Uncertainty Shocks and Financial Shocks

Marco Brianti

October 2018

Boston College

Alternative Drivers of Economic Fluctuations

Depth and duration of **financial crisis**

$\Rightarrow$ several challenges for standard business cycle models

New strands of literature arose proposing alternative shocks

1. **Financial shocks** - Khan and Thomas (2013) JPE
2. **Uncertainty shocks** - Bloom (2009) Econometrica

The shocks that produced the recession were primarily associated with financial disruptions and heightened uncertainty

Stock and Watson (2012)

Definitions

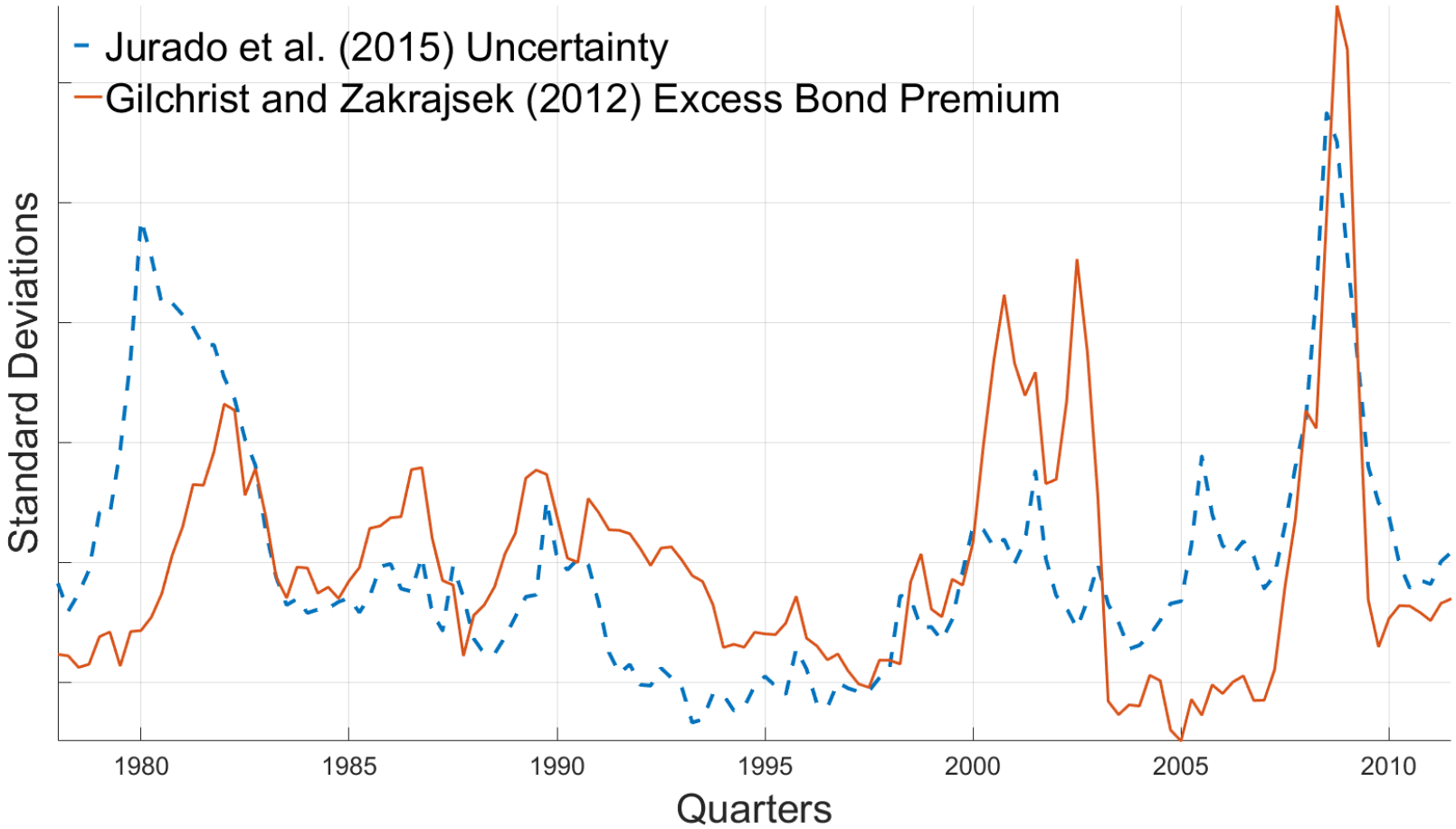
Financial Shocks. Unanticipated innovations to financial conditions orthogonal to any other known economic disturbance.

