Opacity: Insurance and Fragility

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  - Widespread calls for **transparency** in the banking system (e.g. Dodd-Frank Act, Regulation AB II)

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    - ⋆ when the backing asset is difficult to assess,
    - ⋆ the value of bank liabilities do not vary over some period of time

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    by Gorton (2013 NBER), Holmström (2015 BIS), Dang et al. (2017 AER)
- Debates on **transparency** vs. **opacity**

This paper

- **Q. Should the banking system be transparent or opaque?**
  - many dimensions to consider
- This paper addresses the question
  - from the view of **financial stability**
  - *opacity* ⇒ how long asset qualities are unknown
  - prime example: Asset Backed Commercial Paper conduits
- **Show:** uncertainty created by opacity:
  - provides insurance against risky assets (Hirshleifer, 1971 AER)
  - raises incentive to run on the bank
- **Describe:** when the degree of opacity should be regulated

What drives a run?

- There are some works on this topic
  - focus: more information may trigger a bank run
  - show: transparency worsens financial stability
    (Bouvard et al. (2015 JF), Faria-e Castro et al. (2017 ReStud)...etc)

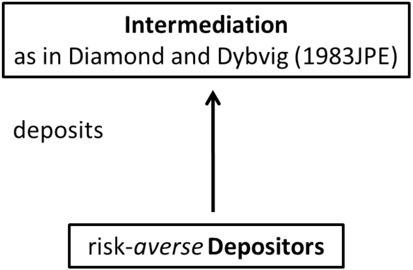
- **My contribution:**
  - focus: opacity **itself** makes depositors more likely to panic
  - show: **opacity** worsens financial stability
  - study trade-off between enhanced risk-sharing and higher fragility
  - explain when opacity should be regulated

▸ Literature Review

The mechanism

Depositors deposit their endowment

Intermediaries make investment
- risky and long-term projects



The mechanism

Depositors deposit their endowment

Intermediaries make investment
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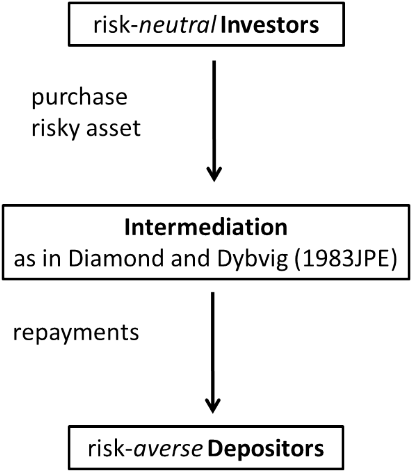
Depositors may withdraw
before projects mature

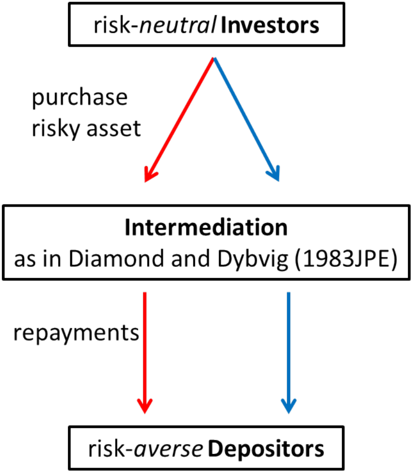
Projects can be sold before maturity
- to investors
- by being securitized
(e.g. Asset Backed Securities)



The mechanism

Once asset qualities are known...

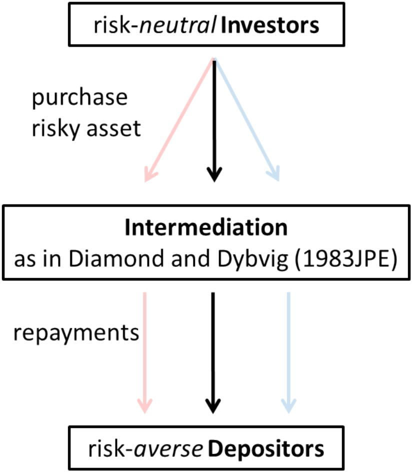
- Price will depend on realized qualities
- Depositors face risk



The mechanism

While asset qualities are unknown...

