Long-Term Contracts, Commitment, and Optimal Information Disclosure

Alessandro Dovis
U Penn and NBER

Paolo Martellini
NYU Stern

SITE – The Economics of Transparency
September 2024

Motivation

- Incumbent firm acquires information about customers by observing past behaviors/outcomes
  - E.g. insurance (health, car, ...), credit, employment
- Informational monopoly ex-post
  - Incumbent has informational advantage relative to competitors
- Policy debate: 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
  - Ex-post market hinders cross-subsidization
  - **Optimal disclosure is no-info** to reduce h-type's outside option
- Two-sided lack of commitment
  - No cross-subsidization possible, all consumers stay with incumbent
  - **Partial info disclosure may be optimal** for intertemporal consumption smoothing

$\Rightarrow$ Under mild conditions on income, **full info never optimal**

Plan for the talk

- Simple insurance economy
- One-sided commitment
- Two-sided lack of commitment
- Value of long-term contracts

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
$$Y_1 \equiv \sum_{y_1} \pi_1(y_1)\, y_1$$
$$Y_{2H} \equiv \sum_{y_2} \pi_2(y_2|y_H)\, y_2, \quad Y_{2L} \equiv \sum_{y_2} \pi_2(y_2|y_L)\, y_2$$
    - Assume $Y_{2H} \geqslant Y_1$ and $Y_{2H} > Y_{2L}$
- 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)

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

Everyone observes 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 of contracts offered by the outsider, $\{c^o(m, y_2)\}$

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

Want: Characterize public disclosure policy that maximizes ex-ante welfare

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 $y_1 = y_H$ given 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 $V_H^o(s)$ be the maximal value outsiders can offer to consumer (y_H, m) given $s(m)$

Outside option: Miyazaki-Wilson contract

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

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

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

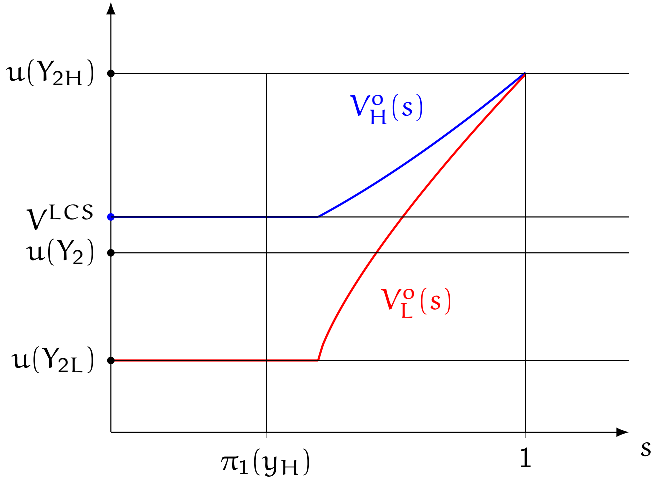
where $C = u^{-1}$, the incentive compatibility constraint,

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

and the participation constraint,

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

Value of outside offers



Participation constraints

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

- To retain consumers, incumbent contract must satisfy

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

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

- Incumbent withdraws its offer if the outsiders offer a cream-skimming contract

- Hence 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

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

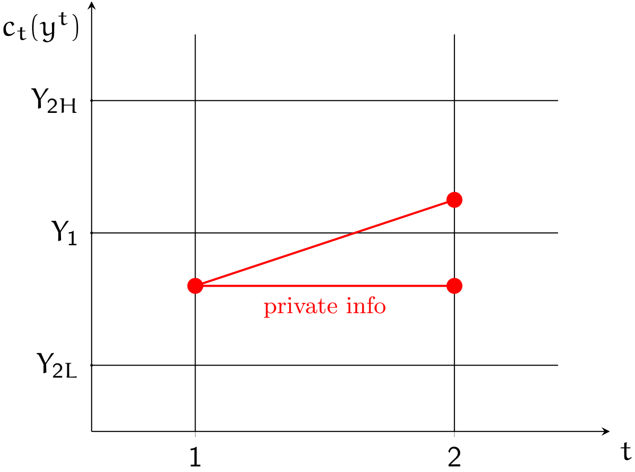
$$\sum_{y_2} \pi_2(y_2|y_L) u(c_2(y_L, m, y_2)) \geqslant u(Y_{2L})$$

Optimal disclosure policy reveals no information

- If $C(V^o(s))$ is convex, same signal to all high-income
- No-info relaxes ex-post participation constraint
- Maximizes resources can be extracted from high-income
- Allows for maximal cross-subsidization

