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Determinants of passengers’ perceived security at railway stations

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Motivation

Flemingsberg – secure or not so secure?
Aim and objectives

To assess passengers’ declared perceived security at railway stations by localization

The analysis involves
- environmental attributes of railway stations and surrounding areas
- city’s and neighbourhood's context
- passengers’ individual/socio-economic characteristics
Theoretical framework

Passengers’ declared perceived security is a function of individuals profile and the types of environments he/she exposed at the station and surrounding areas.
The study

14 Swedish railway stations selected.

Criterion: New or rebuilt, and significantly increased supply of middle- or long-distance trains, since 1990
Study survey and database

Aim: To reveal differences between central and peripheral localization of stations

Survey covering:
• Travel behaviour incl. connecting journeys
• Service at station
• Preferences and valuation
• Perceived security
• Overall satisfaction
• Background socio-economics

In total 1400 responses (all 14 stations) among departing train passengers (≥50 km journey) collected autumn 2016
Question on perceived security

How satisfied are you with the security* …

a) inside the station?
b) at the platform?
c) in the connection to the platform?

Answers given on a 5 degree Likert scale for each aspect:
Very unsatisfied (1) to Very satisfied (5)

Answers of aspects a) b) and c) strongly correlate and were combined into a Perceived Station Security (PSS) index. Whole sample: PSS index=100

The PSS index is then the dependent variable in a linear regression model/Ordinary Least Squares (OLS).

*Swe: Hur nöjd är du med tryggheten … Mycket missnöjd (1) till Mycket nöjd (5)
## Variables tested

<table>
<thead>
<tr>
<th>Variables</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent</strong> PSS Index (Average=100)</td>
<td></td>
</tr>
<tr>
<td><strong>Explanatory</strong></td>
<td></td>
</tr>
<tr>
<td>Duration of stay before departure</td>
<td>1-600 min</td>
</tr>
<tr>
<td>View while waiting in station</td>
<td>(0, 1)</td>
</tr>
<tr>
<td>Built-in (covered) stairs to platform</td>
<td>(0, 1)</td>
</tr>
<tr>
<td>Café, restaurant with seating in station</td>
<td>(0, 1)</td>
</tr>
<tr>
<td>PTA services only (no long-distance services)</td>
<td>(0, 1)</td>
</tr>
<tr>
<td>Reconstruction in progress</td>
<td>(0, 1)</td>
</tr>
<tr>
<td>Avg. time between departures</td>
<td>2.5-33.1 min</td>
</tr>
<tr>
<td>Distance to local/city centre</td>
<td>0.3-3.8 km</td>
</tr>
<tr>
<td>Trains passing platform at speed</td>
<td>(0, 1)</td>
</tr>
<tr>
<td>Station age (since latest reconstruction)</td>
<td>4-26 years</td>
</tr>
<tr>
<td>Age: Young (18-24 years)</td>
<td>(0, 1)</td>
</tr>
<tr>
<td>Age: Elderly (65+ years)</td>
<td>(0, 1)</td>
</tr>
<tr>
<td>Sex: Man</td>
<td>(0, 1)</td>
</tr>
<tr>
<td>Marital status: Married/cohabiting</td>
<td>(0, 1)</td>
</tr>
<tr>
<td>Children: Child(-ren) at home</td>
<td>(0, 1)</td>
</tr>
<tr>
<td>Occupation: Gainfully or self-employed</td>
<td>(0, 1)</td>
</tr>
</tbody>
</table>

A number of other explanatory variables tested but omitted due to strong correlations (Pearson >0.6). 

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**Notes:**

- **Pearson >0.6** indicates strong correlations among variables, which may result in collinearity issues in statistical models, leading to the omission of these variables in the analysis. 
- The table represents a subset of variables tested, highlighting those with more nuanced ranges or binary indicators. 
- Variables such as duration of stay, view while waiting, and reconstruction status provide specific insights into station attributes and user experiences. 
- Other variables like age groups, sex, marital status, and employment status are also considered, offering a broader context of user demographics and their potential impact on passenger satisfaction. 

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**Further Considerations:**

- **Variables with Binary Indicators:** Variables like view, reconstruction, and reconstruction status are often represented as binary indicators (0, 1) to simplify model interpretation and reduce complexity.
- **Range Considerations:** The range for variables such as age and station age (since latest reconstruction) provide a clear understanding of the scope and scale of influence these variables might have on passenger satisfaction indices. 

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**Implications:**

- The inclusion and exclusion of variables based on correlation analysis highlights the importance of statistical methods in identifying significant predictors of passenger satisfaction.
- Understanding these variables and their ranges is crucial for designing effective passenger experience strategies and improving station facilities to meet the needs of diverse user groups.

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**Future Directions:**

- Further exploration of potential interactions between variables, especially those with strong correlations, to uncover deeper insights into passenger behavior and satisfaction.
- Continuous monitoring and adaptation of variables as new data becomes available to reflect changes in passenger preferences and station operations.
### Preliminary model
Dependent variable: Perceived Station Security (PSS) index

<table>
<thead>
<tr>
<th>Explanatory variable</th>
<th>β Model estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>95.451 (t=60.363)***</td>
</tr>
<tr>
<td>Built-in stairs</td>
<td>5.325 (t=2.969)**</td>
</tr>
<tr>
<td>Distance to local/city centre (per km)</td>
<td>-1.794 (t=-3.309)***</td>
</tr>
<tr>
<td>Reconstruction in progress</td>
<td>-8.796 (t=-3.399)***</td>
</tr>
<tr>
<td>Average time between departures (per min.)</td>
<td>0.208 (t=3.212)***</td>
</tr>
<tr>
<td>Café, restaurant with seating</td>
<td>2.873 (t=1.763) *</td>
</tr>
</tbody>
</table>

(T-test in parentheses)

- ** Significant at the 0.01 probability level
- * Significant at the 0.05 probability level
- *** Significant at the 0.001 probability level

Model fit very low, $R^2$ adj = 0.043
Preliminary results

Increasing the Perceived Station Security (PSS)
• Built-in (covered) stairs between station building and platform
• Longer time between train departures
• Café or restaurant with seating in the station

Decreasing the PSS
• Reconstruction in progress
• Longer distance to the city/local centre

No respondent characteristics (age, occupation, marital status, sex, children at home) proved to be significant.
Results – benchmarking do and don’t

Lower perceived security: **Umeå Central**
- PSS index=93
  - Public access (not built-in stairs)
  - Lacks café or restaurant in station
  - Renovation of the station building

City centre 0.5 km

Higher: **Umeå Ö (East)**
- PSS index=111
  + Built-in stairs
  + Café in station

Local centre 0.2 km
(City centre 2 km)
Preliminary conclusions and future research

• Centrally located stations in general perceived more secure than peripherally located
• The significant environmental/situational variables explains Perceived Station Security (PSS) to a relatively low degree, but significant model and variables
• Respondents’ socio-economic characteristics not significant
• How to improve method and analysis to achieve better model fit?
Flemingsberg – secure or not so secure?

Rated PSS index=102 – slightly above average!
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