Uncertainty Shocks and Financial Shocks

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October 2018

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Financial Shocks and Uncertainty Shocks

Stock and Watson (2012); Caldara et al. (2016) among others shown that uncertainty shocks and financial shocks are deeply confounded.

$$corr(\iota_t^{EBP}, \iota_t^{JLN}) \approx 0.45$$

where ι_t^{EBP} is an unpredictable innovation in the **excess bond premium** from Gilchrist and Zakrajzek (2012) and ι_t^{JLN} is an unpredictable innovation in the **uncertainty proxy** from Jurado et al. (2015).

Both a theoretical and empirical question

Literature did not succeed yet to disentangle the two exogenous sources for two main reasons:

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

As a result, both **zero-impact restrictions** cannot be used and **internal instruments** are not available.

This Project

I want to take a step back and argue that it is conceptually wrong to disentangle these two shocks as defined by the literature.

From a theoretical point of view, uncertainty shocks can potentially be a primitive source of financial shocks.

It is more important to gauge how much of the combinations of these shocks appears to be

- a credit supply shock $\Rightarrow$ **financial shock**
- a credit demand shock $\Rightarrow$ **macro uncertainty shock**

Main Contribution

1. I present evidence and theory of an **internal instrument** able to disentangle shifts in credit supply and demand.

2. I provide a **new econometric method** which can be applied to disentangle two structural shocks when an internal instrument is available.

Corporate Cash Reserves

Cash reserves (or **cash holdings**) refer to money or extremely liquid short-term investment which an individual corporation saves in order to be ready to cover any emergency funding or short-term requirements.

The typical U.S. large firm has cash equal to about 10% and 15% of total assets.

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

Cash Reserves and Financial Frictions

Almeida, Campello, Weisbach, 2004. *The Journal of Finance*

$\Rightarrow$ Financially constrained firms tend to build larger cash reserves as a buffer against potential credit supply shocks.

Kaplan and Zingales, 1997. *Quarterly Journal of Economics*

$\Rightarrow$ Investment is positive related to cash reserves when firms are financially constrained.

Campello, Graham, Harvey, 2010. *Journal of Financial Economics*

$\Rightarrow$ After the 2008-09 credit supply shock, cash reserves decrease because adopted as internal source of finance.

Cash Reserves and Uncertainty

Bloom, Mizen, Smietanka (2018). *Working Paper*

$\Rightarrow$ Higher economic uncertainty in the years 2007-09 is related to an increase in cash holdings.

Alfaro, Bloom, Lin (2018). *NBER Working Paper*

$\Rightarrow$ Firms accumulate cash reserves and short-term liquid instruments following uncertainty rises.

Economic Intuition I

To provide an economic intuition of the differential response of **cash holdings** to uncertainty and financial shocks, I present a properly augmented model in the spirit of

- Almeida, Campello, and Weisbach (2004)
- Han and Qiu (2007)

It is a simple representation of a dynamic setting where a credit-constrained profit-maximizing firm has a trade-off between present and future investment opportunities

Model

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

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

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

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

$$\text{subject to} \quad b_t \leq (1-\tau_t) i_t, \quad t = 0, 1$$

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

Solution

Financially constrained firm: $I_t^* < I_t^{FB}$ for $t = 0, 1$

$\Rightarrow \; b_t = (1 - \tau_t) i_t \quad \text{for} \quad t = 0, 1$

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

which implies $I_0 = \frac{y_0 - c}{\tau_0}$ and $I_1 = \frac{y_1 + c}{\tau_1}$. Objective function is,

$$\max_c g\left(\frac{y_0 - c}{\tau_0}\right) - \frac{y_0 - c}{\tau_0} + \mathbb{E}\left[h\left(\frac{y_1 + c}{\tau_1}\right) - \frac{y_1 + c}{\tau_1} \middle| F\right]$$

and optimal condition for $c^*(\tau_0, F)$ is

$$\underbrace{g'\left(\frac{y_0 - c^*(\tau_0, F)}{\tau_0}\right)}_{\text{Marginal Return of } I_0} = \underbrace{\mathbb{E}\left[h'\left(\frac{y_1 + c^*(\tau_0, F)}{\tau_1}\right) \middle| F\right]}_{\mathbb{E} \text{ Marginal Return of } I_1}$$

