Credit Market Frictions and the Linkage between Micro and Macro Uncertainty

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Abstract

This paper proposes a quantitative general equilibrium model with credit market frictions to explain the observed comovement between micro uncertainty (dispersion of firm-level outcomes) and macro uncertainty (volatility of aggregate economic variables), and their countercyclicality. An increase in firm cash flow dispersion leads to more firms receiving bad cash flows and claiming default on debt. Thus, credit frictions get more severe and the shock amplification associated with credit frictions get magnified. As a result, the economy becomes more volatile and macro uncertainty increases. Augmenting the model with recursive preferences is important to quantitatively explain the comovement between micro and macro uncertainty. Consistent with the model predictions, I find that in the data, micro uncertainty, based on the dispersion of firm stock returns or sales growth, positively predicts future credit spreads.

Research Question

- Micro and macro uncertainty measures are conceptually different
  - micro uncertainty: dispersion of firm-level outcomes
  - macro uncertainty: volatility of aggregate economic variables
- Stylized facts of micro and macro uncertainty:
  - comove with each other and countercyclical
  - correlate with credit spread

Stylized Facts

- **Micro uncertainty 1**: cross-section dispersion of idiosyncratic component of firm-level returns
- **Micro uncertainty 2**: interquartile range of firms sales growth
- **Micro uncertainty 3**: cross-section std of industry-level TFP
- **Macro uncertainty**: JLN (Jurado-Ludvigson-Ng) / VIX index / $Vol(S\&P500)$

Correlation between uncertainty measures

	JLN	VIX	$Vol(S\&P500)$
$ICSV^{FF}$	0.38**	0.66***	0.72***
$IQR(\Delta Sales)$	0.60***	0.65***	0.32**
$CSV(TFP)$	0.57***	0.39**	0.35**

Correlations with GDP growth rate and credit spread

	ΔGDP	$Baa - Aaa$
JLN	-0.61***	0.79***
VIX	-0.48**	0.63***
$Vol(S\&P500)$	-0.53***	0.60***
$ICSV^{FF}$	-0.34***	0.33**
$IQR(\Delta Sales)$	-0.10	0.43***
$CSV(TFP)$	-0.39**	0.42***

* p < 0.10, ** p < 0.05, *** p < 0.01

The Model Economy

Overview

- A model to quantify the empirics:
  - credit frictions (costly state verification) à la Bernanke et al. (1999)
  - creditor $\overset{loan}{\rightarrow}$ entrepreneur
  - entrepreneurs operate firms and gain cash flows (capital gain)
  - intuitively:
    - volatility of idiosyncratic shocks $\uparrow\rightarrow$ dispersion of cross-section cash flow $\uparrow\rightarrow$ default $\uparrow$ return dispersion $\uparrow$
    - default $\uparrow\rightarrow$ credit frictions more severe $\rightarrow$ shock amplification of friction $\uparrow\rightarrow$ agg. volatility $\uparrow$ macro uncertainty $\uparrow$
    - non-linearity in the policy rule with respect to volatility of idiosyncratic shocks
    - macro uncertainty $\rightarrow$ micro uncertainty: very small
  - early resolution of uncertainty helps quantitatively

Entrepreneurs

- Entrepreneur j borrows from creditors at the end of period t

$$\underbrace{q_t K^j_{t+1}}_{\text{asset}} = \underbrace{B^j_{t+1}}_{\text{loan}} + \underbrace{N^j_t}_{\text{net worth}}$$

- In period $t+1$: produce final goods, sell capital, earn capital gains

$$\underbrace{R^{j,k}_{t+1}}_{\text{capital return}} \cdot q_t K^j_{t+1} = \underbrace{\omega^j_{t+1}}_{\text{idio. shock}} \cdot \underbrace{R^k_{t+1}}_{\text{avg capital return}} \cdot q_t K^j_{t+1}$$

- Capital efficiency shock ω: $K \rightarrow \omega K$, $\log \omega_{t+1} \overset{iid}{\sim} \log N(\frac{-v_t^2}{2}, \underbrace{v_t}_{\text{vol. idiosyncratic shock}})$
- Period $t+1$ net worth $N^j_{t+1} = \omega^j_{t+1} R^k_{t+1} q_t K^j_{t+1} - \underbrace{Z^j_{t+1}}_{\text{loan rate}} B^j_{t+1}$
- Default happens $\omega^j_{t+1} < \bar{\omega}^j_{t+1} = \frac{Z^j_{t+1} B^j_{t+1}}{R^K_{t+1} q_t K^j_{t+1}}$

- Creditor's bond valuation

$$B^j_{t+1} = E_t M_{t,t+1} \left\{ (1-\eta) R^K_{t+1} q_t K^j_{t+1} \underbrace{\int_0^{\bar{\omega}^j_{t+1}}}_{\text{default}} \omega dF_t(\omega) + Z^j_{t+1} B^j_{t+1} \underbrace{[1 - F_t(\bar{\omega}^j_{t+1})]}_{\text{prob. non-default}} \right\}$$

