Competition, Commitment, and Optimal Information Disclosure

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Motivation

- Incumbent firm acquires information about costumers observing past behaviors/outcomes
  - E.g. insurance (health, car, ...), credit, employment
- Informational monopoly ex-post
  - Incumbent has informational advantage relative to competitors
- Questions:
  - Should incumbent be forced to share information?
  - How to design optimal disclosure?
  - Application: Open-banking

This Paper

- Two period insurance economy
  - High and low income types
  - Long-term relationship between consumer and incumbent firm
- Incumbent acquires more info about consumer's persistent type than competitors
- Two cases:
  - One-sided commitment: Incumbent can commit to long-term contracts but consumer lacks commitment
  - Two-sided lack of commitment: Incumbent and consumer cannot commit to long-term contract

Main results

- One-sided commitment
  - Optimal disclosure policy is no-info
  - Reduce high type's outside option, maximize cross-subsidization
- Two-sided lack of commitment
  - For any info disclosure, no cross-subsidization possible
  - May be optimal to disclosure some info for intertemporal consumption smoothing between the first period and the high state in the second period
    - Ex-ante competition implies that second period profits are rebated in first period
- Full information disclosure is never optimal
  - But may want to provide some information

Plan for the talk

- Simple insurance economy
- One-sided commitment
- Two-sided lack of commitment
- Taste shocks and switchers (in progress)

SIMPLE INSURANCE ECONOMY

Environment

- $t = 1, 2$
- Two types of agents
  - Consumer
  - Two firms
- Consumer
  - Risk-averse with period utility $u(c)$ and discounting β
  - Income in period 1 and 2 can take on two values: $y_t \in \{y_L, y_H\}$
    - $y_1 \sim \pi_1(y_1)$ and $y_2 \sim \pi_2(y_2|y_1)$
    - Define
$$Y_{2H} \equiv \sum_{y_2} \pi_2(y_2|y_H)\, y_2 > Y_{2L} \equiv \sum_{y_2} \pi_2(y_2|y_L)\, y_2.$$
    - Assume
$$Y \equiv \sum_{y_1} \pi_1(y_1)\, y_1 = \sum_{s} \pi_1(y_s)\, Y_{2s}$$
- Firms are risk-neutral and discounting β

Information and market structure

At the beginning of $t = 1$:

- All agents share the same information
- Firms offer long-term contracts
- Consumer enters contract with one firm (*incumbent*)

At the end of $t = 1$:

- y_1 is realized and observed by consumer and incumbent
- Consumption takes place
- *Outsider* does not observe $y_1 \Rightarrow$ incumbent has info advantage
- *Public disclosure policy* (M, μ)

$$\mu : \{y_L, y_H\} \to \Delta(M)$$

Information and market structure, cont.

At the beginning of $t = 2$:

- Outsider offers menu of contracts conditional on $m \in M$
- Consumers choose whether to stay or switch
- y_2 is realized and consumption takes place

An allocation is a contract offered by the incumbent

$$c = \{c_1(y_1), c_2(y_1, m, y_2)\}$$

and a menu contracts offered by the outsider, $\{c^o(m, y_2)\}$

Benchmark: Commitment both sides

$$\max_{c} \sum_{y_1} \pi_1(y_1) \left[u(c_1(y_1)) + \sum_{m} \mu(m|y_1) \sum_{y_2} \pi_2(y_2|y_1) \beta u(c_2(y_1, m, y_2)) \right]$$

subject to

$$\sum_{y_1} \pi_1(y_1) \left[y_1 - c_1(y_1) + \beta \sum_{m} \mu(m|y_1) \sum_{y_2} \pi_2(y_2|y_1)(y_2 - c_2(y_1, m, y_2)) \right] \geqslant 0$$

- Optimum has

$$c(y_1) = c(y_1, m, y_2) = Y$$

ONE-SIDED COMMITMENT

Commitment on firm only

$$\max_{c} \sum_{y_1} \pi_1(y_1) \left[u(c_1(y_1)) + \sum_{m} \mu(m|y_1) \sum_{y_2} \pi_2(y_2|y_1) \beta u(c_2(y_1, m, y_2)) \right]$$

subject to

$$\sum_{y_1} \pi_1(y_1) \left[y_1 - c_1(y_1) + \beta \sum_{m} \mu(m|y_1) \sum_{y_2} \pi_2(y_2|y_1)(y_2 - c_2(y_1, m, y_2)) \right] \geqslant 0$$

and the PC

$$\sum_{y_2} \pi_2(y_2|y_H) u(c_2(y_H, m, y_2)) \geqslant V^o(m; c)$$

where $V^o(m; c)$ is outside option for consumer with history (y_H, m)

