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: θ
  - $h(\theta)$: critical fraction so that it pays to act
    - with $h(\cdot)$ strictly increasing with $\lim_{\theta \uparrow \theta_L} h(\theta) = 0$ and $h(\theta) = 1$ at $\theta = \theta_H > \theta_L$

- Differential payoff of acting: $\pi(y_i = 1, \tilde{y}; \theta) - \pi(y_i = 0, \tilde{y}; \theta)$:

	$\tilde{y} > h(\theta)$	$\tilde{y} \leq h(\theta)$
$\pi^1 - \pi^0$	$B > 0$	$-C < 0$

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

$\theta < \theta_L$: Dominant strategy to act

$\theta \in (\theta_L, \theta_H)$: Multiple equilibria $\{ \begin{matrix} all\ act \\ no\ one\ acts \end{matrix}$

$\theta > \theta_H$: Dominant strategy not to act

Run on interbank market

(Rochet and Vives (2004))

- θ *:* 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))

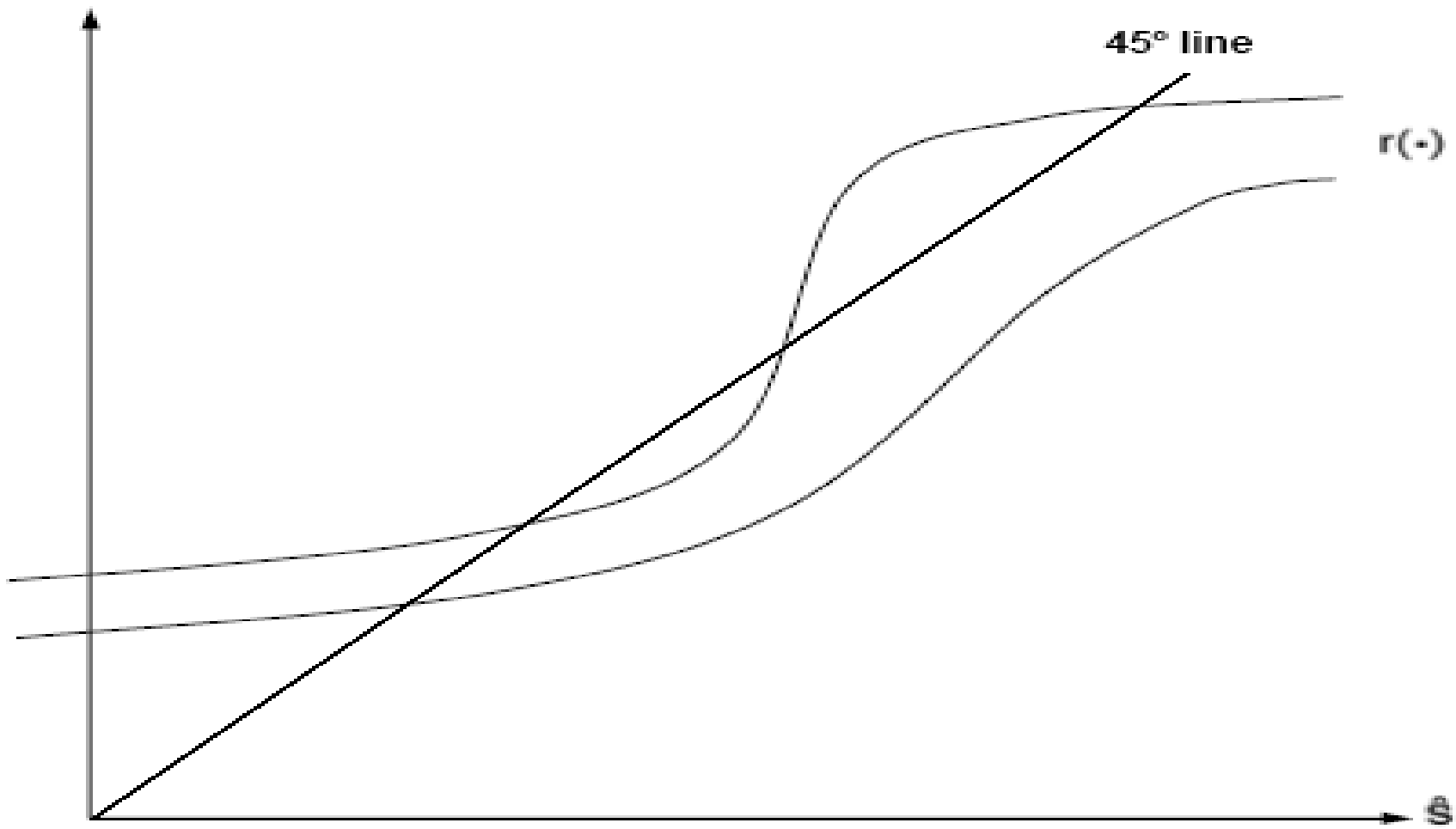
- θ *:* ability of firm to meet short-term claims ($\theta \leq 0$ means no ability)
- Creditor i forecloses if $y_i = 1$
- $h(\theta) = \alpha^{-1}\theta$ where $\alpha > 0$ is mass of creditors (or α^{-1} proportion of uncommitted liquid resources of firm) and project fails if $\tilde{y} \geq \alpha^{-1}\theta$
- 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

