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Fostering Cooperation Between Public Transport And On-demand Services Through Tradable Credits: A Modeling Framework Based On The Trip-based Macroscopic Fundamental Diagram

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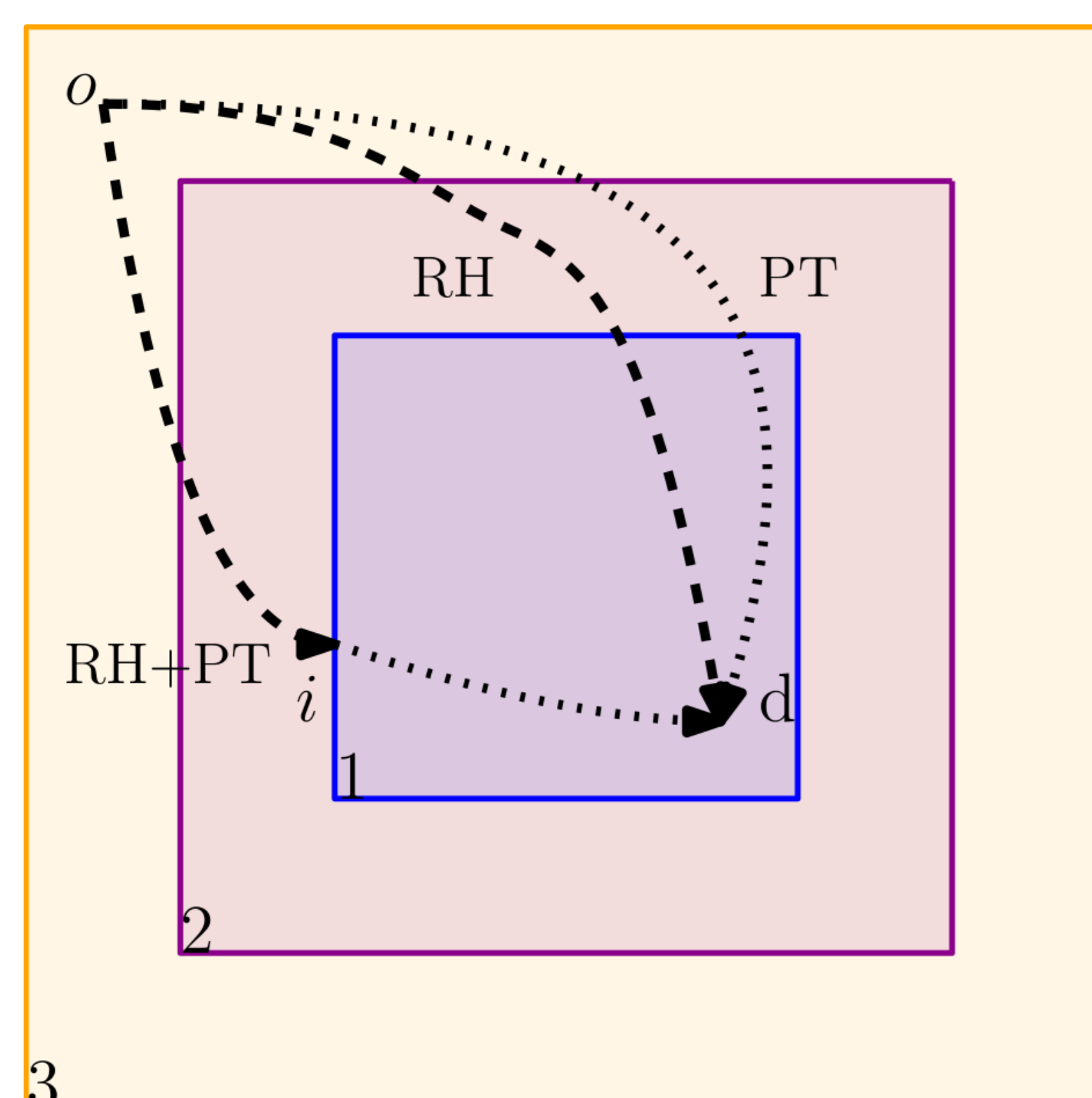
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Motivation

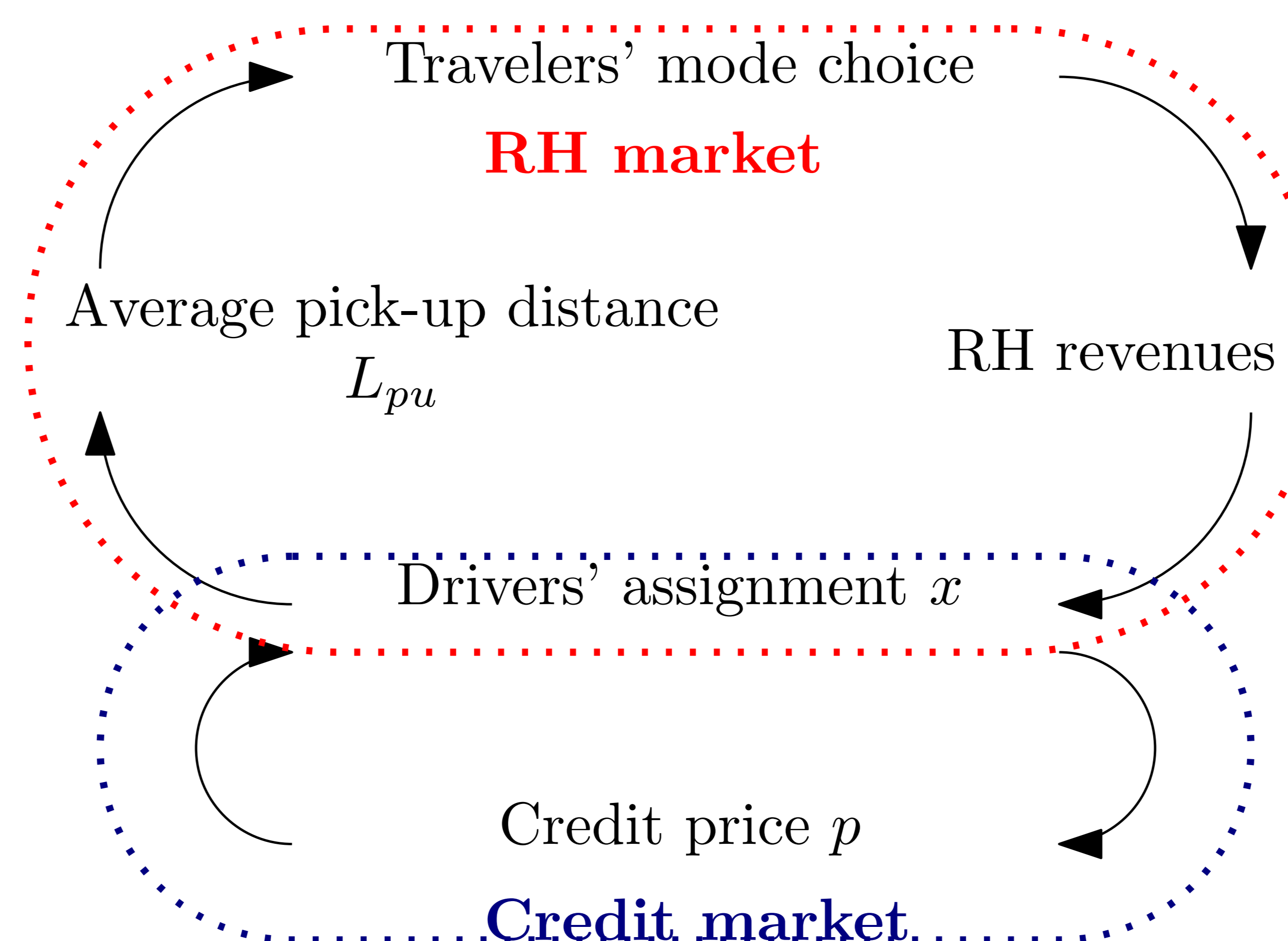
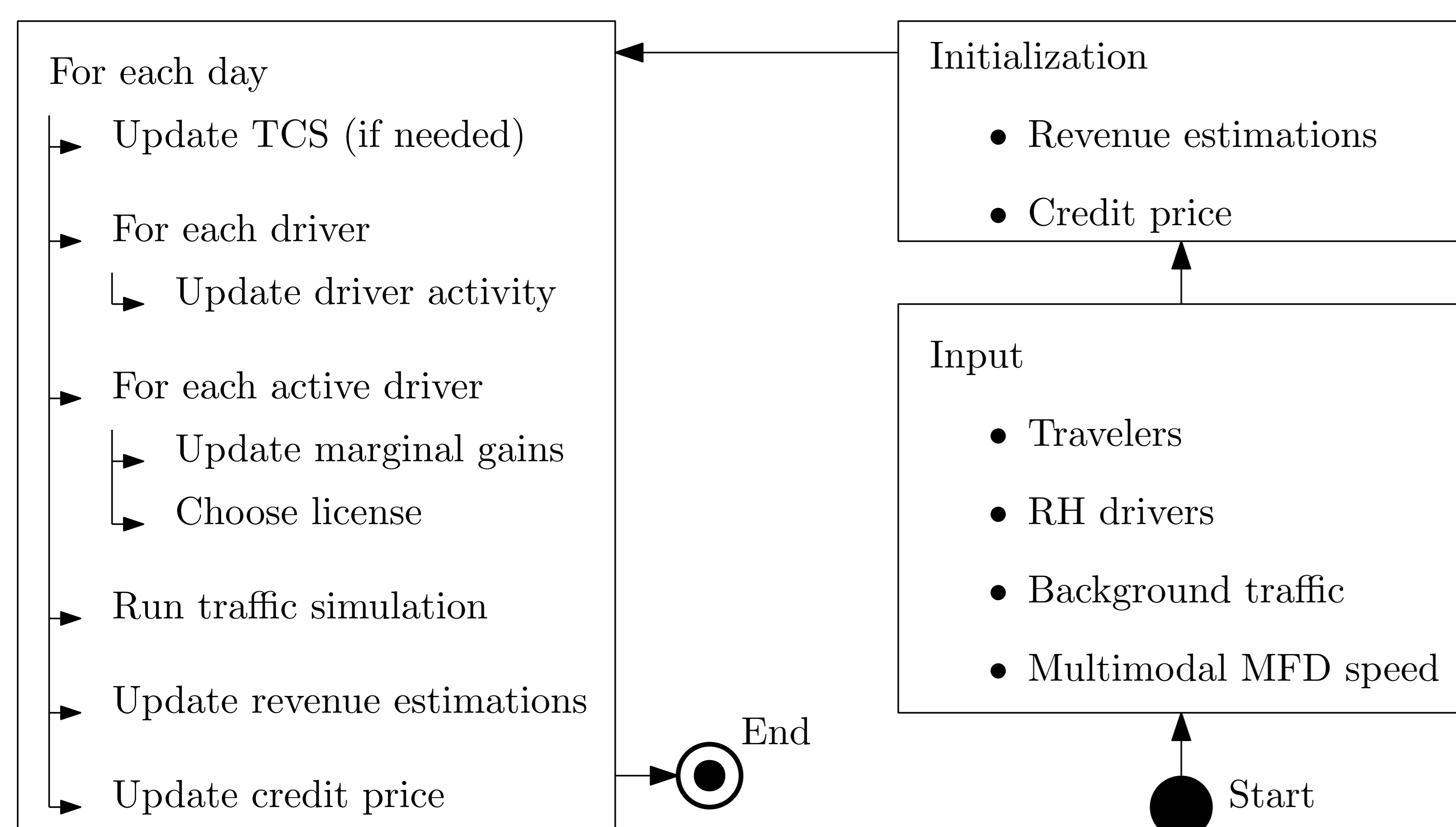
- ✘ Ride-hailing (RH) services may **compete** with public transportation (PT).
- ✘ We propose a Tradable Credit Scheme (TCS) to **promote cooperation** between RH and PT.
- ✘ The goal is to use RH in the suburbs to **complete** the sparse transportation offer.

