The impact of uncertainty and certainty shocks

Yves Schüler

Deutsche Bundesbank, Research Centre

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The views expressed in this presentation represent my personal opinion and do not necessarily reflect the views of the Deutsche Bundesbank or its staff.

“Le doute n’est pas un état bien agréable,
mais l’assurance est un état ridicule.”

(Voltaire, 1785, p. 418)

[“Uncertainty is an uncomfortable position,
but certainty is an absurd one.”]

Introduction

Major economic/political shocks increase uncertainty.

Bloom (2009): Uncertainty shocks...

- as strong rise in stock market volatility.
- severe negative impact on real economy.

This paper: Building on Bloom (2009)...

- unify his two identification steps into one.
- identify certainty shocks.

How? Novel Bayesian quantile VAR.

Introduction

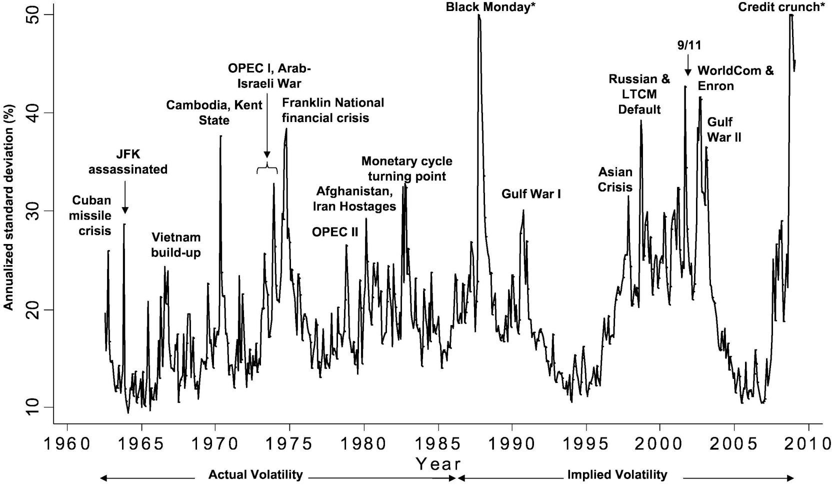
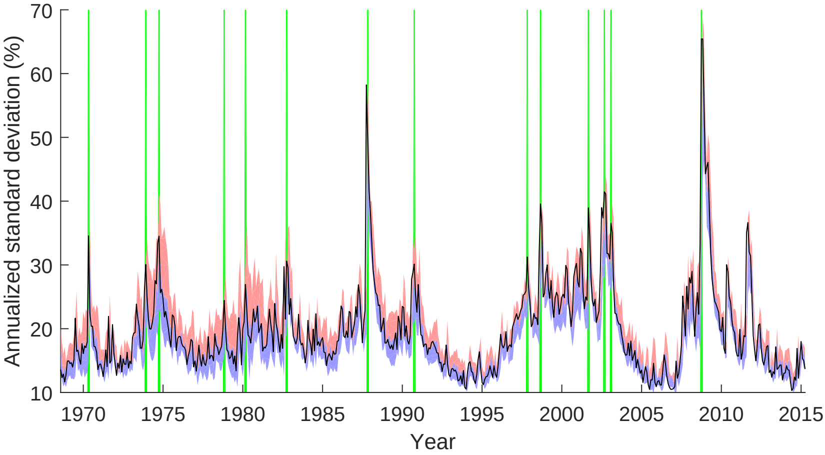


Figure: Bloom (2009): Uncertainty shocks

Introduction



- Here: Uncertainty/certainty shocks identified as shocks to tails of conditional volatility

Preview of findings

Transmission channel important: Uncertainty shocks...

- persistent rise in stock market volatility.
- stronger impact on real economy.

Should distinguish uncertainty/certainty shocks:

- Different impact on real economy.
- Shock events differ.

Downside risks:

- Uncertainty shocks: persistent increase.
- Certainty shocks: temporary decrease.

