

Pricing Mechanisms for Multi-Indication Drugs

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- **Setting:** Multi-indication drugs treating diverse patient groups (with different diseases, at various stages of the same disease, or at distinct treatment phases)
 - E.g., sildenafil used both as Viagra for erectile dysfunction and as Revation for pulmonary arterial hypertension
 - Increasingly common (Preckler & Espín, 2022) and expected to become even more so by industry stakeholders (ISPOR Europe, 2025)
- **Challenge:** Different valuations for essentially the same product
- **Constraint:** Need above-marginal cost pricing for R&D incentives
- **Questions:** How should these drugs be priced?

How are multi-indication drugs priced today (Mills & Kanavos, 2023; Di Brino & Jommi, 2023; Campillo-Artero et al., 2020)?

- Single price based on the first approved indication (Turkey, the Netherlands and, to some extent, the US)
- Average price across all indications, weighted by volume alone (Spain) or by volume and value (Germany, France, Canada, Belgium, Australia)
- Indication-based pricing: Different price per indication, through:
 - Differential MEA/discounting from a single list price (UK, Switzerland, some U.S. insurers, Italy until 2019)
 - Separate brand names with distinct pricing

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What do we already know?

- Uniform pricing
 - Simplifies regulation but creates cross-subsidies across indications (Adida, 2024)
 - Softening-of-competition effect and thus higher prices (Brekke et al., 2025).
- Indication-based pricing (IBP)
 - Surplus extraction via third-degree price discrimination (Adida, 2024; Brekke et al., 2025)
 - Higher prices for high-benefit patients, higher utilization for low-benefit patients, and higher overall spending (Chandra & Garthwaite, 2017)
 - Strengthen innovation incentives but may not improve consumer welfare (Jiang et al., 2024)
 - With indication-specific reimbursement can achieve first-best outcomes (Goldhaber-Fiebert & Cipriano, 2023).

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Preview of the Findings

What we find:

- Three pricing schemes deliver **efficient (static & dynamic) outcomes**: indication-based pricing (IBP), weighted average uniform pricing (WAUP), and two-part tariff (TPT)
- These mechanisms can be **microfounded as Nash bargaining solutions** between manufacturer and health plan (still efficient, surplus division depends on bargaining power)

Key feature of the model:

- Profit-maximizing firm sets **optimal clinical trial population** across indications (through trial's eligibility criteria) to affect expected therapeutic benefit across indications

Main policy implications:

- Policy makers have **three instruments** to deliver the same efficient outcome. The choice depends on the specific domestic infrastructure.

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Model Setup /1

- n indications, all known ex-ante by the manufacturer
- drug is covered for each indication by the health plan if its price does not exceed the expected therapeutic benefit

$$p_i \leq \mathcal{P} \left(\mathbb{E}[g_1(x_1)|x_1 \leq \hat{x}_1], \dots, \mathbb{E}[g_i(x_i)|x_i \leq \hat{x}_i], \dots, \mathbb{E}[g_n(x_n)|x_n \leq \hat{x}_n] \right),$$

- $g_i(x_i)$ gives the therapeutic benefit patients derive from indication i , with $g_i'(x_i) < 0$
- Without loss of generality, $g_i(x_i) = v_i - \tau_i x_i$, where $0 < v_i < \tau_i$, and τ_i is the degree of patients' heterogeneity
- $x \in [0, 1]$ is the therapeutic mismatch with the drug's mechanism of action, with density $f(x)$ and distribution $F(x)$
- \hat{x}_i is the greatest therapeutic mismatch the producer chooses to include in clinical trials

