Secret Rebates and List Prices in Negotiations between Countries and Pharmaceutical Firms

Journée de la Chaire Santé 2019

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May 24, 2019

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Presentation

- A firm and a payer settle a trade for some drug. During the negotiations are determined:
  1. *List price:* the public price of the drug. Publicly available.
  2. *Rebate:* a fraction of the list price that the firm reimburses to the payer. Only the payer pays the drug at its net price:

$$\text{Net price} = \text{list price - rebate}$$

  The rebate is known by the payer and the firm **only**.
- Negotiations between the firm and all payers happen **sequentially**.
- Payers apply the *international reference pricing (IRP)*: price cap for pharmaceuticals based on prices of identical or comparable products in other countries.

Stylized facts

Estimation of the values of rebates

(Rebate over list price)

- From 40% to 70% for specialty pharmaceuticals, and from 10% to 50% for primary care drugs across North America, Europe and Australasia.
- The ratio rebate-list price is larger for new innovative drugs with uncertain clinical efficacy (rebate = mutual risk sharing scheme)
  (Morgan et al. 2017)

Why is a rebate used in a transaction?

Pros

- **Firm:** avoids information leakage about the net price each payer pays; *isolates* the negotiation with a payer from other negotiations with subsequent payers.
- **Payers:** get a better deal for themselves.

Cons

- **Payers:** ineffective at increasing the drug access: what patients pay out of their pocket depends on the *list price*.

Models and Objectives

Model A:

- Negotiations between two institutional payers (countries) and a firm.
- Countries negotiate in turn.
- The first country has a social security system: individual contributions and the total rebate are used for covering the drug.
- The second country uses IRP: it never accepts a list price that is more than the list price in the first country.

Objective of model A: describe the set of efficient and individually rational contracts.

Model B:

- Model the negotiation process.
- The firm has private information on the launch date of a superior drug by a competitor.

Objective of model B: rationalize both IRP and secret rebates by asymmetric information.

Overview of the results

Model A:

- Along the curve that graphs the efficient contracts, **larger list prices** are associated with **larger rebates** and **lower net prices**.
- Large rebates are given when:
  1. the second market is relatively large $\rightarrow$ the rebate is used as *currency* by the firm in exchange for a high list price in the first country;
  2. the first country has a strong bargaining power.

Model B:

- International reference pricing is a response to asymmetric information by countries negotiating later.
- IRP leads to price inflation in the countries that deal at early dates.
- Secret rebates are beneficial to country that negotiate early and detrimental for countries that negotiate later.

Literature Review

Related to our framework:

- *Jelovac (2005)*: for new drugs, the negotiated list price is increasing in the degree of the patients' co-payment (the threat for the firm of failing the negotiation is stonger when the level of co-payment is lower).

About drug launch timing:

- *Houy and Jelovac (2015)*: the firm trades off the profits from selling in a country today against the losses from propagating the list price of the country to all subsequent countries.

The model

The Environment

- The set of players: $\{1, 2, F\}$ with $i = 1, 2$ a country and F a pharmaceutical firm.
- F has the monopoly on selling some drug.
- Trade between i and F is settled in a contract (p_i, r):
  - p_i: **list price in** i
  - r: **secret rebate**.
- Negotiations of the contracts are sequential.

Assumptions

A.1 *The net price* $p_1 - r$ *in country* 1 *is positive.*

A.2 $p_2 = p_1 << p_2^{\mathcal{M}}$.

A.3 *Country* 2 *never gets a rebate.*

Payoffs

Country 1: the population

- Population size: 1, Sick population size: $\alpha \in [0, 1]$.
- Individual wealth: $\omega \sim U[0, 1]$
- All agents pay a contribution τ.
- Drug coverage: 50% of the list price.
- A sick agent buys the drug if and only if he can afford it:

$$q_1(p_1, r, \tau) = \alpha P\left(\omega \geq \tau + \frac{1}{2}p_1\right) \tag{1}$$

- Sick -1; Healthy 0.