Outside option

$V^o(m;c)$ is maximal value outsider can offer to consumer (y_H, m) given insider's continuation contract c

$$V^o(m;c) = \max\left\{V^{lcs}(V_L(c)), V^{both}(s(m), V_L(c))\right\}$$

- V^{lcs}: Value of separating contract
- V^{both}: Value of "pooling" contract

where

- $V_L(c) = \sum_{y_2} \pi_2(y_2|y_L)\, u(c_2(y_L, m, y_2))$
- $s(m)$ be the share of consumers with $y_1 = y_H$ and signal m:

$$s(m) = \frac{\mu(m|y_H)\,\pi_1(y_H)}{\sum_{y_1}\mu(m|y_1)\,\pi_1(y_1)}$$

Outsider's separating contract

$$V^{lcs}(V_L) = \max_{c(y_2)} \sum_{y_2} \pi_2(y_2|y_H)\, u(c(y_2))$$

subject to

$$\sum_{y_2} \pi_2(y_2|y_H)(y_2 - c(y_2)) \geqslant 0$$

$$V_L \geqslant \sum_{y_2} \pi_2(y_2|y_L)\, u(c(y_2))$$

Outsider's "pooling" contract

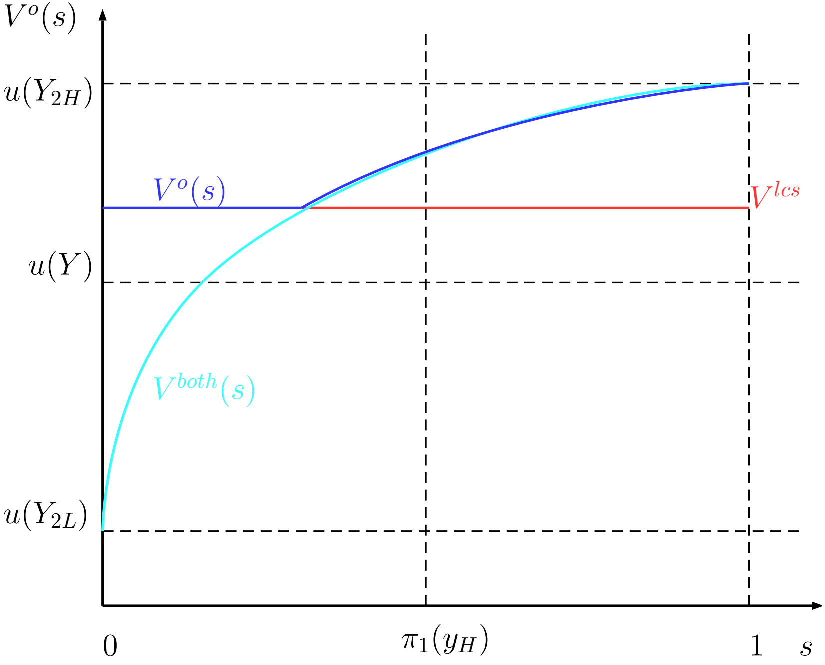
$$V^{both}(s, V_L) = \max_{c_H(y_2), c_L(y_2)} \sum_{y_2} \pi_2(y_2|y_H)\, u(c_H(y_2))$$

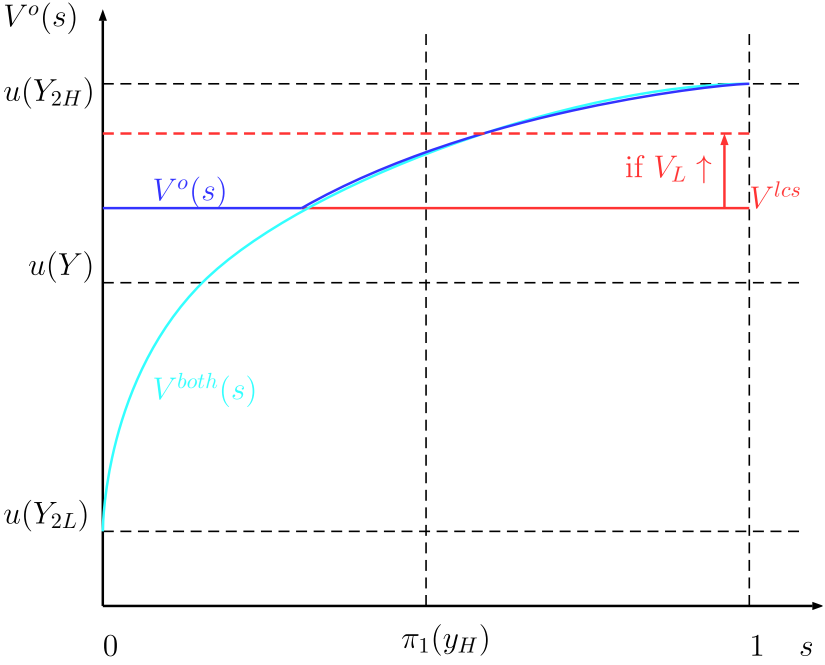
subject to

$$s \sum_{y_2} \pi_2(y_2|y_H)(y_2 - c_H(y_2)) + (1-s)\left[\sum_{y_2} \pi_2(y_2|y_L)(y_2 - c_L(y_2))\right] \geqslant 0$$

