Long-Term Contracts, Commitment, and Optimal Information Disclosure

Alessandro Dovis
U Penn and NBER

Paolo Martellini
Wisconsin

IIES, Stockholm
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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
- Applications: Open banking and salary history bans
- Questions:
  - Should incumbent be forced to share information?
  - How to design optimal disclosure?

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

- Extension: Taste shock over firms
  - Some high-type switch → adverse selection less severe, can support some cross-subsidization
  - Some information might help cross-subsidization
  - Long-term contracts might be harmful

Plan for the talk

- Simple insurance economy
- One-sided commitment
- Two-sided lack of commitment
- Taste shocks and switchers

SIMPLE INSURANCE ECONOMY

Environment

- $t = 1, 2$
- Two types of agents
  - Consumer
  - Continuum of 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

$$Y_1 \equiv \sum_{y_1} \pi_1(y_1)\, y_1$$

$$Y_{2H} \equiv \sum_{y_2} \pi_2(y_2|y_H)\, y_2 > Y_{2L} \equiv \sum_{y_2} \pi_2(y_2|y_L)\, y_2.$$

- Firms are risk-neutral and discounting $\frac{1}{R} = \beta$ $(= 1$ wlog$)$

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)

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

Eveyone obseves signal $m \in M$

Information and market structure, cont.

At the beginning of $t = 2$:

- Outsider offers menu of contracts conditional on $m \in M$
- Firms can withdraw contracts with a cost $\varepsilon \geqslant 0$
- 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

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

subject to

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

- Optimum has

$$c(y_1) = c(y_1, m, y_2) = \frac{Y_1 + Y_2}{2}$$

- Information is irrelevant

EQUILIBRIUM OUTCOME IN PERIOD 2

Outside option

- Characterize continuation equilibrium given signal m, incumbent's contract, and withdrawal strategy
- Let $s(m)$ be the share of consumers with $y_1 = y_H$ and signal m:

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

- Let $V^o(s)$ be the maximal value outsiders can offer to consumer (y_H, m) given $s(m)$

Outside option: Miyazaki-Wilson contract

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

subject to the outsider's non-negative profit condition,

$$s \sum_{y_2} \pi_2(y_2|y_H)(y_2 - c_H(y_2)) + (1-s)\left[\sum_{y_2} \pi_2(y_2|y_L)\, y_2 - C(V_L^o)\right] \geqslant 0$$

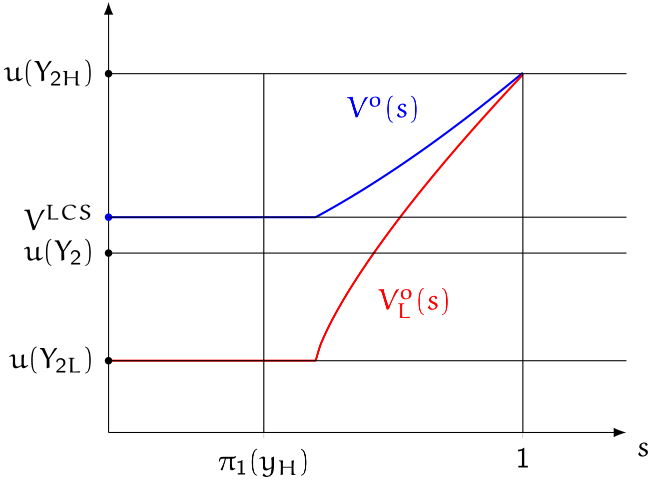
where $C = u^{-1}$, the incentive compatibility constraint,

$$V_L^o \geqslant \sum_{y_2} \pi_2(y_2|y_L)\, u(c_H^o(y_2))$$

and the participation constraint,

$$V_L^o \geqslant u(Y_{2L})$$

Value of outside offers



Participation constraints

- Without incumbent $(V^o(s), V^o_L(s))$ unique equilibrium values
  - Netzer-Scheuer (2014)
  - Ability to withdraw contracts allows for cross-subsidization