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- The manufacturer chooses \hat{x}_i to determine the breadth of the indication's label in terms of clinically eligible patients
 - Clinical trial inclusion/exclusion criteria are often poorly justified (Schmidt et al., 2014; Cherubini et al., 2011)
- Expected benefit $\mathbb{E}(v_i - \tau_i x_i | x_i \leq \hat{x}_i)$ decreases as \hat{x}_i increases
 - Broader age/comorbidity criteria reduce average benefits (Nordon et al., 2023; Hill et al., 2008)
- Manufacturers can strategically influence expected benefit—and hence price—through patient selection
 - Trials typically enroll low-risk patients (Jin et al., 2017), especially when industry-sponsored (Van Spall et al., 2007; Duma et al., 2019)
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On the Manufacturer's Problem

- The health plan purchases and offers the drug to all clinically eligible patients (no strategic behavior on coverage by the health plan).
- The coverage criterion creates a “modified demand curve” where the relationship between (realized) demand, $F(\hat{x}_i)$, and price, p_i , is mediated through expected therapeutic benefit rather than consumer willingness-to-pay
- This generates the key trade-off to the company: expanding the eligible population (higher \hat{x}_i , more patients $F(\hat{x}_i)$) reduces the price through lower expected therapeutic benefit
- The monopolist still optimizes by selecting a price-quantity pair!

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Indication-Based Pricing

- When allowed to charge different prices for each indication, the manufacturer solves:

$$\max_{\hat{x}_1, \dots, \hat{x}_n} \Pi = \sum_{i=1}^n p_i F_i(\hat{x}_i) \quad \text{s.t. } p_i = \mathbb{E}(v_i - \tau_i x_i | x_i \leq \hat{x}_i)$$

- This can be rewritten as:

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- The objective function equals total therapeutic benefit across all indications. The manufacturer maximizes total therapeutic benefit through indication-specific prices

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Weighted Average Uniform Pricing

- When a single price applies to all indications, constrained not to exceed the population-weighted average of expected therapeutic benefits, the manufacturer solves:

$$\begin{aligned} \max_{\hat{x}_1, \dots, \hat{x}_n} \Pi &= \sum_{i=1}^n p F_i(\hat{x}_i) \\ \text{s.t. } p &= \sum_{i=1}^n \omega_i \mathbb{E}(v_i - \tau_i x_i | x_i \leq \hat{x}_i), \quad \omega_i = \frac{F_i(\hat{x}_i)}{\sum_{j=1}^n F_j(\hat{x}_j)} \end{aligned}$$

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Two-Part Tariffs

- In addition to unit prices p_i for each indication, the health plan makes a lump-sum payment T . The manufacturer solves:

$$\begin{aligned} \max_{\hat{x}_1, \dots, \hat{x}_n} \Pi &= \sum_{i=1}^n p_i F_i(\hat{x}_i) + T \\ \text{s.t. } p_i &\leq \bar{p}_i \quad \forall i, \quad T = \sum_{i=1}^n \int_0^{\hat{x}_i} (v_i - \tau_i x_i) f_i(x_i) dx_i - \sum_{i=1}^n p_i F_i(\hat{x}_i) \end{aligned}$$

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$$\begin{aligned} \max_{\hat{x}_1, \dots, \hat{x}_n} \Pi &= \sum_{i=1}^n p_i F_i(\hat{x}_i) + T \\ \text{s.t. } p_i &\leq \bar{p}_i \quad \forall i, \quad T = \sum_{i=1}^n \int_0^{\hat{x}_i} (v_i - \tau_i x_i) f_i(x_i) dx_i - \sum_{i=1}^n p_i F_i(\hat{x}_i) \end{aligned}$$

- The manufacturer sets the fixed fee to extract the health plan's entire surplus, defined as the total therapeutic benefit minus expenditures on unit prices
- The manufacturer maximizes and extracts the total therapeutic benefit through two-part pricing, regardless of specific unit prices

Inefficient Mechanisms

Unweighted Average Uniform Pricing

- High-benefit indications with few patients have their populations inefficiently restricted, pushing the price upwards
- Low-benefit indications with many patients are made available to inefficiently large populations to increase revenues

“Anchor Pricing”

- Uniform price anchored to a single indication's expected therapeutic benefit
- Manufacturer inefficiently restricts the price-setting indication's eligible population while opting for full coverage in all other indications (volume effect).

