Understanding the Modal Shift in Response to Bike-sharing Systems in the City of Delft

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Background

Two-way station-based
*Take and return bike to original location*

One-way station-based
*Take and return bike to docking station*

Two-way free-floating (p2p)
*Share or rent an existing bike*

One-way free-floating (incl. dropzones)
*Take & drop bike anywhere or dropzones (smart-lock, GPS, app)*

Return-trips (A-A)

Single-trips (A-B)

Van Waes et al. 2018
### Bike-sharing Systems in Delft, Netherlands

<table>
<thead>
<tr>
<th>Bike-sharing Type</th>
<th>OV-fiets</th>
<th>Mobike</th>
<th>Swapfiets</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Image illustration</strong></td>
<td><img src="image1" alt="OV-fiets" /></td>
<td><img src="image2" alt="Mobike" /></td>
<td><img src="image3" alt="Swapfiets" /></td>
</tr>
<tr>
<td><strong>Year Launched</strong></td>
<td>2003</td>
<td>2017</td>
<td>2014</td>
</tr>
<tr>
<td><strong>Feature of systems</strong></td>
<td>Docked bike-sharing system</td>
<td>Dockless bike-sharing system</td>
<td>Bicycle-lease system on a subscription basis</td>
</tr>
<tr>
<td><strong>Way to use</strong></td>
<td>1. Subscription online or on a NS App 2. Using the Personal public transport chip card (NS card) to rent a bike.</td>
<td>1. Subscription on a Mobike App 2. Using the Mobike App to open the bike.</td>
<td>Subscription online or on a Swapfiets App and get a Swapfiets bike within 1 day at a location of your choice</td>
</tr>
<tr>
<td><strong>User pricing</strong></td>
<td>€ 3.85/day</td>
<td>€ 12/month, 49.90/year or €1.5/20min</td>
<td>€ 15/month</td>
</tr>
</tbody>
</table>
02 Research questions

Who
Non-bikesharing users? Bike-sharing users?

Why
Reasons? Barriers & Motivations

What
Modal shift caused by bike-sharing systems?

How
Relationship between Modal shift and factors?
03 Survey design

Non-bikesharing users

- Personal characteristics
- Barriers

Bike-sharing users

- Personal characteristics
- Modal shift patterns
- Motivations
Survey collection

- June and July
- Twenty interviewers
- 565 respondents

03 Survey

TU Delft
Binary logit models for each of the bike-sharing systems.

<table>
<thead>
<tr>
<th>Variable name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent variables</strong></td>
<td>Shift to Mobike=1, No shift=0; Shift to OV-fiets=1, No shift=0; Shift to Swapfiets=1, No shift=0</td>
</tr>
<tr>
<td><strong>Independent variables</strong></td>
<td>Socioeconomic variables</td>
</tr>
<tr>
<td></td>
<td>Commuting trip variables</td>
</tr>
<tr>
<td></td>
<td>Motivation variables</td>
</tr>
</tbody>
</table>
Findings: sample composition

Nation

Non-bike-sharing users
- Dutch: 45%
- Non-Dutch: 55%

OV-fiets users
- Dutch: 23%
- Non-Dutch: 78%

Mobike users
- Dutch: 60%
- Non-Dutch: 40%

Swapfiets users
- Dutch: 45%
- Non-Dutch: 55%
Findings: sample composition

Gender

Non-bike-sharing users
- Male: 54%
- Female: 44%
- Other: 1%

Mobike users
- Male: 69%
- Female: 31%
- Other: 1%

OV-fiets users
- Male: 64%
- Female: 35%
- Other: 1%

Swapfiets users
- Male: 70%
- Female: 31%
- Other: 1%
Findings: sample composition

Age

Non-bike-sharing users
- ≤17: 5%
- 18-24: 3%
- 25-34: 2%
- 35-44: 1%
- 45-54: 47%
- 55-64: 44%
- 65+: 38%

Mobike users
- ≤17: 1%
- 18-24: 3%
- 25-34: 2%
- 35-44: 10%
- 45-54: 47%
- 55-64: 42%
- 65+: 1%

OV-fiets users
- ≤17: 5%
- 18-24: 3%
- 25-34: 6%
- 35-44: 40%
- 45-54: 5%
- 55-64: 3%
- 65+: 46%

Swapfiets users
- ≤17: 2%
- 18-24: 1%
- 25-34: 2%
- 35-44: 32%
- 45-54: 32%
- 55-64: 66%
### Findings: sample composition

#### Income

**Non-bike-sharing users**
- $\leq 2000€$: 64%
- 2000–3000€: 13%
- 3000–4000€: 8%
- 4000€+: 7%
- Prefer not to say: 8%

**Mobike users**
- $\leq 2000€$: 73%
- 2000–3000€: 9%
- 3000–4000€: 8%
- 4000€+: 6%
- Prefer not to say: 3%

**OV-fiets users**
- $\leq 2000€$: 57%
- 2000–3000€: 10%
- 3000–4000€: 6%
- 4000€+: 7%
- Prefer not to say: 20%

**Swapfiets users**
- $\leq 2000€$: 81%
- 2000–3000€: 14%
- 3000–4000€: 1%
- 4000€+: 5%
- Prefer not to say: 5%
Findings: sample composition