- ***Price depends on expected qualities***
- ***Investors face risk***



The mechanism

While asset qualities are unknown...

- ***Price depends on expected qualities***
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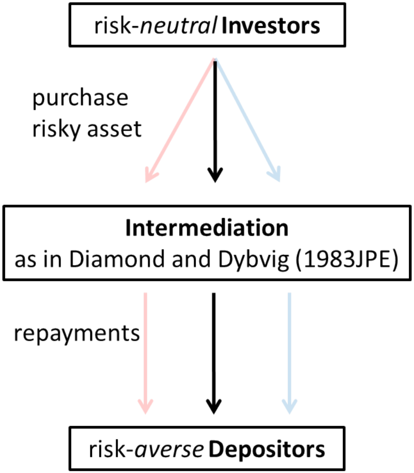
Opacity transfers risk:

- ***Insurance for depositors***

... but only in the short-term:

- ***Influences withdrawal decisions***



Overview

1. **Model: the Environment**
2. Equilibria
3. Optimal opacity
4. Unobservable choice of opacity

Depositors

My model is based on Diamond and Dybvig (1983 JPE)

- $t = \{0, 1, 2\}$
- Continuum of mass 1 **depositors**
  - endowed 1 unit of goods in $t = 0$ and consume in $t = 1, 2$
  - liquidity shock: π depositors need to consume in $t = 1$ (*impatience*)

Technology and Market

Augmented to have Allen and Gale (1998 JF) technology and market

- A risky *project*
  - 1 invested in $t = 0$ yields $\left\{ \begin{array}{c} R_b \\ R_g \end{array} \right\}$ with prob $\left\{ \begin{array}{c} n_g \\ n_b \end{array} \right\}$ in $t = 2$
  - indexed by $j \in \{b, g\}$, where $n_g + n_b = 1$
  - realized in period 1

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  - realized in period 1
- *A competitive asset market*
  - A large number of risk-neutral **investors**
    - large endowment in period 1
    - discount consumption in period 2 by $\rho < 1$
  - given expected return $\mathbb{E}R$, investors drive asset price to $p = \rho\mathbb{E}R$

Intermediation

- **Bank**: collects deposits in $t = 0$
  - allows depositors to choose when to withdraw
  - $t = 1$: payments made sequentially on first-come-first-serve basis
  - the order of withdrawals is random and unknown
  - $t = 2$: remaining payments made by dividing matured projects evenly
  - operated to maximize expected utility of depositors

Sequential service

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Sequential service

- *Opacity* of asset $\theta \in [0, \pi]$
  - asset return revealed after θ withdrawals have been made
    - before θ; nobody knows R_j
    - after θ; everybody know R_j
  - ='time required to investigate R_j'

Runs and Sunspot

- *Runs* occur when patient depositors withdraw in $t = 1$
- Withdrawals may be conditioned on *sunspot* $s \in S = [0, 1]$
  - allows for the possibility that a bank run may occur in equilibrium (Cooper and Ross, 1998 JME, Peck and Shell, 2003 JPE)
  - bank does not observe $s \Rightarrow$ is initially uncertain if a run is underway in period 1

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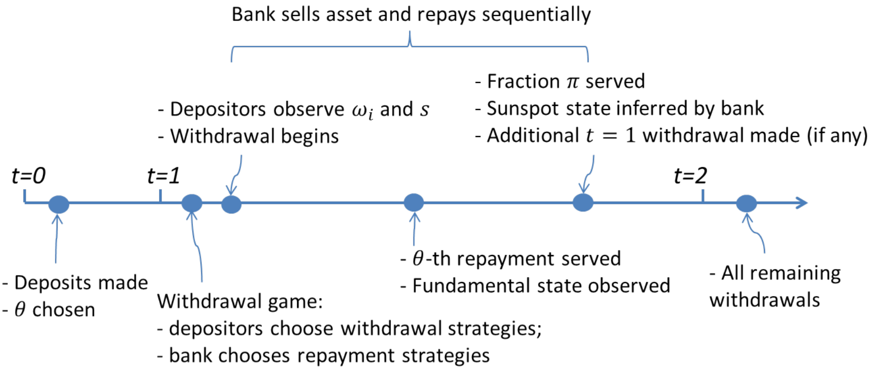
  - bank does not observe $s \Rightarrow$ is initially uncertain if a run is underway in period 1
- At π withdrawals, the bank reacts
  - at this point, the run stops (Ennis and Keister, 2009 AER).
    - ⋆ bank's reaction restores confidence in the bank
  - *No commitment:*
    - ⋆ Diamond-Dybvig: commitment prevents a self-fulfilling run
    - ⋆ Here: prohibited to use this time-inconsistent policy
    - ⋆ bank allocates remaining consumption efficiently

