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Discrete distance-based pricing schemes for public transport (topic presentation)

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Pricing in public transport

- Ticket pricing is a crucial issue – pricing affects the passenger as well as revenue.
- There are different pricing structures. Fares may be set based on e.g. zones or distance travelled.
- Transferring from one pricing structure to another sets requirements, e.g. fares should not change significantly.

Schiewe, Philine & Schöbel, Anita & Urban, Reena. 2025. Design of Distance Tariffs in Public Transport.

- Models for transferring into distance-based pricing structure presented.
- The distance-based prices consists of base amount and price per km.
- Minimizing the total difference between the reference and new prices.

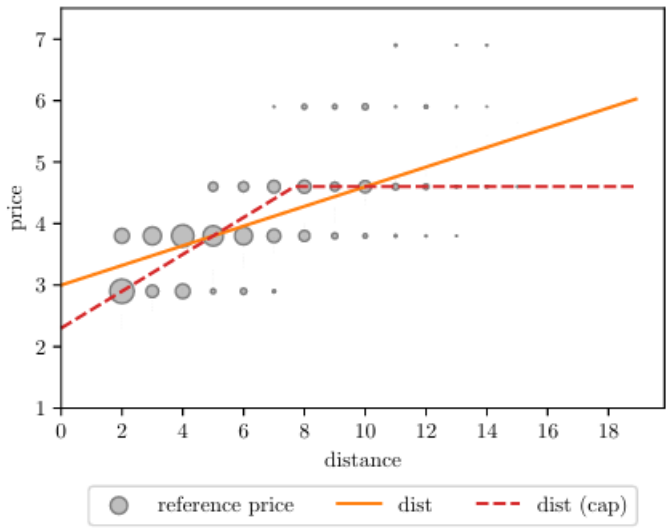
$$\begin{aligned} \min_{p,\, f,\, \pi_d} \quad & \sum_{d \in \mathcal{D}} w_d |r_d - \pi_d| \\ \text{s.t.} \quad & \pi_d = p \cdot l_d + f \quad \text{for all } d \in \mathcal{D} \\ & p, f \geq 0. \end{aligned}$$

Schiewe, Philine & Schöbel, Anita & Urban, Reena. 2025. Design of Distance Tariffs in Public Transport.

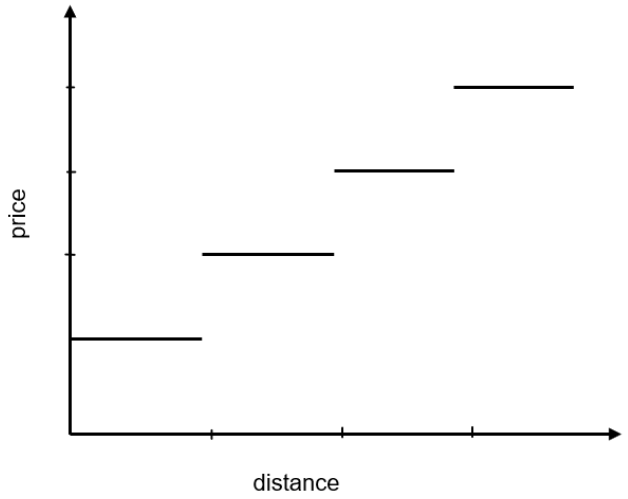
- The following models include constraints to face practical requirements.
  - Integrality constraints
    - Ticket prices to be integers or multiples of e.g.10ct
  - Upper price cap
    - The price needs to be limited to not increase over maximum price.
  - Revenue constraint
    - To obtain the target revenue
  - Highly affected passengers
    - Set of constraints limit the number of highly affected passengers.

Objectives

Mixed-integer model with k discrete pricing brackets.



Fare structure with upper price cap (Schiewe et al., 2025)



Sketch of discrete fare structure with k = 4

Objectives

- Develop a mixed-integer model for discrete distance-based pricing.
- Determine ticket prices and the corresponding brackets of travelled distance.The ticket prices are only depended on the travelled distance.
- Modelled prices and reference prices should not significantly differ.
- In addition, possibility to model practical requirements, e.g. revenue.
- Evaluate the model experimentally.

References

- Schiewe, Philine & Schöbel, Anita & Urban, Reena. 2025. Design of Distance Tariffs in Public Transport.
- Julia JuMP

Schedule

- Started in October 2025
- Presenting the topic 31.10.2025
- Modelling and implementation in November and December
- Writing in December and January
- Final presentation January 2026