$$\sum_{y_2} \pi_2(y_2|y_L)\, u(c_L(y_2)) \geqslant \sum_{y_2} \pi_2(y_2|y_L)\, u(c(y_2))$$

$$\sum_{y_2} \pi_2(y_2|y_L)\, u(c_L(y_2)) \geqslant V_L$$


$V^o(s)$
$u(Y_{2H})$
$V^o(s)$
V^{lcs}
$u(Y)$
$V^{both}(s)$
$u(Y_{2L})$
0
$\pi_1(y_H)$
1
s


$V^o(s)$
$u(Y_{2H})$
if $V_L \uparrow$
$V^o(s)$
V^{lcs}
$u(Y)$
$V^{both}(s)$
$u(Y_{2L})$
0
$\pi_1(y_H)$
1
s

Back to the problem

- $c_1(y_L) = c_1(y_H) = c_1$
- $c_2(y_1, m, y_L) = c_2(y_1, m, y_H) = c_2(y_1, m)$ for all (y_1, m)

$$\max_{c_1, c_2(y_1, m)} u(c_1) + \sum_{y_1} \pi_2(y_1|y_2) \sum_m \mu(m|y_1) \beta u(c_2(y_1, m))$$

subject to

$$(1+q) Y - c_1 - q \sum_{y_1} \pi_1(y_1) \sum_m \mu(m|y_1) c_2(y_1, m) \geqslant 0$$

$$u(c_2(y_H, m)) \geqslant V^o(m; c)$$

What is the best disclosure policy (M, μ)?

Optimal disclosure policy reveals no information

Suppose $u(Y) \geqslant V^{lcs}(u(Y))$

- Then the PC is slack
  - if provide no info and $V_L = u(Y)$ then $V^{both}(\pi_1(y_H), u(Y)) = u(Y)$
- Thus, no disclosure is optimal

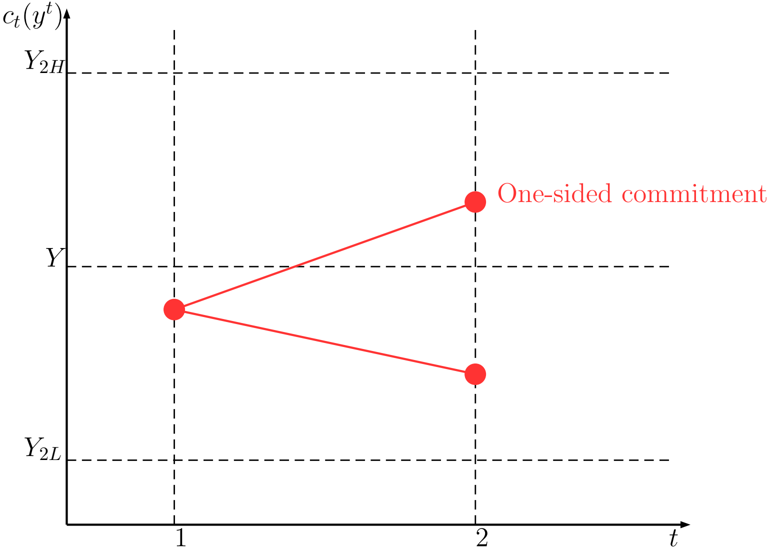
Suppose $u(Y) < V^{lcs}(u(Y))$

- With no info PC is binding
- Can do better by disclosing some information? No.
  - If some information is revealed then PC tightens
  - For any V_L,

$$V^o(m; V_L) = \max\left\{V^{both}(s(m), V_L), V^{lcs}(V_L)\right\} \geqslant V^{lcs}(V_L)$$

