

The marginal external cost of street parking, optimal pricing and supply: evidence from Melbourne

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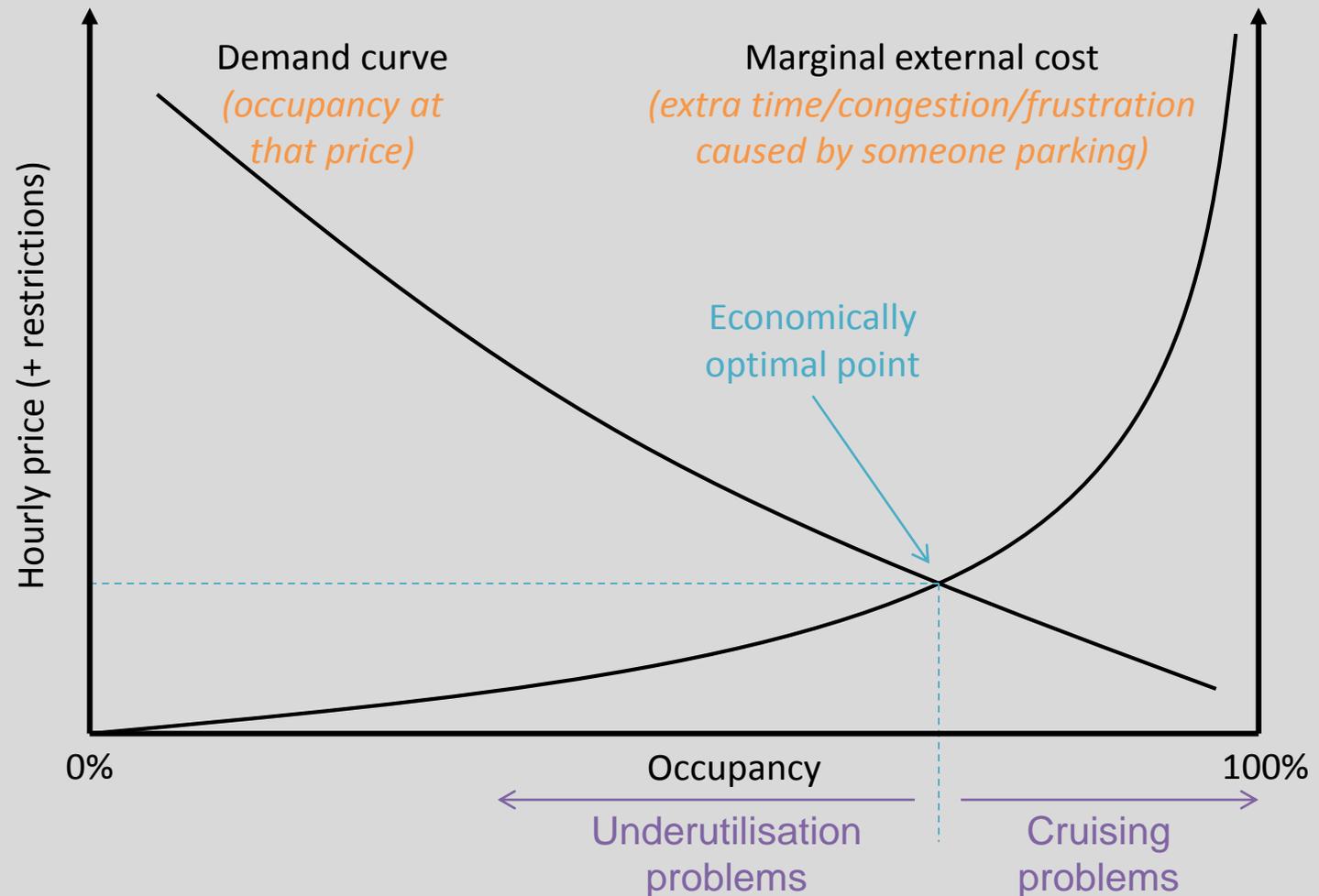
Barcelona

1. Introduction

- On-street parking prices receives a lot of attention in economic theory
- We introduce a method to calculate the marginal external cost of parking, i.e. the cruising time costs imposed on other drivers by increasing a parker's duration
- The marginal external cost of parking is important to examine for:
 - The welfare effects of current parking policy (parking price /time limits)
 - The welfare effects of changing parking supply
- We apply our method to Melbourne

Theory: optimal pricing policy

- One block, at a particular point in time



2. A model of parking search

- We aim to derive the marginal external cruising time when one motorist decides to park longer.
- Assume that all motorists search in one block following a Poisson process, at time
- $A(t)$ = the number of arriving motorists who search in a block
- N = number of parking bays within a block
- $v(t)$ = vacancy rate within the block
- r = sampling rate of bays
- $n(t)$ = number of parked motorists
- $external\ costs = \frac{A(t)}{r v(t)}$; $v(t) = 1 - n(t)/N$
- $C(t) = \underline{marginal\ external\ search\ time\ costs}$
- $= \partial\ external\ costs / \partial\ n(t)$
- $C(t) = \frac{A(t)}{rNv(t)^2}$ (Zakharenko, 2016)