Timeline


Bank sells asset and repays sequentially
- Depositors observe ω_i and s
- Withdrawal begins
- Fraction π served
- Sunspot state inferred by bank
- Additional $t = 1$ withdrawal made (if any)
t=0
t=1
t=2
- Deposits made
- θ chosen
Withdrawal game:
- depositors choose withdrawal strategies;
- bank chooses repayment strategies
- θ-th repayment served
- Fundamental state observed
- All remaining withdrawals

Withdrawal game

- Given θ, the bank and depositors play a simultaneous-move game:
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$$\hat{y}_i(\omega_i, s; q) = \begin{Bmatrix} \omega_i \\ 0 \end{Bmatrix} \text{ if } s \begin{Bmatrix} \geq \\ < \end{Bmatrix} q \text{ for some } q \in [0,1], \forall i.$$

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- **Repayment** depends on $\hat{y}_i$ and her position in the line
  - before θ, funded by selling assets at a pooling price $p_u = \mathbb{E}p_j$
  - after θ in period 1, funded by selling assets at p_j
  - in period 2, funded by realized return of matured assets R_j

Overview

1. Model: the Environment
2. **Equilibria**
3. Optimal opacity
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Equilibrium bank runs

- Is there an equilibrium in which depositors follow this cutoff strategy?
  - answer depends on q
- When a run is more likely ($q \uparrow$):
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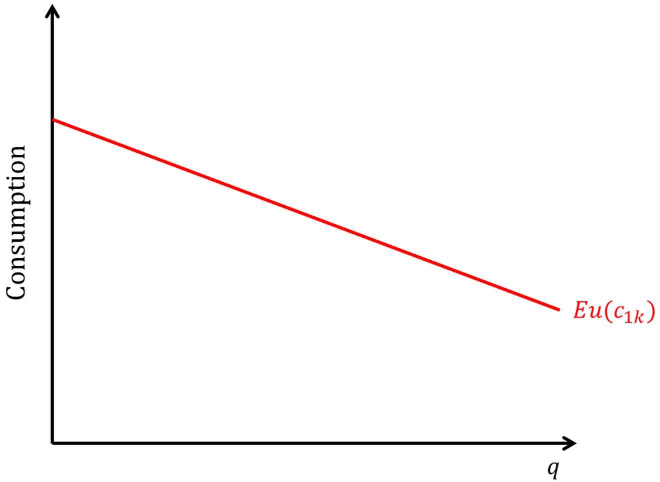
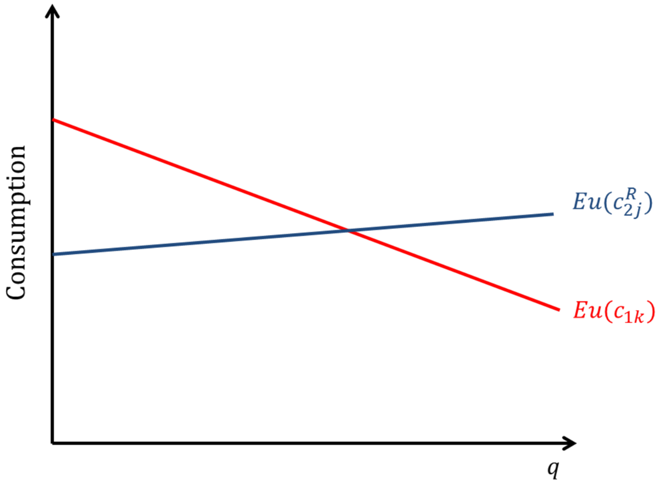
Q. How does the level of opacity (θ) affect financial fragility ($\bar{q}$)?