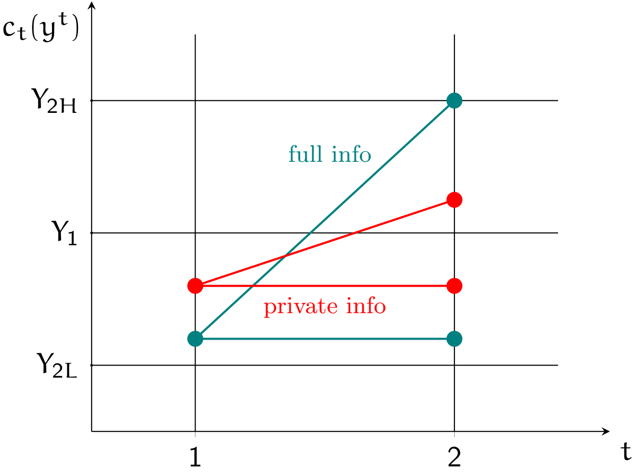
Details

Consumption profile with one-sided commitment



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
- Consumption of high income agents is

$$c_2(y_H, m, y_2) = C\left(V_H^o(s(m))\right)$$

- No cross-subsidization

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

  - if offer more, negative profits w/o lowering value it has to offer to high types

Equilibrium outcome

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

$$c_1(y_1) = c_1 = Y_1 + \beta\pi_1(y_H)\sum_m \mu(m|y_H)\,\Pi(m)$$

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

$$c_2(y_H, m, y_2) = c_2(y_H, m) = Y_{2H} - \Pi(m)$$

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

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

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 $m = b$
- $s(g) \in [\pi_1(y_H), 1]$

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

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

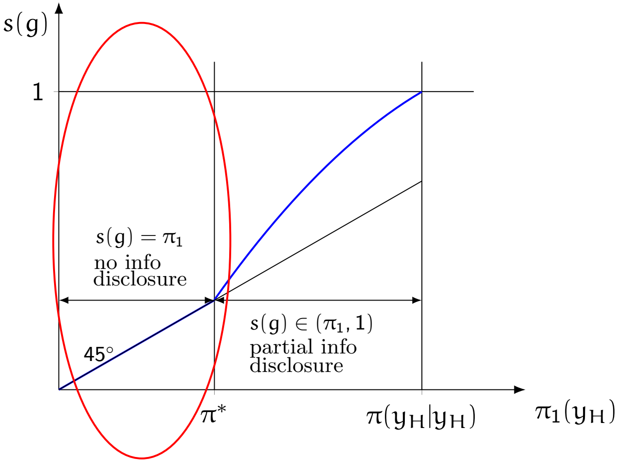
$$c_1\left(c_H\right) = Y_1 + \pi_1\left(y_H\right)\left[Y_{2H} - c_H\right]$$