2. Model

- We then make assumptions on value of time and search strategy
- This provides marginal external cost of parking
- One can then examine whether these costs differ from the price of parking
- This is important because in the (constrained) optimum, these costs equal the price

- One can also calculate now the marginal benefit of increasing supply, because the vacancy rate will go up
- The marginal benefit of increasing supply on one day = the sum of all reductions in search cost during the day

2. Model

- We allow for walking time to the final destination
- We assume those arriving = number of searchers
- We allow for motorists searching in a straight line before they reach the final destination (from an optimally-chosen distance), and searching in a circle on the block after the final destination.
- Therefore requires a minimum block size

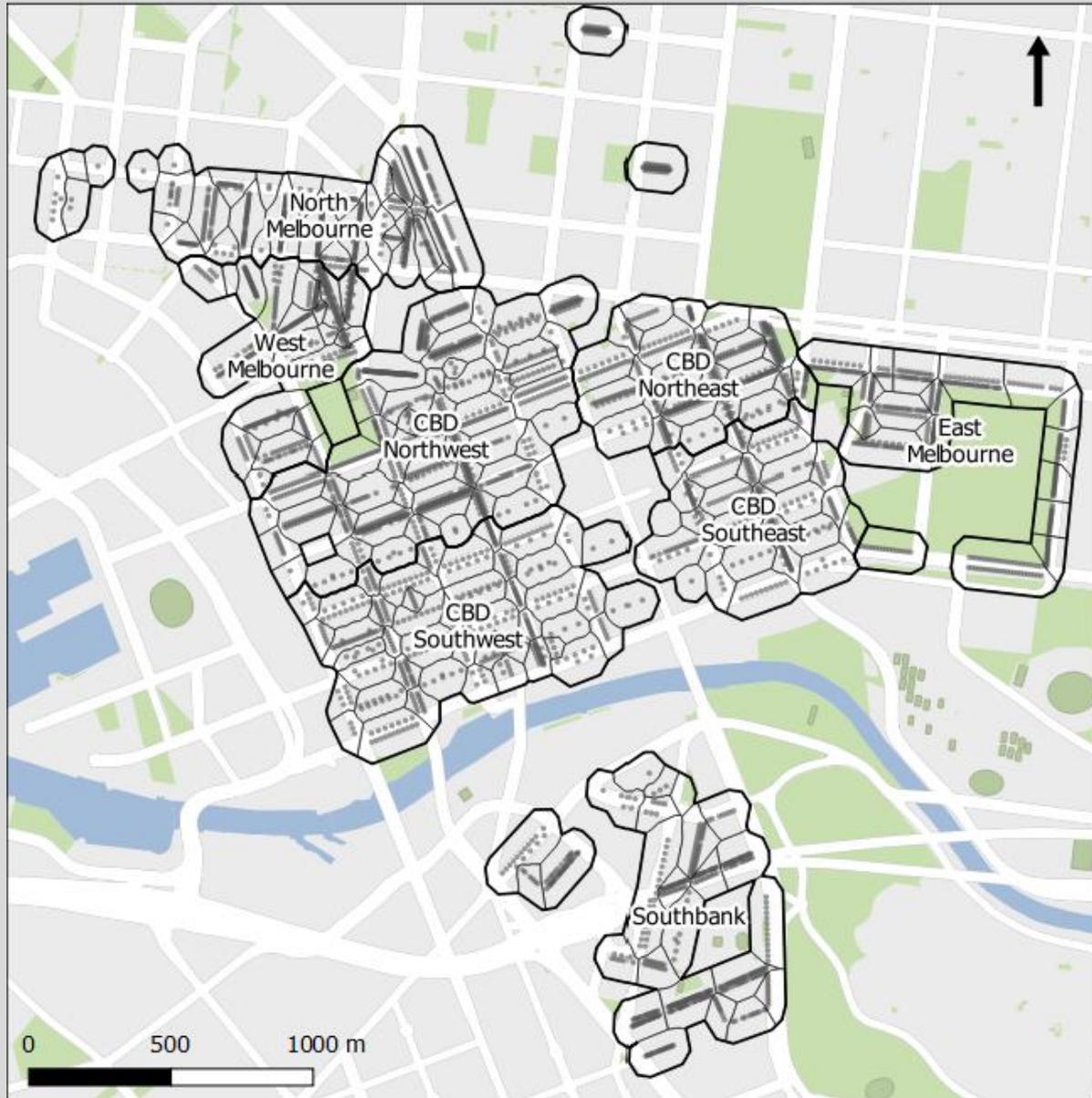
2. Model

- As an aside, we show a well-known self financing result
- Given optimal policy, the revenue of paid parking = total capital cost on parking
- This is useful to say something about whether policy is too strict or too relaxed

