Discussion of Public Information and Coordination: Evidence from a Credit Registry Expansion

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Plan

• Review of issue and results
• Detour on
  – information sharing in oligopoly
  – publicity multiplier in GSC
• Implications for paper
The issue

• Empirical relevance of coordination incentives in creditor runs or publicity multiplier (effect of news over and above pure information impact)

• Example: Creditors run on Bear Sterns or Northern Rock due to bad news or coordination of lenders (do not rollover short-term debt because of anticipation of others not rolling over)?
  – How to disentangle both effects?
The natural experiment

- Expansion of credit registry in Argentina in 1998
  - Pre-announcement period: banks reported information to the Central Bank under the presumption it would remain private
  - Interim period: banks knew information they reported in the pre-expansion period would become public, but they had not yet received other lenders’ information
  - Post-expansion period: banks make lending and reporting decisions having observed the previous reports of other banks
The results

• Interim period:
  – The registry expansion announcement causes a 20% decline in a firm’s debt with lenders that had rated it a poor risk in the pre-announcement period.
    The effect of making information public is identified by comparing firms affected by the expansion (total lending between $150,000 and $200,000) with comparable firms not affected by it (lending between $200,000 and $250,000).
  – Those same firm’s debt with lenders that assigned them a good rating does not decline until the post-expansion period, when another bank’s bad rating becomes public.
  – Firms with a poor rating in the pre-announcement period experience a 5.6% increase in the default hazard rate during the two-month interim period.

• Post-expansion period:
  – Firms concentrate borrowing from fewer creditors after the registry expansion

• No effect in the subsample of borrowers with a single lender
The argument

- Two banks lend to the same firm.
- The probability that a bank is repaid depends on idiosyncratic loan creditworthiness (LC) and the amount of lending by the other bank.
- LC of bank i is private information (IID).
- Complementarity: Lending by bank i is increasing in the expectation of bank j’s lending.
- Publicity multiplier: The elasticity of lending with respect to loan creditworthiness is larger when information on LC is shared.
  - When information is public, raising LC(i) will increase the lending of bank j and hence makes it optimal for bank i to lend more due to the complementarity.
Binary types: impact of information sharing

• Curvature of the cost function: delta
• Publicity multiplier: The expected change in lending for a bank with a high (low) assessment of creditworthiness is positive (negative).
  – Impact increases with lower delta
• If delta is low (high) then average lending will increase (decrease)
Some related literature

Information sharing in oligopoly
Publicity multiplier in GSC
Information sharing in oligopoly

• Long literature starting with Novshek and Sonnenschein (1982), Vives (1984), ...

• Information exchange improves:
  – Information of firm participating in exchange
  – Information of competitors (good or bad for profits depending on nature of competition and shocks)

• Large range of circumstances where pooling information raises profits

• Publicity multiplier (strategic effect)
  – Price game of SC: a firm disclosing than its demand parameter is high induces rival to raise price
  – Quantity game of SC: a firm disclosing its demand parameter is high induces rival to increase output
Welfare impact (I)

- Output adjustment effect
- Output uniformity effect
  (preference for variety effect with product differentiation)
- Selection effect
  (with firm specific shocks, production towards more efficient firms)
- Reducing asymmetric information on customers (banking and credit)
Welfare impact (II)

• Welfare impact is complex and depends on
  – mode of competition (quantity or price),
  – structure of uncertainty (cost or demand) and information (private or common value)

• Examples:
  – Giving more information to a firm with market power can be used to
    • Adjust output better to demand/costs
    • Use better price to extract surplus from consumers under demand uncertainty
    • Soften price competition under cost uncertainty
Binary action GSC

Vives (2010): Stress, crises and policy

- Continuum of players
  - $y_i = 1$ to act; $y_i = 0$ not to act.
  - To act: attack a currency, run on a bank; run on debt; foreclose loan

