# Demand response when dynamic and flat power retail tariffs coexist

## MOTIVATION

Increasing demand-side flexibility is crucial for low-carbon power systems. Retail tariffs shape the demand curve if they are **dynamic and adopted**.
Retail markets channel three ambitions:

- Pass the costs and **foster demand response** through dynamic tariffs
- **Protect (vulnerable) consumers** from too harsh or volatile signals with flat tariffs
- Ensure consumer freedom by removing switching barriers

## RESEARCH QUESTIONS

**What are the interactions of dynamic and flat retail tariffs in liberalized electricity retail markets with flexible consumers?**

→ Can these types of tariffs coexist at market equilibrium?

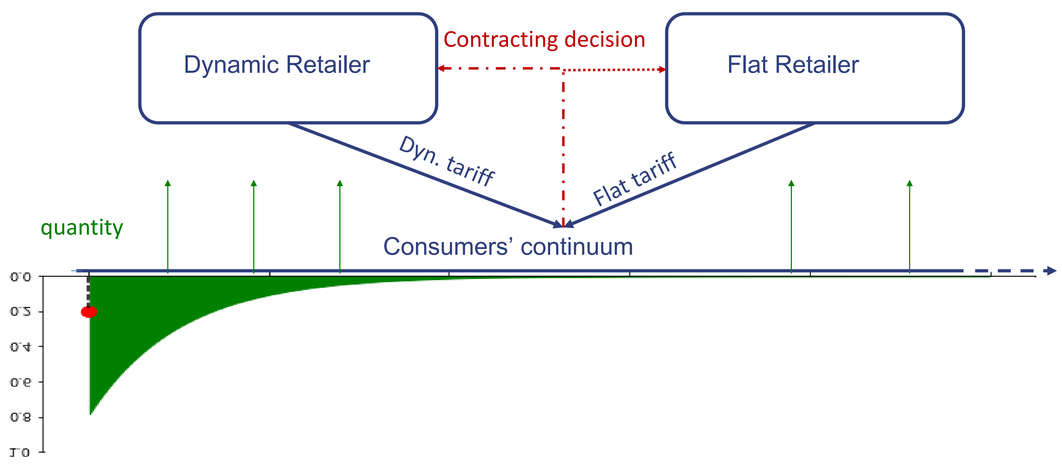
→ If so, how do they influence each other?

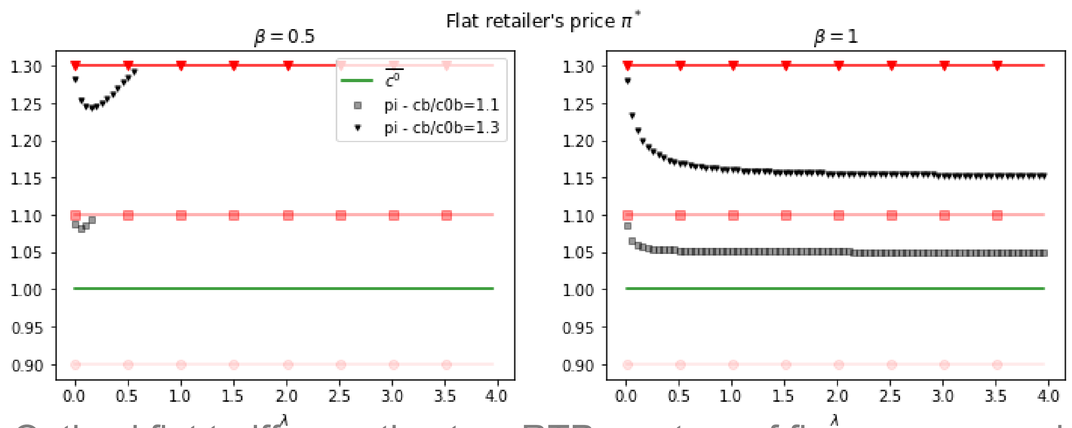
→ How does the distribution of flexibility over the population influence tariffs and, in turn, the flexibility effectively activated through tariffs?

## METHODOLOGY

A multiple leaders - multiple followers model of the retail market (Alasseur et al., 2020; Oggioni et al., 2024) :

- Price competition between specialized retailers
- Consumers are differentiated by their **penalization of load-shifting** (Nakai et al., 2024)




Optimal flat tariffs reacting to a RTP: capture of flex. consumers but non-cost reflectiveness limited by RTP's costs

Solving for the **retail equilibria** in three settings:

- Competition between flat and dynamic retailers

$$\forall t, m, (p_{t,m} - \overline{p_m}) \left[ \mathbb{E}_h[\nu \geq \hat{\nu}] + \frac{\hat{\nu}}{2}(H(\hat{\nu}) - 1) \right] = \frac{\mathbb{E}_h[\nu \geq \hat{\nu}]}{2}(c_{t,m} - \overline{c_m})$$

**Dyn. tariff at equilibrium: not a RTP!** (Joskow & Tirole, 2006)

- Dynamic vs regulated flat tariffs
- Flat tariff reacting to the introduction of a RTP

## KEY RESULTS

- At equilibrium, price competition results in first-best dynamic tariffs being **less dynamic than RTP**.
- The **dynamic nature allows for worse underlying supply strategy** if the population is flexible enough.
- Facing a fixed flat tariff a dynamic retailer **offer closer-to-RTP tariffs** but with **degeneration of the adoption rate**.
- **Some flexible consumers opting for an inflated flat tariff** if a RTP is introduced in a fully flat tariffs situation.

## REFERENCES


- Joskow & Tirole, 2006. "Retail Electricity Competition". RAND Journal of Economics
- Littlechild, 2009. "Retail competition in electricity markets - expectations, outcomes and economics". Energy Policy.
- Alasseur et al., 2020. "An Adverse Selection Approach to Power Pricing". SIAM Journal on Control and Optimization
- Oggioni et al., 2024. "Dynamic pricing and strategic retailers in the energy sector: A multi-leader-follower approach". European Journal of Operational Research
- Nakai et al., 2024. "Preferences for dynamic electricity tariffs: A comparison of households in Germany and Japan". Ecological Economics.



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