- To retain consumers, incumbent contract must satisfy

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

$$\sum_{y_2} \pi_2(y_2|y_L)\, u(c_2(y_L, m, y_2)) \geqslant u(Y_{2L})$$

- Incumbent withdraw its offer if the outsiders offers a cream-skimming contract

- Doing so outsiders cannot poach consumers

ONE-SIDED COMMITMENT

Optimal contract in period 1

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

subject to non-negative profit

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

and the participation constraints

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

$$\sum_{y_2} \pi_2(y_2|y_L)\, u(c_2(y_L, m, y_2)) \geqslant u(Y_{2L})$$

Preliminaries

Clearly optimal to insure against income fluctuations in period 1

$\Rightarrow$ $c_1(y_L) = c_1(y_H) = c_1$

and in period 2 conditional on (y_1, m):

$\Rightarrow$ $c_2(y_1, m, y_L) = c_2(y_1, m, y_H) = c_2(y_1, m)$ for all (y_1, m)

Throughout the paper, we make the following

Assumption. $K(s) \equiv C(V^o(s))$ is convex

Optimal disclosure policy reveals no information

Choose directly distribution p over s such that $\sum_s p(s)s = \pi_1(y_H)$

Optimal disclosure has $p(\pi_1(y_H)) = 1 \Rightarrow$ no-information

For any p such that $\bar{V}_H \equiv \sum_s p(s)sV_H(s)/\pi_1(y_H) \geqslant V^o(\pi_1(y_H))$

- Delivering $\bar{V}_H$ with no information saves resources
- Thus, no disclosure is optimal

For any p such that $\bar{V}_H \equiv \sum_s p(s)sV_H(s)/\pi_1(y_H) < V^o(\pi_1(y_H))$

- With no info PC is binding
- Disclosing info lowers *both* value to y_H consumers and profits

$$\sum_s p(s)sC(V_H(s)) \geqslant \sum_s p(s)sC(V^o(s)) > \pi_1(y_H)C(V^o(\pi_1(y_H)))$$

- Thus, no disclosure is optimal

Optimal disclosure policy reveals no information

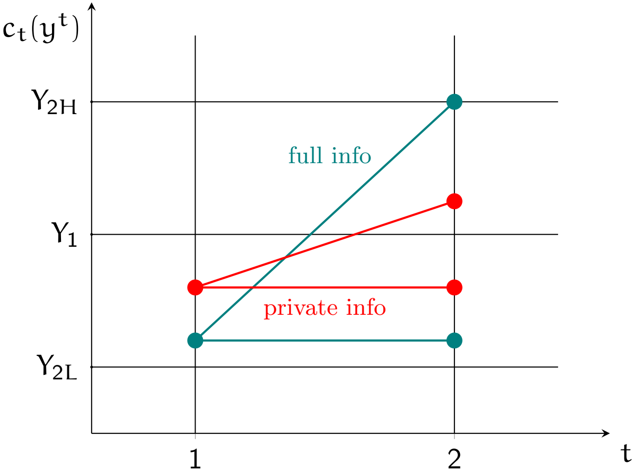
Choose directly distribution p over s such that $\sum_s p(s)s = \pi_1(y_H)$

Optimal disclosure has $p(\pi_1(y_H)) = 1 \Rightarrow$ no-information

- Maximizes resources can be extracted from high-income
- Maximal cross-subsidization

Consumption profile with one-sided commitment

Reminiscent of Harris-Holmstrom result under full info



TWO-SIDED LACK OF COMMITMENT

No cross-subsidization in period 2

Assume incumbent cannot commit to contract

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

$$c_2(y_H, m, y_2) = C(V^o(s(m)))$$

Logic

For high-type: Incumbent offers $c_2(y_H, m, y_2) = C(V^o(s(m)))$

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

For low-type: $V_L = u(Y_{2L})$

- Incumbent has no incentives to offer more
- Outsiders know that in equilibrium only attracts low-type
- Adverse selection $\Rightarrow$ no cross-subsidization possible

Outcome in period 1

Optimal to provide insurance statically:

- $c_1(y_L) = c_1(y_H) = c_1$

Hence:

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

subject to

$$c_1 \leqslant Y_1 + \pi_1(y_H)\left[Y_{2H} - \sum_m \mu(m|y_H)\, C(V_2(y_H, m))\right]$$

