Financial and Uncertainty Shocks

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Alternative Drivers of Economic Fluctuations

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

Stock and Watson (2012)

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) ECMA

Theoretical Definitions

Financial Shocks. Unanticipated innovations to financial conditions orthogonal to other economic disturbances.

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

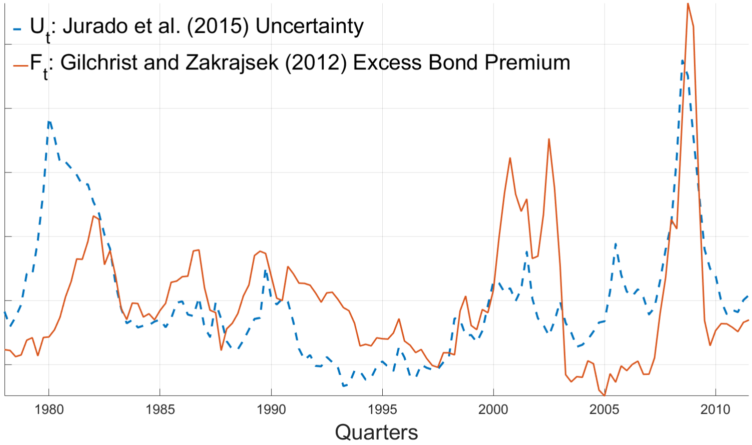
E.g. new banking regulation, banks' balance sheet deterioration, changes in lenders' risk management, . . .

Uncertainty Shocks. Innovations to the forecast error variance of aggregate variables orthogonal to other economic disturbances.

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

E.g. political tension, terrorist attack, sectoral growth opportunities, . . .

Empirical Proxies for Financial Conditions and Uncertainty



Motivation: Empirical Challenge in Structural VAR

Empirically distinguishing between financial and uncertainty shocks is difficult

$\Rightarrow$ financial distress is empirically associated with larger volatility

Within a SVAR framework, this correlation significantly complicates identification of both shocks

1. Implausible **zero-contemporaneous restrictions**
   - $\Rightarrow$ Both F_t and U_t are fast moving
2. Unavailable instruments for **sign restrictions**
   - $\Rightarrow$ Current theoretical models predict same qualitative effects on both 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. **Corporate cash holdings** respond differently to financial and uncertainty shocks.
   $\Rightarrow$ Identification assumption

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

Roadmap

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

Corporate Cash Holdings

Cash and Cash Equivalents refer to assets a business holds as ready cash

- Coffer as petty cash
- Bank account
- Bank certificates of deposits

U.S. large firms have cash equal to about 15% of total assets.

It is a **stock variable**,

$$Cash_t = Cash_{t-1} + NY_t + \delta K_t - I_t + B_t - D_t.$$

Cash is a Substitute for External Finance

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 **reduce 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 is Positively Correlated with 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 Holdings
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Three-Period Partial Equilibrium Model

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

Period 1 $\quad d_1 = y_1 + b_1 - i_1 + c, \quad \text{where} \;\; y_1 \sim F(y_0, \sigma^2)$

Period 2 $\quad d_2 = g(i_0) - b_0(1 + r_0) + g(i_1) - b_1(1 + r_1)$

$$\max_{\{b_t, i_t, c\}_{t=0,1}} \quad \mathbb{E}\left[d_0 + d_1 + d_2 \middle| F\right]$$

$$\text{subject to} \quad r_0 = \frac{1}{2}\alpha_0 b_0 \;\; \text{and} \;\; r_1 = \frac{1}{2}\alpha_1 b_1$$

$$d_t \geq 0, \quad t = 0, 1, 2$$

Financial shock: $\uparrow \alpha_0$ vs Uncertainty shock: $\uparrow \sigma^2$

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,

$$\max_{b_0, b_1, c} \; g\left(i_0\right) - b_0 - \frac{1}{2}\alpha_0 b_0^2 - y_0 + \mathbb{E}\left[g\left(i_1\right) - b_1 - \frac{1}{2}\alpha_1 b_1^2 - y_1 \middle| F\right]$$

First Order Conditions

$$\begin{aligned} b_0 &: \; g'(y_0 + b_0^* - c^*) = 1 + \alpha_0 b_0^* \\ b_1 &: \; \mathbb{E}\left[g'(y_1 + b_1^* + c^*)\right] = 1 + \alpha_1 b_1^* \\ c &: \; \mathbb{E}\left[g'(y_1 + b_1^* + c^*)\right] = g'(y_0 + b_0^* - c^*) \end{aligned}$$

Comparative Statics

Given the first order conditions,

$$
\begin{aligned}
b_0 &: \; g'(y_0 + b_0^* - c^*) = 1 + \alpha_0 b_0^* \\
b_1 &: \; \mathbb{E}\left[g'(y_1 + b_1^* + c^*)\right] = 1 + \alpha_1 b_1^* \\
c &: \; \mathbb{E}\left[g'(y_1 + b_1^* + c^*)\right] = g'(y_0 + b_0^* - c^*)
\end{aligned}
$$

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 $g'''(\cdot) > 0$

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**
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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