3. Data and Context

- We examine parking policy in Melbourne city centre for March 2014
 - Maximum parking limits (usually one hour) most of the time
 - Parking prices far below off-street parking
 - Sunday parking is free
 - Evening parking is free without parking limits
- Sensor data on arrival rates, occupancy rates
 - We only have observations when parking limits are in place (typically 07:30–20:30)
 - We focus on about 200 blocks, with a minimum of 10 parking bays
- We calculate MEC for 30 min. intervals per block

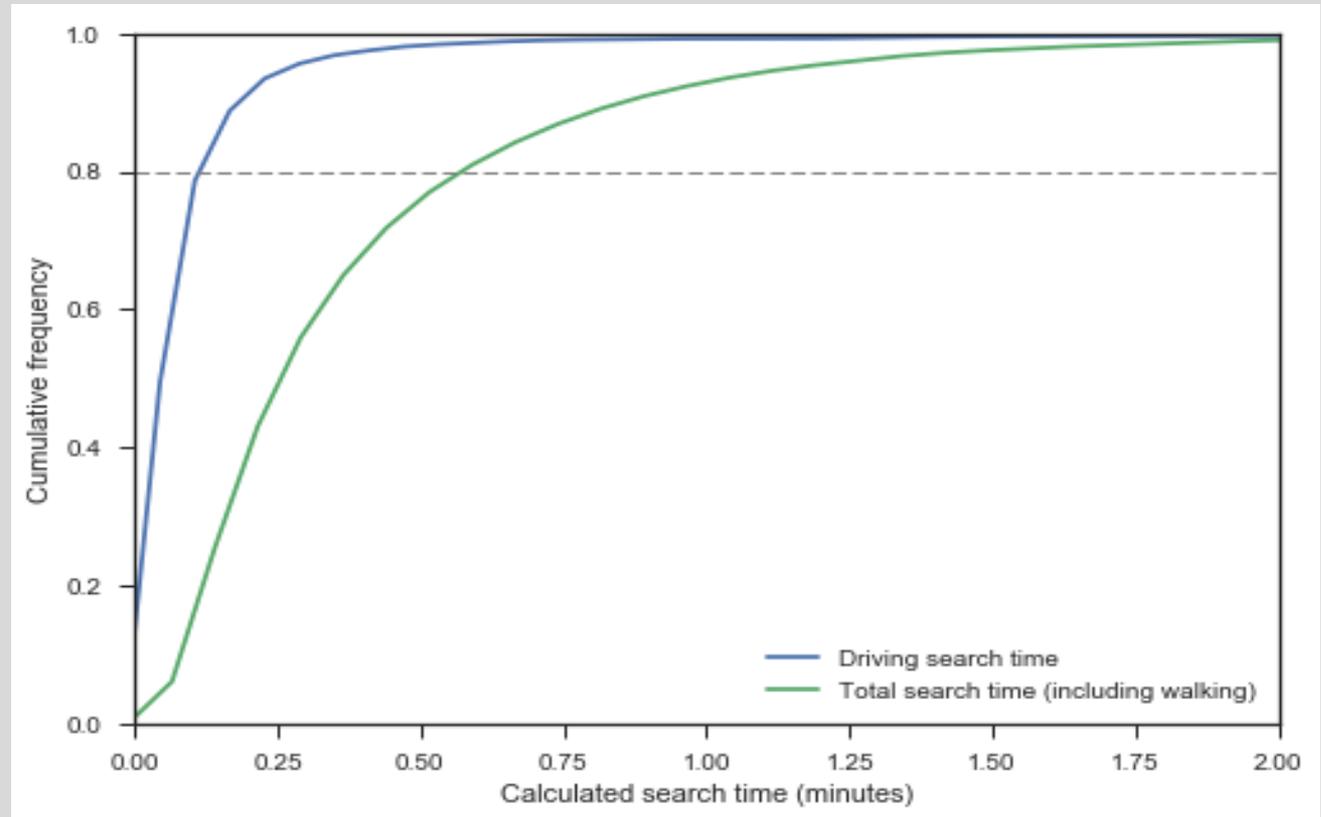
3. Data and Context



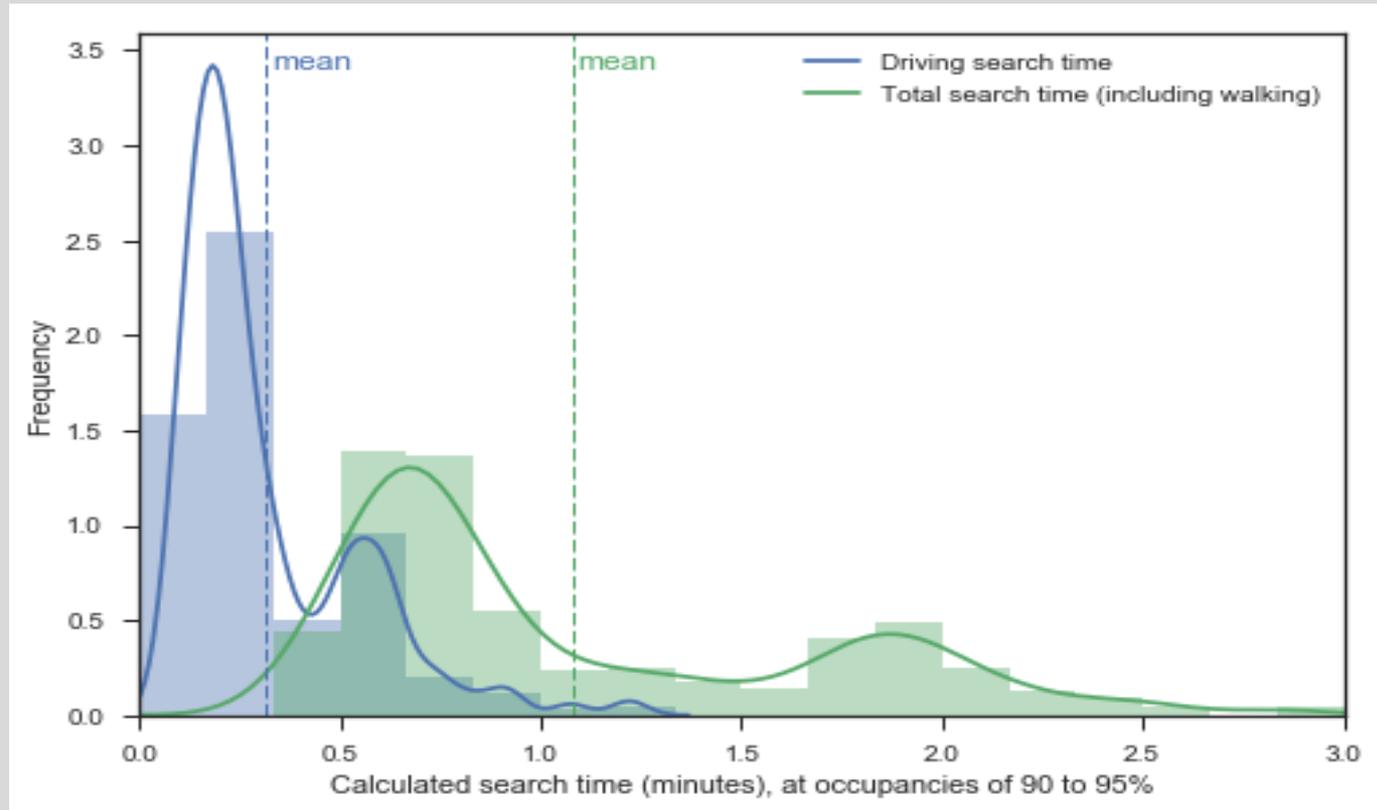
4. Main results

- **Cruising times tend to be small**
 - **Usually less than two minutes**
 - **This is due to low occupancy :**
- **But, when occupancy rates are high, search time is substantial**
- **In 97 percent of the observations, the marginal external cost of parking are small and less than the parking price**