and

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

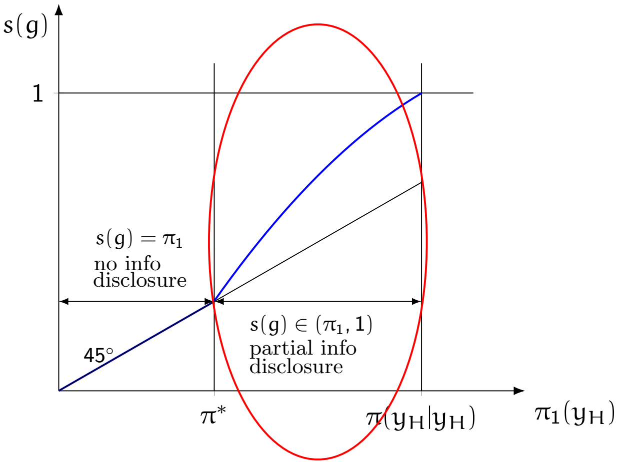
Optimal disclosure policy

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



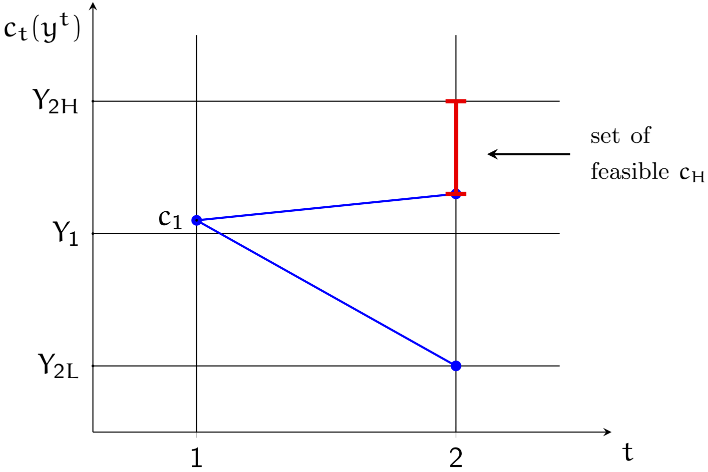
Optimal disclosure policy

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



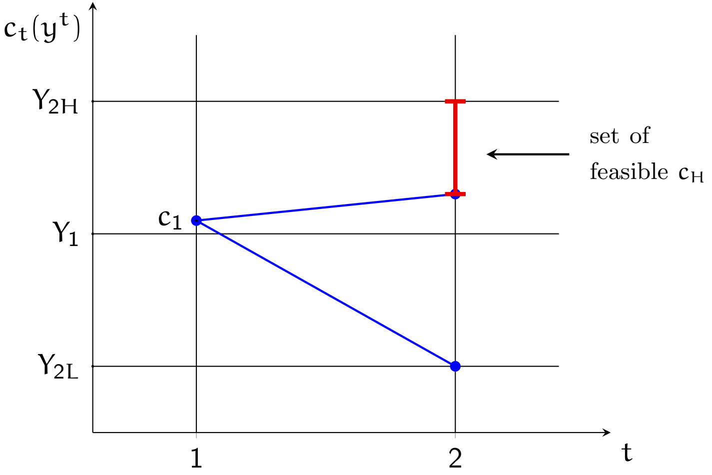
Logic: intertemporal smoothing

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



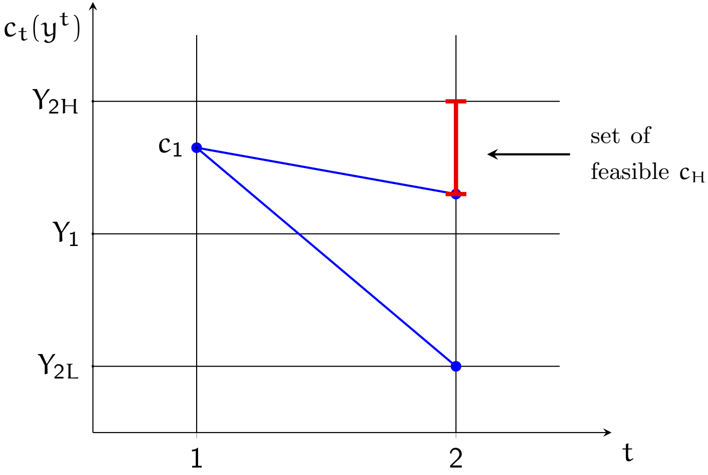
Logic: intertemporal smoothing

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



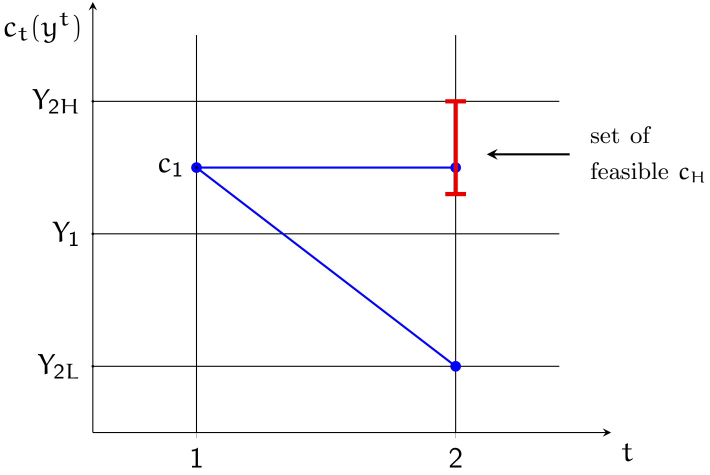
Logic: intertemporal smoothing

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



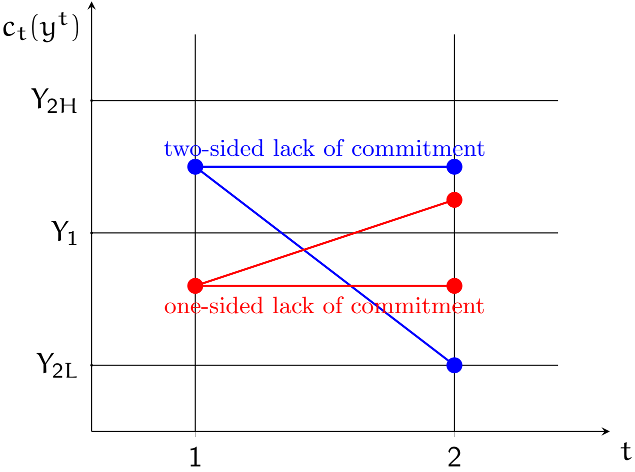
Logic: intertemporal smoothing

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



Consumption profile

"Inverse" of Harris-Holmstrom result



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
  - Optimal disclosure w/ effort is more informative than w/out

