Uncertainty Shocks and Financial Shocks

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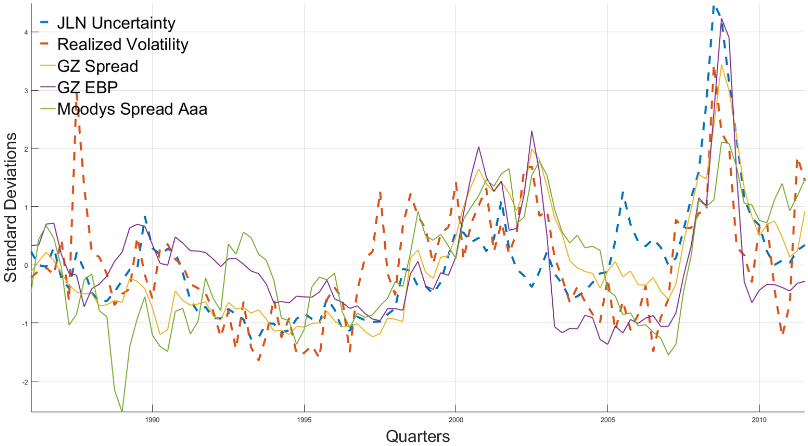
Dissertation Project



Proxies for **credit conditions** and **uncertainty** are both countercyclical and tightly correlated.

Credit Conditions and Uncertainty (II)

	JLN	RV	GZ	EBP	Moodys Aaa
JLN	1	-	-	-	-
RV	0.5865	1	-	-	-
GZ	0.7742	0.6247	1	-	-
EBP	**0.6213**	0.5621	0.7316	1	-
Moodys Aaa	0.4386	0.4554	0.7993	0.5243	1

As suggested by the graph above, all the variables are strongly correlated.

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.

My contribution

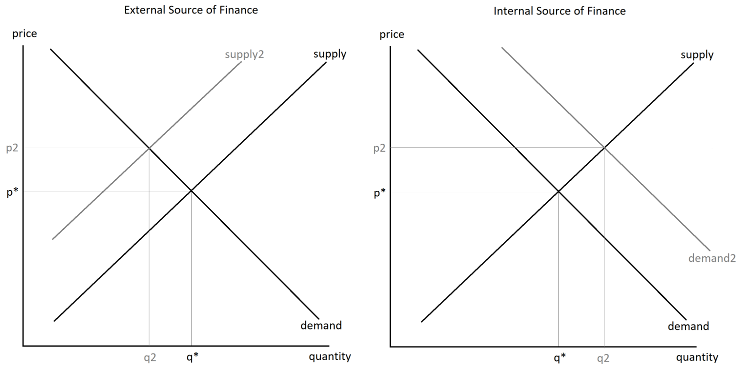
I want to take a step back and show evidence and theory that financial and uncertainty shocks

- are not **qualitatively equivalent**, and
- they can be **successfully disentangled**.

In particular,

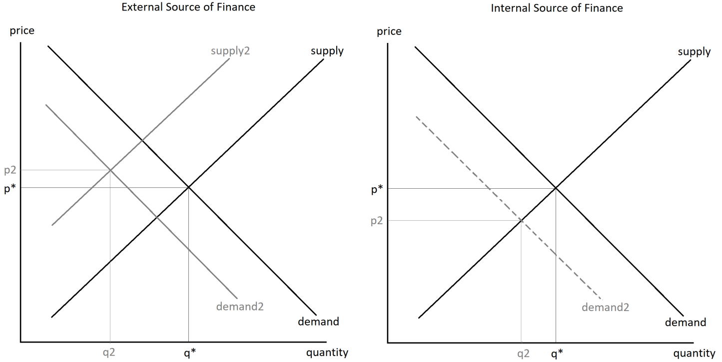
1. I will show evidence that there exists a set of variables which respond differently to financial and uncertainty shocks.
   - there exists an **economic intuition** for this response
   - those variables can be used as **internal instruments**
2. I will provide a **new econometric method** to use internal instruments to disentangle two structural shocks.

Effect of a financial shock:



Notice that I am taking as given the supply of internal source of finance.

Effect of an uncertainty shock:



Notice that I am taking as given the supply of internal source of finance.

