Optimal Retail Pharmaceutical Pricing Policy

Mikko Vanhala [1] Markku Siikanen [2] Jiekai Zhang[3]

[1]University of Helsinki

[2]VATT Research Institute

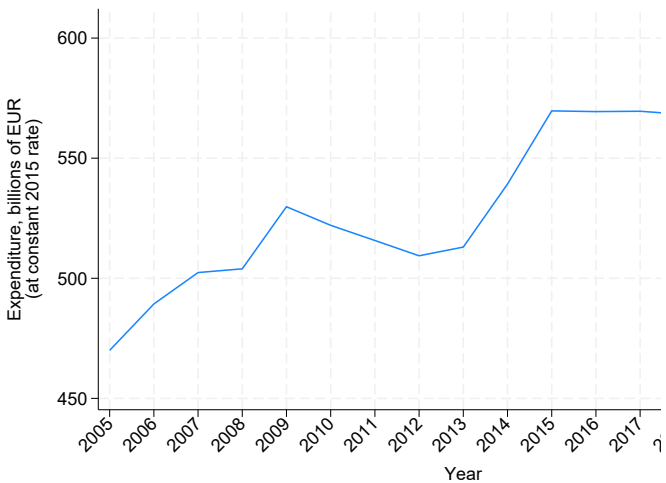
[3]Hanken School of Economics (on leave)

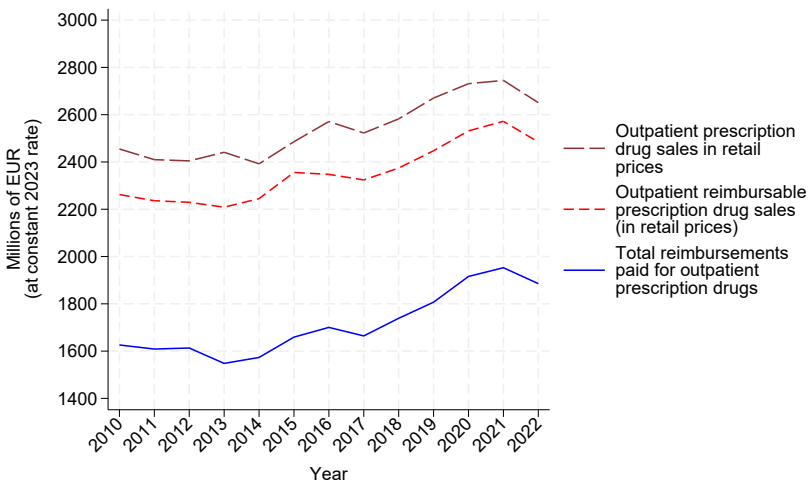
3^{rd} Health Economics Conference, Toulouse, June 2025

Pharmaceutical Spending

Pharmaceuticals account for a substantial share of living costs.

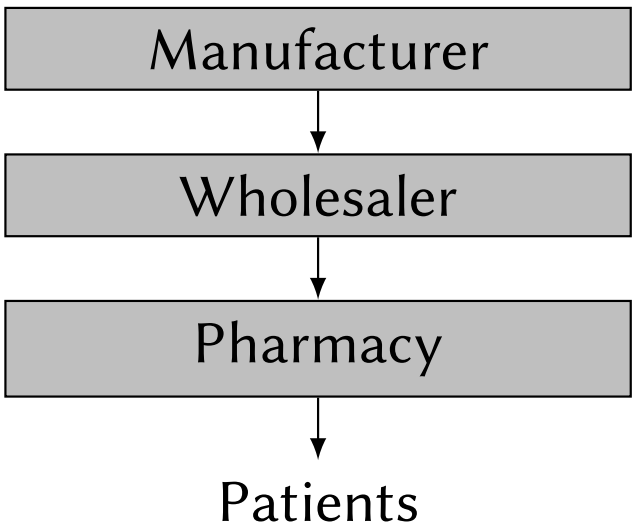
Total prescription drug spending in OECD countries VS Finland





Rent Sharing in the Pharmaceutical Supply Chain

Three parties share the rent resulting from pharmaceutical sales:



global production of pharmaceuticals

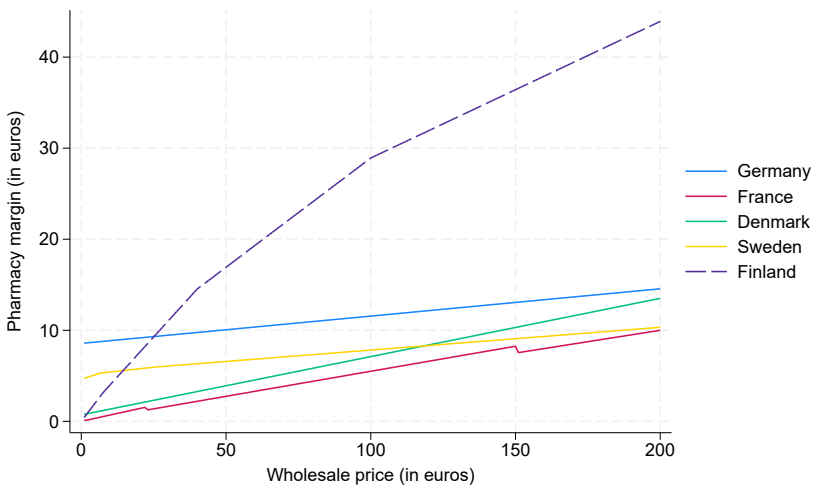
distributing products to local market

intermediary in the drug supply chain

Reducing pharmacies' rent lowers the cost of medication without disincentivizing the production and distribution of drugs to local markets !

European Pharmaceutical Margin Regulation

Most of the OECD countries have a local policy to control the retail pharmaceutical margin



Although varying by country, these formulas universally imply the margin of retail pharmacies increases with the wholesale price of pharmaceuticals

back

Research Questions

1. Reducing the retail pharmacy margin improves patients' welfare ?

   - Drug wholesale prices are predefined nationally $\rightarrow$ lowering pharmacy margins necessarily reduces patients' OOPs
   - Retail pharmacies could adjust their product selection in response to the regulation, however

2. Whether the most popular or the cheapest products are stocked by retail pharmacies under different retail pricing policies ?

3. What's the optimal policy for the retail pharmaceutical pricing ?

Pharmaceutical Prescription and Purchases

Purchase decision of pharmaceuticals:

- physicians prescribes product $j \in$ drug-group g
- pharmacists recommend product $k \in$ drug-group g ($k = j$ is possible)
- patients choose product k or j

Cost sharing:

- Social Insurance covers 40% of the cheapest $k \in$ drug-group g
- patients pay the rest out-of-pocket (i.e., $\geq 60\%$ of the chosen product)

Financial Incentives of Pharmacists

Retail pharmaceutical pricing formula: $p_{jt} = (w_{jt} * r_{jt} + f_{jt})(1 + \tau_t)$

- w_{jt}: product wholesale prices, predefined nationally
- r_{jt}: variable pharmacy margin rate
- f_{jt}: fixed pharmacy margin
- τ_{jt}: VAT
- p_{jt} applies nationally, no price dispersion on retail market

Problem:

pharmacy margins increase with the product wholesale prices !

Retail Pharmaceutical Pricing Scheme in Finland

	Wholesale price, EUR	Retail price, EUR less VAT
2002-2013	0 – 9.25	1.5 × wholesale price + 0.50
	9.26 – 46.25	1.4 × wholesale price + 1.43
	46.26 – 100.91	1.3 × wholesale price + 6.05
	100.92 – 420.47	1.2 × wholesale price + 16.15
	> 420.47	1.125 × wholesale price + 47.6
2014-2022	0 – 9.25	1.45 × wholesale price
	9.26 – 46.25	1.35 × wholesale price + 0.92
	46.26 – 100.91	1.25 × wholesale price + 5.54
	100.92 – 420.47	1.15 × wholesale price + 15.63
	> 420.47	1.1 × wholesale price + 36.65

Graph

Data

All purchases at retail pharmacies for depression and high cholesterol (ATC N06 and C10) between 2013 and 2019:

- (patient) individual-level transactions
- prescribed and purchased products
- patient-specific reimbursement rate and OOP

Full list of products in N06 and C10 available on Finnish market:

- biologically equivalent products (interchangeable at retail pharmacies) are grouped into the same drug-group
- nationwide product wholesale prices, bi-weekly level

Drug Selection

Summary Statistics

Final sample:

- 1,800,622 patients
- 836 pharmacies
- prescriptions from 29,597 different physicians
- in 122 distinct drug-groups (36 in C10 and 86 in N06)

Product Price Difference within a Drug-Group

	mean	sd	p1	p25	p50	p75	p99	N
Wholesale price difference (max. - min.)	15.23	28.70	0.00	0.62	3.35	15.92	146.43	122
Retail price difference (max. - min.)	21.72	39.46	0.00	0.98	5.00	23.12	198.25	122
Pharmacy margin difference (max. - min.)	4.52	7.28	0.00	0.25	1.35	5.26	33.80	122
Out-of-pocket cost difference (max. - min.)	27.06	39.69	0.33	4.54	12.48	30.27	198.36	122