Equilibrium outcome

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

$$
\begin{aligned}
c_1(y_1) &= Y_1 + \beta\pi_1(y_H)\sum_m \mu(m|y_H)\,\Pi(m) \\
c_2(y_L, m, y_2) &= Y_{2L} \\
c_2(y_H, m, y_2) &= Y_{2H} - \Pi(m)
\end{aligned}
$$

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

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

Optimal disclosure policy

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

subject to

$$c_1 = Y_1 + \pi_1(y_H) \sum_m \mu(m|y_H) \Pi(m)$$

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

All high-income consumers get same signal

- Minimize resources to deliver V_H

Bad-news structure: $m \in \{g, b\}$

- High-income: all have $m = g$
- Low-income: fraction $1 - \mu$ have $m = g$ and μ have $m = b$
- $s(g) \in [\pi_1(y_H), 1]$

$$s(g) = \frac{\pi_1(y_H)}{\pi_1 + (1 - \pi_1(y_H))(1 - \mu)}$$

Optimal disclosure policy

All high-income consumers get same signal

- Minimize resources to deliver V_H

Bad-news structure: $m \in \{g, b\}$

- High-income: all have $m = g$
- Low-income: fraction $1 - \mu$ have $m = g$ and μ have $m = b$
- $s(g) \in [\pi_1(y_H), 1]$

$$\max_{c_H} \quad u\left(c_1\left(c_H\right)\right) + \pi_1\left(y_H\right) u(c_H) + \pi_1\left(y_L\right) u\left(Y_{2L}\right)$$

subject to

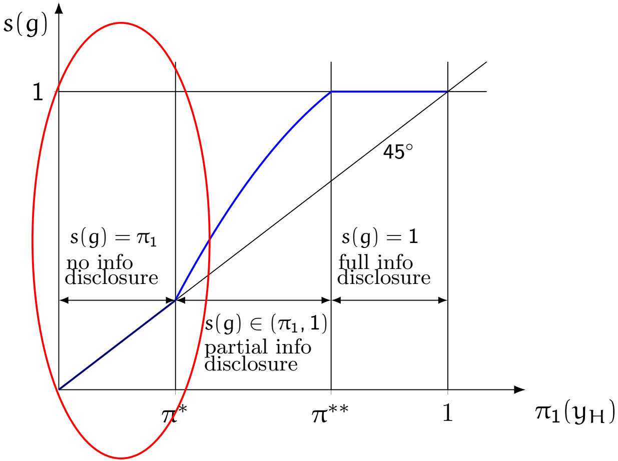
$$c_1\left(c_H\right) = Y_1 + \pi_1\left(y_H\right)\left[Y_{2H} - c_H\right]$$

