Opacity: Insurance and Fragility

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Transparency

- A cause of recent financial and economic crisis

  "Financial firms sometimes found it quite difficult to fully assess their own net derivatives exposures.... The associated uncertainties helped fuel losses of confidence that contributed importantly to the liquidity problems" (Ben Bernanke, testimony, 2010)

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- Widespread calls for **transparency** in the banking system

  "To promote the financial stability of the United States by improving accountability and transparency in the financial system" (Dodd-Frank Act)

  - requirements for ABS issues to provide more information about the underlying asset pool (Regulation AB II)

Opacity

- **Counterargument:**
  - the banking system has been historically and purposefully opaque
  - this opacity enables banks to issue *information insensitive* liabilities:
    - ★ when the backing asset is difficult to assess,
    - ★ the value of bank liabilities do not vary over some period of time

  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* $\Rightarrow$ difficulty of assessing asset qualities
  - 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)

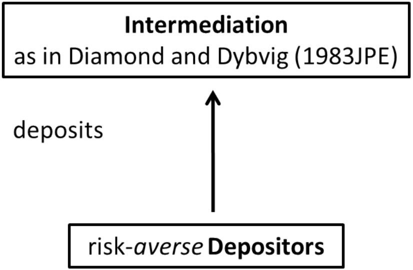
- **My contribution:**
  - focus: opacity **itself** makes depositors more likely to panic
  - show: **opacity** worsens financial stability
  - study trade-off between enhanced risk-sharing and higher fragility
  - explain when opacity should be regulated

▸ Literature Review

The mechanism

Depositors deposit their endowment

Intermediaries make investment
- risky and long-term projects



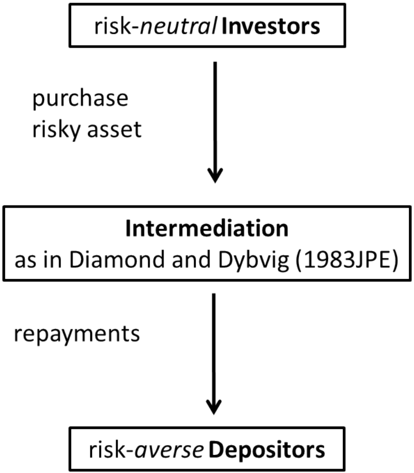
The mechanism

Depositors deposit their endowment

Intermediaries make investment
- risky and long-term projects

Depositors may withdraw
before projects mature

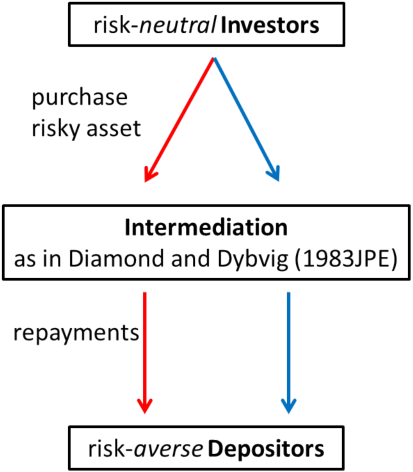
Projects can be sold before maturity
- to investors
- by being securitized
(e.g. Asset Backed Securities)



The mechanism

Once asset qualities are known...

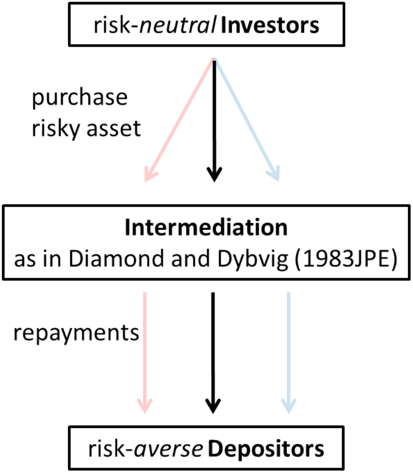
- Price will depend on realized qualities
- Depositors face risk



The mechanism

While asset qualities are <u>unknown</u>...

- ***Price depends on <u>expected</u> qualities***
- ***<u>Investors</u> face risk***



The mechanism

While asset qualities are <u>unknown</u>...