$$F_t = g(s_t^Y) + s_t^F$$

Uncertainty Shocks. Innovations in the expected variance of future (traditional) shocks which cannot be explained by any current source of economic fluctuations.

$$U_t = h(s_t^Y) + s_t^U$$

Empirical Challenge in Structural VAR



Empirical Challenge in Structural VAR (cont.)

Uncertainty shocks and financial shocks are deeply **confounded**.

$\Rightarrow$ correlation of raw series is above 0.5

$\Rightarrow$ correlation of their **innovations** remains close to 0.5

Empirical literature did not succeed yet to disentangle these two exogenous sources due to:

1. Simultaneity
   $\Rightarrow$ Both types of variables are fast moving
2. Effect on observables
   $\Rightarrow$ They have the same qualitative effects on prices and quantities

My contribution

I want to take a step back and show evidence and theory that financial and uncertainty shocks are **qualitative different**.

In particular,

1. I argue that there exists a variable which responds differently to financial and uncertainty shocks.
   $\Rightarrow$ Identification assumption

2. I provide a **new econometric tool** to sequentially identify two structural shocks when an internal instrument is available.
   $\Rightarrow$ Generalized Penalty Function Approach in Structural VAR

Roadmap

1. **Cash Reserves**
2. Model
3. Empirical Strategy
4. Results
5. Conclusions

Corporate Cash Holdings

Cash reserves refer to money which a corporation keeps on hand to cover any emergency funding or short-term requirements.

The typical U.S. large firm has cash equal to about 15% of total assets.

Together with current cash flow is consider the most important **internal source of finance**.

Cash provides **unconditional liquidity** available at any time.

Cash Reserves and Financial Frictions

1. Financially constrained firms use cash as an **internal source of investment funding**.

   Kaplan and Zingales, 1997 QJE

2. Financially constrained firms **store cash in good times** and **use it in bad ones**.

   Almeida, Campello, Weisbach, 2004 JF

3. After a negative credit supply shock firms **burn cash** to **avoid investment cuts** and **decrease financial costs**.

   Campello, Graham, Harvey, 2010 JFE

4. At a country level, **cash-to-assets is positively correlated to credit-to-GDP**.

   Lins, Servaes, Tufano (2010) JFE

Cash Reserves and Uncertainty

1. Financially constrained firm **holds more cash if cash flow is more volatile**.

   Han and Qiu (2007) JCF

2. Firms **increase their liquidity ratios when macroeconomic uncertainty increases**.

   Baum, Coglayan, Stephan, Talavera (2008) EM

3. Using UK data, they show that **cash is positively associated to higher uncertainty**.

   Bloom, Mizen, Smietanka (2018) WP

4. In response to an **uncertainty shock**, firms **increase cash reserves**.

   Alfaro, Bloom, Lin (2018) NBER WP

Roadmap

1. Cash Reserves
2. **Model**
3. Empirical Strategy
4. Results
5. Conclusions

Setting

Period 0 $\quad d_0 = y_0 + b_0 - i_0 - c$

Period 1 $\quad d_1 = y_1 + b_1 - i_1 + c, \quad$ where $\; y_1 \sim F$

Period 2 $\quad d_2 = g(I_0) - b_0(1 + r_0) + g(I_1) - b_1(1 + r_1)$

$$\begin{aligned} \max_{\{b_t, i_t, c\}_{t=0,1}} \quad & \mathbb{E}\left[d_0 + d_1 + d_2 \middle| F \right] \\ \text{subject to} \quad & r_t = \alpha_t b_t, \quad t = 0, 1 \\ & d_t \geq 0, \quad t = 0, 1, 2 \end{aligned}$$