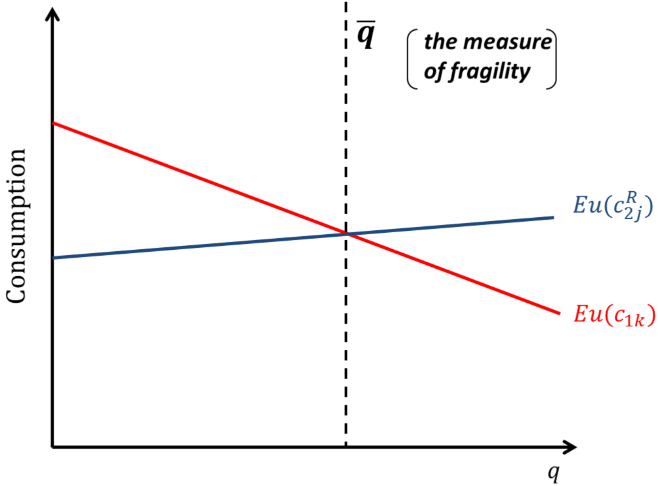
$\Rightarrow$ need to compare expected payoffs of patient depositors.



Result: expected payoffs in period 1 are monotonically decreasing in q



Result: expected payoffs in period 2 are monotonically increasing in q



Result: $\mathbb{E}u(c_{2j}^R) \leq \mathbb{E}u(c_{1k})$ when $q \leq \bar{q}$

$\Rightarrow$ the cutoff strategy profile is a part of equilibrium

Impact of opacity

- Recall: expected payoffs depend on θ

  Q. How does **an increase in** θ affect equilibria?

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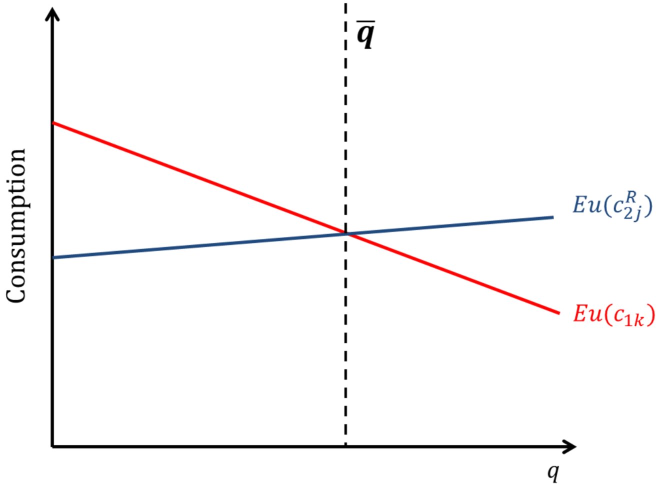
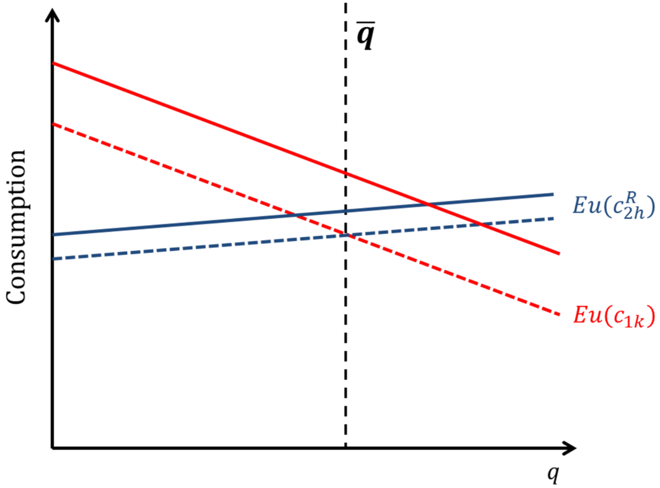