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Pricing Constraints With a Myopic Manufacturer

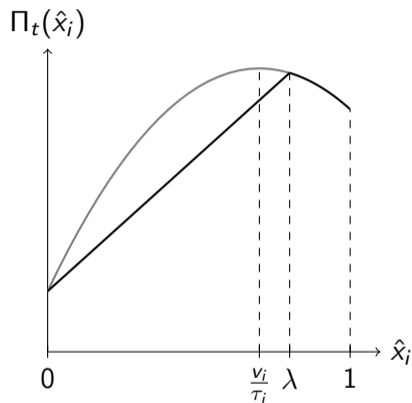
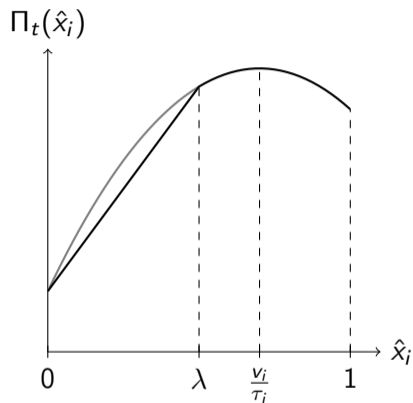


Figure: Manufacturer's profits in period t . Binding price cap for $\hat{x}_i < \lambda$, and v_i/τ_i is the efficient outcome. The solid gray line shows the "unconstrained" profit function were the price cap absent.

Pricing Constraints With a Forward-Looking Manufacturer

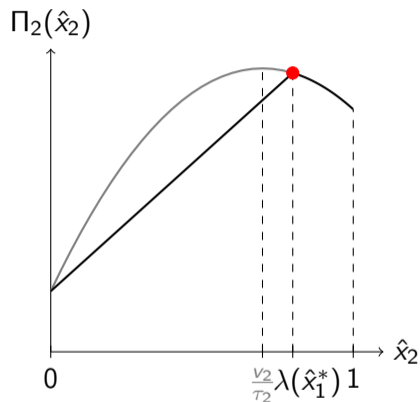
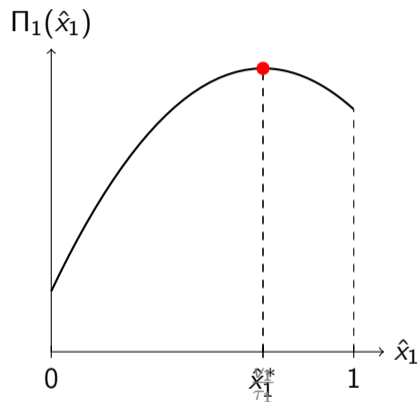


Figure: Manufacturer's *instantaneous* profits with two sequentially introduced indications. $\lambda(\hat{x}_1^*)$ is an increasing function of the manufacturer's choice of \hat{x}_1 .

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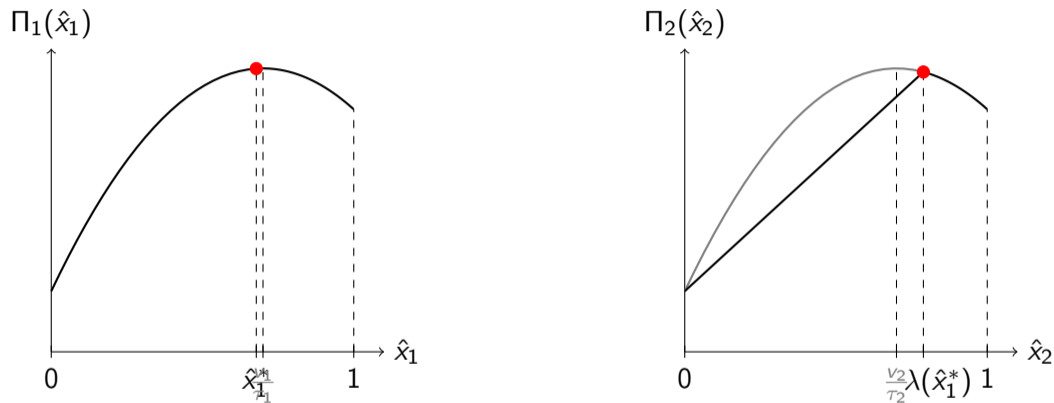