Comparative Statics

Given the Euler equation for cash c,

$$\underbrace{g'\left(\frac{y_0 - c^*(\tau_0, F)}{\tau_0}\right)}_{\text{Marginal Return of } I_0} = \underbrace{\mathbb{E}\left[h'\left(\frac{y_1 + c^*(\tau_0, F)}{\tau_1}\right)\middle| F\right]}_{\mathbb{E} \text{ Marginal Return of } I_1}$$

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

$\Rightarrow\ c^*(\tau_0, Q) > c^*(\tau_0, F)$ as long as $h'''(\cdot) > 0$

Financial shock: $\tau_0^f > \tau_0$ which is a decrease in b_0

$\Rightarrow\ c^*(\tau_0^f, Q) < c^*(\tau_0, F)$

Penalty Functions (I)

Penalty functions is a maximization problem where the importance of the constraint depends on some assumptions.

Consider the standard constrained maximization problem,

$$\max_{x} f(x) \quad \text{s.t} \quad g(x) \geq 0$$

a penalty function is an unconstrained maximization problem

$$\max_{x} f(x) + G(g(x))$$

$\Rightarrow$ Assumptions on $G(\cdot)$ determines the importance of $g(x)$.

Penalty Functions (II)

Given $\max_x f(x)$ s.t $g(x) \geq 0$, I assume $G(\cdot)$ to be linear,

$$\max_x f(x) + \delta g(x), \quad \delta > 0$$

$\Rightarrow$ the larger δ, the more important $g(x)$

Applied to SVARs, PFA has the flavor of **sign restrictions** but with the advantage that the problem is **just identified**.

Shortcoming: parameter δ is exogenously chosen making the identification strategy less credible.

Identification (I)

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

- $X_t = [U_t \quad F_t \quad Y_t]'$ where Y_t are macroeconomic variables.
- $\iota_t' \iota_t = \Sigma_\iota$

Step 1

$$\begin{array}{rl} \max\limits_{\gamma_U} & \sum_{t=0}^{K} e_U' B^t \tilde{A}_0 \gamma_U + \delta e_C' \tilde{A}_0 \gamma_U \\ \text{subject to} & \delta \geq 0 \;\; \text{and} \;\; \gamma_U \gamma_U' = 1 \end{array}$$

Step 2

$$\begin{array}{rl} \max\limits_{\gamma_F} & \sum_{t=0}^{J} e_F' B^t \tilde{A}_0 \gamma_F - \delta e_C' \tilde{A}_0 \gamma_F \\ \text{subject to} & \delta \geq 0, \;\; \gamma_F \gamma_F' = 1 \;\; \text{and} \;\; \gamma_U \gamma_F' = 0 \end{array}$$

where $\tilde{A}_0 \tilde{A}_0' = \Sigma_\iota$ and e_j is a selection vector of variable j.

Identification (I)

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

- $X_t = [U_t \quad F_t \quad C_t \quad Y_t]'$
- $\iota_t' \iota_t = \Sigma_\iota$

Step 1 - Uncertainty Shock

$$\begin{array}{rc} \max\limits_{\gamma_U} & \sum_{t=0}^{K} e_U' B^t \tilde{A}_0 \gamma_U + \delta e_C' \tilde{A}_0 \gamma_U \\ \text{subject to} & \delta \geq 0 \ \text{ and } \ \gamma_U \gamma_U' = 1 \end{array}$$

An uncertainty shock maximizes its effect on uncertainty over the first K quarters with penalty (merit) δ if cash is negative (positive) on impact.

Identification (I)

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

- $X_t = [U_t \quad F_t \quad Y_t]'$ where Y_t are macroeconomic variables.
- $\iota_t' \iota_t = \Sigma_\iota$

Step 2 - Financial Shock

$$\begin{array}{cc} \max\limits_{\gamma_F} & \sum_{t=0}^{J} e_F' B^t \tilde{A}_0 \gamma_F - \delta e_C' \tilde{A}_0 \gamma_F \\ \text{subject to} & \delta \geq 0, \quad \gamma_F \gamma_F' = 1 \ \text{ and } \ \gamma_U \gamma_F' = 0 \end{array}$$

A financial shock maximizes its effect on credit spread over the first J quarters with penalty (merit) δ if cash is positive (negative) on impact.