Cumulative search time



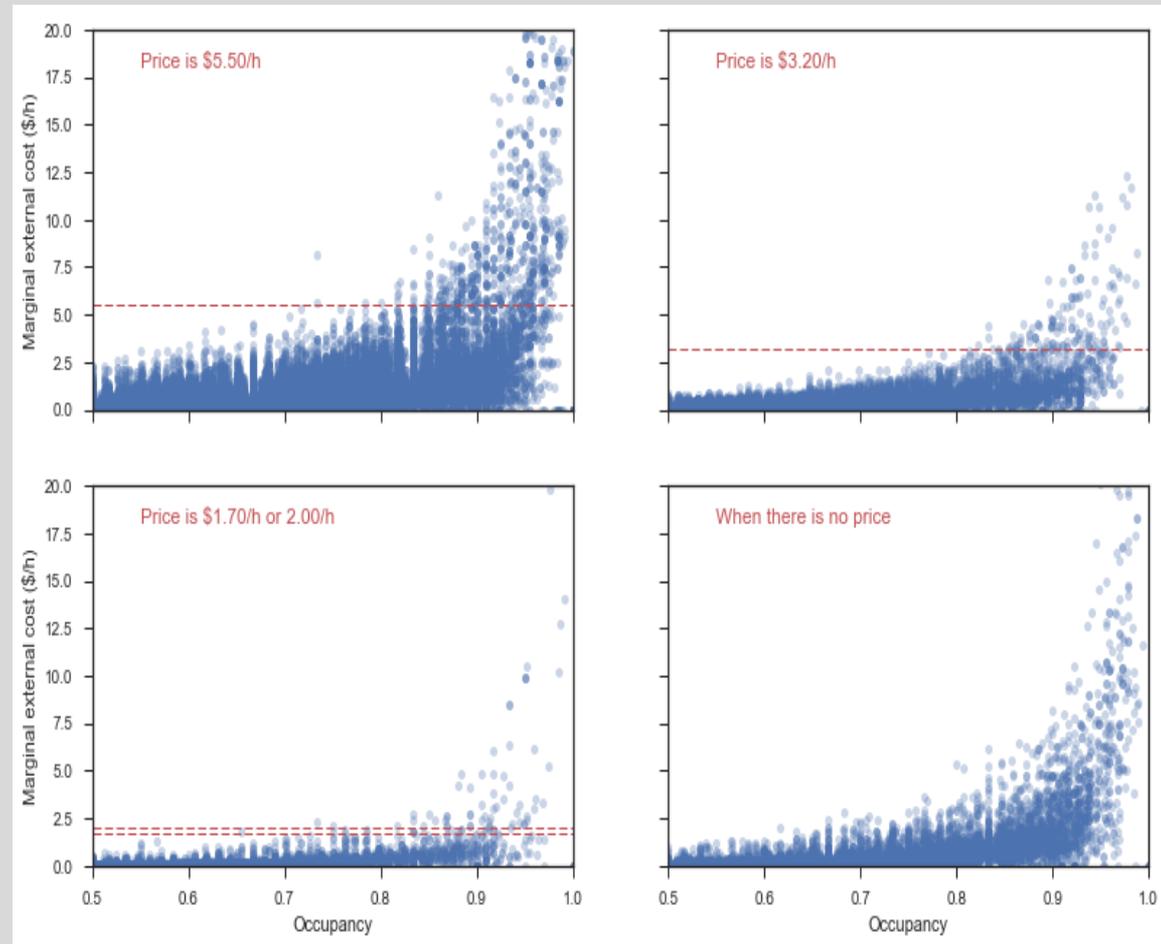
Distribution of search time, for high occupancy rates



4. Main results

- **Marginal external cost of parking also depends on the arrival rate (not just occupancy)**
- **In 97 percent of the observations, the marginal external cost of parking is small and less than the parking price**
- **Due to very restrictive time limits: welfare losses because of that.**
- **When the occupancy rate is above 90%, marginal external costs tends to be substantial**
- **The parking price is too low: welfare losses because of that**