and

$$c_H \in \left[C(V^o(\pi_1\left(y_H\right))), Y_{2H}\right]$$

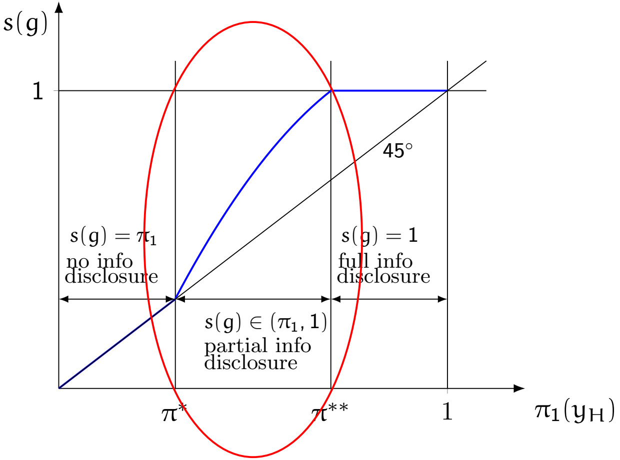
Optimal disclosure policy

i. Low π_1: $c_1 < c_H$ and no info is optimal



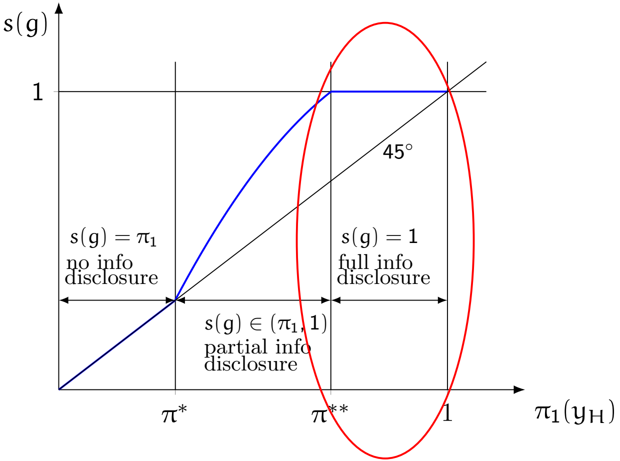
Optimal disclosure policy

ii. Intermediate π_1: $c_1 = c_H$ and partial information, $\mu(b|y_L) \in (0,1)$