Outline

1. Introduction
2. Bayesian quantile VAR
3. Empirical issues: Data, priors, shock identification
4. Impact of uncertainty and certainty shocks
5. External shock validation
6. Concluding remarks

Outline

Bayesian quantile VAR

$$\underset{(d\times 1)}{\mathbf{y}_t} = \underset{(d\times 1)}{\boldsymbol{\nu}_{\boldsymbol{\tau}}} + \sum_{i=1}^{p} \underset{(d\times d)}{\mathbf{A}_{\boldsymbol{\tau},i}} \mathbf{y}_{t-i} + \underset{(d\times 1)}{\mathbf{v}_t} \tag{1}$$

- $\boldsymbol{\tau} = (\tau_1, \ldots, \tau_d)'$: quantile values
- $\mathrm{Q}_{\tau_j}(v_{jt}|\mathcal{F}_{t-1}) = 0$
  - $Q_{\tau_j}(\cdot|\cdot)$: τ_j-th conditional quantile with $j \in \{1, \ldots, d\}$
  - $\mathcal{F}_{t-1}$ information set $t-1$.

Bayesian estimation I/II

Proposition 1

Assume

$$\mathbf{v}_t \sim \mathcal{L}_d, \tag{2}$$

to estimate coefficient matrix $\mathbf{A}_{\boldsymbol{\tau}} = (\boldsymbol{\nu}_{\boldsymbol{\tau}}, \mathbf{A}_{\boldsymbol{\tau},1}, \ldots, \mathbf{A}_{\boldsymbol{\tau},p})'$.

- $\mathcal{L}_d$: General multivariate Laplace distribution

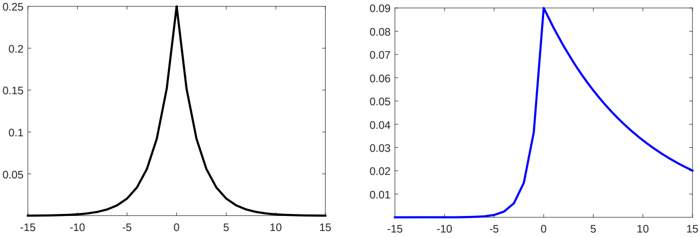


Figure: Univariate Laplace: $\tau = 0.5$ and $\tau = 0.1$

Bayesian estimation II/II

Proposition 2

Using mixture representation of Laplace,

$$\mathbf{y}_t | \mathbf{A}_{\boldsymbol{\tau}}, \mathcal{F}_{t-1}, \ldots \sim \mathcal{N}_d \tag{3}$$

and commonly known results for estimation apply.

- Metropolis-within-Gibbs-sampler

Pseudo structural analysis

Blomqvist (1950):

$$\boldsymbol{\Omega}_{\boldsymbol{\tau}} = (\omega_{jk}) = \mathsf{E}[\tilde{\psi}_{\tau_j}(v_{jt})\tilde{\psi}_{\tau_k}(v_{kt})], \tag{4}$$

- $\tilde{\psi}_{\tau_j}(v_{jt}) \propto (\tau_j - \mathbb{1}(v_{jt} < 0))$.

Pseudo structural innovations:

$$\boldsymbol{\Omega}_{\boldsymbol{\tau}} = P_{\boldsymbol{\tau}} P'_{\boldsymbol{\tau}} \tag{5}$$

$$\tilde{\psi}_{\boldsymbol{\tau}}(\mathbf{v}_t) = P_{\boldsymbol{\tau}} \boldsymbol{\varepsilon}_t, \tag{6}$$

- $\tilde{\psi}_{\boldsymbol{\tau}}(\mathbf{v}_t) = (\tilde{\psi}_{\tau_j}(v_{1t}), \ldots, \tilde{\psi}_{\tau_d}(v_{dt}))'$.

Pseudo structural analysis

Pseudo quantile impulse response function (PQIRF):

- $\check{Q}_{\boldsymbol{\tau}}(\mathbf{y}_t|\boldsymbol{\varepsilon}_t, \mathcal{F}_{t-1}) \equiv \boldsymbol{\nu}_{\boldsymbol{\tau}} + \sum_{i=1}^{p} \mathbf{A}_{\boldsymbol{\tau},i}\mathbf{y}_{t-i} + P_{\boldsymbol{\tau}}\boldsymbol{\varepsilon}_t$
- $Q_{\boldsymbol{\tau}}(\mathbf{y}_t|\mathcal{F}_{t-1}) = \boldsymbol{\nu}_{\boldsymbol{\tau}} + \sum_{i=1}^{p} \mathbf{A}_{\boldsymbol{\tau},i}\mathbf{y}_{t-i}$

$$PQIRF_{\boldsymbol{\tau}}(h, \varepsilon_{jt} = 1, \mathcal{F}_{t-1}) = \check{Q}_{\boldsymbol{\tau}}(\mathbf{y}_{t+h}|\varepsilon_{jt} = 1, \mathcal{F}_{t-1}) - Q_{\boldsymbol{\tau}}(\mathbf{y}_{t+h}|\mathcal{F}_{t-1}) \quad (7)$$