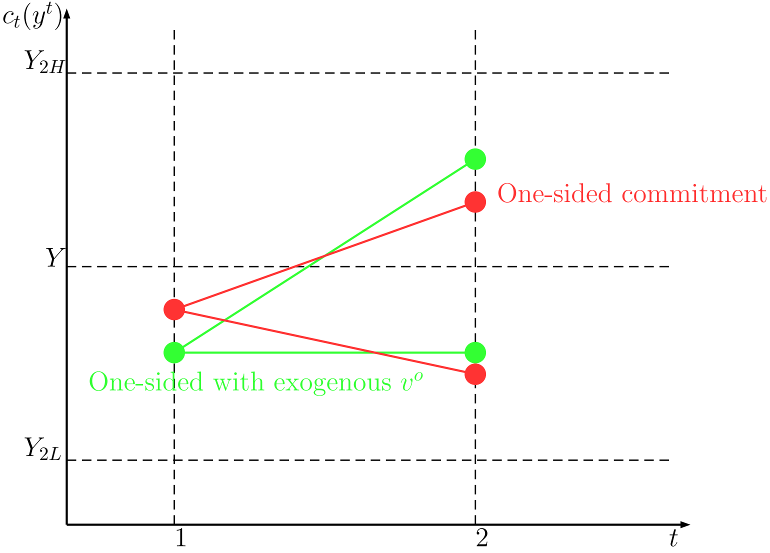
- Thus, no disclosure is optimal

Consumption profile



$c_2(y_L) < c_1 < c_2(y_H)$ because $\partial V^{lcs}(V_L)/\partial V_L > 0$ then distort $c_2(y_L)$ downward to relax PC

Consumption profile



$c_2(y_L) < c_1 < c_2(y_H)$ because $\partial V^{lcs}(V_L)/\partial V_L > 0$ then distort $c_2(y_L)$ downward to relax PC

TWO-SIDED LACK OF COMMITMENT

No commitment

- Assume incumbent cannot commit to contract
- Show cannot cross-subsidize the low type in period 2
  - For all public disclosure policy

$$c_2(y_L, m, y_2) = Y_{2L}$$

- It may be optimal to disclose some information to smooth consumption between period 1 and period 2 after a good realization in period 1

Next: Characterize the outcome by backward induction.

Outcome in period 2

Timing:

- Incumbent offers contract $c_2 = c_2(y_1, m, y_2)$
- Outsider offers a menu $c_2^o(y_1, m, y_2)$
  - Cannot directly be contingent on y_1 but must be IC
- Always fringe of firms offering $c^o(y_2) = Y_{2L}$
  - Or Netzer-Scheuer (2014)

Outcome in period 2

Lemma For any signal m:

- Consumers fully insured against income fluctuations in period 2
- No cross-subsidization

$$c_2(y_L, m, y_2) = Y_{2L}$$

- Consumption of high income agents is

$$c_2(y_H, m, y_2) = C\left(V^o\left(s(m), u(Y_{2L})\right)\right)$$

where $C = u^{-1}$

Logic

Spse $V_L = u(Y_{2L}) \Rightarrow c_2(y_H, m, y_2) = C(V^o(s(m), u(Y_{2L})))$

- Incumbent's positive profits $C(V^o(s(m), u(Y_{2L}))) \leqslant Y_{2H}$
  - With equality only if the signal is fully revealing
  - Can offer value V^o with full insurance while outsider cannot
- Offer value $V^o(s(m), u(Y_{2L}))$ to retain high type

Show that $V_L = u(Y_{2L})$ is optimal

- Offering less not feasible
- May want to offer more to reduce $V^o(s(m), V_L)$ but
  - $V^{lcs}(V_L)$ is increasing
  - If $V^{both}(s(m), V_L) > V^{lcs}(V_L)$ then V^{both} constant in V_L
- So offer $V_L = u(Y_{2L})$

Outcome in period 1

$$\max_{c_1} \sum_{y_1} \pi_1(y_1) \left[u(c_1(y_1)) + \beta \sum_{m} \mu(m|y_1) V_2(y_1, m) \right]$$

subject to

$$\sum_{y_1} \pi_1(y_1) \left[y_1 - c_1(y_1) + \beta \sum_{m} \mu(m|y_1) \sum_{y_2} \pi_2(y_2|y_1) (y_2 - C(V_2(y_s, m))) \right] \geqslant 0$$

Outcome in period 1

- $c_1(y_L) = c_1(y_H) = c_1$
- $V_2(y_L, m) = u(Y_{2L})$
- $V_2(y_H, m) = V^o(s(m))$

$$\max_{c_1} u(c_1) + \beta\pi_1(y_H) \sum_m \mu(m|y_H) V^o(s(m)) + \beta\pi_1(y_L) u(Y_{2L})$$

subject to

$$Y + \beta\pi_1(y_H) Y_{2H} \geqslant c_1 + \beta\pi_1(y_H) \sum_m \mu(m|y_H) C(V_2(y_H, m))$$