- ***Price depends on <u>expected</u> qualities***
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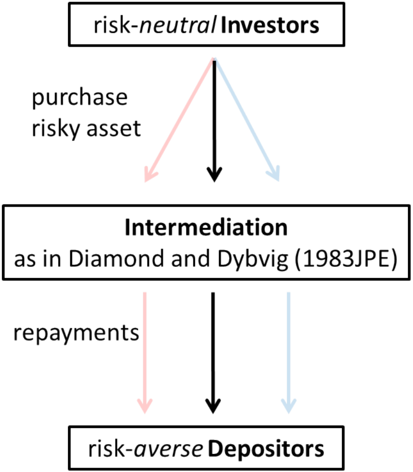
Opacity transfers risk:

- ***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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- *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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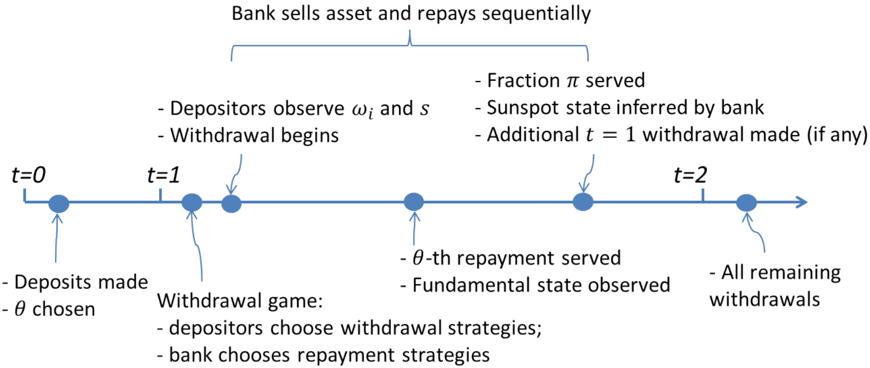
- At π withdrawals, the bank reacts
  - at this point, the run stops (Ennis and Keister, 2009 AER).
    - bank's reaction restores confidence in the bank
  - *No commitment:*
    - Diamond-Dybvig: commitment prevents a self-fulfilling run
    - Here: prohibited to use this time-inconsistent policy
    - 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:
  - depositor i maximizes her expected utility
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- **My interest:** the following *cutoff strategy profile* of depositors

$$\hat{y}_i(\omega_i, s; q) = \begin{Bmatrix} \omega_i \\ 0 \end{Bmatrix} \text{ if } s \begin{Bmatrix} \geq \\ < \end{Bmatrix} q \text{ for some } q \in [0,1], \forall i.$$

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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

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1. Model: the Environment
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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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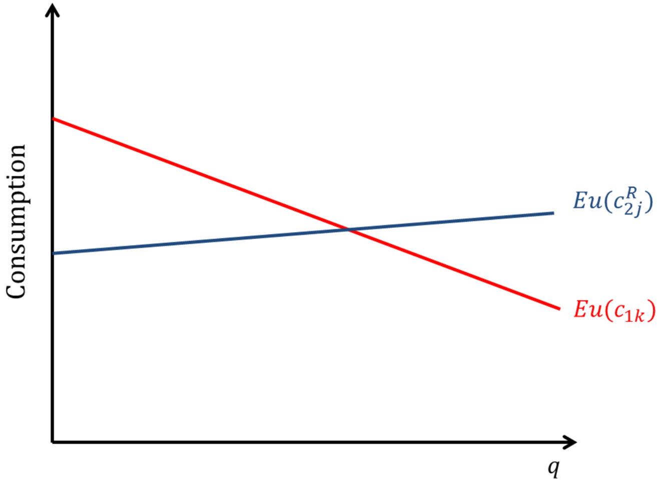
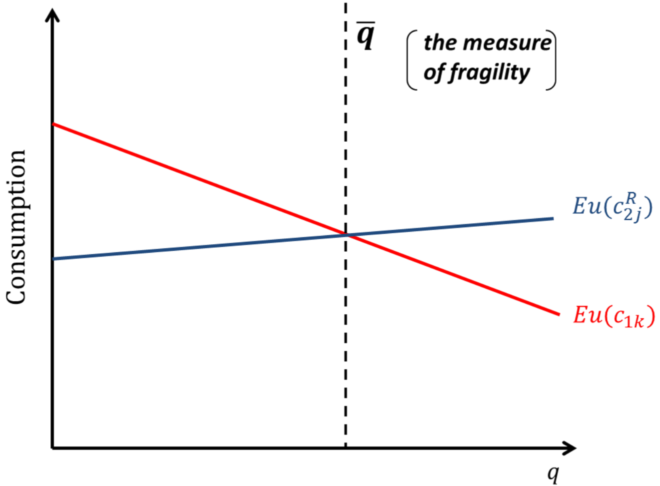
Q. How does the level of opacity (θ) affect financial fragility ($\bar{q}$)?

$\Rightarrow$ 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?