Also study case where

- **Outsiders more attractive**: (e.g. fintech)
  - Switches in equilibrium allow for cross-subsidization
  - Partial info disclosure may be optimal to induce consumer switching and cross-subsidization

details figure

LONG vs. SHORT TERM CONTRACTS

Value of long-term relationship vs. short-term contracts

With short-term contracts (or no pre-existing conditions)

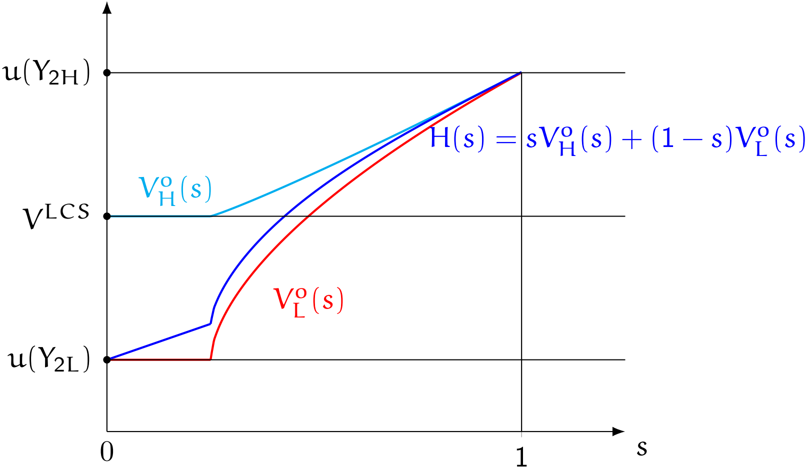
- In period 1 value is $u(Y_1)$
- In period 2 Miyazaki-Wilson contract: $(V_H^o(s), V_L^o(s))$
- Optimal public disclosure maximizes expected continuation value