Equilibrium outcome

Given a disclosure policy (μ, M), the equilibrium outcome has

$$c_1(y_1) = Y + \beta\pi_1(y_H)\sum_m \mu(m|y_H)\,\Pi(m)$$
$$c_2(y_L, m, y_2) = Y_{2L}$$
$$c_2(y_H, m, y_2) = Y_{2H} - \Pi(m)$$

where $\Pi(m) = Y_{2H} - C(V^o(s(m))) \geqslant 0$

- Disclosure policy can affect c_1 and $c_2(y_H, m)$

Optimal disclosure policy

$$\max_{c_1,(\mu,M),s(m)} u(c_1) + \beta\pi_1(y_H)\sum_{m\in M}\mu(m|y_H)V^o(s(m))$$
$$+\beta\pi_1(y_L)u(Y_{2L})$$

subject to

$$c_1 = Y + \beta\pi_1(y_H)\sum_m \mu(m|y_H)\Pi(m)$$

and the share of y_H type with signal m is

$$s(m) = \frac{\pi_1(y_H)\mu(m|y_H)}{\pi_1(y_H)\mu(m|y_H) + (1-\pi_1(y_H))\mu(m|y_L)}$$

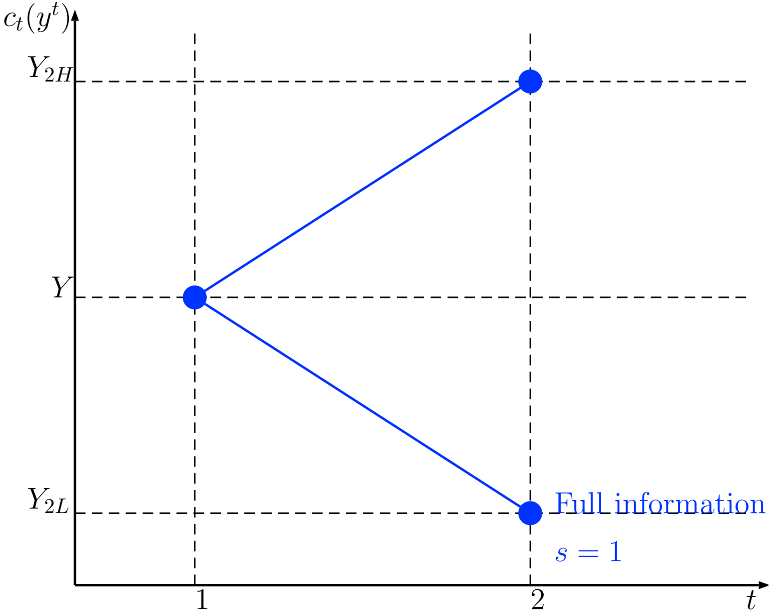
Optimal disclosure policy

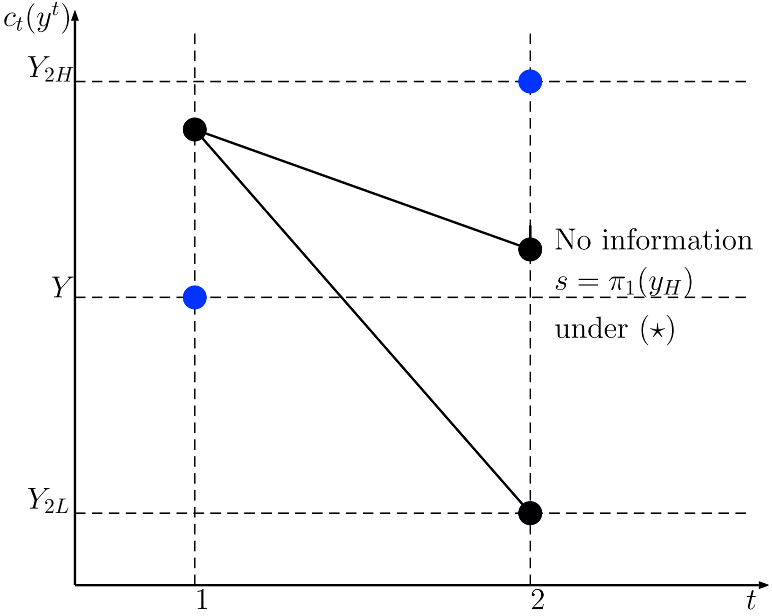
$$(\star) \quad C\left(V^{o}\left(\pi_1\left(y_H\right)\right)\right) \leqslant Y + \beta\pi_1\left(y_H\right)\left(Y_{2H} - C\left(V^{o}\left(\pi_1\left(y_H\right)\right)\right)\right)$$