<u>Proposition 1</u>.

- An equilibrium is characterized by two thresholds $\left(s^*, \theta^* \right)$ with s^* yielding the signal threshold below which an investor acts and $\theta^* \in \left[\theta_L, \theta_H \right]$ 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 τ_θ 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 α)
  - 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 $Pr\left(\theta_L \leq \theta < \theta^*\right)$ increases with α
- Both θ^* and s^* (and the probability of crisis) are decreasing in the expected value of state of the world $\bar{\theta}$.

Multiplier of public information

- The prior mean $\bar{\theta}$ of θ can be understood as a public signal of precision τ_θ.
- Information sharing can be understood as influencing $\bar{\theta}$ and boosting its precision τ_θ:
  - 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 $\partial r / \partial \bar{\theta}$:

$$\left| \frac{ds^*}{d\bar{\theta}} \right| = \frac{\left| \partial r / \partial \bar{\theta} \right|}{1 - r'} > \left| \frac{\partial r}{\partial \bar{\theta}} \right|$$

  whenever the uniqueness condition ($r' < 1$) is met and the game is a GSC ($r' > 0$).
- The multiplier increases with α:
  - 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

	Common value	Private value
Price setting	↓ Output adjustment (-) ↑ Output uniformity (+) ETS (–)	↓ Output adjustment (-) ↓ Output uniformity (-) ETS (–)
Quantity setting	↑ Output adjustment (+) ↑ Output uniformity (+) ETS (+)	↑ *Output* adjustment (+) ↓ Output uniformity (-) ETS (+)

Impact of information sharing on welfare

Demand uncertainty

	Common value	Private value
Price setting	ECS: - ETS: $\begin{cases} - & poor \quad substitutes \\ + & good \quad substitutes \end{cases}$ (n large: -)	ECS: - ETS: $\begin{cases} - & Monopolistic \quad Competition \\ + & n = 2 \end{cases}$
Quantity setting	ECS: + ETS: +	ECS: $\begin{cases} - & n \quad small \quad (n < 9) \\ ? & otherwise \end{cases}$ ETS: +

Cost uncertainty

Price setting	ECS: ? ETS: +	ECS: $\begin{cases} - & n \quad small \quad (n < 9) \\ ? & n \quad large \end{cases}$ ETS: -
Quantity setting	same as demand	same as demand

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 α means more vulnerability or a more stressful environment for the institution attacked

Proposition 1.

- An equilibrium is characterized by two thresholds $\left(s^*, \theta^*\right)$ 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 γ.
- 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 $\left(s^*, \theta^*\right)$ fulfils:
  - $\tilde{y}(\theta^*, s^*) = Pr\left(s \le s^* \mid \theta^*\right) = h\left(\theta^*\right)$, and
  - $E\left(\pi(1, \tilde{y}(\theta); \theta) - \pi(0, \tilde{y}(\theta); \theta) \mid s = s^*\right) = 0$ or $Pr\left(\theta \le \theta^* \mid s^*\right) = \gamma$,

  where $\gamma \equiv C / (B + C) < 1$.

- Show that $\theta^* = \theta_L$ for $h_0 \ge \overline{h}_0$, and for $h_0 < \overline{h}_0$ we have that $\theta^* > \theta_L$ and then $\overline{s} = \underline{s}$ and the equilibrium is unique if and only if $\tau_\theta / \sqrt{\tau_\varepsilon} \le h_1 \sqrt{2\pi}$.

Comparative statics: unique equilibrium

- Both θ^* 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 $\bar{\theta}$.

