Discussion of
Equilibrium Bank Runs Revisited
by Ed Nosal

Ali Shourideh

NYU, Wharton

November 2011

What is the paper about

- Does maturity mismatch lead to fragility and inefficiency?

What is the paper about

- Does maturity mismatch lead to fragility and inefficiency?
- Can banks designs optimal contracts that prevent runs or do we need FDIC?

What is the paper about

- Does maturity mismatch lead to fragility and inefficiency?
- Can banks designs optimal contracts that prevent runs or do we need FDIC?
  - FDIC has its own issues: Kareken-Wallace

What is the paper about

- Does maturity mismatch lead to fragility and inefficiency?
- Can banks designs optimal contracts that prevent runs or do we need FDIC?
  - FDIC has its own issues: Kareken-Wallace
- Many models: Bank runs do arise
  Diamond-Dybvig, Peck-Shell, Ennis-Keister

What is the paper about

- Does maturity mismatch lead to fragility and inefficiency?
- Can banks designs optimal contracts that prevent runs or do we need FDIC?
  - FDIC has its own issues: Kareken-Wallace
- Many models: Bank runs do arise
  Diamond-Dybvig, Peck-Shell, Ennis-Keister
- This paper: Enriching the contracts offered can prevent bank runs

This Discussion

- Bank Runs: Implementation question.

This Discussion

- Bank Runs: Implementation question.

- We know the allocation that we like (no bank run): How can we implement it?

This Discussion

- Bank Runs: Implementation question.
- We know the allocation that we like (no bank run): How can we implement it?
- There is a lot to be learned from the implementation literature (social choice and Mechanism Design):

This Discussion

- Bank Runs: Implementation question.
- We know the allocation that we like (no bank run): How can we implement it?
- There is a lot to be learned from the implementation literature (social choice and Mechanism Design):
  - What conditions should an allocation rule have so that it can be implemented?
  - What environments allow for implementation?

This Discussion

- Bank Runs: Implementation question.
- We know the allocation that we like (no bank run): How can we implement it?
- There is a lot to be learned from the implementation literature (social choice and Mechanism Design):
  - What conditions should an allocation rule have so that it can be implemented?
  - What environments allow for implementation?
- My discussion:
  - Implementation Thoery
  - What's so special about this environment?
  - I view Ed's paper as closing a gap between two literatures

Implementation Problem

- N agents

Implementation Problem

- N agents
- Possible states of the world: $\theta = (\theta_1, \cdots, \theta_N) \in \Theta$
  - θ_i: patient/impatient; place in line(if known)

Implementation Problem

- N agents
- Possible states of the world: $\theta = (\theta_1, \cdots, \theta_N) \in \Theta$
  - θ_i: patient/impatient; place in line(if known)
- Allocation and preferences: $x = (x_1, \cdots, x_N)$; $u_i(x_i, \theta_i)$
  - Set of outcomes: $x \in X$.
  - $x_i = (c_1^i, c_2^i)$

Implementation Problem

- N agents
- Possible states of the world: $\theta = (\theta_1, \cdots, \theta_N) \in \Theta$
  - θ_i: patient/impatient; place in line(if known)
- Allocation and preferences: $x = (x_1, \cdots, x_N)$; $u_i(x_i, \theta_i)$
  - Set of outcomes: $x \in X$.
  - $x_i = (c_1^i, c_2^i)$
- Social choice function: $x(\theta) = (x_1(\theta), \cdots, x_N(\theta)), x : \Theta \to X$

Implementation Problem

- Mechanism: (M, g):

Implementation Problem

- Mechanism: (M, g):
  - messages: $m = (m_1, \cdots, m_N) \in M$; m_i: message by agent i

Implementation Problem

- Mechanism: (M, g):
  - messages: $m = (m_1, \cdots, m_N) \in M$; m_i: message by agent i
  - outcome function: $g : M \to X$

Implementation Problem

- Mechanism: (M, g):
  - messages: $m = (m_1, \cdots, m_N) \in M$; m_i: message by agent i
  - outcome function: $g : M \to X$
  - Defines a game between agents

Implementation Problem

- Mechanism: (M, g):
  - messages: $m = (m_1, \cdots, m_N) \in M$; m_i: message by agent i
  - outcome function: $g : M \to X$
  - Defines a game between agents
- Example: Revelation game, $M = \Theta, g(\theta) = x(\theta)$.

Implementation Problem

- Mechanism: (M, g):
  - messages: $m = (m_1, \cdots, m_N) \in M$; m_i: message by agent i
  - outcome function: $g : M \to X$
  - Defines a game between agents

- Example: Revelation game, $M = \Theta, g(\theta) = x(\theta)$.