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

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

Step 2 - Financial Shock

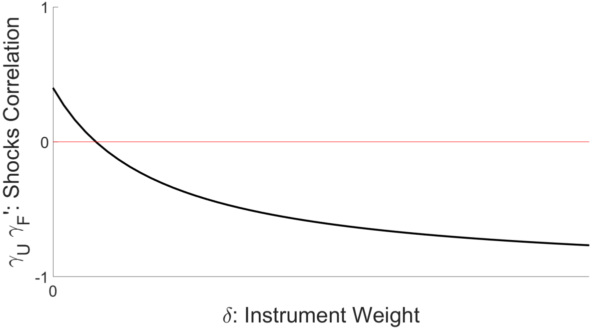
$$\max_{\gamma_F} \quad \underbrace{e_F A_0 \gamma_F}_{\text{Impact on F}} \quad - \quad \delta \quad \underbrace{e_C A_0 \gamma_F}_{\text{Impact on Cash}}$$

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

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. Weight of the internal instrument should be large enough such that $\gamma_U \gamma_F' = 0$ endogenously holds.

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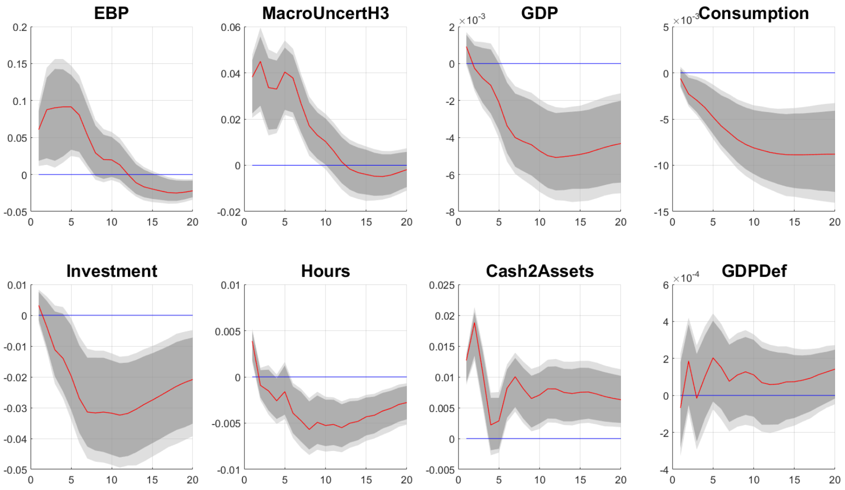
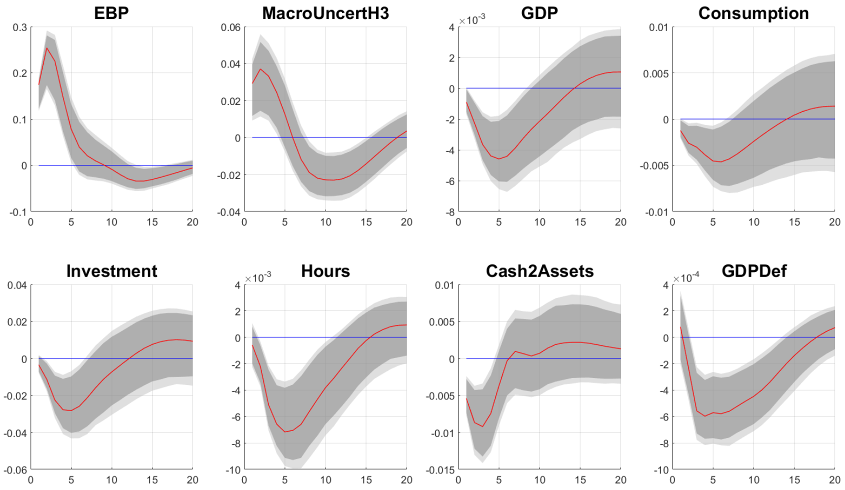
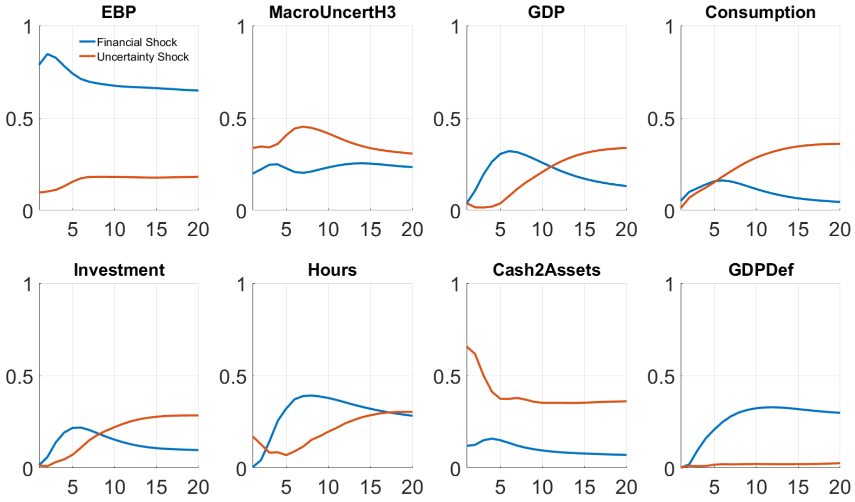
Uncertainty Shock