Substitution Pattern of Prescribed Drugs

Panel A: Full sample of observation			
	Frequency		Frequency
C10		**N06**	
Branded prescribed		Branded prescribed	
Not substituted	43.3%	*Not substituted*	40.0%
Substituted to generic	56.7%	*Substituted to generic*	60.0%
Generic prescribed		Generic prescribed	
Not substituted	74.7%	*Not substituted*	78.2%
Subst. to a cheaper generic	8.0%	*Subst. to a cheaper generic*	4.6%
Subst. to same-priced generic	12.3%	*Subst. to same-priced generic*	12.0%
Subst. to a pricier generic	5.0%	*Subst. to a pricier generic*	4.6%
Subst. to brand-name	0.06%	*Subst. to brand-name*	0.63%
Panel B: Sub-sample of observations with substitution			
	Frequency		Frequency
C10		**N06**	
Branded prescribed		Branded prescribed	
Substituted to generic	100%	*Substituted to generic*	100%
Generic prescribed		Generic prescribed	
Subst. to a cheaper generic	31.7%	*Subst. to a cheaper generic*	21.1%
Subst. to same-priced generic	48.5%	*Subst. to same-priced generic*	55.0%
Subst. to a pricier generic	19.6%	*Subst. to a pricier generic*	21.0%
Subst. to brand-name	0.23%	*Subst. to brand-name*	2.9%

Reduced-Form Evidence

• Do patients' out-of-pocket (OOP) costs influence the drug choices at retail pharmacy ?

• Do pharmacists' profit motives affect their decision making ?

• To what extent does the product assortment at different retail pharmacies explain the observed substitution patterns ?

Linear probability model:

$$S_{igmt} = \alpha \Delta OOP_{it} + X_{it}\Gamma_1 + Y_{mt}\Gamma_2 + Z_{imt}\Gamma_3 + \rho \mathbb{1}_{i,t-1} + \xi_g + \xi_{bw(t)}$$
$$S_{igmt} = \beta \Delta MK_t + X_{it}\Gamma_1 + Y_{mt}\Gamma_2 + Z_{imt}\Gamma_3 + \rho \mathbb{1}_{i,t-1} + \xi_g + \xi_{bw(t)}$$
$$S_{igmt} = \alpha \Delta OOP_{it} + \beta \Delta MK_t + X_{it}\Gamma_1 + Y_{mt}\Gamma_2 + Z_{imt}\Gamma_3 + \rho \mathbb{1}_{i,t-1} + \xi_g + \xi_{bw(t)}$$

- $S_{igmt} = 1$ if substitution and $S_{igmt} = 0$ if not
- $\Delta OOP_{it} = (OOP^k_{it} - OOP^j_{it})/OOP^j_{it}$: patient's OOP difference
- $\Delta MK_t = (MK^k_t - MK^j_t)/MK^j_t$: pharmacist's margin difference

Reduced-Form Evidence (cont.)

Patient-specific characteristics X_{it}

- age
- income
- gender
- educational level
- health educational background or not
- employment status (student, unemployed, pensioner)
- citizenship (Finnish or not)

$\mathbb{1}_{i,t-1}$: patient history-dependence in drug demand

Reduced-Form Evidence (cont.)

Pharmacy-specific characteristic Y_{mt}

- pharmacy size and product variety $\equiv n_{mgt}/N_{gt}$
  - n_{mgt}: number of substitutable products in the visited pharmacy
  - N_{gt}: number of substitutable products on national market
- the location (urban, semi-urban, or rural)
- the number of potentially competing pharmacies

Relationship between the patient and the pharmacist Z_{imt}

- number of previous visits of patient i to pharmacy m
- minimum travel distance of the patient i to the pharmacy m

Reduced-Form Results (I)

$S_{igmt} = 1$ for substitution to a less expensive drug

	Brand j ➜ Generic k		Generic j ➜ Generic k	
$\lvert\Delta OOP\rvert$, %	1.218***	3.144***	1.451***	1.482***
$\lvert\Delta Margin\rvert$, %	1.268***	-2.261***	1.804***	-0.041***

$S_{igmt} = 1$ for substitution to a more expensive drug

	Generic j ➜ Brand k		Generic j ➜ Generic k	
$\lvert\Delta OOP\rvert$, %	0.088***	-0.076***	0.577***	-1.311***
$\lvert\Delta Margin\rvert$, %	0.168***	0.307***	1.713***	3.987***

☞ There is a clear trade-off between the interest of patients and of pharmacists at the point of purchase !

Reduced-Form Results (II)

Patients' age, income and location can explain the substitution:

- substitution is unlikely for older people
- substituting a prescribed generic to a brand-name product is more likely for high income individuals
- substitution happens more for patients in rural area (eventually due to unavailability of prescribed products)

Indicator variable $\mathbb{1}_{i,t-1}$ always significant ➜ history-dependence of drug consumption !