- Fraction of people acting: $\tilde{y}$

- State of the world: $\theta$
  - $h(\theta)$: critical fraction so that it pays to act
    - with $h(\cdot)$ strictly increasing with
      \[
      \lim_{\theta \uparrow \theta_L} h(\theta) = 0 \quad \text{and} \quad h(\theta) = 1 \quad \text{at} \quad \theta = \theta_H > \theta_L
      \]
• Differential payoff of acting: \( \pi(y_i = 1, \tilde{y}; \theta) - \pi(y_i = 0, \tilde{y}; \theta) \):

\[
\begin{array}{c|c|c}
\tilde{y} > h(\theta) & \tilde{y} \leq h(\theta) \\
\pi^1 - \pi^0 & B > 0 & -C < 0
\end{array}
\]

with \( \pi^1 - \pi^0 \) increasing in \( \tilde{y} \) and \( -\theta \) or \( \pi(y_i, \tilde{y}; \theta) \) with increasing differences in \( (y_i, (\tilde{y}, -\theta)) \)

• Let \( \gamma \equiv C / (B + C) \) be the critical success probability of the collective action such that it makes an agent indifferent between acting and not acting.

• This is the ratio of the cost of acting to the differential incremental benefit of acting in case of success in relation to failure.
Complete information game

\[ \theta < \theta_L : \text{ Dominant strategy to act} \]

\[ \theta \in (\theta_L, \theta_H) : \text{ Multiple equilibria } \{ \begin{array}{c} \text{all act} \\ \text{no one acts} \end{array} \] 

\[ \theta > \theta_H : \text{ Dominant strategy not to act} \]
Run on interbank market
(Rochet and Vives (2004))

- $\theta$: unit return of risky investment of bank
- Fund manager decides whether to cancel ($y_i = 1$) or renew CD ($y_i = 0$)
- Bank fails if $\tilde{y} \geq h(\theta)$ where $h(\theta) = m + \frac{1-m}{\lambda} (\frac{\theta}{\theta_L} - 1)$ for $\theta \geq \theta_L$ and $h(\theta) < 0$ otherwise, with
  - $m = M / D$: liquidity ratio
  - $\theta_L = (D - M) / I$: solvency threshold
  - $\lambda > 0$: fire sales premium of bank assets
- Fund manager rewarded for taking the right decision
- Cost of canceling: $C$
- Benefit for getting money back or canceling when bank fails: $\hat{B}$. Let $B = \hat{B} - C$
Foreclosing a loan
(Morris and Shin (2004))

- $\theta$: ability of firm to meet short-term claims ($\theta \leq 0$ means no ability)
- Creditor $i$ forecloses if $y_i = 1$
- $h(\theta) = \alpha^{-1}\theta$ where $\alpha > 0$ is mass of creditors (or $\alpha^{-1}$ proportion of uncommitted liquid resources of firm) and project fails if $\tilde{y} \geq \alpha^{-1}\theta$
- Face value of loan: $L$
- Value of collateral (interim liquidation): $K < L$
- Let $B = K$ and $-C = K - L$
• Incomplete information game
• $\theta \sim N(\bar{\theta}, \tau_\theta^{-1})$
• Investor $i$ observes private signal $s_i = \theta + \varepsilon_i$
• with $\varepsilon_i \sim N(0, \tau_\varepsilon^{-1})$, i.i.d
Proposition 1.

