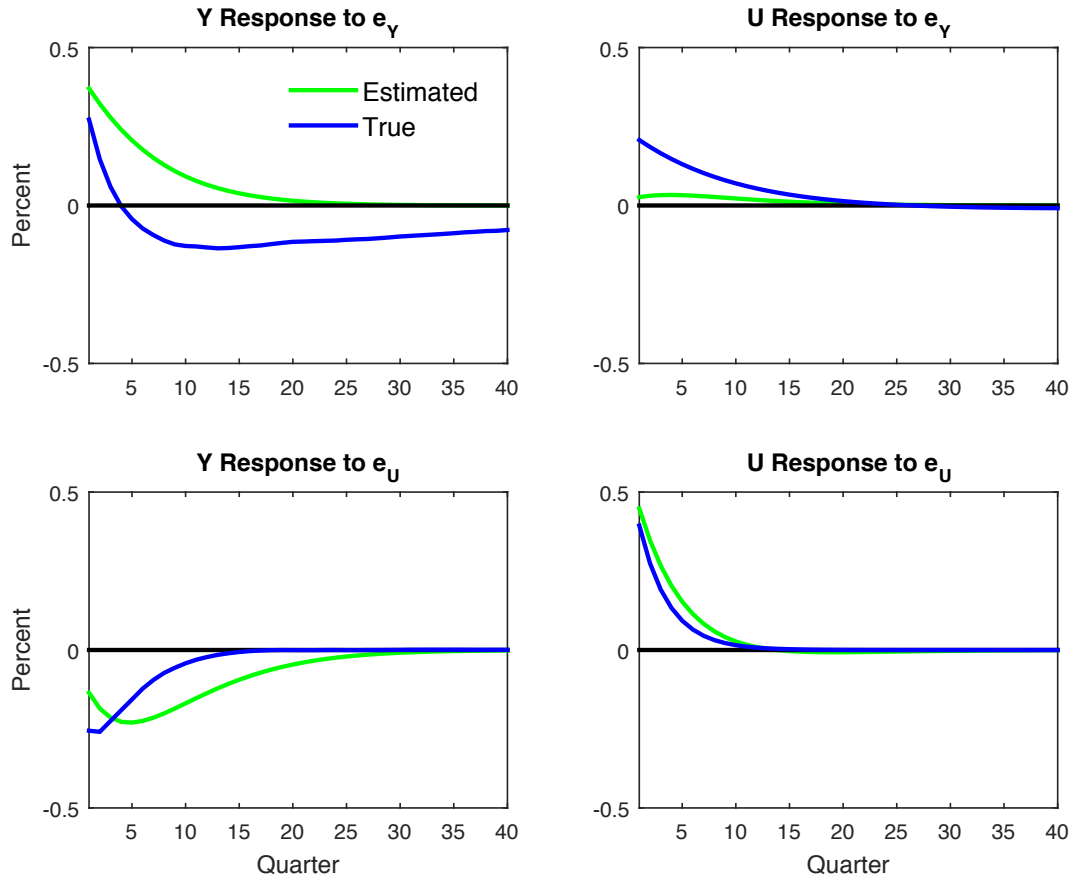
Y: aggregate output

U: expected variance of stock returns

S: mean stock returns

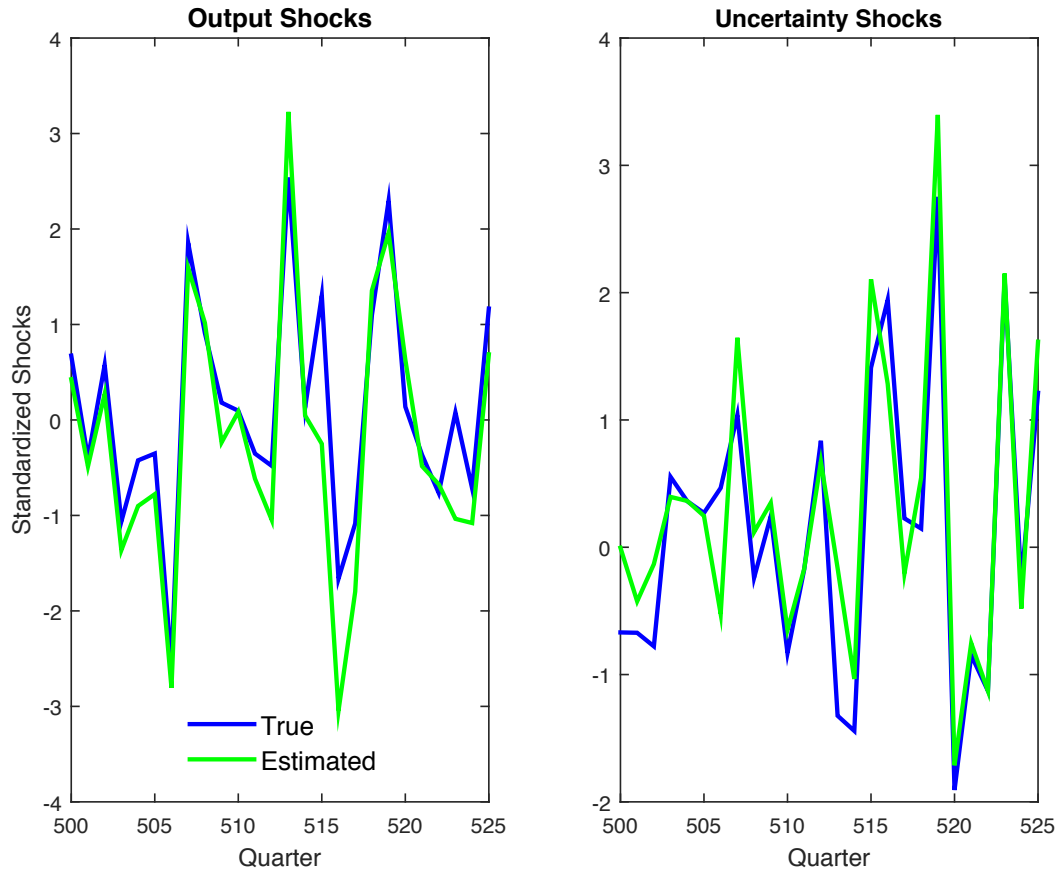
Thanks to authors for code and simulated data.

