Do commercial vehicles cruise for parking?

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1. Introduction: parking cruising
2. Methodology
3. Data
4. Results
5. Conclusion
1. Introduction

Parking cruising
1. Introduction

Parking cruising

Parking demand $\approx$ Parking supply $\rightarrow$ Parking cruising

![Parking Lot Image]
I. Introduction

Parking cruising

Parking demand ≈ Parking supply → Parking cruising

Cost of parking cruising

- \textbf{Internal cost:} 7.5 minutes average search time
- \textbf{External cost:} 34\% average share of traffic cruising

1 h parking → 3.6 cars to cruise

I. Introduction

Parking cruising

Parking demand ≈ Parking supply → Parking cruising

- Cost of parking cruising
  - Internal cost: 7.5 minutes average search time
  - External cost: 34% average share of traffic cruising
    - 1 h parking → 3.6 cars to cruise

- Factors affecting parking cruising: on-street/off-street parking cost, traffic and parking information, travel duration, activity type …
1. Introduction

Parking policies

Parking and cruising behaviours

- Value of time
- Dwell time
- Patience
- Willingness to pay
1. Introduction

Parking policies

Parking and cruising behaviours

- Value of time
- Dwell time
- Patience
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Data-driven parking policies

- Parking enforcement
- Minimum parking requirements
- Parking pricing
- Time limits
1. Introduction

What about commercial vehicles?
1. Introduction

What about commercial vehicles?

Freight Parking demand

E-commerce retail sales

U.S. E-commerce retail sales as % of total sales
(U.S. Census Bureau)
1. Introduction

What about commercial vehicles?

**Freight Parking demand**

U.S. E-commerce retail sales as % of total sales (U.S. Census Bureau)

**Freight parking supply**

Curbside parking allocation by parking type in Seattle (Seattle DOT)
1. Introduction

Research gaps & objectives
I. Introduction

Research gaps & objectives

Research gaps
- Literature on parking cruising: focus on passenger vehicles
- Literature on commercial vehicles parking:
  - Common assumption: commercial vehicles do not cruise for parking
  - Empirical evidence of un-authorised parking
1. Introduction

Research gaps & objectives

Research gaps

- Literature on parking cruising: focus on passenger vehicles
- Literature on commercial vehicles parking:
  - Common assumption: commercial vehicles do not cruise for parking
  - Empirical evidence of un-authorised parking

Research questions

1) Is there empirical evidence of parking cruising for commercial vehicles?
2) What is the “internal cost” of parking cruising?
3) What factors affects parking cruising?
1. Introduction: parking cruising
2. **Methodology**
3. Data
4. Results
5. Conclusion
2. Methodology

Decomposing trip time
2. Methodology

Decomposing trip time

- Departure time
- Trip time
- Arrival time
2. Methodology

Decomposing trip time

- Departure time
- Travel time
- Arrival time

Trip time

Travel time
2. Methodology

Decomposing trip time
2. Methodology

Travel time estimation

1) Observe real trip times
2) Obtain reliable travel time estimations
3) Deviation = Real travel time - estimated travel time
4) Check whether parking infrastructure affects deviations
2. Methodology

Travel time estimation

1) Observe real trip times
2) Obtain reliable travel time estimations
3) Deviation = Real travel time - estimated travel time
4) Check whether parking infrastructure affects deviations

Google Maps’ Distance Matrix API
• Assume fastest route
• Outputs a travel time estimation
• Considers historical traffic conditions
3. Data

Trip data

• 2,011 real truck trips are obtained from a parcel delivery company
• Trips are performed by 11 drivers over 28 weekdays (Oct-Nov 2018)
• For each trip, the trip start time, end time and start/end GPS locations are recorded

<table>
<thead>
<tr>
<th>Trip ID</th>
<th>Start</th>
<th>End</th>
<th>Trip time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10:10:10</td>
<td>10:11:01</td>
<td>51 sec.</td>
</tr>
<tr>
<td>2</td>
<td>10:45:18</td>
<td>10:49:00</td>
<td>222 sec.</td>
</tr>
<tr>
<td>3</td>
<td>11:00:06</td>
<td>11:03:12</td>
<td>186 sec.</td>
</tr>
</tbody>
</table>
3. Data

Parking infrastructure and occupancy data

Parking buffers
- centred at the destination parking location
- 80 meters (260 feet) rad.

Infrastructure & built env:
- Curb allocation
- No. bus stops,
- No. bus routes

Parking occupancy
- Mean paid parking occupancy estimate
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4. Results

Empirical distribution of deviations

Trip deviation = real trip time - estimated travel time
4. Results

Geographical distribution of deviations

1) Hierarchical clustering
2) Mean cluster trip deviation
4. Results

Do parking infrastructure affect deviations?

$log(trip\ time) = \beta_0 + \beta_{tt} travel\ time + \ldots + \beta_{ic} length\ CVLZ + \ldots + \varepsilon$

- Independent variable: trip time
- Explanatory variables:

<table>
<thead>
<tr>
<th>Trip variables</th>
<th>Travel time &amp; distance, dwell time, departure time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tour variables</td>
<td>Tour time &amp; distance, no. stops, driver ID, …</td>
</tr>
<tr>
<td>Parking variables</td>
<td>Curb space allocated to CVLZ, paid parking, …</td>
</tr>
<tr>
<td></td>
<td>Parking occupancy, no. bus routes</td>
</tr>
</tbody>
</table>

- Model formulations: 1) OLS
  2) location random effect
  3) location & driver random effect
4. Results

Regression model results

Independent variable: trip time

<table>
<thead>
<tr>
<th>Variable</th>
<th>Sign</th>
<th>Stat. Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>Travel time</td>
<td>+</td>
<td>***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tour variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stop sequence in tour</td>
<td>-</td>
<td>***</td>
</tr>
<tr>
<td>Time per stop</td>
<td>+</td>
<td>***</td>
</tr>
<tr>
<td># stops per tour</td>
<td>-</td>
<td>*</td>
</tr>
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</tr>
<tr>
<td><strong>Parking variables</strong></td>
<td></td>
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<tr>
<td>Length CVLZ</td>
<td>-</td>
<td>***</td>
</tr>
<tr>
<td>Length bus zone</td>
<td>+</td>
<td>***</td>
</tr>
<tr>
<td>Length paid parking</td>
<td>+</td>
<td>.</td>
</tr>
</tbody>
</table>
5. Conclusion

Do commercial vehicles cruise for parking?

We found:

1. Non-zero trip time deviations w.r.t. estimated travel time (9 min., 70% trip times >0)

2. Deviations are statistically significantly affected by parking infrastructure provided at destination

Which other factors might explain trip time deviations?

- Re-routing
- Exceptional traffic conditions
- Exceptional events
- Noise in the data
Thank you!

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