Proposition

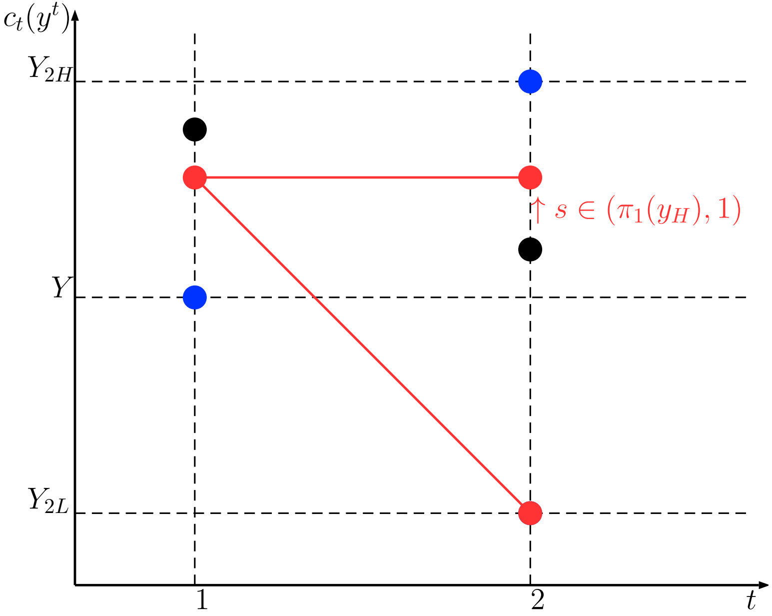
- If $(\star)$ holds, then the optimal disclosure policy has a bad-signal structure i.e. $M = \{g, b\}$ (good or bad) and $\mu\left(g|y_H\right) = 1$ and $\mu\left(g|y_L\right) \in (0, 1)$ to attain $c_1 = c_2\left(y_H\right)$

- If $(\star)$ does not hold, then it is optimal to provide no information and $c_1 < c_2\left(y_2\right)$

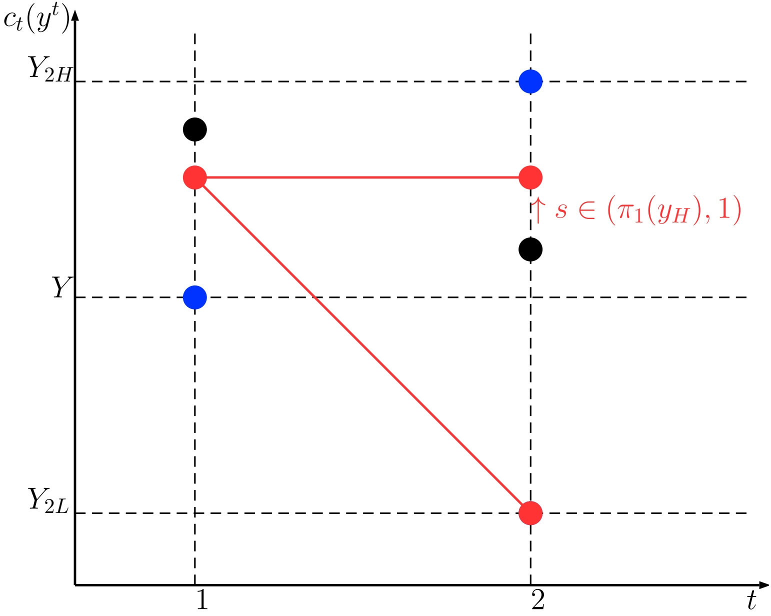

$c_t(y^t)$
Y_{2H}
Y
Y_{2L}
Full information
$s = 1$
1
2
t



If $(\star)$ holds $\Rightarrow$ consumption is front-loaded under no-info



Provide some information to have $c_1 = c_2(y_H)$



“Inverse” of Harris-Holmstrom result

Optimal disclosure policy

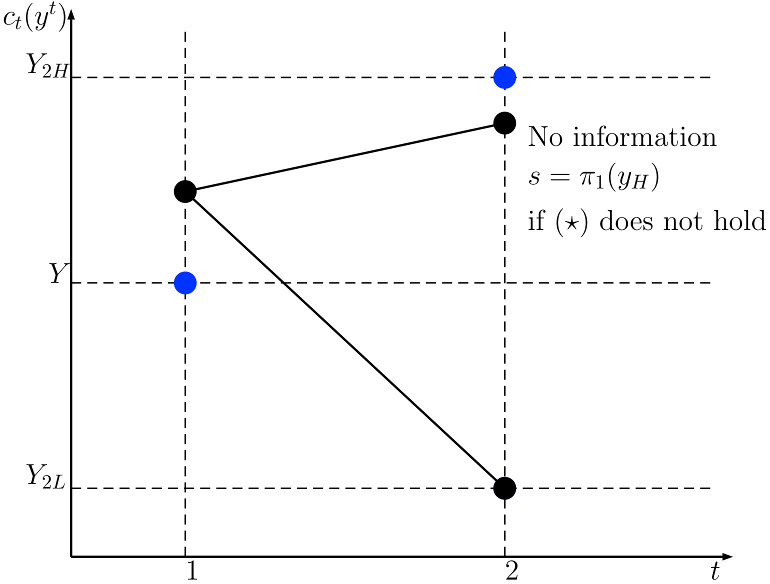
$$(\star) \quad C\left(V^{o}\left(\pi_1\left(y_H\right)\right)\right) \leqslant Y + \beta\pi_1\left(y_H\right)\left(Y_{2H} - C\left(V^{o}\left(\pi_1\left(y_H\right)\right)\right)\right)$$

