

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

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Noémie Cabau and Sidartha Gordon

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Université Paris Dauphine, PSL Research University

- 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:

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

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.

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 → 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.

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 $p_2 = p_1 << p_2^M$.

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

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:

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

- Sick -1 ; Healthy 0 .

- Aggregate Utility:

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

- Social security system is budget constrained:

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

- **Payoff country 1:**

$$v_1(p_1, r, \tau) = W(p_1, r, \tau) + B(p_1, r, \tau) \quad (4)$$

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

$$\pi(p_1, r) = (p_1 - r)q_1(p_1, r) + p_1(a - bp_1) \quad (5)$$

- Country 1:

$$v_1 = -\alpha$$

- Firm:

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

FIRST STAGE:

Country 1 negotiates (p_1, r) with F .

SECOND STAGE:

Country 1 chooses τ .

THIRD STAGE:

Country 2 gets $p_2 = p_1 \ll p_2^M$ and no rebate.

Optimal contribution

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

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

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

- 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:

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

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:

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

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 .

$$\begin{aligned}v^*(p_1, r) &= [1 - (p_1 - r)]q_1(p_1, r) - \alpha \\ \pi^*(p_1, r) &= (p_1 - r)q_1(p_1, r) + p_1(a - bp_1)\end{aligned}$$

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

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:*

$$\frac{p_1}{2} \leq 1, \quad (9)$$

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

and:

$$p_1 - r \leq 1 \quad (10)$$

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

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

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

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

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

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

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**.

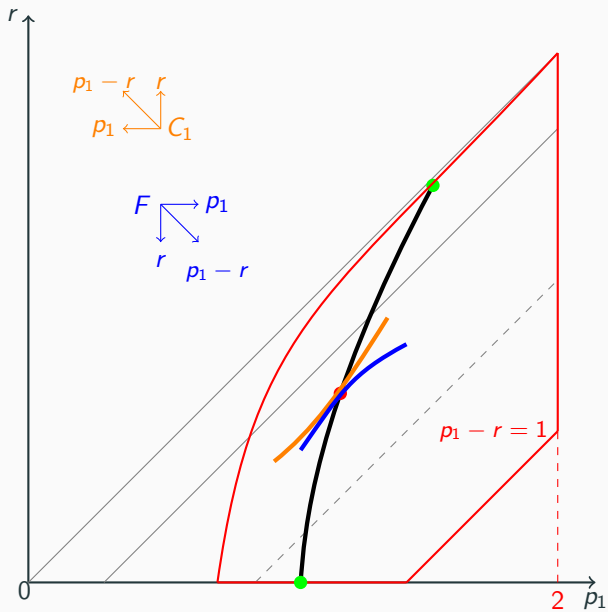
Proposition 2. *A contract (p_1, r) is PO-IR if:*

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

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

Noémie Cabau

Sidarth Gordon

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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

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

- ▶ Thus country is like a monopsonist facing supply

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

- ▶ Monopsony price

$$\max_p (1 - p) S(p)$$

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

accepted by all types lower than

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

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^o

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 $(p_1^*, t_1^*, p_2^L, p_2^H)$ 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 $\Delta_\varepsilon = \varepsilon (p_2^H - p_1^L) > 0$ to reject country 1's offer at date τ'_1 .

Forward looking firm and no secret rebates

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

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

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

$$p_2^l(t_1^\circ) = \min \left\{ p_2^*, 1 - \frac{(\tau_2'' - \tau_2')}{t_1^\circ - \tau_2'} \right\}.$$

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

Forward looking firm and no secret rebates

- ▶ For small $\varepsilon > 0$ an equilibrium close to $(p_1^*, t_1^*, p_2^L, p_2^H)$ exists.
- ▶ Can linearize the model around $(p_1^*, t_1^*, p_2^L, p_2^H)$ to find $(p_1^\circ, t_1^\circ, p_2^L, p_2^H)$ 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 ?