Payoffs

- Aggregate Utility:

$$W(p_1, r, \tau) = q_1(p_1, r, \tau)\left(1 - \frac{p_1}{2}\right) - \tau - \alpha \tag{2}$$

- Social security system is budget constrained:

$$B(p_1, r, \tau) = \tau - q_1(p_1, r, \tau)\left(\frac{p_1}{2} - r\right) \geq 0 \tag{3}$$

- **Payoff country** 1**:**

$$v_1(p_1, r, \tau) = W(p_1, r, \tau) + B(p_1, r, \tau) \tag{4}$$

- **Payoff firm:** zero production cost and $R\&D$ costs are sunk.

$$\pi(p_1, r) = (p_1 - r)q_1(p_1, r) + p_1(a - bp_1) \tag{5}$$

Payoffs: no trade

- Country 1:

$$v_1 = -\alpha$$

- Firm:

$$\pi = \pi_2^{\mathcal{M}} = \frac{a^2}{4b}.$$

Timing

First stage:

Country 1 negotiates (p_1, r) *with* F*.*

Second stage:

Country 1 chooses τ*.*

Third stage:

Country 2 gets $p_2 = p_1 << p_2^{\mathcal{M}}$ *and no rebate.*

Optimal contribution

Optimal contribution

Proposition 1. *Given a contract* (p_1, r)*, the optimal level of the private contribution saturates the country's budget constraint:*

$$\tau^*(p_1, r) = q_1(p_1, r)\left(\frac{p_1}{2} - r\right) \tag{6}$$

- Optimal to set the private contribution to its lowest possible level.
  $\rightarrow$ *Increases the share of the sick population that gets treated.*

Payoffs

- The quantity demanded is :

$$q_1(p_1, r) = \frac{\alpha(2 - p_1)}{2 + 2\alpha(p_1 - r) - \alpha p_1} \leq \alpha$$

Decreasing in p_1 (for some r); $(p_1 - r)$ (for some p_1).
Increasing in α; r (for some p_1).

- The payoff of country 1 is:

$$v^*(p_1, r) = [1 - (p_1 - r)]q_1(p_1, r) - \alpha \tag{7}$$

Decreasing in p_1 (for some r); $(p_1 - r)$ (for some p_1); α.
Increasing in r (for some p_1).

- The payoff of the firm is:

$$\pi^*(p_1, r) = (p_1 - r)q_1(p_1, r) + p_1(a - bp_1) \tag{8}$$

Single-peaked in p_1 (for some r). Decreasing in r (for some p_1).
Increasing in $p_1 - r$ (for some p_1); α.

Preliminary remarks

$$v^*(p_1, r) = [1 - (p_1 - r)]q_1(p_1, r) - \alpha$$
$$\pi^*(p_1, r) = (p_1 - r)q_1(p_1, r) + p_1(a - bp_1)$$

R.1 *For a given net price $p_1 - r$, the country always prefers the pair with the lowest list price and rebate.*

The rebate is less effective at increasing the number of treated agents than a low list price.

R.2 *If there were no country 2, the firm also prefers, given a net price $p_1 - r$, the pair with the lowest list price and rebate.*

Pareto optimal and Individually rational contracts

PO-IR contracts

Definition: *A contract* (p_1, r) *is PO-IR if:*

(i) each party has at least is disagreement payoff (IR),

(ii) there is no other contract (p_1', r') *that gives both parties a higher payoff (PO).*

Participation constraints

- *The country is willing to sign contract* (p_1, r) *only if:*

$$\frac{p_1}{2} \leq 1, \tag{9}$$

(the marginal net gain of a treated agent is positive $\rightarrow$ the quantity traded is positive)
and:

$$p_1 - r \leq 1 \tag{10}$$

(the marginal net gain to society from treating a sick agent is positive.)

- *The firm is willing to sign contract* (p_1, r)*:*

$$p_1 - r \geq \{0 \ , \ \frac{(2 - p_1)(\pi_2^M - \pi_2(p_1))}{\alpha[2 - p_1 - 2(\pi_2^M - \pi_2(p_1))]}\} \tag{11}$$

The profit on the first market compensates the loss in profit on the second one.