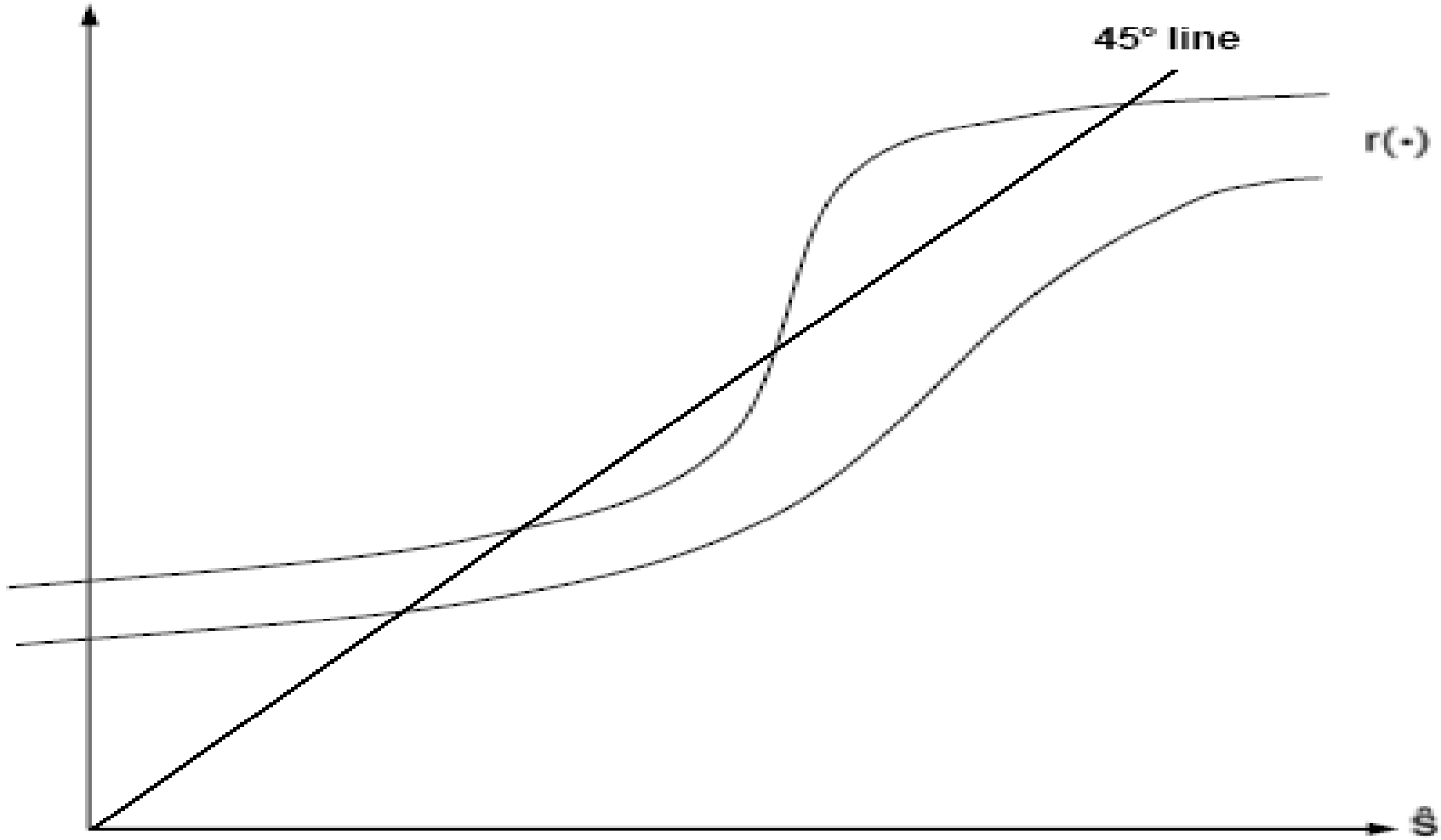
Comparative statics (unique equilibrium)

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

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 θ^* 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 $E(\theta \mid s) = \left(\tau_\theta \bar{\theta} + \tau_\epsilon s\right) / \left(\tau_\theta + \tau_\epsilon\right)$ is increasing in $\bar{\theta}$.
  - It follows then that extremal equilibrium thresholds $\left(-\theta^*, -s^*\right)$ increase with $\bar{\theta}$.
- Critical thresholds θ^* and s^* decrease with stress indicator α at extremal equilibria

Adjustment out-of-equilibrium dynamics: asymmetry