Financial shock: $\uparrow \alpha_0$ vs Uncertainty shock: $\uparrow F$

Solution

Firm needs external finance: $\mathbb{E}_0\left[g(y_t)\right] > 1$ for $t = 0, 1$

$$\Rightarrow \; d_t = 0 \quad \text{for} \quad t = 0, 1$$

which implies $i_0 = y_0 + b_0 - c$ and $i_1 = y_1 + b_1 + c$. Objective function is,

$$\max_{b_0, b_1, c} \; g(i_0) - b_0 - \alpha_0 b_0^2 - y_0 + \mathbb{E}\left[g(i_1) - b_1 - \alpha_1 b_1^2 - y_1 \middle| F\right]$$

First Order Conditions

$$b_0 : \; g'(y_0 + b_0^* - c^*) = 1 + 2\alpha b_0^*$$
$$b_1 : \; \mathbb{E}\left[g'(y_1 + b_1^* + c^*)\right] = 1 + 2\alpha b_1^*$$
$$c : \; \mathbb{E}\left[g'(y_1 + b_1^* + c^*)\right] = g'(y_0 + b_0^* - c^*)$$

Comparative Statics

Given the first order conditions,

$$b_0 : \; g'(y_0 + b_0^* - c^*) = 1 + 2\alpha b_0^*$$
$$b_1 : \; \mathbb{E}\left[g'(y_1 + b_1^* + c^*)\right] = 1 + 2\alpha b_1^*$$
$$c : \; \mathbb{E}\left[g'(y_1 + b_1^* + c^*)\right] = g'(y_0 + b_0^* - c^*)$$

Uncertainty shock: $y_1 \sim Q$ which is mean-preserving spread in F

$\Rightarrow \; c^*(\alpha_0, Q) > c^*(\alpha_0, F)$ as long as $h'''(\cdot) > 0$

Financial shock: $\alpha_0^f > \alpha_0$ which is an exogenous increase in r_0

$\Rightarrow \; c^*(\alpha_0^f, F) < c^*(\alpha_0, F)$

Roadmap

1. Cash Reserves
2. Model
3. **Empirical Strategy**
4. Results
5. Conclusions

Empirical Analysis

Given the reduced-form system $X_t = BX_{t-1} + \iota_t$ where

$$X_t = \begin{bmatrix} U_t \\ F_t \\ GDP_t \\ C_t \\ I_t \\ H_t \\ C2A_t \end{bmatrix}$$

- where $\iota_t' \iota_t = \Sigma_\iota$
- dataset ranges from 1986q1 to 2015q4

Sequential Penalty Function Approach

Step 1 - Uncertainty Shock

$$\max_{\gamma_U} \quad \underbrace{e_U A_0 \gamma_U}_{\text{Impact on U}} + \delta \underbrace{e_C A_0 \gamma_U}_{\text{Impact on Cash}}$$

$$\text{subject to} \quad \delta \geq 0 \quad \text{and} \quad \underbrace{\gamma_U \gamma_U' = 1}_{\text{Normalization}}$$