Data and priors

Small model of the US economy:

Equation	Symbol	Description
1	Δq	Growth in real industrial production
2	Δc	Growth in real personal cons. exp. (PCE)
3	Δp	Growth in PCE deflator
4	Δi	Change in effective federal funds rate
5	u_v	Bloom (2009) proxy of uncertainty
6	r	Return of S&P500 index

- 1968:M4-2015:M4
- Similar to Jurado et al. (2015), Caldara et al. (2016)

Non-informative priors

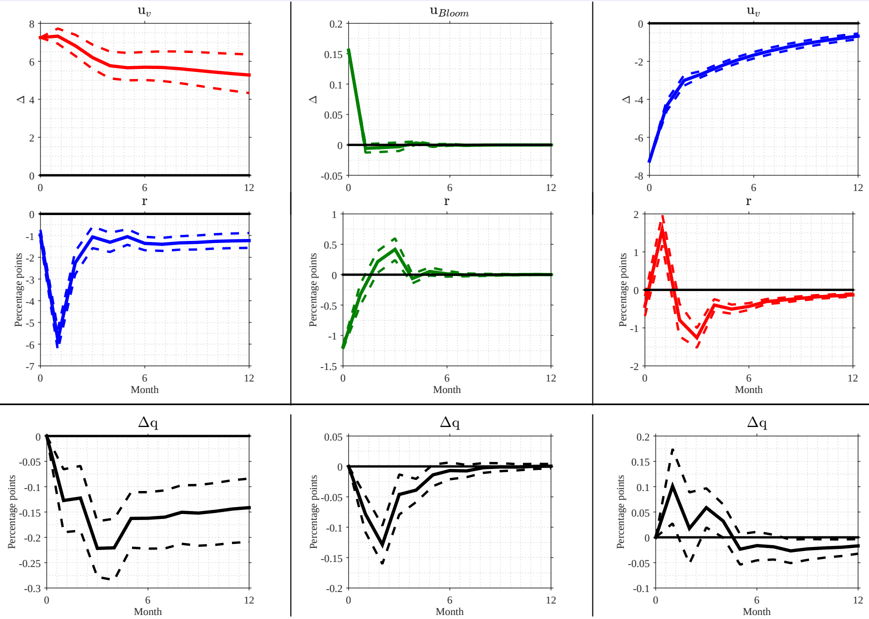
Schock identification

Cholesky ordering (e.g. Jurado et al. (2015))

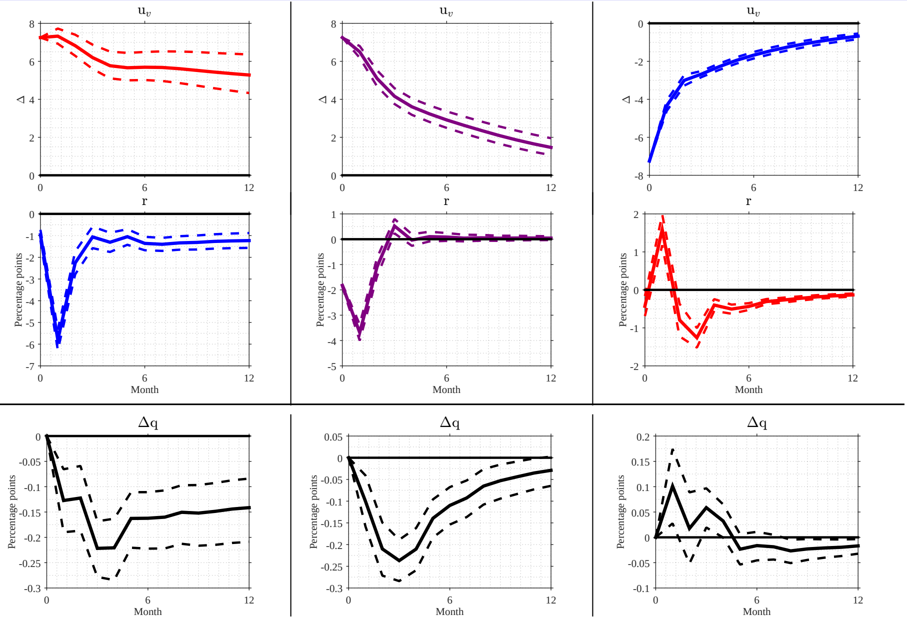
In the spirit of Bloom (2009):