Identification (I)

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

- $X_t = [U_t \quad F_t \quad Y_t]'$ where Y_t are macroeconomic variables.
- $\iota_t' \iota_t = \Sigma_\iota$

Step 1 - Uncertainty Shock

$$\begin{array}{rl} \max\limits_{\gamma_U} & \sum_{t=0}^{K} e_U' B^t \tilde{A}_0 \gamma_U + \delta e_C' \tilde{A}_0 \gamma_U \\ \text{subject to} & \delta \geq 0 \quad \text{and} \quad \gamma_U \gamma_U' = 1 \end{array}$$

Step 2 - Financial Shock

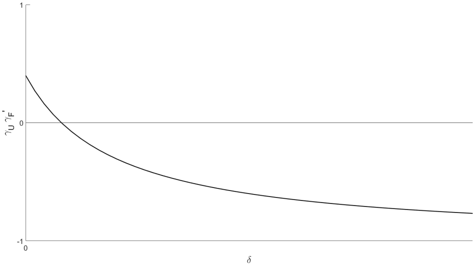
$$\begin{array}{rl} \max\limits_{\gamma_F} & \sum_{t=0}^{J} e_F' B^t \tilde{A}_0 \gamma_F - \delta e_C' \tilde{A}_0 \gamma_F \\ \text{subject to} & \delta \geq 0, \quad \gamma_F \gamma_F' = 1 \quad \text{and} \quad \gamma_U \gamma_F' = 0 \end{array}$$

where $\tilde{A}_0 \tilde{A}_0' = \Sigma_\iota$ and e_j is a selection vector of variable j.

Identification (II)

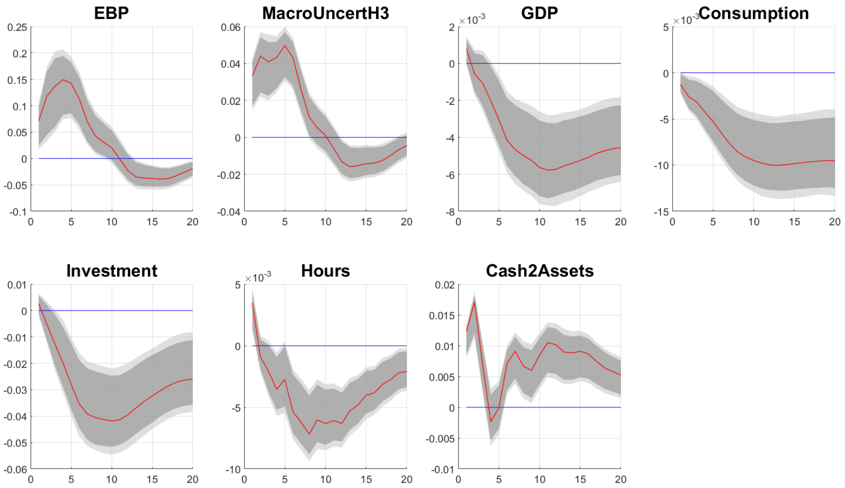
I suggest a **general approach** where δ is treated as an endogenous parameter chosen by the data.

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

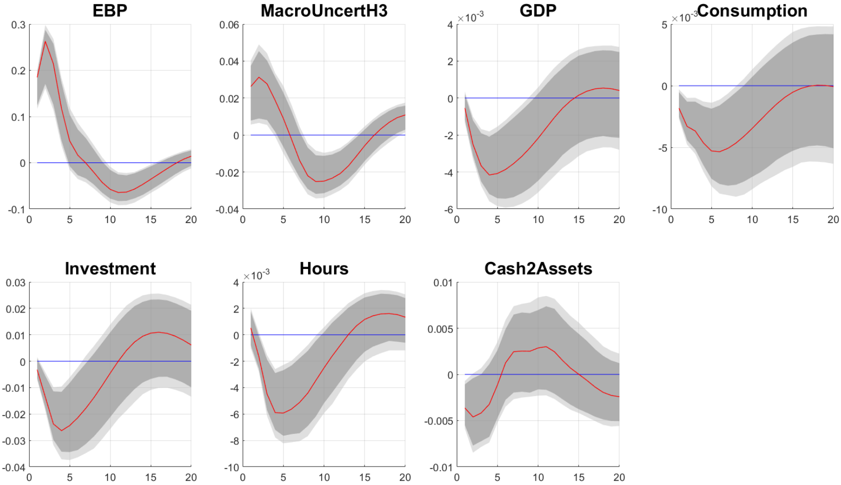


Intuition. Internal instrument intervention should be strong enough such that $\gamma_U \gamma_F' = 0$.

Results - Uncertainty Shock



Results - Financial Shock



Results - Variance Explained