$$\max_{p(s)} \sum_s p(s)[sV_H^o(s) + (1-s)V_L^o(s)]$$

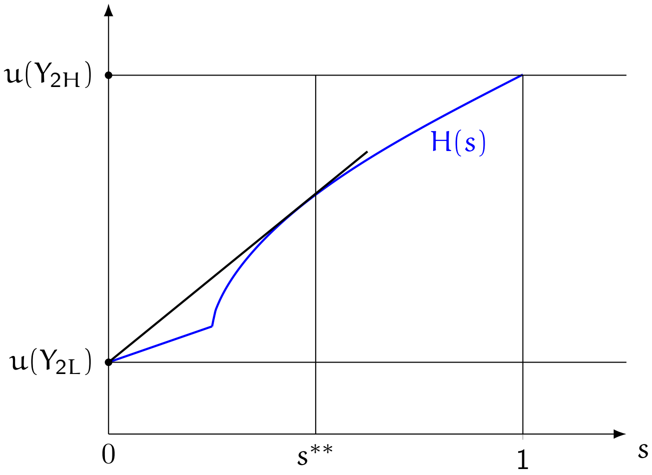
subject to

$$\sum_s p(s)s = \pi_1(y_H)$$

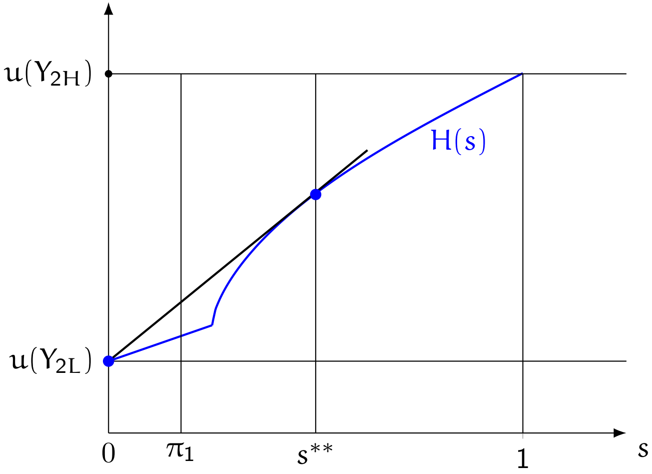
Expected continuation value



Expected continuation value

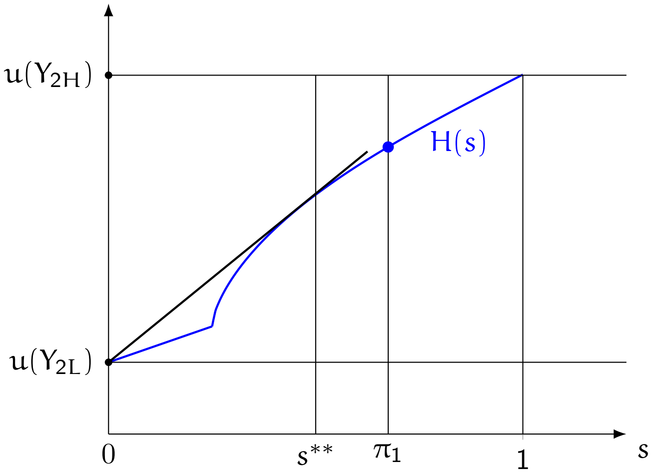


Expected continuation value



- If $\pi_1 \in [0, s^{**}]$ two signals with shares 0 and s^{**}

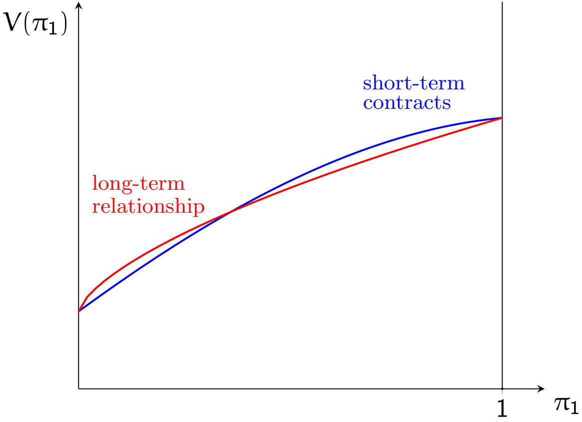
Expected continuation value



- If $\pi_1 > s^{**}$ no information

Value of long-term relationship

- $\pi_1 \approx 0$: small gains from cross-subsidization and large gains from intertemporal smoothing ⇒ long-term relationship optimal
- $\pi_1 \approx 1$: large gains from cross-subsidization and small gains from intertemporal smoothing ⇒ short-term 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
  - Partial disclosure for intertemporal smoothing
  - If preferences for outsiders, *more* information to induce switching but full info never optimal
- Long term relationships are beneficial if quality of the pool poor but *not* if pool good enough

ADDITIONAL SLIDES

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

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

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

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

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

- Thus, no disclosure is optimal

back

Switching motives

- So far, equilibrium has no firm switches in $t = 2$
  - Except perhaps low types who are indifferent

- Add switches motivated by preference for outsiders
  - Outsiders provide utility equal to $u(c) + \Delta$, with $\Delta > 0$

- Weakens adverse selection
  - Switches less informative about the agents' types

- Optimal to disclose less info to get cross-subsidization? Or more information to induce switches?

Optimal information disclosure

If Δ is low

- High types stay with incumbent

$$V_H^o(s(\Delta)) + \Delta \leqslant u(Y_{2H})$$

- Low types switch

$$u(Y_{2L}) + \Delta$$

$s(\Delta)$ chosen to smooth consumption as before

- $s(\Delta)$ decreases to attain $V_H^o(s(\Delta)) + \Delta = V_H^o(s(0))$

Optimal information disclosure

If Δ is high

- High types switch

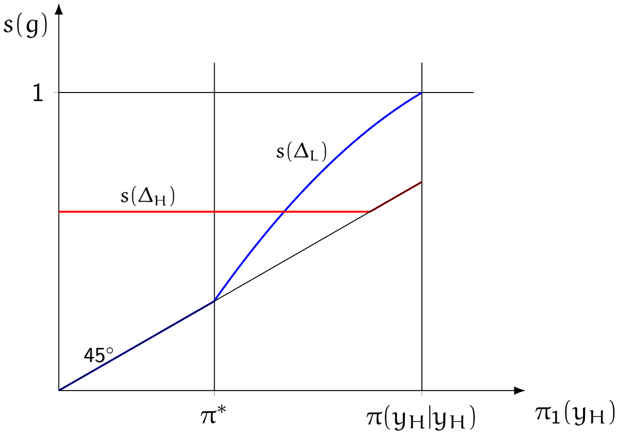
$$V_H^o(s(\Delta)) + \Delta > u(Y_{2H})$$

- Low types switch and some are cross-subsidized

$$V_L^o > u(Y_{2L}) + \Delta$$

$s(\Delta)$ chosen to maximize expected continuation value w/ outsiders

Optimal information disclosure



back