Step 2 - Financial Shock

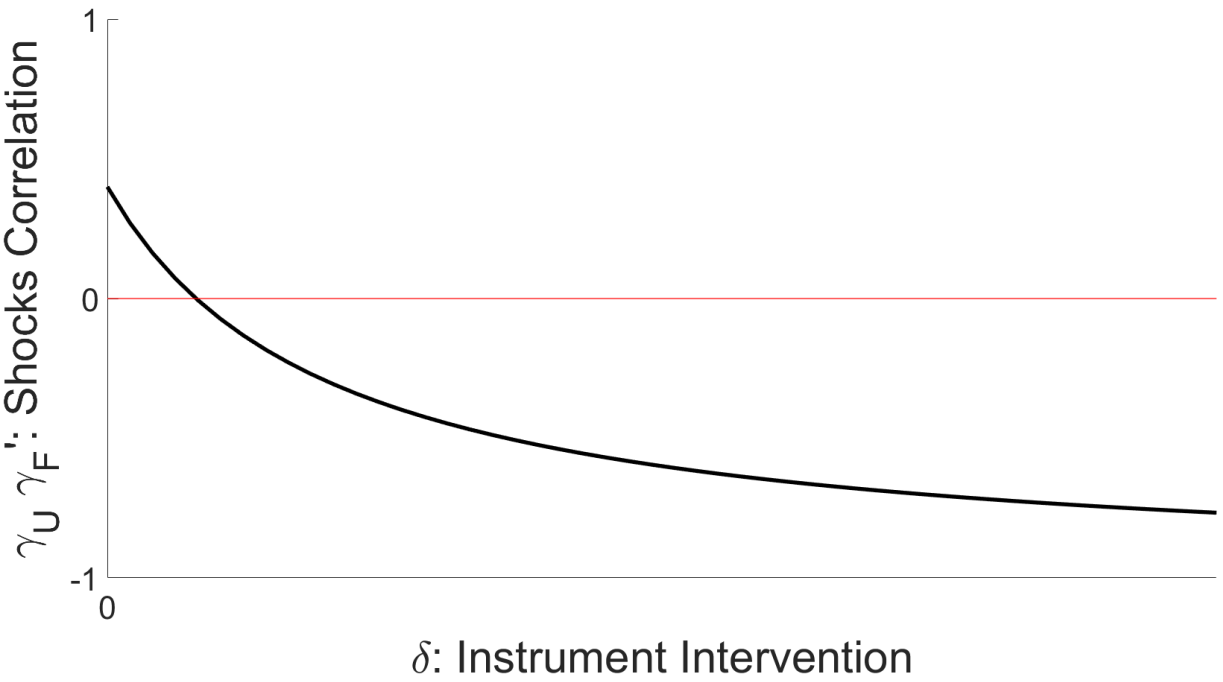
$$\max_{\gamma_F} \quad \underbrace{e_F A_0 \gamma_F}_{\text{Impact on F}} - \delta \underbrace{e_C A_0 \gamma_F}_{\text{Impact on Cash}}$$

$$\text{subject to} \quad \delta \geq 0, \quad \underbrace{\gamma_F \gamma_F' = 1}_{\text{Normalization}}, \quad \text{and} \quad \underbrace{\gamma_U \gamma_F' = 0}_{\text{Orthogonality with U shock}}$$

A Novel Approach

I suggest a **general approach** where δ is treated as an endogenous parameter chosen by the data.

$\Rightarrow$ Given the problem above, set δ such that $\gamma_U \gamma_F' = 0$

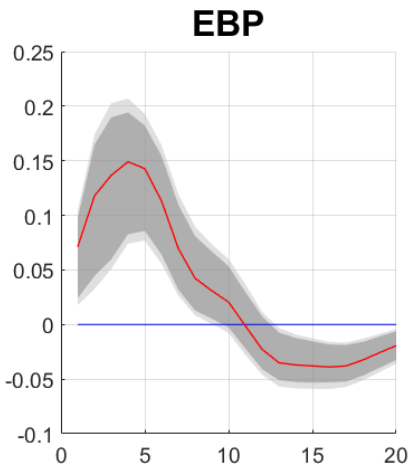


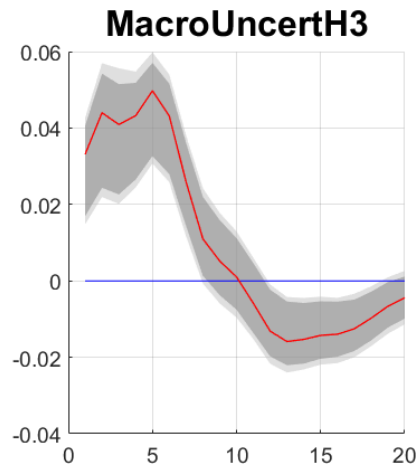
Intuition. Internal instrument intervention should be strong enough such that $\gamma_U \gamma_F' = 0$ endogenously holds.