Mutually advantageous trade

Remark: *There is a possibility for mutually advantageous trade when:*

$$\alpha \geq 4b(p_2^{\mathcal{M}} - 2)$$

The market size in the first country is not too small compared to the market size in the second country.

Summary of individual preferences

- **The firm:**
  Higher profits are achieved through pairs (p_1, r) that have **larger net prices**, **lower list prices** and **lower rebates**.
- **Country** 1**:**
  Higher payoffs are achieved through pairs (p_1, r) that have **lower net prices**, **lower list prices** and **larger rebates**.
  For a same net price, the payoff is larger for **lower list prices** and **lower (null) rebates**.

PO-IR contracts

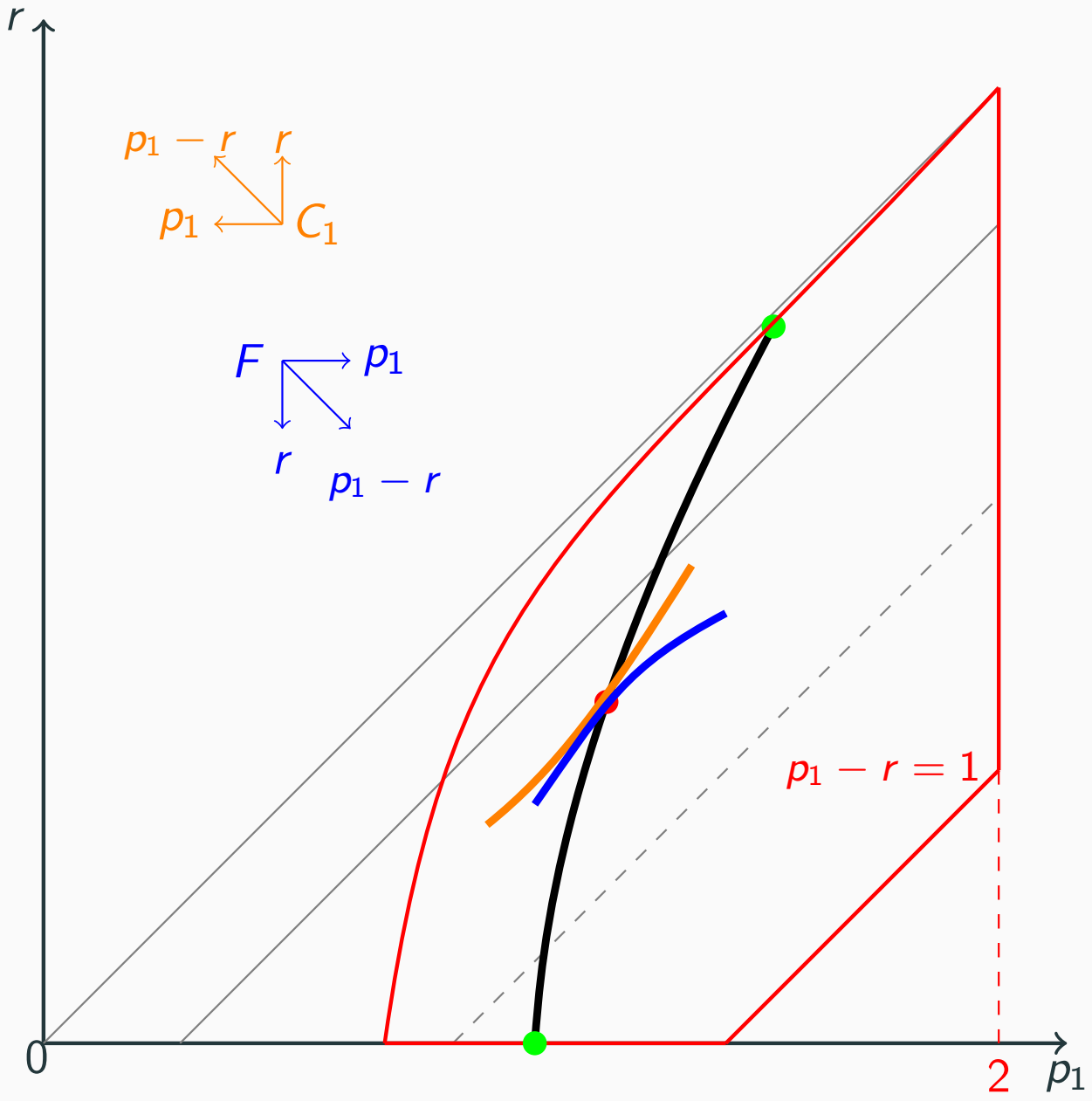
Proposition 2. *A contract* (p_1, r) *is PO-IR if:*

