Corporate Debt Structure and the Financial Crisis

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Motivation and research question

- Crisis 2008-09, EU banks experience difficulties to finance themselves
  - These difficulties soon passed on to Euro area non financial corporations, heavily dependent on bank finance

- This caused the 3 main facts that motivate this paper
  1. Non financial corporations started shifting their debt structure: From bank loans to debt securities
  2. Cost of market debt rose together with the cost of bank loans
  3. Default rate of non financial corporations rise sharply

- Research question: DSGE model that can account for these 3 facts
  1. Model assess the importance of bank flexibility and firm's ability to shift among instruments of external finance
  2. Generates an endogenous debt structure consistent with the data
Model: DSGE where lenders and borrowers face agency costs
- Heterogeneous firms choose among alternative instruments of finance
- 3 choices: Bond finance, bank finance or abstaining from production
- Firms differ regarding their prediction about final productivity

In equilibrium
- Firms experiencing high risk of default choose to abstain from production
- Firms with relative low risk of default choose to issue bonds
- Firms with intermediate risk of default approach banks
Empirical facts

Panel A: Corporate debt and GDP in the euro area

Panel B: Cost of bank finance vs market finance

Corporate debt instruments and their costs during the financial crisis.
Households

- Households, entrepreneurs, capital market funds, banks, and central banks

- Household start period $t$ with **nominal wealth** $W_t$
  - Nominal payoffs on assets acquired on $t-1$
  - Monetary transfer $P_t \theta_t$
  - Cash balances $\tilde{M}_{t-1}$
  - $W_t = B_t + R^{d}_{t-1} D_{t-1} + P_t \theta_t + \tilde{M}_{t-1}$

- Nominal wealth $W_t$ can be distributed among four nominal assets
  1. $M_t$ Cash for transactions
  2. $B_{t+1}$ Nominal state contingent bonds
  3. $D^B_t$ One period deposits at banks
  4. $D^C_t$ One period deposits at capital market funds
Households and entrepreneur

- **Problem of the household**
  \[
  \max_{l_t, k_t, B_{t+1}, D_t, M_t} U = \mathbb{E} \left\{ \sum_0^\infty \beta^t \left[ \log(c_t) - \frac{\eta}{1+\frac{1}{1+\kappa}} h_t^{1+\frac{1}{\kappa}} \right] \right\}
  \]
  \[
  \tilde{M}_t \equiv M_t - P_t [c_t + k_{t+1} - (1 - \delta) k_t] + P_t (w_t h_t + r_t k_t)
  \]
  \[
  M_t + D_t + \mathbb{E}[Q_{t+1} B_{t+1}] \leq W_t
  \]

- Households supply capital/labor, purchase \( c_t \) and new capital

- **Problem of the entrepreneur**
  \[
  \mathbb{E}_0 + \sum_{t=0}^\infty (\beta \gamma)^t e_{it} \quad 0 < \gamma < 1
  \]
  \[
  e_{it} + z_{it+1} = \pi_{it}
  \]

- Entrepreneurs can decide if produce or abstain
Entrepreneurs i

- If entrepreneurs produces, maximizes expected profits
  \[
  \max_{H_{it}, K_{it}} y_{it} = \epsilon_{1, it}\epsilon_{2, it}\epsilon_{3, it} K_{it}^{1-\alpha} H_{it}^{\alpha} - w_t H_{it} - r_t K_{it}
  \]
  \[\text{st } P_t x_{it} = P_t (w_t H_{it} + r_t K_{it})\]

- \(\epsilon_{1, it}, \epsilon_{2, it}, \epsilon_{3, it}\) are random, positive, independent, idiosyncratic.

- Entrepreneurs need external finance to fulfill their total fund \(x_{it}\)
  - Entrepreneurs enter period with net worth \(n_{it} = (1 - \delta + r_t)z_{it}\)
  - \(x_{it} = \text{cash loan} + \text{internal funds}\)
  - \(x_{it} = \xi n_{it}\), so cash loan should be \(\frac{\xi - 1}{\xi} x_{it}\)
  - Cash loan can be obtained from capital market funds or banks
Entrepreneurs ii

- **Banks**
  - Reveals additional information with costly investigation.
  - Flexibility: Entrepreneur can stop loan procedure

- **Capital market funds**
  - No information acquisition, cheaper and riskier than bank
  - Both offer break-even costly state verification contracts covering remaining uncertainty

**Flow of funds**

- Households $\xrightarrow{Deposits} \begin{cases} \text{Banks} \\ \text{CMF} \end{cases} \xrightarrow{\text{Cash loans}} \text{Firms}$

- Firms use $x_{it}$ to pay factor prices and produces
  - Sell final good to households. Repays cash loan with interest

- Financial intermediaries pay deposits back
Entrepreneurs, 3 stages of decision

- Shocks realized sequentially during the period, three stages of decision

**First stage**

- Shock $\epsilon_{1,it}$ is realized and publicly observed.
- Conditional on the realization of the shock $\epsilon_{1,it}$, the entrepreneur can:
  - **A**: Abstain from production
    - Split net worth into consumption and capital for next period
  - **B**: Approach borrow from banks
    - Possibly borrow from a bank in stage 2
  - **C**: Borrow from CMFs (capital market funds)
    - Receives cash loan $P_t x_{it} \frac{\xi - 1}{\xi}$ where $x_{it} = \xi n_{it}$
Entrepreneurs, 3 stages of decision