Reduced-Form Results (III)

Pharmacies' product assortment could explain observed substitution:

$S_{igmt} = 1$ for substitution to a less expensive drug

	Brand j ➜ Generic k			Generic j ➜ Generic k		
Pharmacy size / product variety	0.1367^{***}	0.1546^{***}	0.0776^{***}	0.0207^{***}	0.0221^{***}	0.0206^{***}

$S_{igmt} = 1$ for substitution to a more expensive drug

	Generic j ➜ Brand k			Generic j ➜ Generic k		
Pharmacy size / product variety	-0.0051^{***}	-0.0051^{***}	-0.0051^{***}	-0.0321^{***}	-0.0257^{***}	-0.0206^{***}

Conclusion: pharmacy margin and assortment are two factors beyond patients' idiosyncratic preferences which impact the product choices at retail pharmacies

Structural Model

Why ?

Various alternatives for regulating the retail pharmaceutical prices exist

Which policy leads to the highest consumer welfare ?

☞ Model product demand and supply at retail pharmacy
➠ counterfactual policy evaluations

Compare the current regulatory framework to three alternative policies:

- free retail pricing
- retail price cap
- uniform pharmaceutical margin for all products

Alternative Policies

Compare the current regulatory framework to three alternative policies:

- retail price cap
- uniform pharmacy margin for all products
- free retail pricing

Empirical Design:

	Formula	€8.65 (observed average margin)
$\overline{MK}^g$	Uniform low margin	€5.86 (the smallest observed margin)
	Uniform high margin	€14.76 (the resulting average retail prices are comparable to free pricing under monopoly)
$\overline{p}^g$	Low price cap	€23.08 (the highest generic retail price under uniform low margin)
	High price cap	€90.65 (free retail pricing under monopoly)

Sample: Escitalopram 10 mg, Q12015

Counterfactual Simulation

Simulate the product demand and supply at different retail pharmacies

- keep the assortment size of each pharmacy as observed
- allow pharmacies to adjust their product selections $\mathcal{J}_{mt}^{g}$

Two-stage games: A pharmacy

- first decides on the assortment
- then determines the retail prices

Algorithm:

- compute the expected profits of retail pharmacies for each possible assortment they may offer
- pharmacies choose the assortment that yields the highest expected profit

Counterfactual Results and Policy Recommendation

Monopoly Pharmacy Areas

- Free retail pricing: product retail prices twice as high as the currently observed levels → restricting retail prices improve consumer welfare
- Retail price cap: reduces the average OOP, but only products with the lowest wholesale prices are stocked by pharmacies → not necessarily increase consumer welfare
- Uniform pharmacy margin: pharmacies always stock the most popular products → imposing small pharmacy margins improve consumer welfare

Pharmacy Area with Competition

- Free retail pricing: equilibrium margins significantly lower than currently observed levels → competition reduces needs for price regulation

Thank you!

jkz_work@outlook.com

Drug Selection

Antidepressant (N06) and High Cholesterol (C10)

- focus on drugs treating long-term disease because

  products treating temporary or non-severe conditions are not eligible for the public reimbursement and thus not registered in the administrative database

- sample covers a significant size and a wide range of individuals
  - about 10% (13%) of Finnish population are taking medication for depression (high cholesterol)
  - about25% of patients treated for depression are below 35 and the median age of them is 54

back

Literature and Contribution

◇ Effect of the price controls of pharmaceuticals

- **Internal reference pricing:** Brekke *et al.* (2009, 2011), Kaiser *et al.* (2014)
- **External reference pricing:** Maini and Pammolli (2023)
- **Role of government reimbursement:** Pavcnik (2002), Duggan et al. (2016), Herr and Suppliet (2017) and Yurukoglu *et al.* (2017)
- **Wholesale price regulation:** Giaccotto *et al.* (2005), Kyle (2007), Costa-Font *et al.* (2014), Cockburn *et al.* (2016)
- **Retail price cap:** Dubois and Lasio (2018)
- Among the first to evaluate the regulation of retail pharmacy margin

Literature and Contribution (cont.)

◇ Agency problem:

- **Physician agency:** Iizuka (2007, 2012), Tang 2023, Müller *et al.* (2023)
- **Pharmacy agency:** Brekke *et al.* (2013), and Alpert *et al.* (2013), Song and Barthold (2018) highlight the likely responses of retail pharmacies to their financial incentives
- We explicitly address the agency problem in pharmaceutical market using micro-level prescription and sales data

◇ Pharmacieutical supply and pricing:

- Dubois and Sæthre (2020) examine the incentives of pharmacies to supply parallel imports versus direct imports
- Among the first to study the strategic assortment planning of retail pharmacies in response to the price regulation