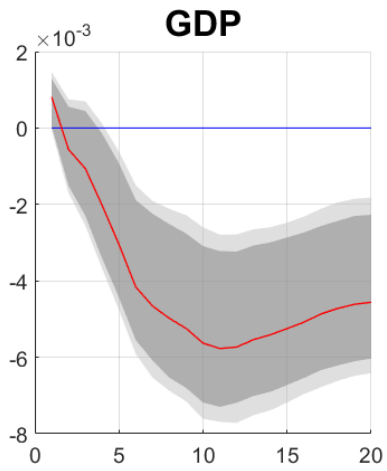
Roadmap

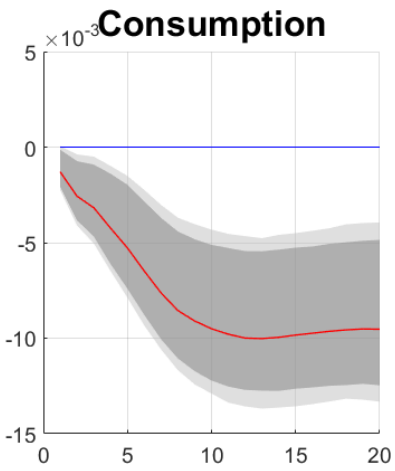
1. Cash Reserves
2. Model
3. Empirical Strategy
4. **Results**
5. Conclusions