Second stage

- Shock $\epsilon_{2,it}$ is realized, and not observed by anyone
- If entrepreneur has approached a bank in stage 1
  - Bank investigate the quality of the project, revealing $\epsilon_{2,it}$ as public info
  - Investigation is costly: Net worth shrink $\tilde{n}_{it} = (1 - \tau_t)n_{it}$
- Conditional on the realization of the shock $\epsilon_{2,it}$, the entrepreneur can:
  - **D**: Abstain from production
    - Split net worth into consumption and capital for next period
  - **E**: Borrow from banks
    - Receives cash loan $P_t x_{it} \frac{\xi - 1}{\xi}$ where $x_{it} = \xi \tilde{n}_{it}$
Entrepreneurs, 3 stages of decision

Third stage

- Upon producing, entrepreneur learns about remaining uncertainty
  - $\epsilon_{2,it}$ and $\epsilon_{3,it}$ if firm chose CMF
  - $\epsilon_{3,it}$ if firm chose bank

- Produce and sell the goods to the household

- Repayment of cash loans
  - Costly state verification contract
  - Defaults if and only if they cannot repay, then lender monitors project
Optimal contract $i$

- Maximization problem of firm at the time of loan contracting
  \[ y_{it} = \epsilon_{1,it}\epsilon_{2,it}\epsilon_{3,it}K_{it}^{1-\alpha}H_{it}^{\alpha} - w_{t}H_{it} - r_{t}K_{it} \]
  \[ x_{it} = (w_{t}H_{it} + r_{t}K_{it}) \]
  Solution: \( w_{t}H_{it} = \alpha x_{it} \quad r_{t}K_{it} = (1 - \alpha)x_{it} \)

- Expected output at the time of loan contracting is given by \( y_{it}^e \equiv \epsilon_{it}^e q_{t}x_{t} \)
  \[ q = \left(\frac{\alpha}{w_{t}}\right)^{\alpha}\left(\frac{1-\alpha}{r_{t}}\right)^{1-\alpha} \]
  \( y_{it}^e \equiv \epsilon_{1,it}^e q_{t}x_{t} \) if CMF
  \( y_{it}^e \equiv \epsilon_{1,it}^e \epsilon_{2,it}^e q_{t}x_{t} \) if bank finance

- Actual output is given by \( y_{it} \equiv \omega_{it}y_{it}^e \)
  \( \omega_{it} \equiv \epsilon_{2,it}, \epsilon_{3,it} \) if CMF
  \( \omega_{it} \equiv \epsilon_{3,it} \) if bank finance
Optimal contract ii

- Optimal contract
  - Sets fixed payment of $P_t \omega_{it} e_{it} q_t x_{it}$
  - $\omega_{it}$ indicates which share of output goes for each agent

- If the entrepreneur announces $\omega_{it} \geq \bar{\omega}_{it}$, no monitoring cost occurs

- If $\omega_{it} < \bar{\omega}_{it}$, intermediary monitors the entrepreneur
  - At the cost of destroying $0 \leq \mu \leq 1$ of the firm’s output

- Expected share of final output to each agent
  - Entrepreneur $f(\bar{\omega}, \sigma) = \int_{\bar{\omega}}^{\infty} (\omega - \bar{\omega}) \varphi(\omega; \sigma) d\omega$
  - Lender $g(\bar{\omega}, \sigma, \mu) = \int_{0}^{\bar{\omega}} (1 - \mu) \omega \varphi(\omega; \sigma) d\omega + \bar{\omega}[1 - \Phi(\bar{\omega}; \sigma)]$

- Break even condition $e_{it} q_t g(\bar{\omega}, \sigma, \mu) x_{it} = R_t(\frac{\xi-1}{\xi}) x_{it}$
Threshold $\omega$ different if proceeds with bank finance or cmf finance

\[ \bar{\omega} \equiv \begin{cases} 
\bar{\omega}^c(\epsilon_{1, it}^e, \epsilon_{1, it}^e; q_t R_t, \sigma_{2t}, \sigma_{3t}) & \text{if CMF} \\
\bar{\omega}^b(\epsilon_{1, it}; q_t, R_t, \sigma_{3t}) & \text{if bank finance} 
\end{cases} \]

In any case, the $\bar{\omega}_{it}$ is increasing in $R_t$, and decreasing in $\epsilon_{it}$ and $q_t$

Conditional on $q_t, R_t, \tau_t, \sigma_{2t}, \sigma_{3t}$ entrepreneurs split in three sets that intervals of the first idiosyncratic productivity shock, $\epsilon_{1, it}$

- Under $\epsilon_{bt}$
- Between $\epsilon_{bt}$ and $\epsilon_{ct}$
- Above $\epsilon_{ct}$
Authors seek to account for:
- Observed fall in bank loans relative to debt securities
- Simultaneous rise in the cost of market finance and bank finance
- Sharp increase in the default rate
- Permanent rise in bank information costs $\tau$
  - $\nabla$ creditworthiness of CMF-financed firms $\rightarrow \triangle$ spread on bond
  - Spread on bank finance can increase or fall
Three temporal shocks

- $\triangle$ of $\tau$ by 2.5%, $\triangle$ standard deviation of $\epsilon_2, \epsilon_3$
- 3 key facts matched, but small real effects
- Firm’s ability to shift among alternative debts mitigate real effects

**Counterfactual**: No bonds available and no bank flexibility
Conclusions

- Points to an important role played by the composition of corporate debt in determining the response of the real activity during crisis.

- No access to bond market + No bank flexibility $\rightarrow \triangle$ negative real effects of $\triangle \tau$

- Abstracting from an endogenous corporate debt structure and from the flexibility offered by financial entrepreneurs may mislead analysis.