- Uncertainty shock: $\tau_5 = 0.9$ and $\tau_6 = 0.1$;
  others: $\tau_1 = \tau_2 = \tau_3 = \tau_4 = 0.5$.
- Certainty shock: $\tau_5 = 0.1$ and $\tau_6 = 0.9$;
  others: $\tau_1 = \tau_2 = \tau_3 = \tau_4 = 0.5$.

Uncertainty, Bloom, and certainty shocks



Uncertainty, linear, and certainty shock

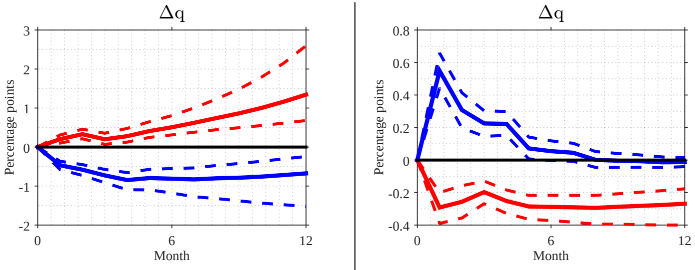


Importance of shocks

Table: First half-year: Average variance explained (%)

Shock	Δq	$u_.$	r
Uncertainty	6.7	93.4	37.9
Certainty	0.3	93.5	2.8
Bloom	2.8	94.2	8.1
Linear	3.8	96.2	20.8

Downside risks



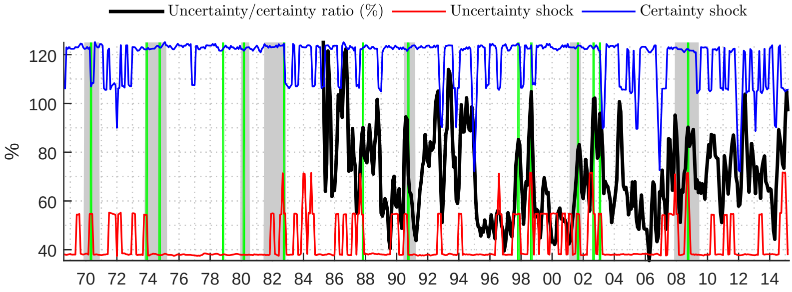
Uncertainty shock | Certainty shock

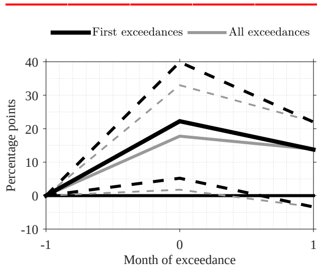
Figure: Lower and upper tail of real activity growth

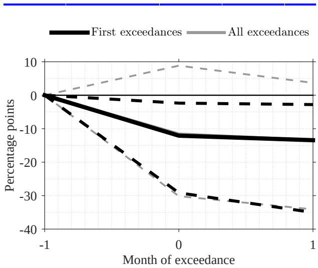
Examples of events at exeedances

Uncertainty shocks	Certainty shocks
Bloom (2009) dates, such as 9/11	Dow's first time above 1,000 in history (1972-11)
Downgrading of U.S. credit rating (2011-8)	S&P500 new highs for the year (2005-12)
Growing concerns about the nation's economy (1986-09)	"Stocks soar, but many ask why" (2010-03)
Uncty. about pol. future of President Nixon (1973-11)	Sudden peace hopes in Vietnam (1968-08)
Nuclear crisis in Japan (2011-3)	Sudden decline in oil prices (2005-06)

Uncertainty/certainty ratio, exceedances







Concluding remarks

Uncertainty shocks non-linear:

$\Rightarrow$ Correct dynamics for modelling?

$\Rightarrow$ Correct importance of uncertainty shocks?

$\Rightarrow$ Downside risk.

Significant impact of certainty shocks:

$\Rightarrow$ Relate to irrational exuberance.

$\Rightarrow$ Caution statements/actions by policy makers?

$\Rightarrow$ Identify periods through quantile VAR?

Thank you for your attention!

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