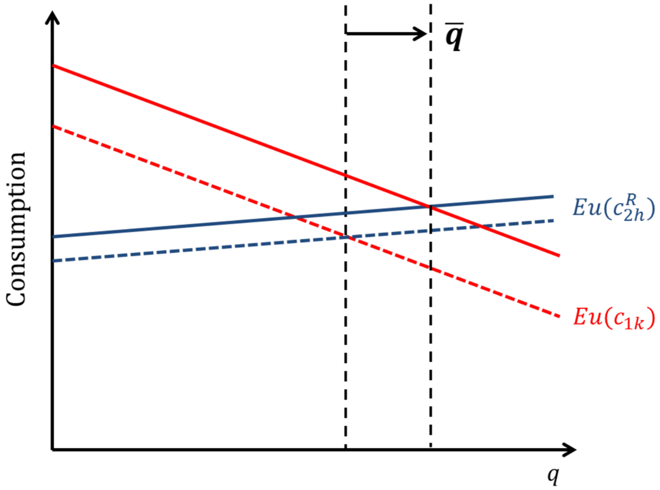
An increase in θ

- raises chance of receiving insurance in $t = 1$: $\mathbb{E}u(c_{1k}) \uparrow\uparrow$
- has indirect effects through (c_{1k}, c_{2j}^R): $\mathbb{E}u(c_{2j}^R) \uparrow$



Proposition

- $\bar{q}$ is increasing in θ
  $\Rightarrow$ **Opacity increases fragility**



Opacity increases fragility

- This result is novel in the literature
  - Literature: information causes bank runs
  - Here: no information causes self-fulfilling bank runs
- Opacity
  - provides insurance by transferring risks
  - increases financial fragility

$\Rightarrow$ **Q.** What is the optimal degree of opacity?

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Skip

Pessimistic views

- Recall $U(c^*, y^*; \theta)$ depends on θ.
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  - Intuition: minimizing losses in the worst case over $q \in \mathcal{Q}(\theta)$.
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  - the worst case $\Rightarrow$ $\bar{q}(\theta)$ ($\because$ $U(c^*, \hat{y}(q); \theta)$ is decreasing in q)
- Anticipating the worst equilibrium outcomes, the bank solves

$$max_{\theta \in [0,\pi]} \; U(c^*, \hat{y}(\bar{q}(\theta)); \theta)$$

  - trade-off: Hirshleifer effect versus Fragility effect

Optimal opacity

Result: For some parameter values, $\theta^* < \pi$.

Numerical example

Optimal opacity

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Optimal opacity

Result: For some parameter values, $\theta^* < \pi$. ▸ Numerical example

The optimal opacity becomes smaller when:

- the discount rate of investors ρ increases.
- assets are riskier
  - R_g increases; R_b decreases.
  - the fundamental state is more uncertain (when n is closer to $\frac{1}{2}$).

Overview

1. Model: the Environment
2. Equilibria
3. Determining optimal opacity
4. **Unobservable choice of opacity**
   - I have assumed that θ is observable.
     $\Rightarrow$ **Q.** How does the bank behave if θ is not observable?

Skip

Unobservable choice of opacity

- **In the previous analysis:**
  depositors could directly observe their bank's choice of θ
- **Now:** Suppose instead this information is difficult to observe
  - Intuition: depositors may find it difficult to know which of assets takes a longer time to investigate
- In the model,
  - depositors can still make inferences and understand bank's incentives
  - expectations will be correct in equilbrium
  - ... but bank cannot credibly reveal its choice

Regulating opacity

- **Result:** The bank's dominant strategy is the highest possible opacity.
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- Welfare comparison
  - the bank may become more opaque $\theta^{**} = \pi \geq \theta^*$
    $\Rightarrow$ equilibrium outcomes may be worse for depositors
- *Regulating opacity*
  - imposing an observable upper bound on θ so that $\theta \in [0, \theta^*]$
  - the conditional dominant strategy of bank is now θ^*
  - the outcome is the same as when θ is observable
  - Example: limiting asset classes of investment