- Strong Implementation:

  The mechanism (M, g) *strongly implements* the social choice function $x(\theta)$ if the Bayesian game defined by (M, g) has a unique Bayesian Perfect Equilibrium m^* such that

$$g(m^*(\theta)) = x(\theta), \forall \theta \in \Theta$$

Implementation Problem

- What properties should the social choice function have so that it can be strongly implemented?

Implementation Problem

- What properties should the social choice function have so that it can be strongly implemented?

- Revelation Principle It should be incentive compatible:

$$E_{\theta_{-i}}\left[u^i(x_i(\theta_i,\theta_{-i}),\theta_i)|\theta_i\right] \geq E_{\theta_{-i}}\left[u^i(x_i(\hat{\theta}_i,\theta_{-i}),\theta_i)|\theta_i\right],\ \forall\theta_i,\hat{\theta}_i$$

Implementation Problem

- What properties should the social choice function have so that it can be strongly implemented?

- Revelation Principle It should be incentive compatible:

$$E_{\theta_{-i}}\left[u^i(x_i(\theta_i,\theta_{-i}),\theta_i)|\theta_i\right] \geq E_{\theta_{-i}}\left[u^i(x_i(\hat{\theta}_i,\theta_{-i}),\theta_i)|\theta_i\right],\ \forall\theta_i,\hat{\theta}_i$$

- Green-Lin: When θ_i's are i.i.d, revelation game has a unique equilibrium

Implementation Problem

- What properties should the social choice function have so that it can be strongly implemented?

- Revelation Principle It should be incentive compatible:

$$E_{\theta_{-i}}\left[u^i(x_i(\theta_i,\theta_{-i}),\theta_i)|\theta_i\right] \geq E_{\theta_{-i}}\left[u^i(x_i(\hat{\theta}_i,\theta_{-i}),\theta_i)|\theta_i\right],\ \forall\theta_i,\hat{\theta}_i$$

- Green-Lin: When θ_i's are i.i.d, revelation game has a unique equilibrium

- This is not enough; There might be other equilibria to the revelation game with correlated types: Ennis-Keister

Implementation Problem

- What properties should the social choice function have so that it can be strongly implemented?

- Revelation Principle It should be incentive compatible:

Implementation Problem

- What properties should the social choice function have so that it can be strongly implemented?
- Revelation Principle It should be incentive compatible:
- Bayesian Monotonicity

Implementation Problem

- What properties should the social choice function have so that it can be strongly implemented?

- Revelation Principle It should be incentive compatible:

- Bayesian Monotonicity
  For any reporting strategy $\sigma(\theta) = (\sigma_1(\theta_1), \cdots, \sigma_N(\theta_N))$, there exists i and a function $y_i : \Theta_{-i} \to X$ such that

$$E_{\theta_{-i}}\left[u^i(x_i(\theta_i, \theta_{-i}), \theta_i)|\theta_i\right] \geq E_{\theta_{-i}}\left[u^i(y_i(\theta_{-i}), \theta_i)|\theta_i\right]$$

  for all θ_i and for some θ_i'

$$E_{\theta_{-i}}\left[u^i(x_i(\sigma(\theta_i, \theta_{-i})), \theta_i')|\theta_i'\right] < E_{\theta_{-i}}\left[u^i(y_i(\theta_{-i}), \theta_i')|\theta_i'\right]$$

Implementation Problem

- What properties should the social choice function have so that it can be strongly implemented?

- Revelation Principle It should be incentive compatible:

- Bayesian Monotonicity
  For any reporting strategy $\sigma(\theta) = (\sigma_1(\theta_1), \cdots, \sigma_N(\theta_N))$, there exists i and a function $y_i : \Theta_{-i} \to X$ such that

$$E_{\theta_{-i}}\left[u^i(x_i(\theta_i, \theta_{-i}), \theta_i)|\theta_i\right] \geq E_{\theta_{-i}}\left[u^i(y_i(\theta_{-i}), \theta_i)|\theta_i\right]$$

  for all θ_i and for some θ_i'

$$E_{\theta_{-i}}\left[u^i(x_i(\sigma(\theta_i, \theta_{-i})), \theta_i')|\theta_i'\right] < E_{\theta_{-i}}\left[u^i(y_i(\theta_{-i}), \theta_i')|\theta_i'\right]$$

- For any lying strategy by others $-i$, the designer can offer y to player i and he would prefer y to the original allocation at some state of the world.

Implementation Problem

Theorem (Jackson, 1991)

When $N \geq 3$, a social choice function $x(\theta)$ is strongly implementable if and only if it satisfies Bayesian Monotonicity and Incentive Compatibility (and some other technical condition).

- Unfortunately Jackson uses non-existence methods to implement.
- Alternatively, Repullo and Moore (Bassetto and Phelan), subgame perfect implementation.
- Conjecture: Bayesian monotonicity is satisfied by the efficient outcome.(Of course Ed proves this!)