Impact of opacity

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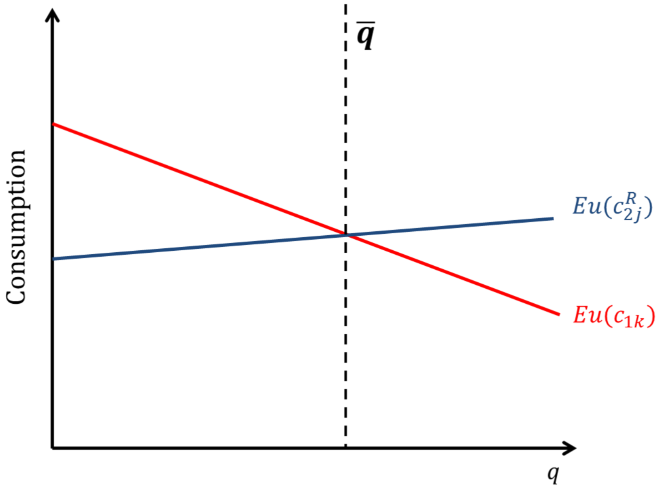
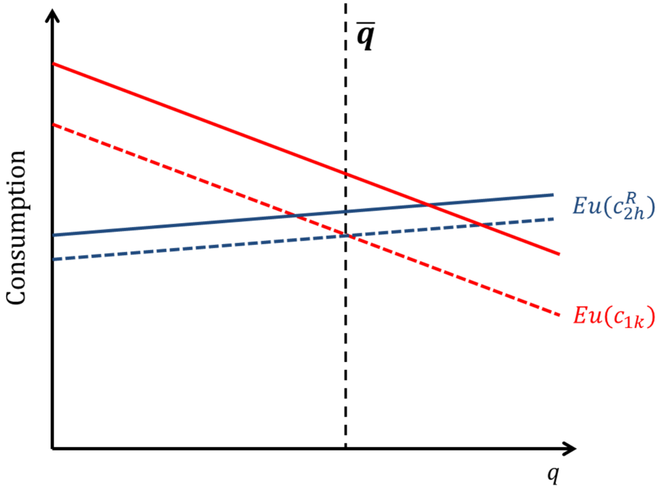
  Q. How does **an increase in** θ affect equilibria?



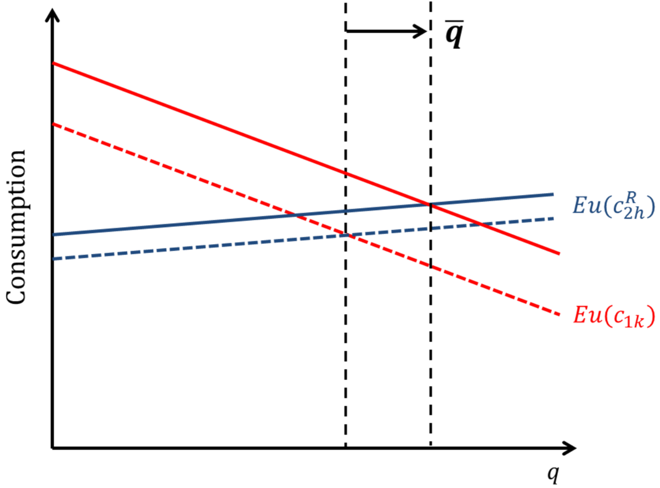
An increase in θ

- 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?

Overview

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Skip

Pessimistic views

- Recall $U(c^*, y^*; \theta)$ depends on θ.
  - multiple equilibria associated with each choice of θ

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$$max_\theta min_{q \in \mathcal{Q}(\theta)} \; U(c^*, \hat{y}(q); \theta)$$

  - Intuition: minimizing losses in the worst case over $q \in \mathcal{Q}(\theta)$.
  - the worst case $\Rightarrow$ $\bar{q}(\theta)$ ($\because$ $U(c^*, \hat{y}(q); \theta)$ is decreasing in q)

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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

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Optimal opacity

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The optimal opacity becomes larger when:

- the discount rate of investors ρ increases.
- assets are riskier
  - the gap of returns between fundamental states (R_g/R_b) increases,
  - 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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    $\Rightarrow$ equilibrium outcomes may be worse for depositors

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  - a larger opacity can still provide insurance to more depositors
  - depositors cannot observe the level of opacity
- 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

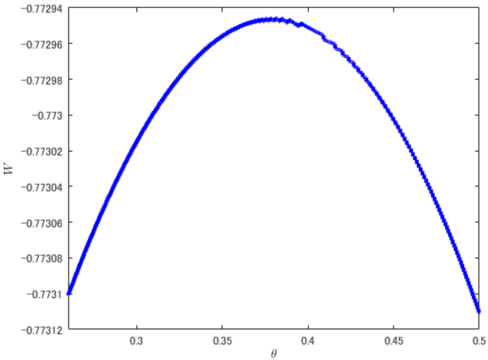
Sequential services

- 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

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