Conclusion

- I have presented a model of financial intermediation where:
  - opacity determines time required to investigate asset quality
  - repayment and withdrawal behavior are chosen given the opacity
  - bank chooses the opacity anticipating equilibrium outcomes
- I show that opacity increases fragility
- In choosing opacity, a bank faces trade-off between:
  - providing insurance by keeping asset return unknown
  - increasing fragility by raising incentives to run

    $\Rightarrow$ optimal level of opacity is often interior
- Bank becomes maximally opaque if its choice is unobservable
  - In this case, regulating opacity may improve welfare

Thank you

Literature

- Effect of opacity on risk-sharing
  Hirshleifer (1971AER), Kaplan (2006ET), Dang et al. (2017AER)
- Effect of opacity on financial stability
  - positive effects: Parlatorre (2015WP), Chen and Hasan (2006JFI, 2008JMCB), Faria-e Castro et al. (2016ReStud)
  - mixed effects: Bouvard et al. (2015JF), Ahnert and Nelson (2016WP)
- Effect of opacity on bank's risk-taking
  Hyytinen and Takalo (2002RoF), Moreno and Takalo (2016JMCB), Jungherr (2016WP)

Back

Literature

- Bank anticipates the possibility of runs
  Peck and Shell (2003 JPE), Cooper and Ross (1998 JME)
- Bank trades assets in financial markets
  Jacklin (1987), Allen and Gale (1998 JF), Allen and Gale (2000 JPE)
- Bank is prohibited from using time-inconsistent policy (i.e. suspension)
  Ennis and Keister (2009 AER), Ennis and Keister (2010 JME)

Back

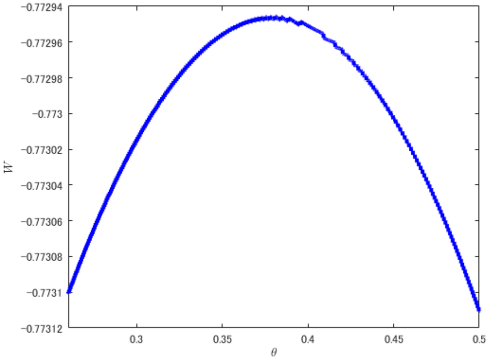
Sequential services

- Agents are isolated from each others
- Repayments are made immediately as each agent arrive
- Order of withdrawal opportunities is random
- Depositors do not know their position in the order (Peck and Shell, 2003 JPE)
- Each agent can contact the bank either in period 1 or period 2

Back

Optimal opacity

Numerical example:



given $(\gamma, \pi, n, R_g, R_b, \rho) = (2, 0.5, 0.5, 2, 1, 0.9)$.

▸ Back

Modified banking problem

Given $\hat{y}(q)$, the bank chooses $(\theta, c_1, \{c_{1j}, c_{1j}^N, c_{2j}^N, c_{2j}^R\}_{j=b,g})$ to maximize

$$\max_{[\theta, c_1, \{c_{1j}, c_{1j}^N, c_{2j}^N, c_{2j}^R\}_{j=b,g}]} \theta u(c_1) + \Sigma_j n_j \Big[(\pi - \theta) u(c_{1j}) + (1-q)(1-\pi) u(c_{2j}^N) + q(1-\pi)[\pi u(c_{1j}^R) + (1-\pi) u(c_{2j}^R)] \Big]$$

subject to

$$\begin{aligned} (1-\pi)\frac{c_{2j}^N}{R_j} &= 1 - \theta\frac{c_1}{p_u} - (\pi - \theta)\frac{c_{1j}}{p_j}, \\ \pi(1-\pi)\frac{c_{1j}^R}{p_j} + (1-\pi)^2\frac{c_{2j}^R}{R_j} &= 1 - \theta\frac{c_1}{p_u} - (\pi - \theta)\frac{c_{1j}}{p_j}, \forall j. \end{aligned}$$

Back