$$r = \frac{p_1}{2} + \frac{1}{\alpha} - \frac{\alpha(2 - p_1)}{2[\alpha - 2b(p_2^{\mathcal{M}} - p_1)(2 + 2\alpha - \alpha p_1)]} \tag{12}$$

and for this pair, each participation constraint is satisfied.

The function in (12) is increasing in p_1: larger list prices are traded against larger rebates.

Results



When shall we expect large rebates?

- The second market is relatively large: the firm uses a high rebate as currency in exchange for a high list price.
- Country 1 has a strong bargaining power.

Asymmetric Information in Markets for Pharmaceutical Drugs : International Reference Pricing and Secret Rebates

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Overview

- Simplify the previous model by removing the targeting inefficiency of secret rebates.
- Model country 2 and the two negotiations more precisely.
- Why is International Reference Pricing (IRP) a thing ?
- Rationalize IRP by asymmetric information between firm and countries.
- Firm has information on when the drug will be replaced by a new one and become obsolete.
- The price agreed with country 1 carries information that enables country 2 to get a lower price.
- Asymmetric information and informative prices $\Rightarrow$ IRP $\Rightarrow$ secret rebates.

Negotiation with asymmetric information : one country, no secret rebate.

- Fixed quantity demanded 1 and willingness to pay $= 1$.
- Product becomes obsolete at date $t \geq 0$.
- Negotiate on p.
- At date τ', country makes a price offer. Firm accepts or rejects.
- If firm rejects, firm makes a price counteroffer at date τ''.
- With $\tau' < \tau'' < 0 \leq t$.
- Payoffs if an offer p is accepted at date $\tau \in \{\tau', \tau''\}$.

$$\begin{aligned} \pi_F &= (t - \tau)\, p \\ v_C &= (t - \tau)\,(1 - p)\,. \end{aligned}$$

- Information structure : firm privately knows t, country believes $t \in [0, 1]$, with $F(t) = t^{\mu}$, with $\mu \in (0, 1)$.

One country: results

- At date τ'', country will accept any price ≤ 1, so firm offer price 1 and it is accepted.
- At date τ', if country offers price p, country accepts it iff

$$\left(t-\tau'\right)p > \left(t-\tau''\right)1.$$

- Thus country is like a monopsonist facing supply

$$S\left(p\right) = \left(\tau' + \frac{\tau''-\tau'}{1-p}\right)^{\mu}.$$

- Monopsony price

$$\max_{p}\left(1-p\right)S\left(p\right)$$

$$p_C^* = 1-\left(1-\mu\right)\frac{\tau''-\tau'}{\left(-\tau'\right)} \in \left[\mu,1\right] \subseteq \left[0,1\right].$$

accepted by all types lower than

$$t_C^* = -\frac{\mu\tau'}{\left(1-\mu\right)}$$

Two countries, with a myopic firm

$$\tau_1' < \tau_1'' < \tau_2' < \tau_2'' < 0 \leq t \leq 1.$$

- Country 1: same as only one country.
- Country 2 only observes list price p_1 paid by country 1 and updates beliefs about t.
- If $p_1 = p_1^*$, believes truncated distribution $t \leq t_C^*$.
- If $p_1 = 1$, believes truncated distribution $t > t_C^*$.
- Assume
$$\frac{\tau_2''}{\tau_2'} = \frac{\tau_1''}{\tau_1'}.$$
- Following p_1^*, C2 offers $p_2^L = p_1^*$.
- Following $p_1 = 1$, C2 offers $p_2^H \in (p_1^*, 1)$, which depends positively on t_1°

Two countries, with a myopic firm

- Country 2 benefits from info generated by country 1.
- Country 2 uses a form of IRP.
- Country 1 is not negatively affected by presence of country 2.
- Secret rebates are not useful yet.