- If $(\star)$ holds, then under no-information disclosure $c_2\left(y_H\right) < c_1$
- Disclosure policy designed to perfectly smooth consumption

$$c_1 = c_2\left(y_H\right) = \frac{Y + \beta\pi_1\left(y_H\right) Y_{2H}}{1 + gb\pi_1\left(y_H\right)} > Y$$

- Two signals: $M = \{g, b\}$ (good or bad)
    - All high income consumers receive a good signal together with a fraction of low income individuals.
- $\mu\left(g|y_L\right) \in (0, 1)$ solves

$$V^{o}\left(\frac{\pi_1\left(y_H\right)}{\pi_1\left(y_H\right) + \pi_1\left(y_L\right)\mu\left(g|y_L\right)}\right) = u\left(c_1\right)$$



If $(\star)$ does not hold $\Rightarrow \mathsf{c}_1 < \mathsf{c}_2(\mathsf{y}_\mathrm{H})$ under no-info

Optimal disclosure policy

$$(\star) \quad C\left(V^{o}\left(\pi_{1}\left(y_{H}\right)\right)\right) \leqslant Y + q\pi_{1}\left(y_{H}\right)\left(Y_{2H} - C\left(V^{o}\left(\pi_{1}\left(y_{H}\right)\right)\right)\right)$$

- If $(\star)$ does not hold, then under no-information disclosure $c_2\left(y_H\right) > c_1$
- Would like to increase consumption in period 1 by reducing profits in period 2
- Providing no-info is best can be done
  - Show $K\left(s\right) = C \circ V^{o}\left(s\right)$ is convex
  - Assigning different signals to y_H consumers to reduce expected value does not increase profits to be rebated in period 1

Regulation and commitment

Is regulation needed?

- No
- Incumbent in period 1 with a commitment technology for reporting information will choose optimal disclosure policy

Is commitment technology needed?

- Yes, if condition ($\star$) holds and optimal to provide some info
- Incumbent's optimal report in period 2 is no-info
  - No-info maximizes ex-post profits

Unobserved effort

- Spse income is result of innate characteristics and effort
  - E.g. employment relation with investment in human capital
- Spse effort is private information
- Then info disclosure affects the amount of effort that can be sustained by affecting the spread in continuation value
- Optimal disclosure w/ effort is more informative than w/out

TASTE SHOCKS AND SWITCHERS (IN PROGRESS)

Taste shock and switchers

- So far, equilibrium has no firm transitions in $t = 2$
  - Except perhaps low types who are indifferent
- Add transitions motivated by idiosyncratic preferences
- Weakens adverse selection
  - Switches less informative about the agents' types
- Do want to disclose less info to get cross-subsidization?

Modified environment

- In $t = 2$, fraction $(1 - \alpha)$ of consumers receives a shock that induces them to leave incumbent firm
- Shock is consumer's private information
- Fraction of high type consumers with signal m who leave

$$\tilde{s}(m) = \frac{(1-\alpha)\, s(m)}{(1-\alpha)\, s(m) + (1 - s(m))}$$

$$s(m) = \frac{\pi_0}{\pi_0 + (1-\pi_0)\,\mu(g|y_L)}$$

Modified environment

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- Shock is consumer's private information
- Fraction of high type consumers with signal m who leave