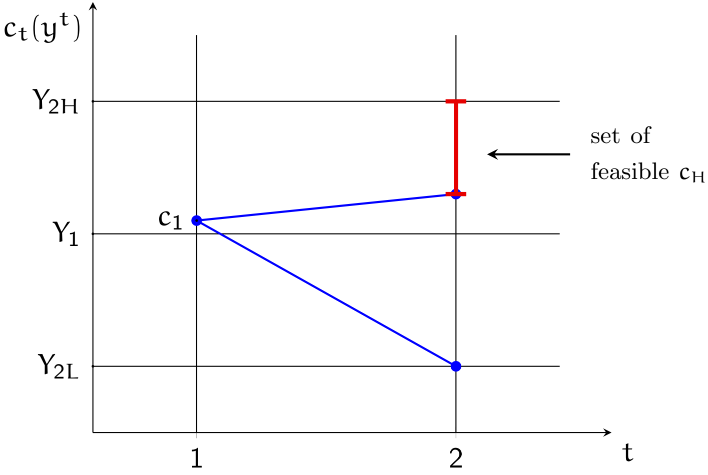
Optimal disclosure policy

iii. High π_1: $c_1 > c_H$ and full info is optimal



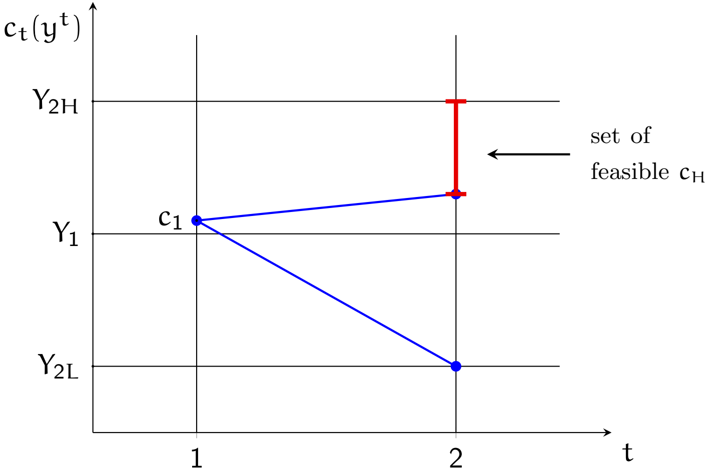
Logic

i. Low $\pi_1(y_H)$: If no info $\Rightarrow c_1 < c_H$



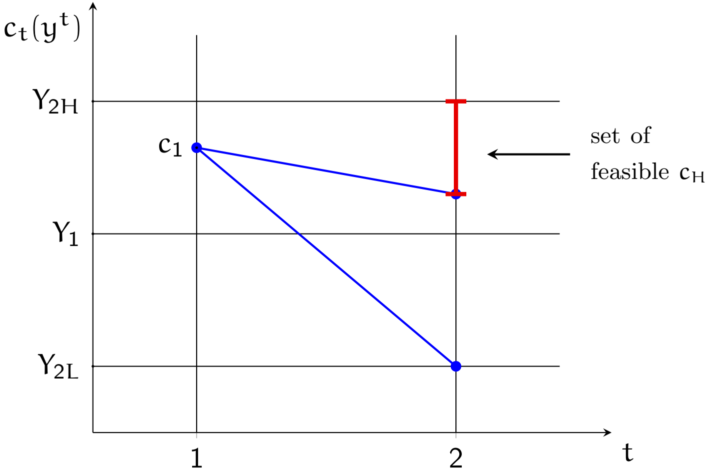
Logic

i. Low $\pi_1(y_H)$: Optimal info = no info



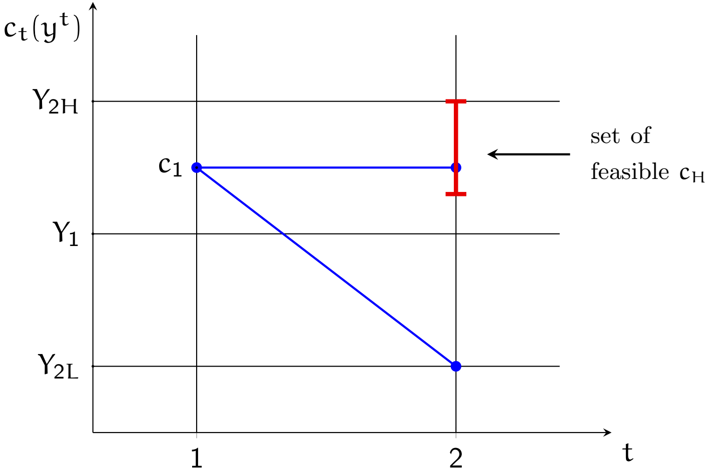
Logic

ii. Intermediate $\pi_1(y_H)$: If no info $\Rightarrow c_1 > c_H$



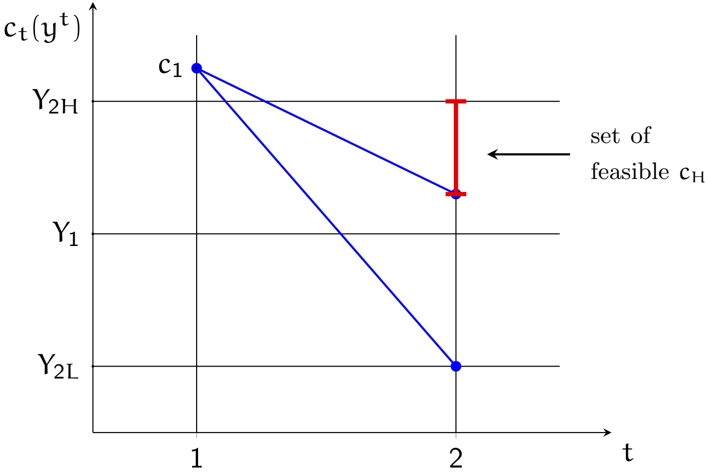
Logic

ii. Intermediate $\pi_1(y_H)$: Optimal info = partial info and $c_1 = c_H$



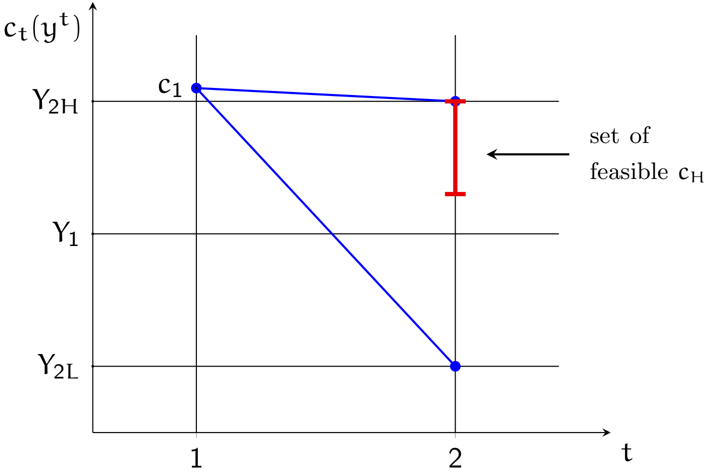
Logic

iii. High $\pi_1(y_H)$: If no info $\Rightarrow c_1 > c_H$



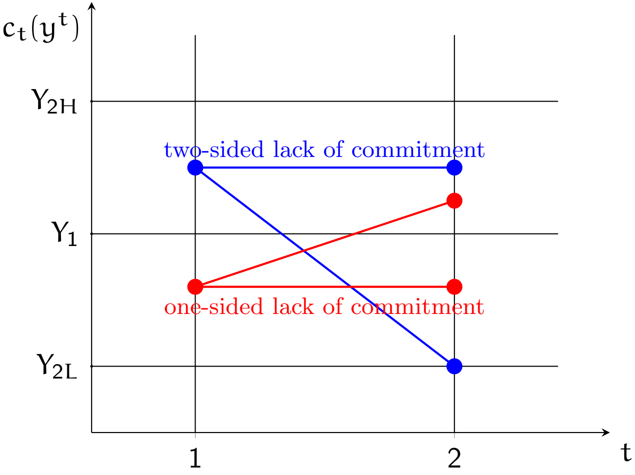
Logic

iii. High $\pi_1(y_H)$: Optimal info = full info and still $c_1 > c_H$



Consumption profile

"Inverse" of Harris-Holmstrom result (for intermediate π)



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 optimal to provide some info
- Incumbent's optimal report in period 2 is no-info
  - No-info maximizes ex-post profits

Extensions

Same qualitative result if change in

- **Information structure**: public and private info in period 2
- **Contract space**: restriction to pooling contract or discrimination among consumers with same history allowed
- **Hidden action**:
    - 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 spread in continuation value
    - Optimal disclosure w/ effort is more informative than w/out

TASTE SHOCKS AND SWITCHERS

Taste shock and switchers

- So far, equilibrium has no firm switches in $t = 2$
  - Except perhaps low types who are indifferent
- Add switches motivated by idiosyncratic preferences
- Weakens adverse selection
  - Switches less informative about the agents' types