Forward looking firm and no secret rebates

- Now if price p_i is accepted at date τ_i firm has the payoff

$$\pi'_F = p_1 (t - \tau_1) + \varepsilon p_2 (t - \tau_2).$$

  where $\varepsilon \in (0, 1)$ is relative size of market 2, or degree of the firm's farsightedness.
- Unique equilibrium of the myopic model $\left(p_1^*, t_1^*, p_2^L, p_2^H\right)$ is not an equilibrium of the farsighted model.
- For the threshold type t_1^*, $\tau_2 = \tau'_2$.
- We have $p_2^L < p_2^H$.
- Thus type t_1^* has a new additional incentive $\Delta_\varepsilon = \varepsilon \left(p_2^H - p_1^L\right) > 0$ to reject country 1's offer at date τ'_1.

Forward looking firm and no secret rebates

- Look for an equilibrium $\left(p_1^\circ, t_1^\circ, p_2^l, p_2^h\right)$ close to $\left(p_1^*, t_1^*, p_2^L, p_2^H\right)$, for small $\varepsilon > 0$.
- Type t_1° has a new additional incentive $\Delta_\varepsilon = \varepsilon\left(p_2^h - p_1^l\right) > 0$ to reject country 1's offer at date τ_1'.
- This shifts the date τ_1' supply $S_\varepsilon\left(p_1\right)$ "to the left".

$$S_\varepsilon\left(p_1\right) = \left(\tau_1' + \frac{\Delta_\varepsilon\left(\tau_2' - \tau_1'\right) + \tau_1'' - \tau_1'}{1 + \Delta_\varepsilon - p_1}\right)^\mu.$$

- For a given Δ_ε, $p_1^\circ\left(\Delta_\varepsilon\right)$ shifts up.
- Country 2 best responds to t_1° :

$$p_2^l\left(t_1^\circ\right) = \min\left\{p_2^*, 1 - \frac{\left(\tau_2'' - \tau_2'\right)}{t^\circ - \tau_2'}\right\}.$$

and $p_2^h\left(t_1^\circ\right)$ is the same function as $p_2^H\left(t_1^*\right)$.

Forward looking firm and no secret rebates

- For small $\varepsilon > 0$ an equilibrium close to $\left(p_1^*, t_1^*, p_2^L, p_2^H\right)$ exists.
- Can linearize the model around $\left(p_1^*, t_1^*, p_2^L, p_2^H\right)$ to find $\left(p_1^\circ, t_1^\circ, p_2^l, p_2^h\right)$ as linear functions of ε.
- Because $p_2^h > p_2^l$, we get $p_1^\circ > p_1^*$.
- Country 1 pays more than in myopic case and has a lower expected payoff.

Forward looking firm and secret rebates

- To avoid penalty, country 1 can offer price $p = 1$ in period τ_1' and a secret rebate $r = 1 - p_C^*$.
- Country 1 gets back its myopic model payoff.
- Relative to the no-secret rebates case, better for country 1, worse for country 2.

FIRST MODEL

- A secret rebate for country 1 is
  - worse than list price reduction for country 1
  - worse for country 2
  - better for the firm
- List price and rebate are both interior.
- PO-IR curve: for higher p_1, higher r and lower $p_1 - r$.
- Surprising result that a greater bargaining power of country 1 leads to higher p_1, higher r and lower $p_1 - r$.

SECOND MODEL

- Rebate is no longer assumed to be bad for country 1.
- A form of IRP emerges endogenously in response to asymmetric info.
- Secret rebates are a natural arrangement between country 1 and the firm in response to IRP.

COMBINING BOTH

- In model 2, if only secret rebates are used, IRP is useless.
- But if we bring back the inefficiency of rebates from model 1, interior list prices, secret rebates and IRP coexist.
- Overall effect on countries' welfare ?