Grocery stores and urban transport

Theoretical and empirical approaches to explain store location

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Retail delivery accounts for a high proportion of urban transport.

How is this associated with urban transport?

https://pbs.twimg.com/media/DJv6aIaXkAAMQ-2.jpg

How will this change with increasing online retail?

Which methodology can be used to analyze this?

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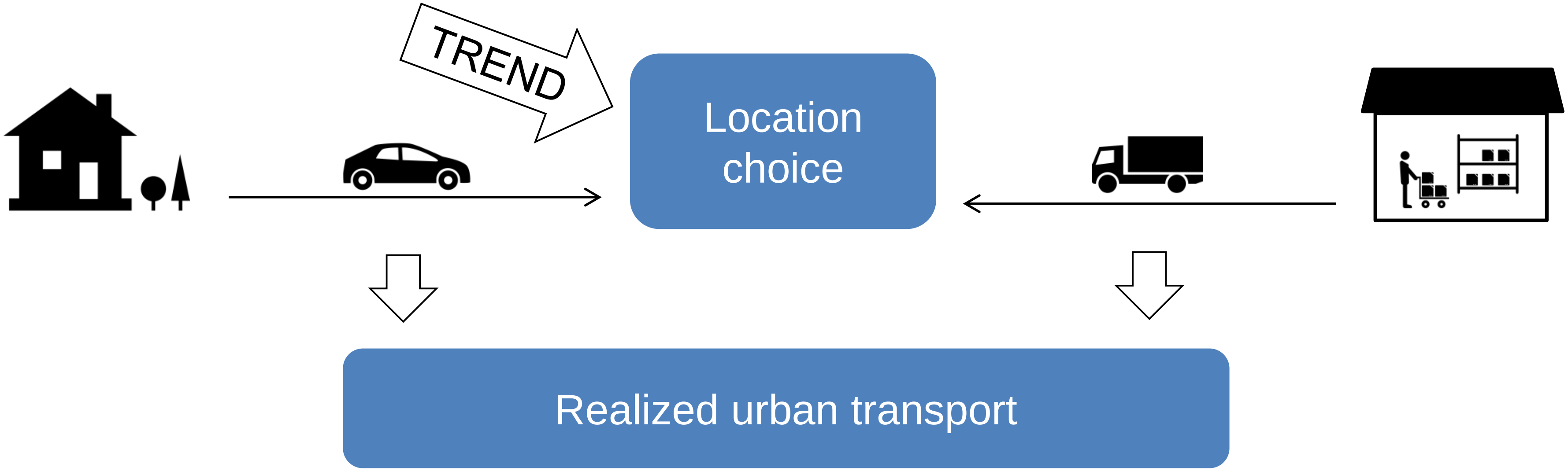
Analysis of the impact of urban trends on supply and mobility in the city: case study grocery retail

- Purpose: investigate urban transport as a result of consumer trips and freight trips
- Grocery shopping requires both transport of persons to goods and transport of goods to points of sale respectively persons
- Location choice proxies other decision problems in urban contexts
- Objective: predict number of grocery stores under changing conditions



Methodology: overview

Hypothesis building

- Theories on store location choice
- Related empirical studies

Case study: Variable selection

- Data availability
- Explained variance of variables

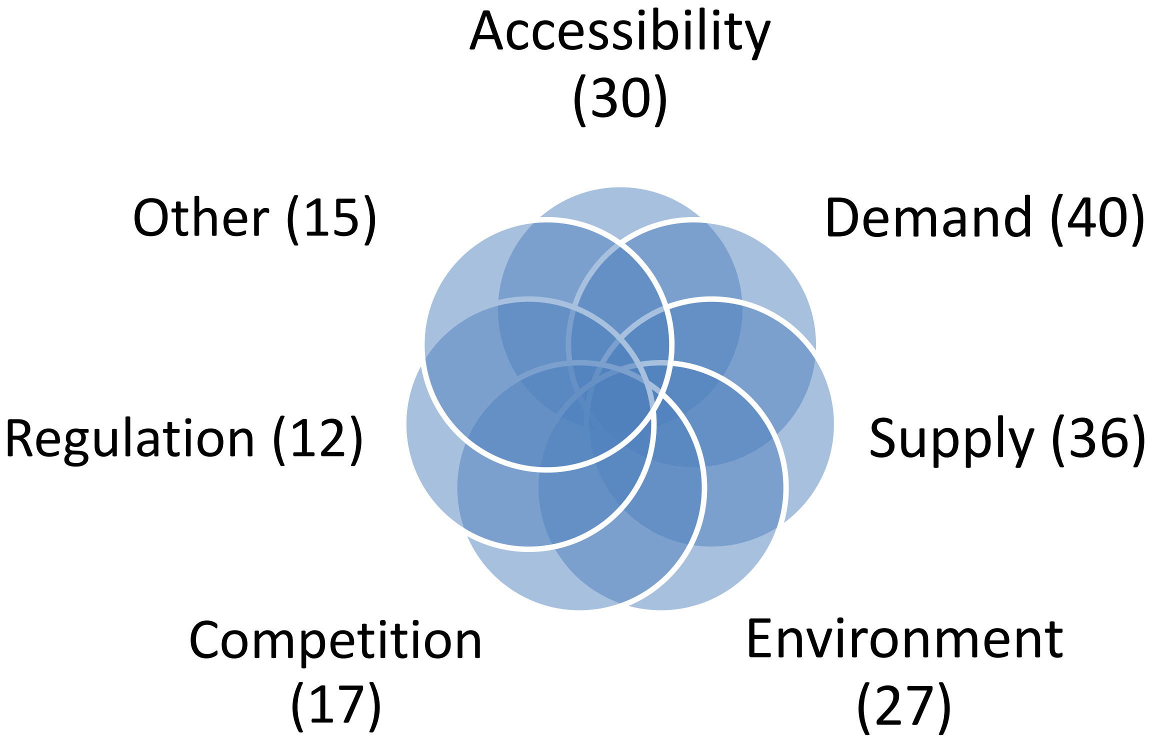
Case study: Model estimation

- Hypothesis check
- Prediction

Hypothesis building

Variables and ‚constructs‘ that explain store location

- Review of 13 empirical studies and literature reviews
- 177 variables in 7 ‚constructs‘ that group interactions between retailer and other agents