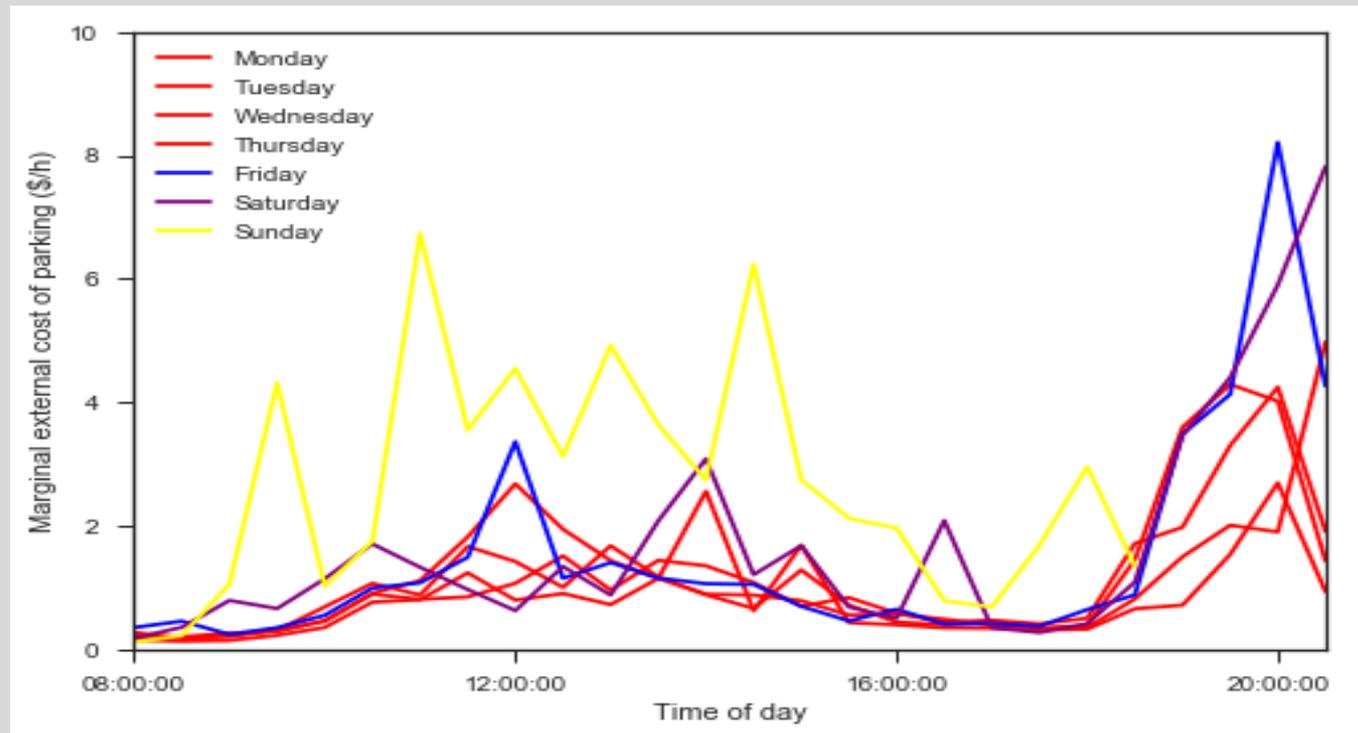
Marginal external cost of parking



Main results

- **Marginal external cost of parking explode Friday and Saturday evenings just before parking becomes free and time limit restrictions do not apply**
- **On Sunday, from 11 to 15 o'clock, marginal external parking cost are substantial (parking is free!)**