- Optimal 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

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

where

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

Continuation values

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

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

where

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

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

Objective

3 terms:

$$\underbrace{V^d(s)}_{t=1\ \&\ y_H\ \text{stayers}} + \underbrace{\pi(1-\alpha)V^o(\tilde{s})}_{y_h\ \text{switchers}} + \underbrace{(1-\pi)\mathbb{E}_\mu[V_L(\tilde{s})]}_{\text{all}\ y_L}$$

where

$$V^d(s) \equiv u(Y_1 + \pi\alpha(Y_{2H} - C(V^o(s))) + \pi\alpha V^o(s)$$

- If $\alpha = 1$ then just maximize $V^d(s)$
- If $\alpha = 0$ then just maximize $\pi V^o(\tilde{s}) + (1-\pi)\mathbb{E}_\mu[V_L(\tilde{s})]$

Forces at play

- V^d: Intertemporal consumption smoothing
  - As before: want to equate c_1 and $c_2(y_H)$ for stayers
- $\pi(1-\alpha)V^o(\tilde{s})$: Distortions of high-income switchers
  - Cost of IC constraint (not present for stayers)
  - Calls for more information
- $(1-\pi)\mathbb{E}_\mu[V_L(\tilde{s})]$: Cross-subsidization of low-income type
  - If $\tilde{V}^o(m) > V^{lcs}$ so $\tilde{V}^o_L(m) > u(Y_{2L})$
  - Calls for intermediate information

Forces at play

- V^d: Intertemporal consumption smoothing
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- $(1-\pi)\mathbb{E}_\mu[V_L(\tilde{s})]$: Cross-subsidization of low-income type
  - If $\tilde{V}^o(m) > V^{lcs}$ so $\tilde{V}^o_L(m) > u(Y_{2L})$
  - Calls for intermediate information
- Bad-news structure still optimal
  - All high-income consumers receive good signal