$$\tilde{s}(m) = \frac{(1-\alpha)\, s(m)}{(1-\alpha)\, s(m) + (1 - s(m))}$$

$$s(m) = \frac{\pi_0}{\pi_0 + (1 - \pi_0)\, \mu(g|y_L)}$$

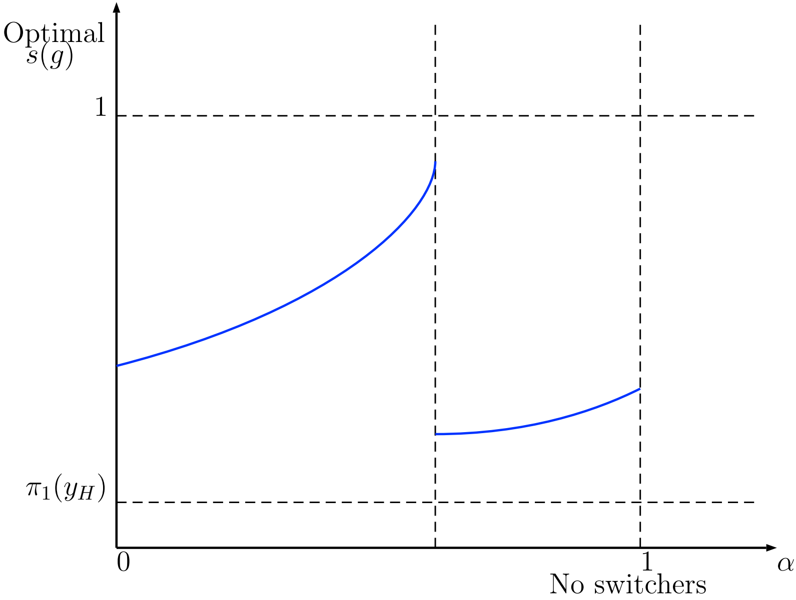
- Continuation equilibrium values
  - Stayers (high-income): $V^o(m; c)$
  - Switchers (high-income): $\tilde{V}^o(m; c) = V^o(\tilde{s}(m))$
  - Low-income:

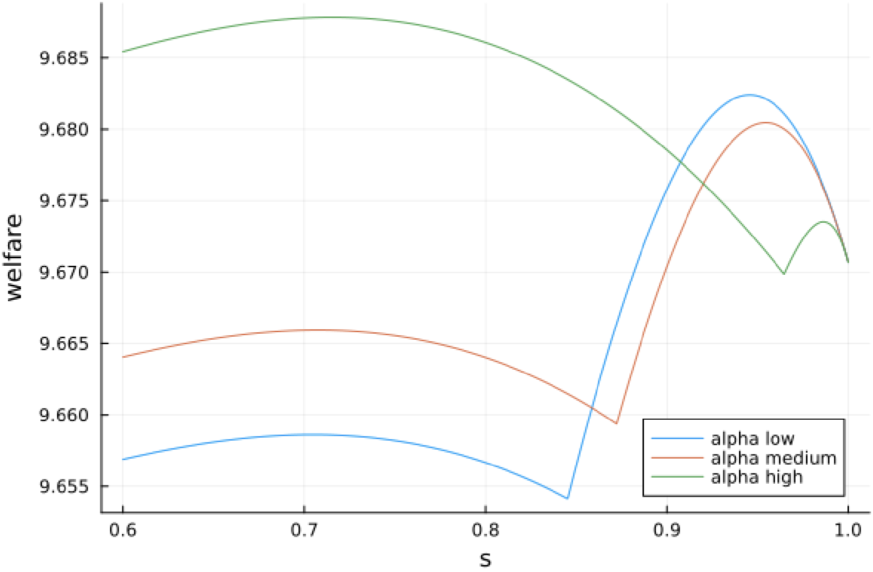
$$\tilde{V}^o_L(m; c) = \begin{cases} u(Y_{2L}) & \text{if } V^o = V^{lcs} \\ \sum_{y_2} \pi_2(y_2|y_L)\, u\left(c_L^{both}(\tilde{s}(m), y_2)\right) & \text{otherwise} \end{cases}$$

Optimal disclosure policy

Trade off 3 forces

- Intertemporal consumption smoothing
  - As before
- Cross-subsidization of low-income type
  - If $V^{o}\left(\tilde{s}\left(m\right)\right) = V^{both}\left(\tilde{s}\left(m\right)\right)$ so $\tilde{V}_{L}^{o}\left(m;c\right) > u\left(Y_{2L}\right)$
  - Calls for less information
- Distortions of high-income switchers
  - Cost of IC for low switchers
  - Calls for more information


Optimal
$s(g)$
1
$\pi_1(y_H)$
0
1
α
No switchers


welfare
9.685
9.680
9.675
9.670
9.665
9.660
9.655
0.6
0.7
0.8
0.9
1.0
s
alpha low
alpha medium
alpha high

Conclusion

- Study optimal information disclosure in economy where incumbent acquires ex-post info advantage
- If incumbent can commit disclose no info
  - Reduce high type's outside option and maximize cross-subsidization
- If incumbent cannot commit
  - No cross-subsidization possible
  - May be optimal to disclosure some info for intertemporal consumption smoothing between the first period and the high state in the second period
- Full information disclosure is never optimal
  - Policies like open-banking not optimal

  But may want to provide some information