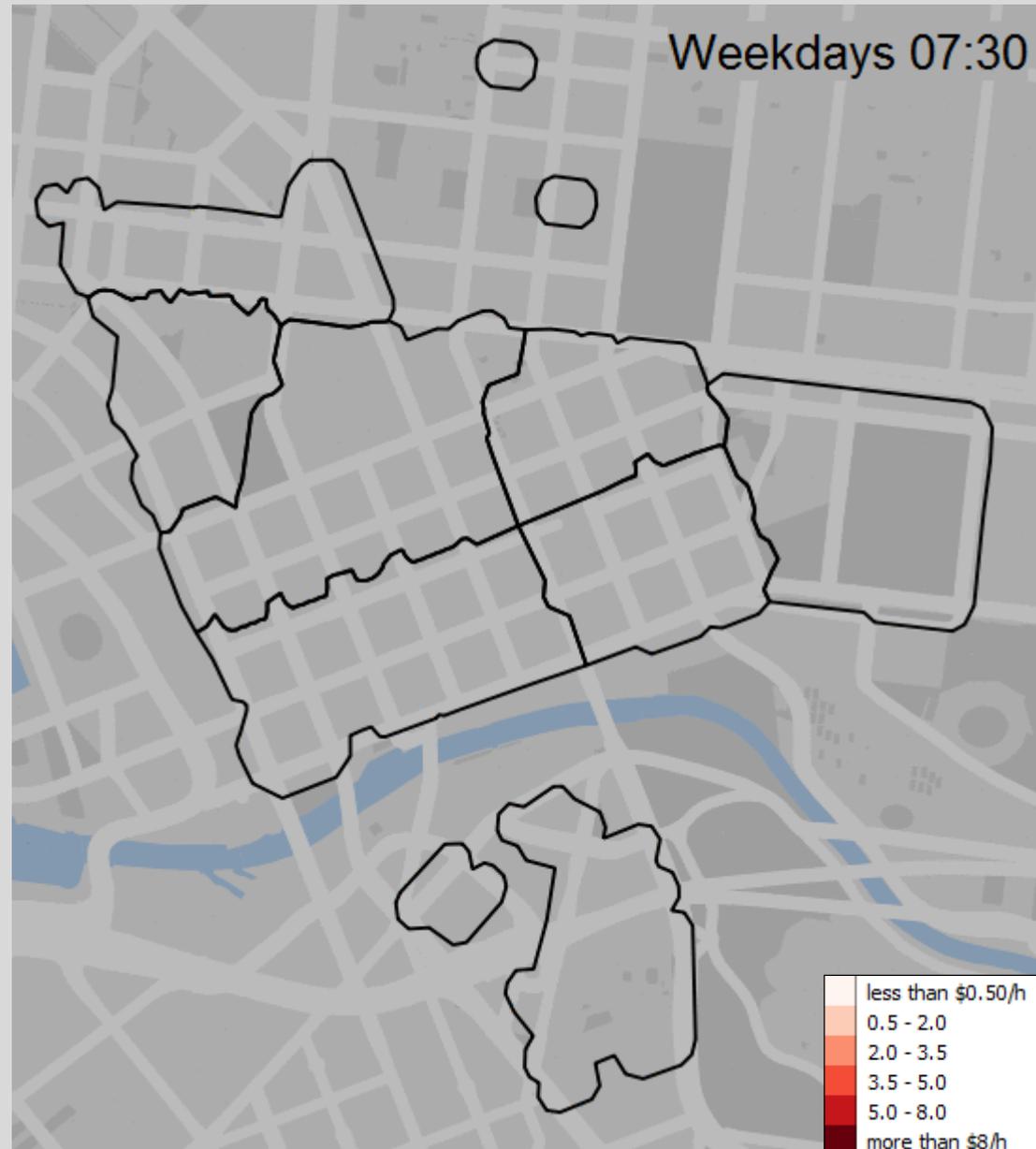
Marginal external cost of parking



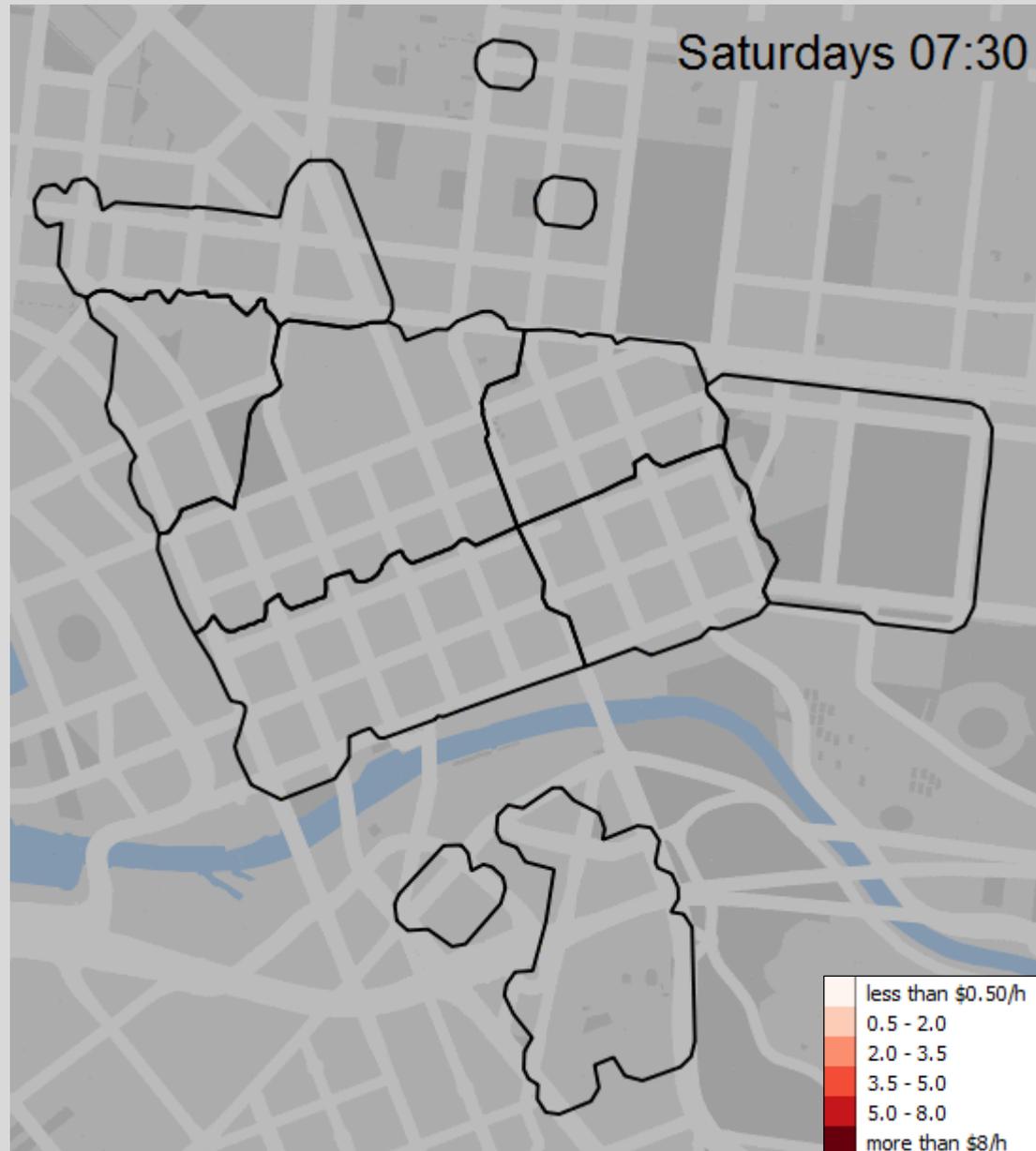
Main results

- We calculated the benefits of increasing marginal supply
- In the suburbs around the central city, the benefits are much less than the capital (opportunity costs), about \$300 per month (derived from the private rental market)
- Conditional on current policy (of low prices and harsh time limits), it seems a good idea to reduce supply.