Employment status

Non-bike-sharing users
- 62% Full-time employed
- 28% Student
- 5% Self-employed
- 2% Seeking for a job
- 1% Retired
- 1% Other

OV-fiets users
- 56% Full-time employed
- 33% Student
- 7% Self-employed
- 1% Seeking for a job
- 1% Retired
- 2% Other

Mobike users
- 70% Full-time employed
- 22% Student
- 1% Self-employed
- 0% Seeking for a job
- 1% Retired
- 1% Other

Swapfiets users
- 86% Full-time employed
- 12% Student
- 2% Self-employed
- 2% Seeking for a job
- 2% Retired
- 2% Other
Vehicle ownership (Multiple choice)

- **Private bicycle(s)**: 98% ( Swapfiets users: 78%, OV-fiets users: 80%, Mobike users: 80%, Non-bike-sharing users: 98%)
- **Private E-bike(s)**: 6% ( Swapfiets users: 4%, OV-fiets users: 3%, Mobike users: 6%, Non-bike-sharing users: 6%)
- **Car(s)**: 26% ( Swapfiets users: 22%, OV-fiets users: 8%, Mobike users: 8%, Non-bike-sharing users: 26%)
- **None**: 14% ( Swapfiets users: 11%, OV-fiets users: 3%, Mobike users: 22%, Non-bike-sharing users: 14%)
- **Other**: 2% ( Swapfiets users: 3%, OV-fiets users: 6%, Mobike users: 2%, Non-bike-sharing users: 2%)

Findings: sample composition
Findings: barriers and motivations

Non-bike-sharing users (Barriers)

<table>
<thead>
<tr>
<th></th>
<th>HP.</th>
<th>FE.</th>
<th>PB.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Having private bicycle</td>
<td>Fee charge</td>
<td>Poor bicycle quality</td>
</tr>
</tbody>
</table>

Mobike users (Motivations)

<table>
<thead>
<tr>
<th></th>
<th>DS.</th>
<th>CO.</th>
<th>LE.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>no fixed pick-up and drop-off locations</td>
<td>Convenience of the app, payment method</td>
<td>Less effort than walking</td>
</tr>
</tbody>
</table>
Findings: barriers and motivations

OV-fiets users (Motivations)

<table>
<thead>
<tr>
<th></th>
<th>ST.</th>
<th>LE.</th>
<th>GQ.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Saving time</td>
<td>Less effort than walking</td>
<td>Good quality of bikes</td>
</tr>
</tbody>
</table>

Swapfiets users (Motivations)

<table>
<thead>
<tr>
<th></th>
<th>LW.</th>
<th>LE.</th>
<th>GQ.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Less worried about being stolen/damaged</td>
<td>Less effort than walking</td>
<td>Good quality of bikes</td>
</tr>
</tbody>
</table>
Findings: modal shift

(a) Modal Shift as a result of Mobike

(b) Modal Shift as a result of OV-fiets

(c) Modal Shift as a result of Swapfiets
Findings: modal shift for commuting of Mobike users

- Private Bike: 38.55%
- Private Bike: 18.07%
- Mobike: 28.91%
- Swapfiets: 1.20%
- Walk: 13.25%
- Walk: 6.02%
- Multimodal: 43.38%
- Multimodal: 19.28%
- Bus/Tram/Train of Multimodal: 7.23%
- Mobike of Multimodal: 24.10%
- Private Bike of Multimodal: 4.82%
- OV-fiets of Multimodal: 2.41%
- Swapfiets of Multimodal: 1.20%
- Private Car: 3.61%
Findings: modal shift for commuting of OV-fiets users

- Private Bike: 34.26%
- Multimodal: 64.82%
- Bus/Tram/Train of Multimodal: 16.67%
- Walk of Multimodal: 3.70%
- OV-fiets of Multimodal: 23.15%
- Private Car: 0.93%
Findings: modal shift for commuting of Swapfiets users
Findings: binary logit model results

**Mobike**
- Male (+)
- Travel with multiple modes (+)
- No stolen/damaged problem (+)
- Cheaper than other modes (+)

**OV-fiets**
- Public transport subsidy (+)
- Private bicycle ownership (-)
- Good quality of bicycles (+)
- Convenient (+)
- Short Trip (-)

**Swapfiets**
- Student discount (-)
- No stolen/damaged problem (+)
- Cheaper than other modes (+)
- Good quality of bicycles (+)
Further research

- Modal shift: Non-bike-sharing users (car users)
- Modal shift: Within bike-sharing systems
Thanks for Listening!

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