Financial Shock



Variance Explained



Roadmap

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Conclusions

So far,

- Cash as an internal instrument to simultaneously identify financial and uncertainty shocks
- An econometric tool to overcome known SVAR shortcomings
  - $\Rightarrow$ Simulated data confirm the reliability of the procedure
- Empirical results confirm the relevance of both shocks
- Financial shocks have larger effects in the short run while uncertainty shocks in the medium run

Nest Steps,

- Firm-level evidence on the differential response of cash
- General equilibrium model

Appendix A - Simulated Data

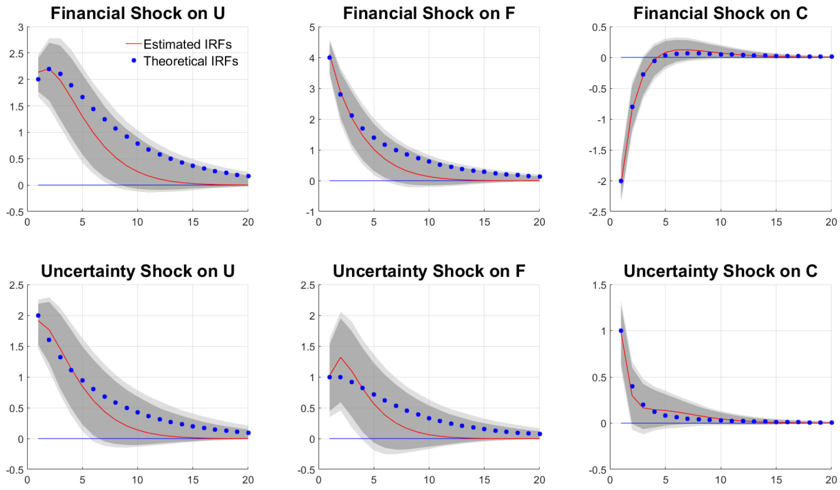
Consider the following structural model,

- $U_t = B_{UU} U_{t-1} + B_{UF} F_{t-1} + B_{UC} C_{t-1} + \underbrace{A_{UU} s_t^U + A_{UF} s_t^F}_{\iota_t^U}$
- $F_t = B_{FU} U_{t-1} + B_{FF} F_{t-1} + B_{FC} C_{t-1} + \underbrace{A_{FU} s_t^U + A_{FF} s_t^F}_{\iota_t^F}$
- $C_t = B_{CU} U_{t-1} - B_{CF} F_{t-1} + B_{CC} C_{t-1} + \underbrace{A_{CU} s_t^U - A_{CF} s_t^F}_{\iota_t^C}$

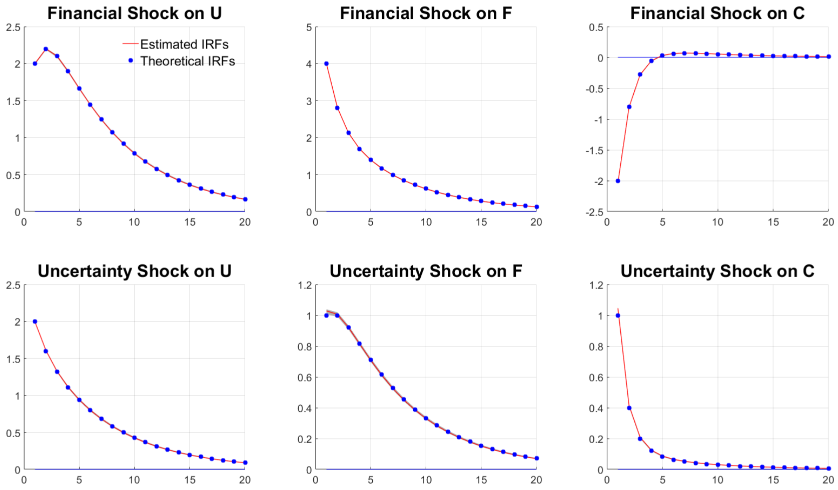
Objective is to estimate s_t^U and s_t^F under the assumption that we just know the sign of each element of A.

I apply the GPF approach - as shown previously - on simulated data.

Appendix A - Result for T = 100



Appendix A - Result for T = 100000



Appendix B - Correlations with Other External Shocks

	Uncertainty Shocks	**Financial Shocks**
External Shocks		
BZP Military News	−0.10 (0.24)	0.08 (0.31)
Ramey Military news	0.07 (0.44)	0.02 (0.82)
LWY Exp. Tax	0.03 (0.74)	0.15 (0.11)
RRMR Unexp. Tax	−0.13 (0.16)	0.05 (0.59)
RRMR Exp. Tax	−0.08 (0.36)	0.03 (0.76)
AdjTFP AR(1)	0.08 (0.31)	−0.14 (0.11)
RR Mon. Policy	−0.13 (0.18)	−0.04 (0.70)