Basu & Bundick (2015) LMN Approach Works Well



Results from application of the LMN approach to 10,000 quarters of simulated data from the Basu & Bundick model.

Basu & Bundick (2015)
LMN Approach Works Well



$\text{Corr}(e_{Yt}, \hat{e}_{Yt}) \approx 0.8, \ \text{Corr}(e_{Ut}, \hat{e}_{Ut}) \approx 0.9$

Gilchrist, Sim, & Zakrajsek (2014)
Adding Financial Shocks

Neoclassical model with micro TFP shocks, nonconvex capital adj. costs, financial frictions via equity dilution at issuance

Three Macro Shocks

Macro TFP: level shock to macro productivity
Uncertainty: shock to volatility of micro TFP shocks
Financial: shock to liquidation value of capital

Firm-Side Real Options Mechanism

$$\text{Uncertainty} \rightarrow \left(\begin{array}{c} \text{“wait and see” behavior,} \\ \text{investment freeze} \end{array} \right) \rightarrow \text{Recession}$$

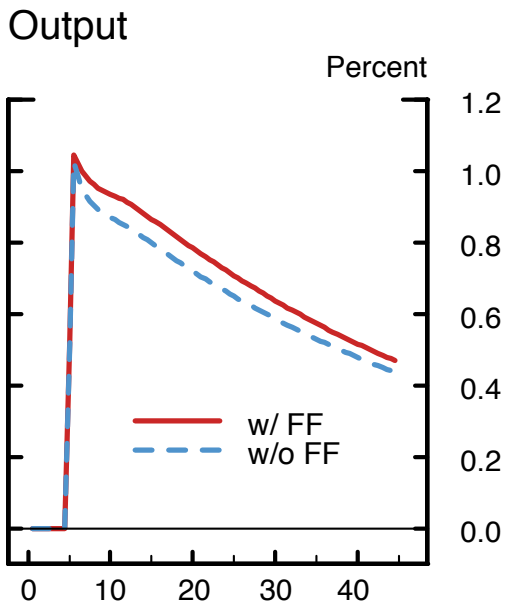
Measurement

Y: aggregate output
U: cross-sectional standard deviation of returns
S: mean returns

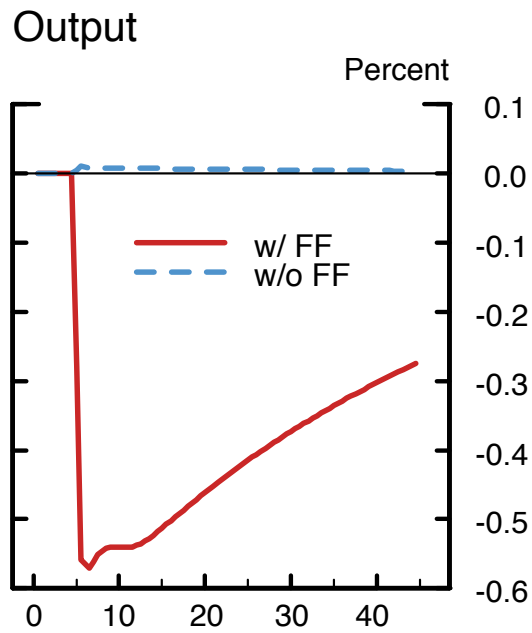
Thanks to authors for simulated data.