Model description and regulation



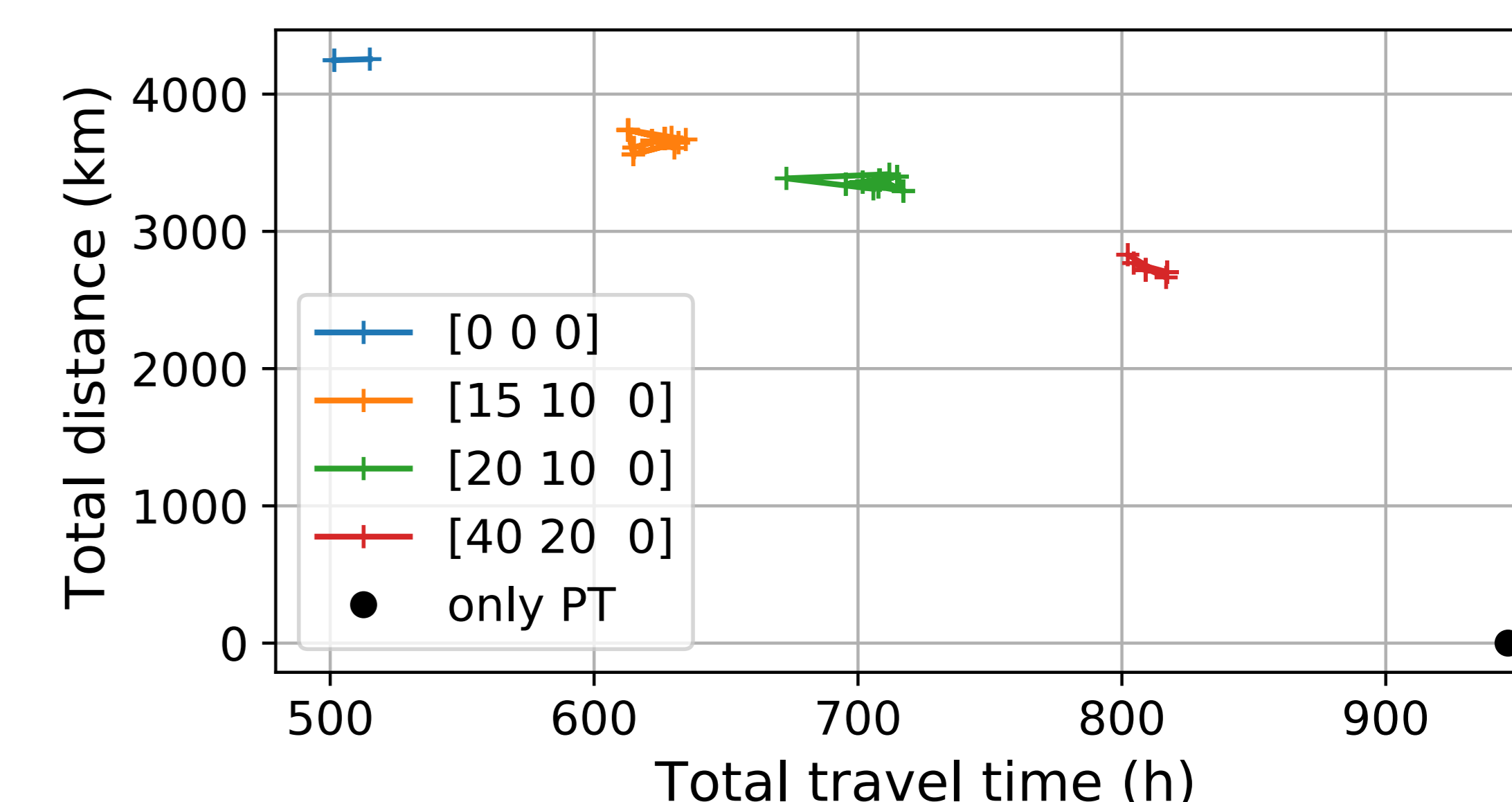
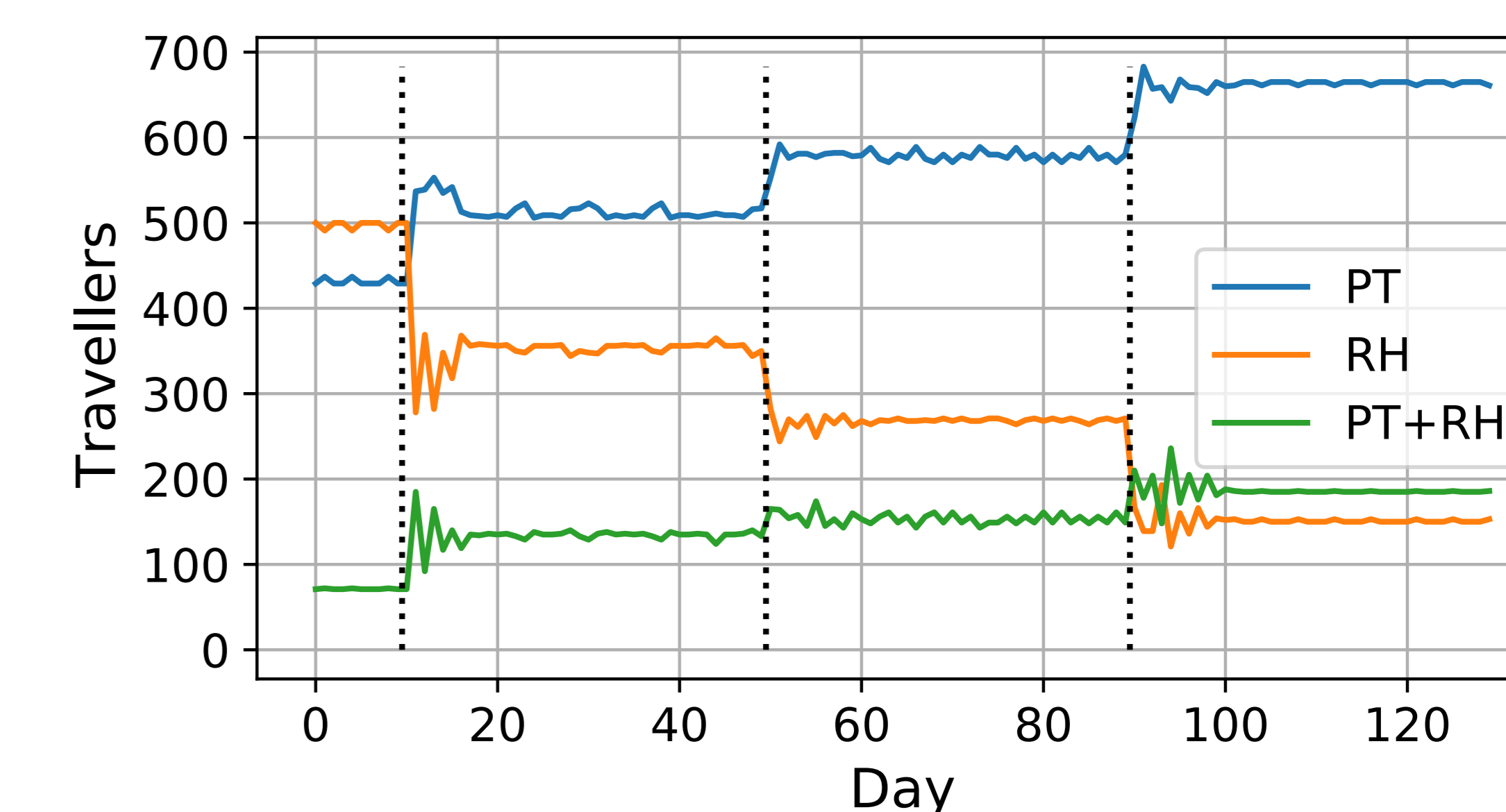
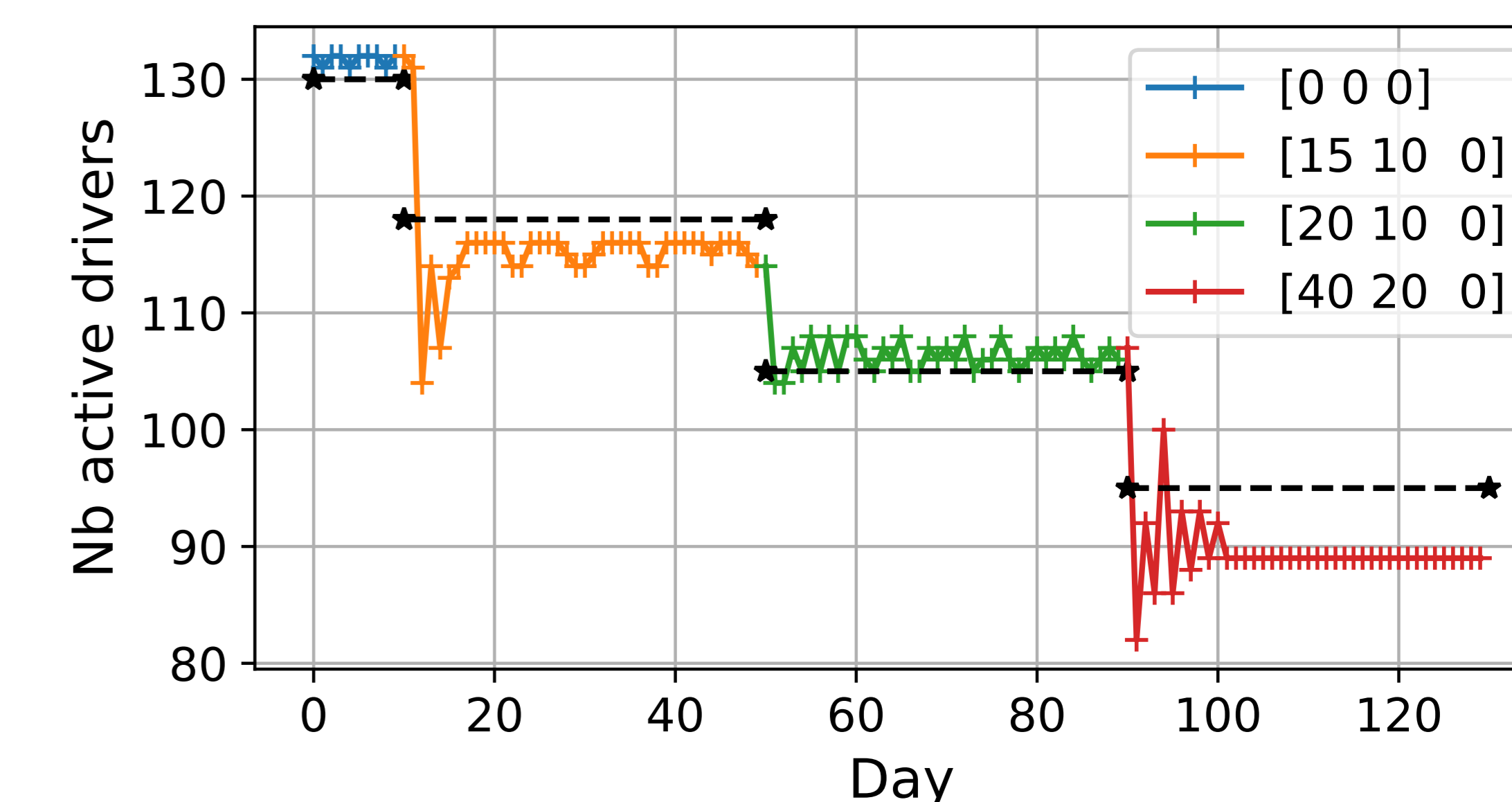
- ✘ Each traveler can use **RH, PT**, or a combination of **RH and PT** to travel from its origin o to its destination d .
- ✘ The city is divided into three **concentric regions**. RH drivers need a **license lic_r** to operate in the regions with an index higher or equal to r .
- ✘ City model: one reservoir with trip-based MFD.
- ✘ Each active RH driver gets κ **credits**, needs τ_r credits to buy license lic_r . They trade credits with the regulator, which adjusts the price to be budget-neutral.
- ✘ The RH offer is **elastic**: RH drivers can join or leave the service based on the expected RH revenues.
- ✘ RH drivers **choose regions** of operation according to expected gains: RH revenues minus license price.

Equilibrium computation and day-to-day process



Results

Allocation κ is 10 credits and the credit charges τ are set to [15,10,0] on day 10, [20, 10, 0] on day 50, and finally [40, 20, 0] on day 90.



Conclusion

- ✘ TCS regulates RH operations to **foster PT and combined trips**.
- ✘ Mitigates RH externalities at the expense of total travel time and provides **trade-offs** between laissez-faire and RH ban.