- An equilibrium is characterized by two thresholds \((s^*, \theta^*)\) with \(s^*\) yielding the signal threshold below which an investor acts and \(\theta^* \in [\theta_L, \theta_H]\) the state-of-the-world below which the acting mass is successful.
- There are at most three equilibria.
Equilibria and strength of SC
Strength of SC

- Depends on the slope of the best reply $r'$
- The maximal value of $r'$ is increasing in $\tau_\theta$ and in the slope of $h$
- The slope $r'$ will tend to be larger
  - in a more stressful environment (smaller slope of $h$ with larger $\alpha$)
  - with more noise in the signals in relation to the prior ($\tau_\theta / \sqrt{\tau_\varepsilon}$)
Comparative statics: unique equilibrium

- When $h(\theta) = \alpha^{-1}\theta$ (as in the credit foreclosure case) the probability of illiquidity $Pr(\theta_L \leq \theta < \theta^*)$ increases with $\alpha$
- Both $\theta^*$ and $s^*$ (and the probability of crisis) are decreasing in the expected value of state of the world $\theta$. 
Multiplier of public information

- The prior mean $\bar{\theta}$ of $\theta$ can be understood as a public signal of precision $\tau_\theta$.
- Information sharing can be understood as influencing $\bar{\theta}$ and boosting its precision $\tau_\theta$:
  - A worse signal for lender $i$ decreases $\bar{\theta}$ and therefore increases threshold $s^*$.
- An increase in $\bar{\theta}$ will have an effect on the equilibrium threshold $s^*$ over and above the direct impact on the best response of a player $\partial r / \partial \bar{\theta}$:
  $$\left| \frac{ds^*}{d\bar{\theta}} \right| = \left| \frac{\partial r / \partial \bar{\theta}}{1 - r'} \right| > \left| \frac{\partial r}{\partial \bar{\theta}} \right|$$

  whenever the uniqueness condition ($r' < 1$) is met and the game is a GSC ($r' > 0$).
- The multiplier increases with $\alpha$:
  - The impact of bad news about the fundamentals (lower $\bar{\theta}$) will be magnified with stronger SC
Implications

• Publicity multiplier larger when SC stronger (delta lower)
• Robustness of argument
• Welfare impact of information sharing:
  – Tension between better information on credit risks and increased coordination problem
• Crucial question:
  – Was the credit registry expansion welfare improving?
Robustness

• Game is monotone supermodular (Van Zandt-Vives (JET 2007)):
  • payoff has complementarity properties
  • signals are affiliated.

• Extremal equilibria exist and are in monotone strategies in type

• Can handle multiple equilibria and comparative statics
Extra slides
Decomposition of impact on welfare of information sharing in monopolistic competition under demand uncertainty

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<tr>
<th>Price setting</th>
<th>Common value</th>
<th>Private value</th>
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<tr>
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<td>↓ Output adjustment (-)</td>
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<td>↑ Output uniformity (+)</td>
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# Impact of information sharing on welfare

## Demand uncertainty

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<tr>
<td><strong>Price setting</strong></td>
<td><strong>ETS:</strong> ( \begin{cases} \text{ECS: -} \ - \text{poor substitutes} \ + \text{good substitutes} \ (n \text{ large: -}) \end{cases} )</td>
<td><strong>ETS:</strong> ( \begin{cases} \text{ECS: -} \ - \text{Monopolistic Competition} \ + \text{n = 2} \end{cases} )</td>
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<tr>
<td><strong>Quantity setting</strong></td>
<td><strong>ETS:</strong> +</td>
<td><strong>ETS:</strong> ( \begin{cases} \text{ECS: -} \ n \text{ small } (n &lt; 9) \end{cases} )</td>
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## Cost uncertainty

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<td><strong>Quantity setting</strong></td>
<td><strong>same as demand</strong></td>
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Linear case

• $h(\theta; \alpha) = h_0(\alpha) + h_1(\alpha)(\theta - \theta_L)$ for $\theta \geq \theta_L$

  with

  • $h_0(\alpha) \geq 0$, $h_1(\alpha) > 0$,

    $\frac{\partial h_0}{\partial \alpha} \leq 0$ and $\frac{\partial h_1}{\partial \alpha} < 0$,

    and $h(\theta; \alpha) < 0$ for $\theta < \theta_L$.

• A larger $\alpha$ means more vulnerability or a more stressful environment for the institution attacked
Proposition 1.