Gilchrist, Sim, & Zakrajsek (2014)
Three Separate Shocks

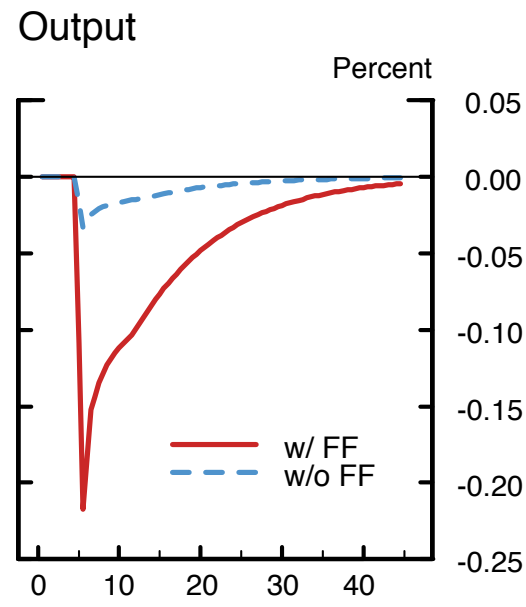
TFP Shock



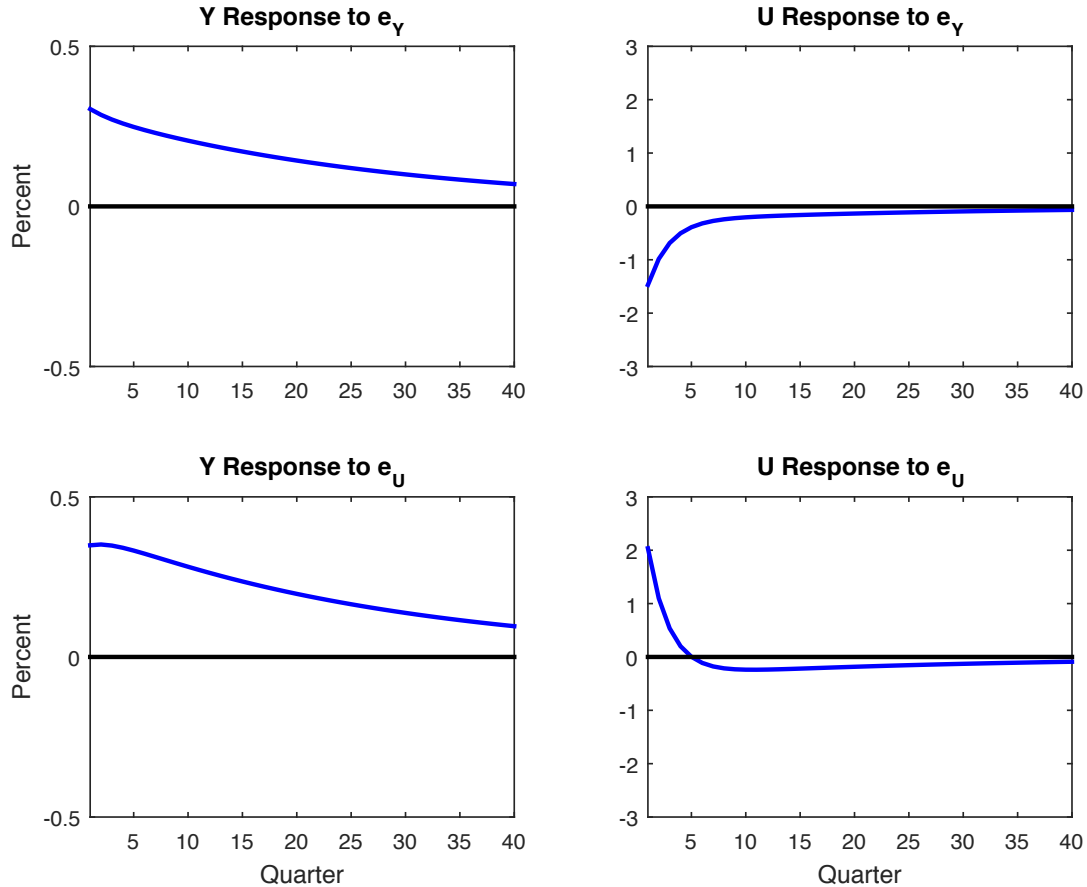
Negative Fin. Shock



Uncertainty Shock



Gilchrist, Sim, & Zakrajsek (2014) Applying the LMN Approach



Results from application of the LMN approach to 900 quarters of simulated data from the Gilchrist, Sim, and Zakrajsek model.

Gilchrist, Sim, & Zakrajsek (2014) Why Didn't LMN Work?

LMN Exclusion Restriction Violated
With nontrivial – and independent – financial shocks, stock returns should have been in the VAR all along.

Resulting Identified Shocks are an Amalgam of True Shocks
"Activity Shocks" = TFP (+), financial (-), uncertainty (-)
"Uncertainty Shocks" = TFP (+), financial (+), and uncertainty (+)

Spurious Conclusions
- Uncertainty appears to be endogenously countercyclical.
- Uncertainty appears to cause booms.
- Neither is true in underlying model.

My Conclusions

A New and Useful Econometric Tool from LMN
SVAR identification using an external endogenous series to construct an instrument.

An Exclusion Restriction with Economic Content
- External series must not belong in the VAR.
- "Other shocks reflected in stock returns must not affect activity or uncertainty."

Should We Worry about this Assumption?
- Seems ok in some state of the art uncertainty models.
- Fails with independent financial shocks, spurious conclusions of endogenous uncertainty, wrong sign of uncertainty impact.

I'm not yet convinced that uncertainty is endogenous or that uncertainty causes booms.