- Liquidation: non-defaulters exit with probability $1-\lambda$
  - upon liquidation: forced to submit net worth to HH
  - replaced by equal mass of new entrepreneurs
- **Entrepreneurs j's problem**

$$\begin{aligned} V(N^j_t) &= \max_{K^j_{t+1}, \bar{\omega}^j_{t+1}} E_t \left[M_{t,t+1} \int_{\bar{\omega}^j_{t+1}}^{\infty} [\underbrace{\lambda V(N^j_{t+1})}_{\text{continuation}} + \underbrace{(1-\lambda) N^j_{t+1}}_{\text{transfers}}] dF_t(\omega) \right] \\ \text{s.t.} \quad q_t K^j_{t+1} &= N^j_t + B^j_{t+1} \\ N^j_{t+1} &= \omega^j_{t+1} R^K_{t+1} q_t K^j_{t+1} - Z^j_{t+1} B^j_{t+1} \end{aligned}$$

$$B^j_{t+1} = E_t M_{t,t+1} \left\{ (1-\eta) R^K_{t+1} q_t K^j_{t+1} \underbrace{\int_0^{\bar{\omega}^j_{t+1}}}_{\text{default}} \omega dF_t(\omega) + Z^j_{t+1} B^j_{t+1} \underbrace{[1 - F_t(\bar{\omega}^j_{t+1})]}_{\text{prob. non-default}} \right\}$$

- Define market equity return $R^E_{t+1} = \frac{N_{t+1}}{N_t} = \frac{\overbrace{(1-\Gamma_t(\bar{\omega}_{t+1}))}^{\text{profit share goes to entrep}} R^K_{t+1} q_t K_{t+1}}{N_t} = (1-\Gamma_t(\bar{\omega}_{t+1})) R^K_{t+1} \overbrace{\phi_t}^{leverage}$

Households

$$\begin{aligned} \max_{C_t, B^f_t, B^j_t, L_t} U_t &= \left\{ (1-\beta) C_t^{1-\frac{1}{\psi}} + \beta (E_t[U_{t+1}^{1-\gamma}])^{\frac{1-\frac{1}{\psi}}{1-\gamma}} \right\}^{\frac{1}{1-\frac{1}{\psi}}} \\ \text{s.t.} \quad C_t + B^f_{t+1} &= R^f_t B^f_t + W_t L_t + \underbrace{\Pi_t}_{\text{transfers from entrep}} \end{aligned}$$

The stochastic discount factor of HH:

$$M_{t,t+1} = \beta \left(\frac{C_{t+1}}{C_t} \right)^{-\frac{1}{\psi}} \left(\frac{U_{t+1}}{E_t[U_{t+1}^{1-\gamma}]^{\frac{1}{1-\gamma}}} \right)^{\frac{1}{\psi} - \gamma}$$

Quantitative Results

	Data	$\gamma = 6, \psi = 0.6$	$\gamma = 1/\psi = 6$
$\sigma(Y^{cyc})$	2.05	2.32	2.31
$\rho(Y^{cyc})$	0.55	0.60	0.60
$corr(Y^{cyc}, C^{cyc})$	0.87	0.93	0.98
$E[R^E - R^f]\%$	6.51	7.74	8.00
$\sigma(R^E - R^f)\%$	16.66	5.69	5.83
$E[R^f]\%$	1.17	1.35	1.06
$\sigma(R^f)\%$	0.89	1.68	2.41
$E[Z - R^f]\%$	0.96	0.64	0.64
$\sigma(Z - R^f)\%$	0.44	0.60	0.55
$corr(\sigma(R^E), ICSV)$	0.48	0.29	0.17
$corr(Y^{cyc}, \sigma(R^E))$	-0.18	-0.23	-0.26
$corr(Y^{cyc}, ICSV)$	-0.12	-0.10	-0.09
$corr(Z - R^f, \sigma(R^E))$	0.51	0.50	0.38

Implications

- **In the model**
  - an increase in the volatility of idiosyncratic shocks drives up the volatility of SDF
- **Both in the model and in the data**
  - micro uncertainty predicts future credit spread
  - default probability predicts future market excess returns
  - idiosyncratic risk comoves with market risk

Data

h	1	2	3	6	12
$ICSV$	0.004	0.007	0.011	0.022	0.032
	(0.002)	(0.003)	(0.005)	(0.009)	(0.014)

Model

h	1	2	3	6	12
$ICSV$	0.007	0.015	0.022	0.041	0.077
	(0.001)	(0.002)	(0.003)	(0.004)	(0.005)

Numbers in parathensis are standard errors

Conclusions

- Credit market frictions make idiosyncratic risks undiversifiable, thus it matters for the aggregates
- Frictions create non-linear reactions of the economy w.r.t. idiosyncratic shocks, thus micro and macro uncertainty comove
- The mechanism also helps to explain the comovement between idiosyncratic and market risk