- An equilibrium is characterized by two thresholds \((s^*, \theta^*)\) with \(s^*\) yielding the signal threshold below which an investor acts and \(\theta^* \in [\theta_L, \theta_H]\) the state-of-the-world below which the acting mass is successful.
- The probability of a crisis conditional on \(s = s^*\) is \(\gamma\).
- There are at most three equilibria.
- There is a critical \(\bar{h}_0 \in (0,1)\) such that \(\theta^* = \theta_L\) for \(h_0 \geq \bar{h}_0\), and for \(h_0 < \bar{h}_0\) we have that \(\theta^* > \theta_L\) and then the equilibrium is unique if and only if \(\tau_\theta / \sqrt{\tau_\varepsilon} \leq h_1 \sqrt{2\pi}\).
Argument

- Game is (symmetric) monotone supermodular (Van Zandt-Vives (2007)):
  - $\pi(y_i, \tilde{y}; \theta)$ has increasing differences in $(y_i, (\tilde{y}, -\theta))$,
  - signals are affiliated.

- Therefore,
  - extremal equilibria exist, are symmetric, and
  - in monotone (decreasing) strategies of the form: $y_i = 1$ if $s_i < \hat{s};$

- Any equilibrium $(s^*, \theta^*)$ fulfils:
  - $\tilde{y}(\theta^*, s^*) = Pr(s \leq s^* | \theta^*) = h(\theta^*)$, and
  - $E(\pi(1, \tilde{y}(\theta); \theta) - \pi(0, \tilde{y}(\theta); \theta) | s = s^*) = 0$ or $Pr(\theta \leq \theta^* | s^*) = \gamma$,
  where $\gamma \equiv C / (B + C) < 1.$

- Show that $\theta^* = \theta_L$ for $h_0 \geq \bar{h}_0$, and for $h_0 < \bar{h}_0$ we have that $\theta^* > \theta_L$ and then $\bar{s} = s$ and the equilibrium is unique if and only if $\tau_\theta / \sqrt{\tau_c} \leq h_1 \sqrt{2\pi}.$
Comparative statics: unique equilibrium

• Both $\theta^*$ and $s^*$ (and the probability of crisis) are decreasing in $\gamma \equiv C / (B + C)$ (less conservative investors) and in the expected value of state of the world $\bar{\theta}$.
Comparative statics (unique equilibrium)

- As $\alpha$ increases fragility increases:
  - the region of multiplicity $\frac{\tau_\theta}{\sqrt{\tau_\varepsilon}} > h_1(\alpha)\sqrt{2\pi}$ grows;
  - the probability of crisis $Pr(\theta \leq \theta^*)$ increases; and
  - the range of fundamentals for which there is coordination failure and illiquidity) $[\theta_L, \theta^*]$ increases.

- Examples:
  - $\alpha$ is mass of attackers/creditors
  - $\alpha^{-1}$ is proportion of uncommitted reserves of CB or of liquid resources of firm
  - $\alpha = D$ is face value of deposit or fire sales penalty $\lambda$
The effect of better information

- If $\gamma < 1/2$ and $\bar{\theta}$ is low then a more precise public signal increases the probability of crisis while a more precise private signal reduces it.
Comparative statics: multiple equilibria

- Critical thresholds $\theta^*$ and $s^*$ decrease with $\bar{\theta}$ at extremal equilibria
  - Extremal equilibria of monotone supermodular games are increasing in the posteriors of the players.
  - A player posterior $E(\theta \mid s) = (\tau_\theta \bar{\theta} + \tau_s s) / (\tau_\theta + \tau_s)$ is increasing in $\bar{\theta}$.
  - It follows then that extremal equilibrium thresholds $(-\theta^*, -s^*)$ increase with $\bar{\theta}$.

- Critical thresholds $\theta^*$ and $s^*$ decrease with stress indicator $\alpha$ at extremal equilibria
Adjustment out-of-equilibrium dynamics: asymmetry