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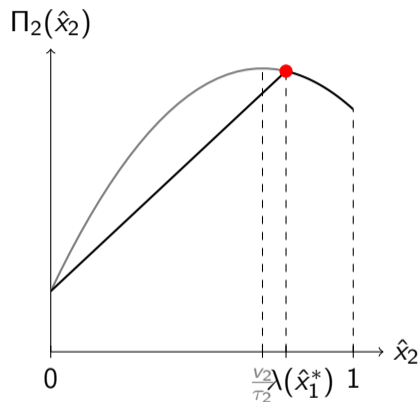
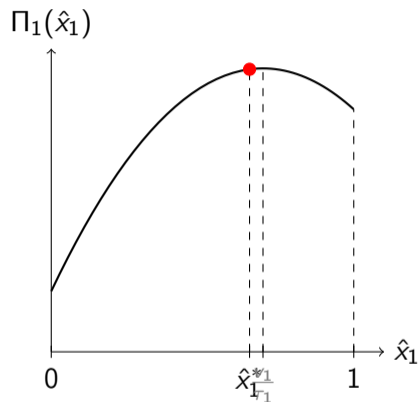


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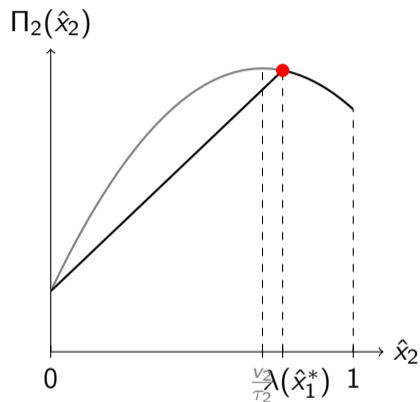
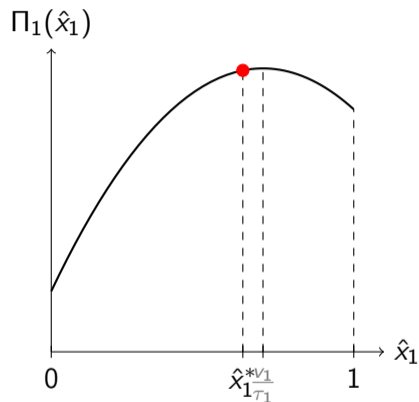


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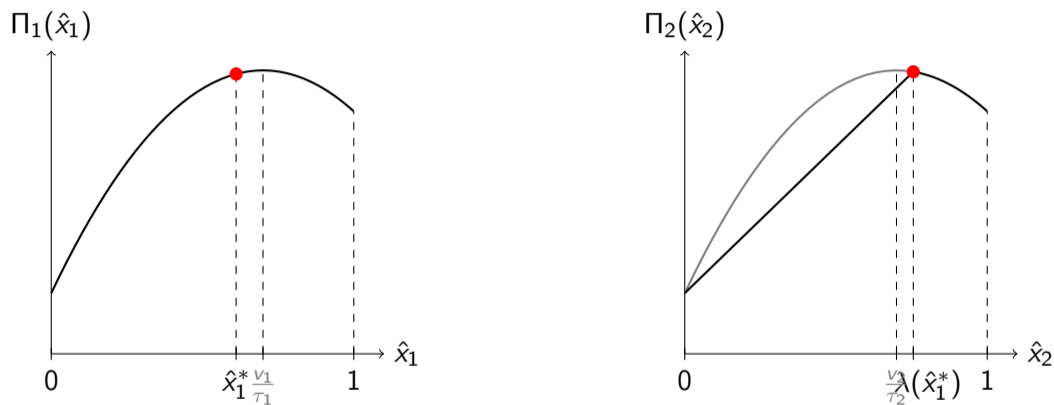