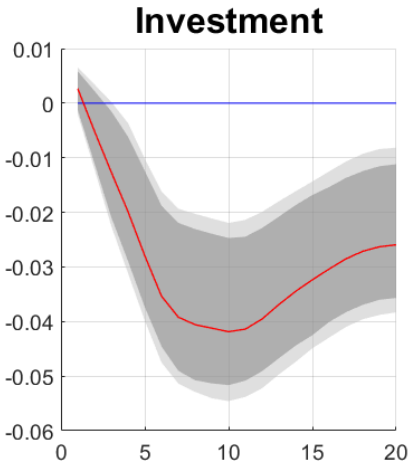
Uncertainty Shock

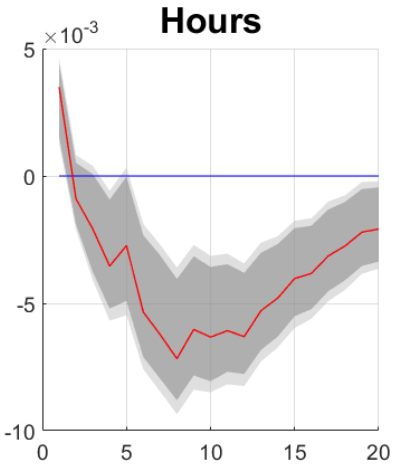


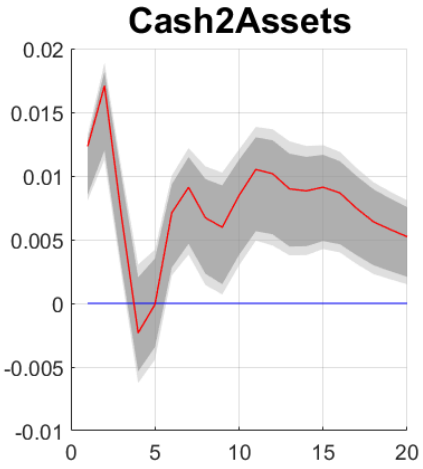




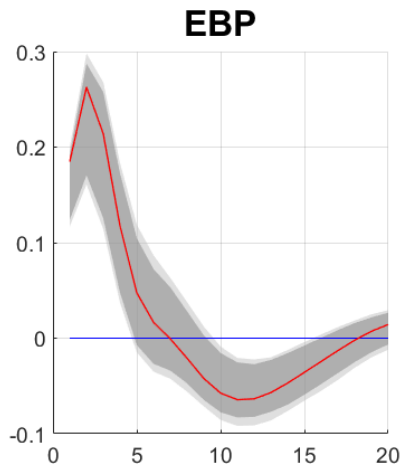


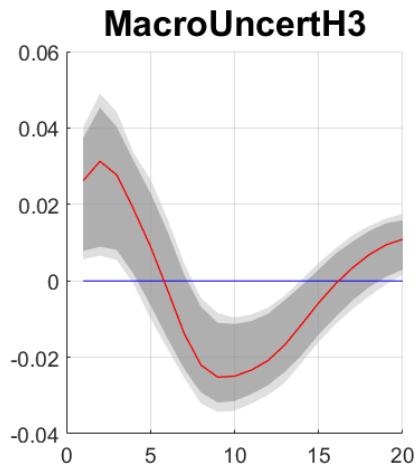


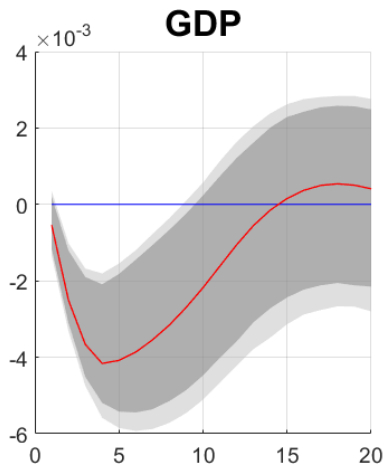


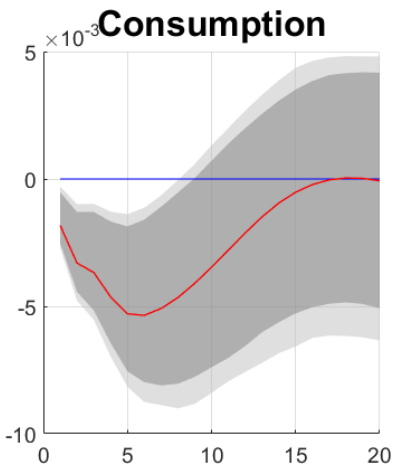


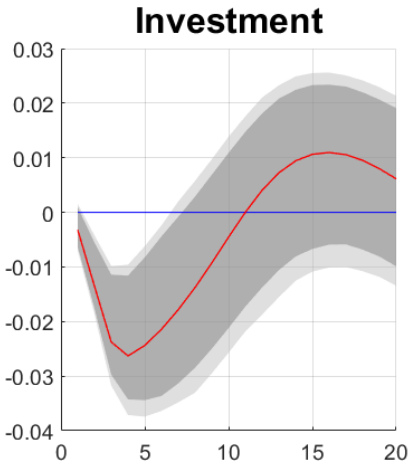
Financial Shock

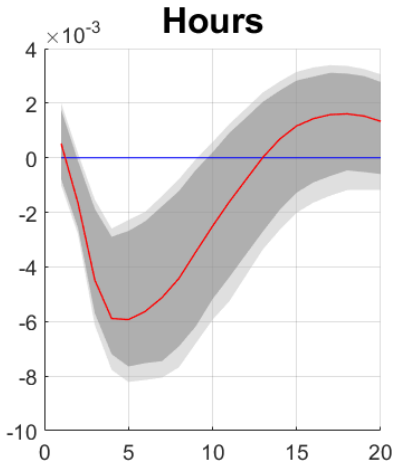


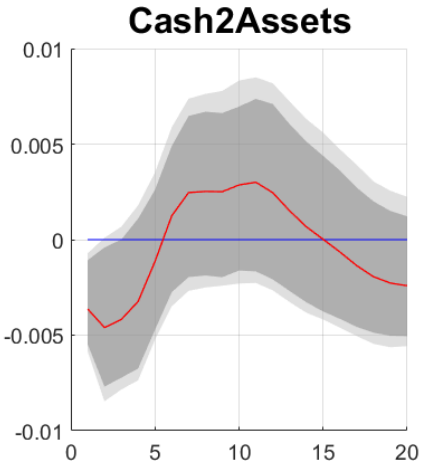




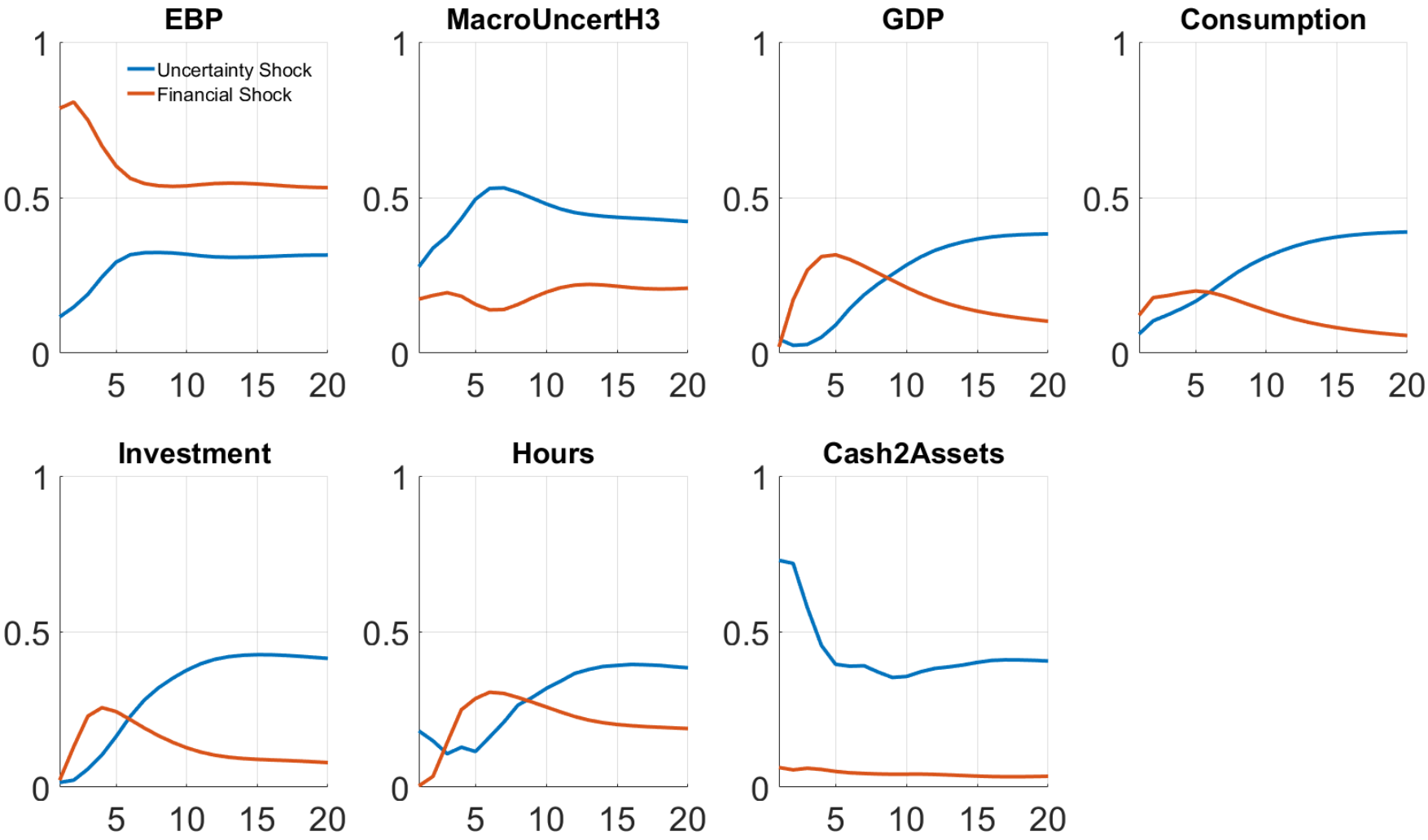








Variance Explained



Roadmap

1. Cash Reserves
2. Model
3. Empirical Strategy
4. Results
5. **Conclusions**

Conclusions

Cash can be used as an internal instrument to simultaneously identify uncertainty and financial shocks

GPFA seems to be able to use internal instruments to fully disentangle two confounded shocks

Both shocks have a remarkable effect on aggregate variables

Financial shocks have larger effect in the short run while uncertainty shocks in the medium run