

# Uncertainty Shocks and Financial Shocks

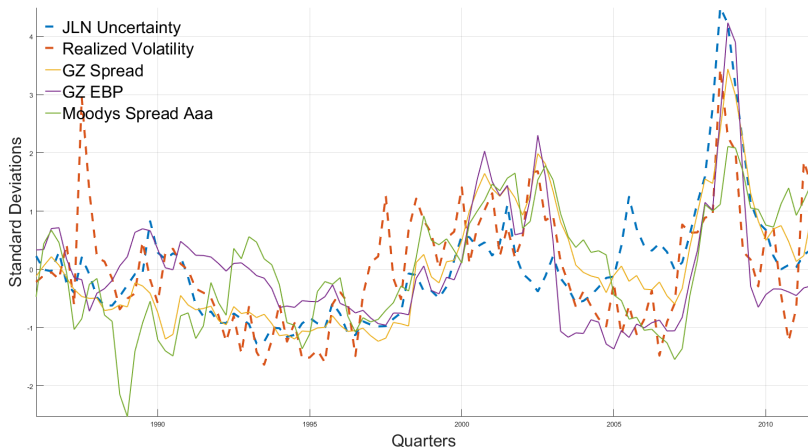
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Dissertation Project

# Credit Conditions and Uncertainty (I)



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

## Credit Conditions and Uncertainty (II)

	JLN	RV	GZ	EBP	Moody's Aaa
JLN	1	-	-	-	-
RV	0.5865	1	-	-	-
GZ	0.7742	0.6247	1	-	-
EBP	<b>0.6213</b>	0.5621	0.7316	1	-
Moody's 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.

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

where  $\iota_t^{EBP}$  is an unpredictable innovation in the **excess bond premium** from Gilchrist and Zakrajsek (2012) and  $\iota_t^{JLN}$  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.

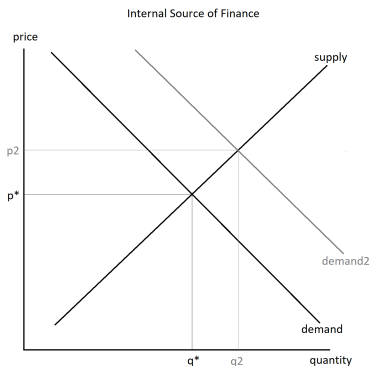
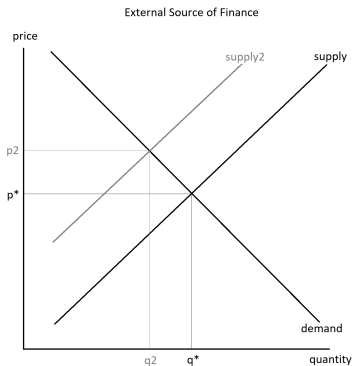
I want to take a step back and show evidence and theory that financial and uncertainty shocks are **qualitative different**.

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.

# Economic Intuition - Partial Equilibrium Analysis (I)

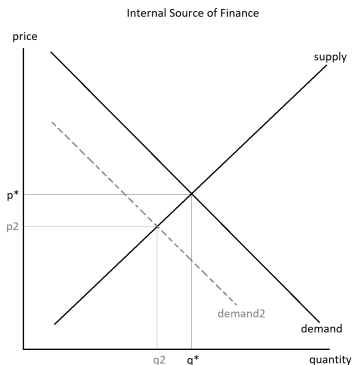
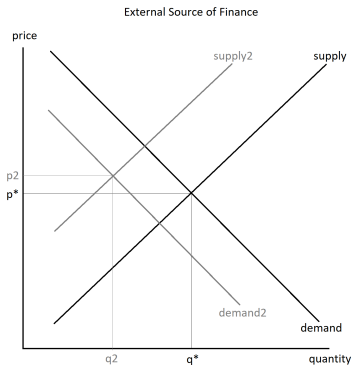
Effect of a financial shock:



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

# Economic Intuition - Partial Equilibrium Analysis (II)

Effect of an uncertainty shock:



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



- 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]

Corporate Profits

- Dividends
- + Consumption of Fixed Capital
- Net Capital Transfers Paid
- = **Cash Flow**

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

Partial equilibrium analysis suggests that

- Normalized cash flow should **increase** after a **financial shock**
  - ⇒ Firms focus on different source of finance because financially constrained
- Normalized cash flow should **not increase** after an **uncertainty shock**
  - ⇒ 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  $\iota_t^F$  and  $\iota_t^U$  as **unforecastable components** of  $F_t$  and  $U_t$ , respectively.

## Step 2

Regress normalized cash flow on both innovations  $\iota_t^F$  and  $\iota_t^U$ , 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.

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

- 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,

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

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  $\delta \rightarrow \infty$  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  $\delta$  is exogenously chosen making the identification strategy less credible.

I suggest a **general penalty function approach** for internal instruments where  $\delta$  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

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

## Step 1

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

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  $\delta$  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

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

### Step 2

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

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  $\delta$  if cash flow is negative on impact.

# How to choose $\delta$

Choose  $\delta$  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.