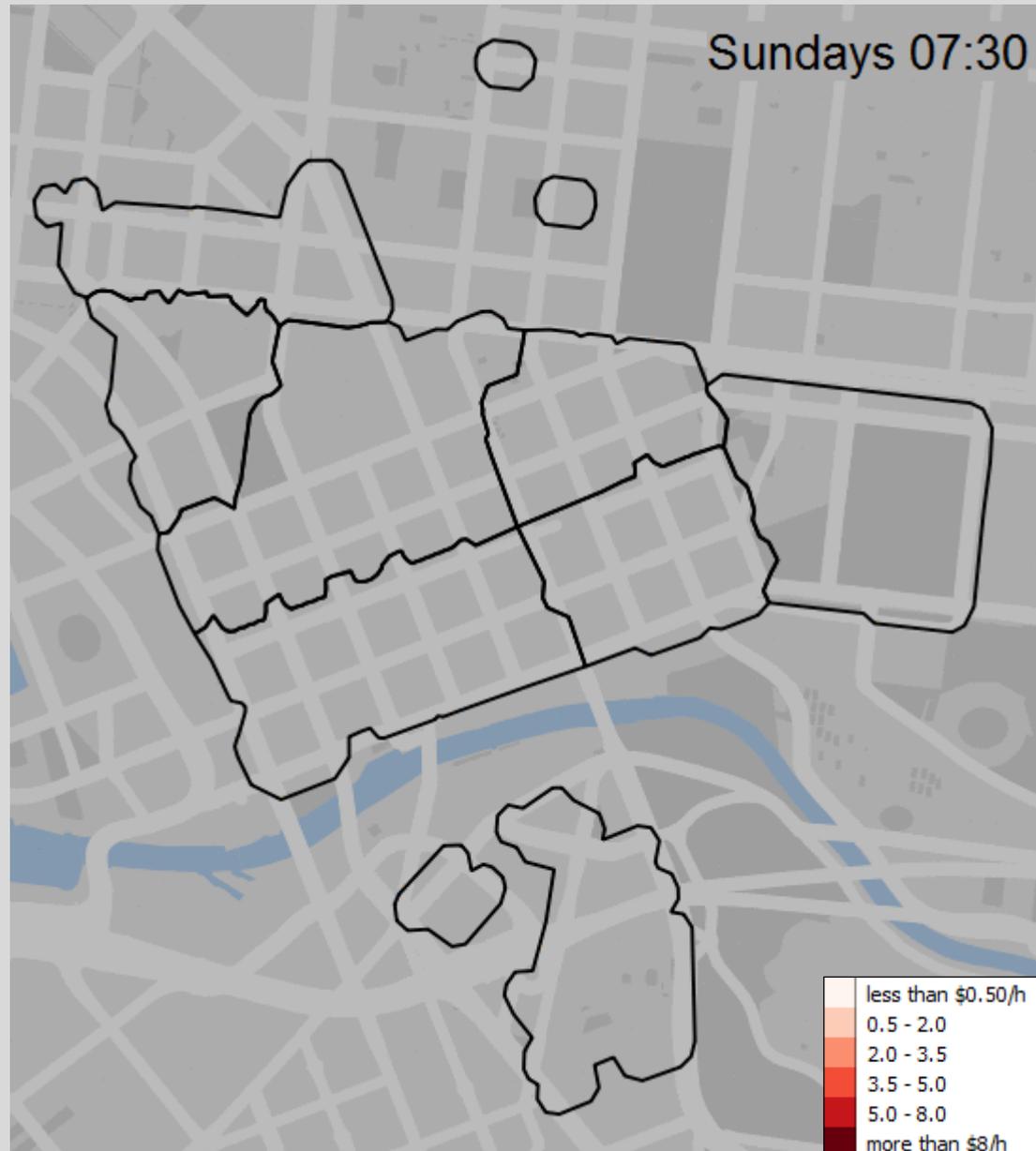
Marginal external cost



Marginal external cost



Marginal external cost



Conclusion

- We introduce a method to calculate the marginal external cost of parking.
 - Using data that many parking authorities already have
- We examine for Melbourne
 - The welfare effects of current parking policy (parking price /time limits)
 - The welfare effects of changing parking supply
 - During most of the weekdays, time-limit restrictions reduce welfare (i.e., the occupancy rate is too low)
 - High costs just before time limits expire
 - On Sunday, substantial marginal external cost