This Paper

- This paper:
  - message space: Patient, Impatient, Flag

This Paper

- This paper:
  - message space: Patient, Impatient, Flag
  - Design outcome function so that:
    - $u^i(\text{Flag}, \text{High Prob of Lying by Others}) > u^i(\text{Lie}, \text{High Prob of Lying by Others})$

This Paper

- This paper:
  - message space: Patient, Impatient, Flag
  - Design outcome function so that:
    - $u^i(\text{Flag}, \text{High Prob of Lying by Others}) > u^i(\text{Lie}, \text{High Prob of Lying by Others})$
    - $u^i(\text{Lie}, \text{High prob of Flag by Others}) > u^i(\text{Flag}, \text{High prob of Flag by Others})$

This Paper

- This paper:
  - message space: Patient, Impatient, Flag
  - Design outcome function so that:
    - $u^i(\text{Flag}, \text{High Prob of Lying by Others}) > u^i(\text{Lie}, \text{High Prob of Lying by Others})$
    - $u^i(\text{Lie}, \text{High prob of Flag by Others}) > u^i(\text{Flag}, \text{High prob of Flag by Others})$
    - Truth-telling is unique equilibrium.

This Paper

- How does it work?

This Paper

- How does it work?

- If i Flags and no one says patient:

$$c_2(m^{k-1}, \text{Flag}) = c_1^{TRG}(m^{k-1}, Impatient)(1+\epsilon)$$

This Paper

- How does it work?

- If i Flags and no one says patient:

$$c_2(m^{k-1}, \text{Flag}) = c_1^{TRG}(m^{k-1}, Impatient)(1+\epsilon)$$

- If i says Impatient, $i = N$, and no one says patient:

$$c_1(m^{k-1}, Impatient) = c_1^{TRG}(m^{k-1}, Impatient) + \Delta$$

Δ: the amount planner doesn't carry over to next period (when some people Flag); when ϵ small, Δ large

This Paper

- How does it work?

- If i Flags and no one says patient:

$$c_2(m^{k-1}, \text{Flag}) = c_1^{TRG}(m^{k-1}, Impatient)(1+\epsilon)$$

- If i says Impatient, $i = N$, and no one says patient:

$$c_1(m^{k-1}, Impatient) = c_1^{TRG}(m^{k-1}, Impatient) + \Delta$$

  Δ: the amount planner doesn't carry over to next period (when some people Flag); when ϵ small, Δ large

- If everybody says Impatient, Flag is Best Response.

This Paper

- How does it work?

- If i Flags and no one says patient:

$$c_2(m^{k-1}, \text{Flag}) = c_1^{TRG}(m^{k-1}, Impatient)(1+\epsilon)$$

- If i says Impatient, $i = N$, and no one says patient:

$$c_1(m^{k-1}, Impatient) = c_1^{TRG}(m^{k-1}, Impatient) + \Delta$$

  Δ: the amount planner doesn't carry over to next period (when some people Flag); when ϵ small, Δ large

- If everybody says Impatient, Flag is Best Response.

- If everybody Flags, saying Impatient is Best Response.

Question

- It would be good if we could see a real world implementation too:
  - A sequence of interest rates and suspension rules
  - The i-th person in line is offered a menu of (withdrawal quantity, interest rate) up to a suspension limit

Some Thoughts

- Bank Runs $\equiv$ Impossibility Theorem

Some Thoughts

- Bank Runs $\equiv$ Impossibility Theorem
  There is no mechanism that uniquely implements the efficient allocation.

Some Thoughts

- Bank Runs $\equiv$ Impossibility Theorem
  There is no mechanism that uniquely implements the efficient allocation.

- What can cause Bank Runs?

Some Thoughts

- Bank Runs $\equiv$ Impossibility Theorem
  There is no mechanism that uniquely implements the efficient allocation.

- What can cause Bank Runs?

- Can we get rid of complexity?
  - Non-exclusivity or hidden trade?

Some Thoughts

- Bank Runs ≡ Impossibility Theorem
  There is no mechanism that uniquely implements the efficient allocation.

- What can cause Bank Runs?

- Can we get rid of complexity?
  - Non-exclusivity or hidden trade?

  - The mechanism designer and agents have a lot of information. What if not?

Some Thoughts

- Bank Runs ≡ Impossibility Theorem
  There is no mechanism that uniquely implements the efficient allocation.

- What can cause Bank Runs?

- Can we get rid of complexity?
  - Non-exclusivity or hidden trade?
  - The mechanism designer and agents have a lot of information. What if not?
  - Commitment?

Some Thoughts

- Bank Runs ≡ Impossibility Theorem
  There is no mechanism that uniquely implements the efficient allocation.

- What can cause Bank Runs?

- Can we get rid of complexity?
  - Non-exclusivity or hidden trade?
  - The mechanism designer and agents have a lot of information. What if not?
  - Commitment?
- Overall, very nice paper, I enjoyed it a lot.