Economic Intuition

- After a **decrease in credit supply** - for a given supply of internal funds - quantity of the internal source of finance should increase.
    - On impact, firms do not invest because they are **financially constrained**.
    - Bernanke, Gertler, and Gilchrist, 1999; Jermann and Quadrini, 2012.

- After an **increase in uncertainty** - for a given supply of internal funds - quantity of the internal source of finance should either decrease or remain unchanged.
    - **Real-options effects** imply that during period of uncertainty firms opt for wait-and-see rather than investing.
    - Bernanke, 1983; Brennan and Schwartz, 1985; McDonald and Siegel, 1986.

Variables of Interest by Bureau of Economic Analysis

Cash Flow is a profit-related measure of **internal funds** available for investment. [The NIPA Handbook, December 2015]

$$
\begin{array}{rl}
 & \text{Corporate Profits} \\
- & \text{Dividends} \\
+ & \text{Consumption of Fixed Capital} \\
- & \text{Net Capital Transfers Paid} \\
= & \textbf{Cash Flow}
\end{array}
$$

where

1. **consumption of fixed capital** is capital depreciation
2. **net capital transfers paid** are unrequited transfers associated with the acquisition or disposal of assets.

Controlling for the Supply of Internal Funds

The main source (**supply**) of internal funds available for investment is **corporate profits** of the current period.

Not surprisingly, profits are **procyclical** implying that the supply of internal funds cannot be taken as given.

In order to control for **general equilibrium effect**, cash flow needs to be normalized by the corporate profit.

As an intuition, cash flow over profits is an **index** between 0 and 1

- If the index is equal to zero, current profits are fully distributed outside the firm
- If index is equal to one, current profits are going to be fully used inside the firm

From Theory to Data

Partial equilibrium analysis suggests that

- Normalized cash flow should **increase** after a **financial shock**
  - $\Rightarrow$ Firms focus on different source of finance because financially constrained
- Normalized cash flow should **not increase** after an **uncertainty shock**
  - $\Rightarrow$ Demand for any source of finance decrease together with the supply

Using aggregate US data I run a 2-step regression in favor of previous analysis.

Step 1

Regress both a proxy for uncertainty and financial conditions on lagged principal components obtained from a large dataset,

- $F_t = \alpha^F + A_F(L)PC_{t-1} + \iota_t^F$
- $U_t = \alpha^U + A_U(L)PC_{t-1} + \iota_t^U$

where

- F_t is a proxy of financial conditions
- U_t is a proxy of uncertainty
- PC_t is a vector of principal components

Goal is to obtain ι_t^F and ι_t^U as **unforecastable components** of F_t and U_t, respectively.

Step 2

Regress normalized cash flow on both innovations ι_t^F and ι_t^U, controlling for its forecastable part,

$$\tilde{CF}_t = \alpha + B(L)PC_{t-1} + \beta^F \iota_t^F + \beta^U \iota_t^U + \varepsilon_t$$

where $\tilde{CF}_t$ is cash flow normalized by corporate profits.

Results.

- β^F is always **positive** and **significant** at 1%.
- β^U is almost always **not significant**.

Robustness Checks

- Changing the number of lags, ranging from 3 to 6
- Changing the number of PC_t, ranging from 4 to 8
- Adding different controls in both steps
- Using different measures of uncertainty and credit supply

Penalty Functions

Penalty functions is a constrained maximization problem where the importance of the constraint depends on a exogenously given coefficient.

Given a standard constrained maximization problem,

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

a penalty function is

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

- If $\delta = 0$ the constraint $g(x)$ is not taken into account
- If $\delta \to \infty$ optimal solution maximizes constraint $g(x)$

Penalty Functions Approach (PFA) on Structural VARs

Firstly presented by Uhlig (2005), PFA has the flavor of **sign restrictions** but with the advantage that the problem is just identified, delivering an **unique solution**.

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

I suggest a **general penalty function approach** for internal instruments where δ is treated as an endogenous parameter chosen by the data.

Step 1 - Identifying uncertainty shocks

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

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

where

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

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

Step 2 - Identifying financial shocks

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

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

where

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

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

How to choose δ

Choose δ large enough such that it does not matter if you run Step 1 or Step 2 first.

In other words, internal instrument intervention should be strong enough such that $\gamma_U \gamma_F' \simeq 0$

Solution is **unique** over many dimensions.