Warm-up: all switchers ($\alpha = 0$)

$$u(Y_1) + \pi V^o(\tilde{s}) + (1-\pi)\mathbb{E}_\mu[V_L(\tilde{s})]$$

- Akin to static adverse selection economy in $t = 2$

Lemma

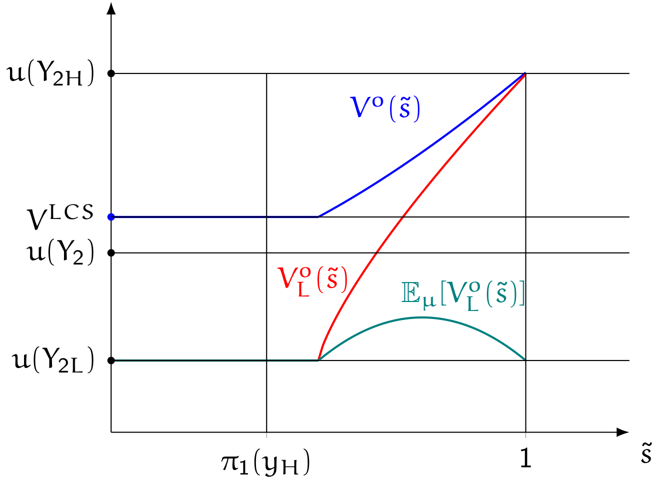
There exists a cutoff pool composition $\tilde{s}^* \in (0, 1)$ such that $V^o(\tilde{s}) > V^{lcs}$ if and only if $\tilde{s} > \tilde{s}^*$

Proposition

i. If $\pi < \tilde{s}^*$ some info disclosure is optimal, $\mu(b|y_L) > 0$.

ii. $\forall\, \pi \in (0, 1)$, full info is never optimal, $\mu(b|y_L) < 1$.

Warm-up: all switchers ($\alpha = 0$)



Optimal information disclosure: Full model

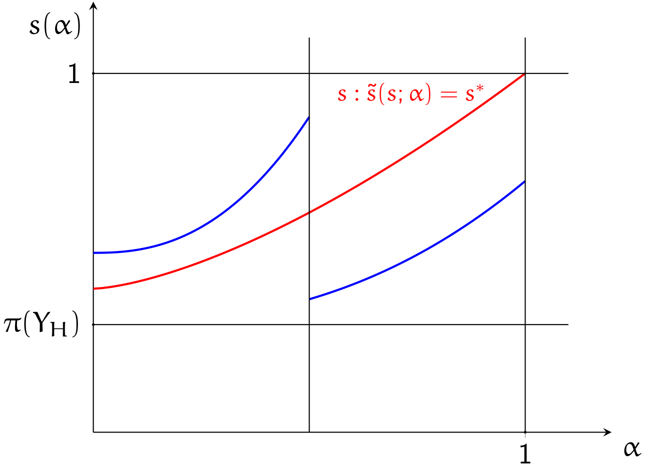
- Information disclosure is not monotone in fraction of switchers
  - If π not too high

- Let $s(\alpha)$ be the optimal share of high-income consumers among those with good signal.

Proposition

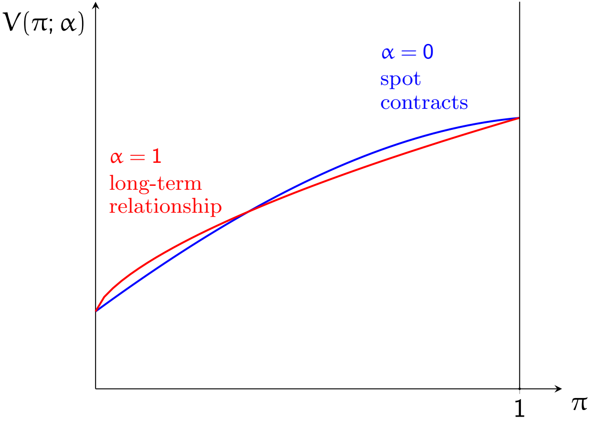
If $\pi < \pi^{**}$, then $s(\alpha)$ is not strictly increasing in α.

Optimal information disclosure and switching motives



Value of long-term relationship

- $\pi \approx 0$: insurance too costly, information reduces adverse selection distortion ⇒ long-term relationship optimal
- $\pi \approx 1$: asymmetric info prevents cross-subsidization ⇒ spot contracts optimal



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
- Idiosyncratic taste might call for *more* information disclosure
- Long-term relationship harmful if pool sufficiently good