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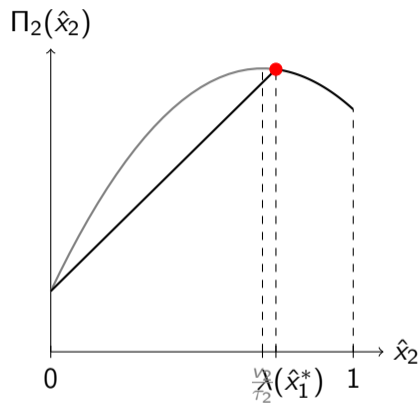
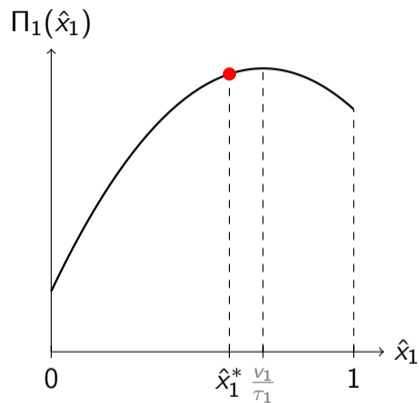


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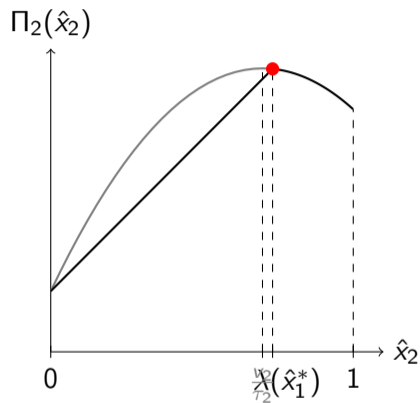
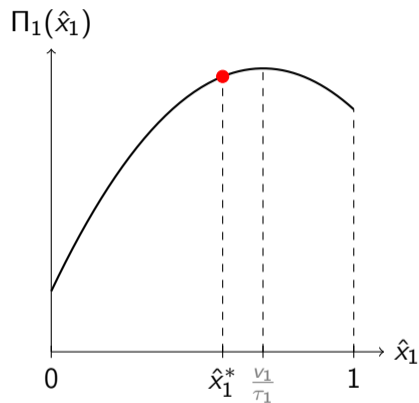


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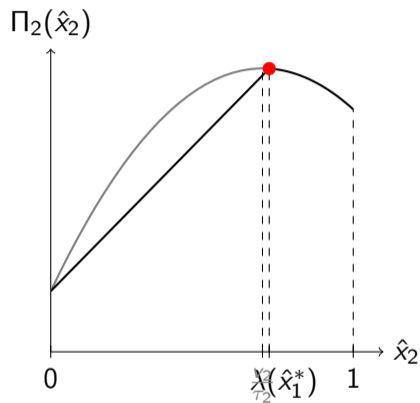
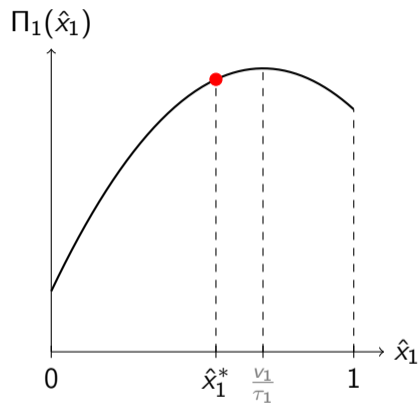


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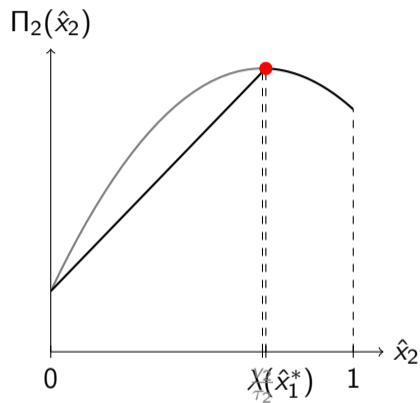
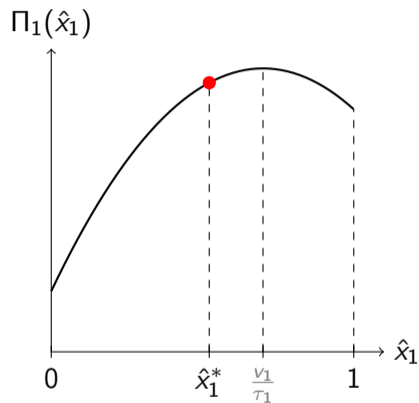


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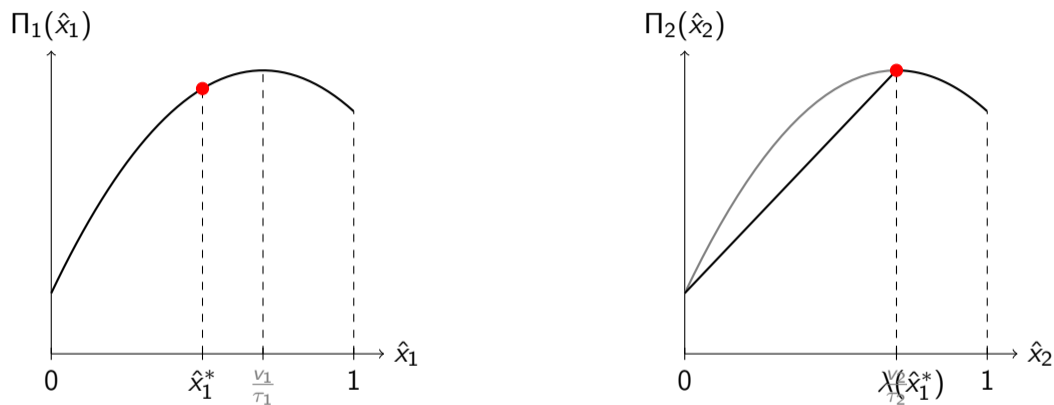


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Efficient Pricing Mechanisms as Bargaining Outcomes

- Pricing negotiations as a two-stage game:
 1. Manufacturer strategically chooses the clinically eligible patient populations $\{\hat{x}_i\}_{i=1}^n$
 2. Given $\{\hat{x}_i\}_{i=1}^n$, the manufacturer and health plan engage in Nash bargaining over prices
- IBP, WAUP, and TPT emerge as equilibrium outcomes: no need to be exogenously imposed
 - Both parties benefit from maximizing total therapeutic benefit across indications (patient selection remains efficient), then split it according to bargaining power
 - Bargaining power essentially prevents full surplus extraction by the manufacturer while keeping efficient patient selection.

Key Takeaways

- **Three pricing mechanisms achieve efficient allocation** by maximizing therapeutic benefit and ensuring only patients with non-negative therapeutic benefit receive treatment:
 - Indication-based pricing
 - Uniform pricing with weighted average expected therapeutic benefit criteria
 - Two-part tariffs
- **Dynamic efficiency is maintained** when indications are introduced sequentially, **provided prices can adjust both upward and downward** over time
- **Policy flexibility exists**: While all three mechanisms deliver identical efficient outcomes, they differ conceptually and in practical feasibility. Use other criteria to select preferred mechanism.

Thanks for your attention!

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