Case study
Methodology

- Aggregate model
- Predict number of grocery stores by region
  →Count data
  →Poisson regression model

- Determining goods travel demand requires to segment market according to different delivery concepts in two sizes:
  - Small grocery retail until 1,499 m² floorspace
  - Large grocery retail from 1,500 m² floorspace

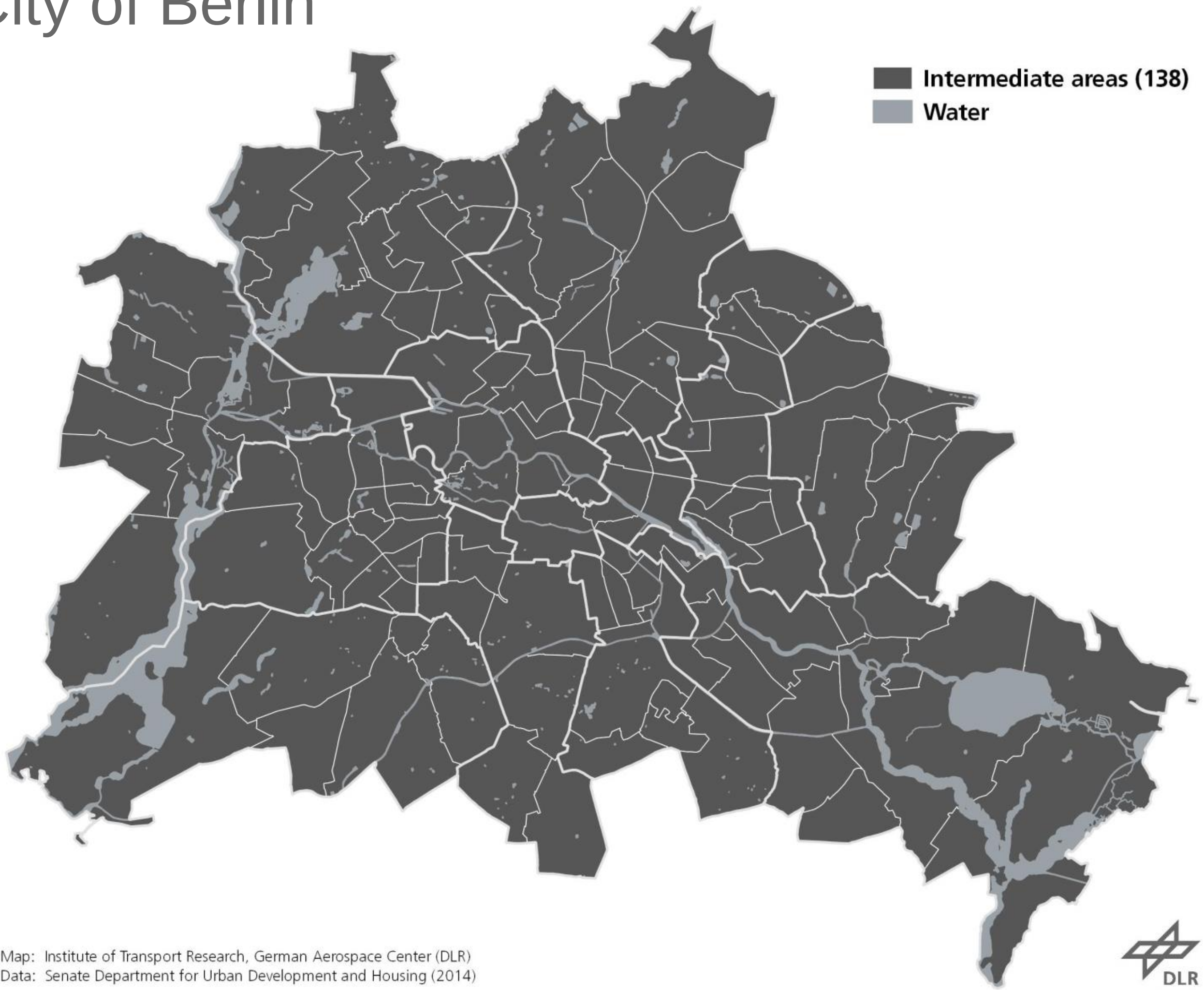
Hypothesis building

Hypotheses on grocery store location choice

Accessibility	The better accessible the location is, the more likely stores locate there (Reilly 1931, Huff 1964).
Demand	The higher the demand (= the number of persons) is in an area, the more likely grocery retail locates there (Agergard et al. 1970).
Income	The higher the income level is in an area the more likely large retailers locate in that area (Lange 1973).
Competition	Cumulative advantages can arise from a grocery store's location close to another (Nelson 1958).

	Expected
Accessibility	+
Demand	+
Income	o/+
Coopetition	+

Case study
City of Berlin



Map: Institute of Transport Research, German Aerospace Center (DLR)
Data: Senate Department for Urban Development and Housing (2014)

Case study
Grocery store locations

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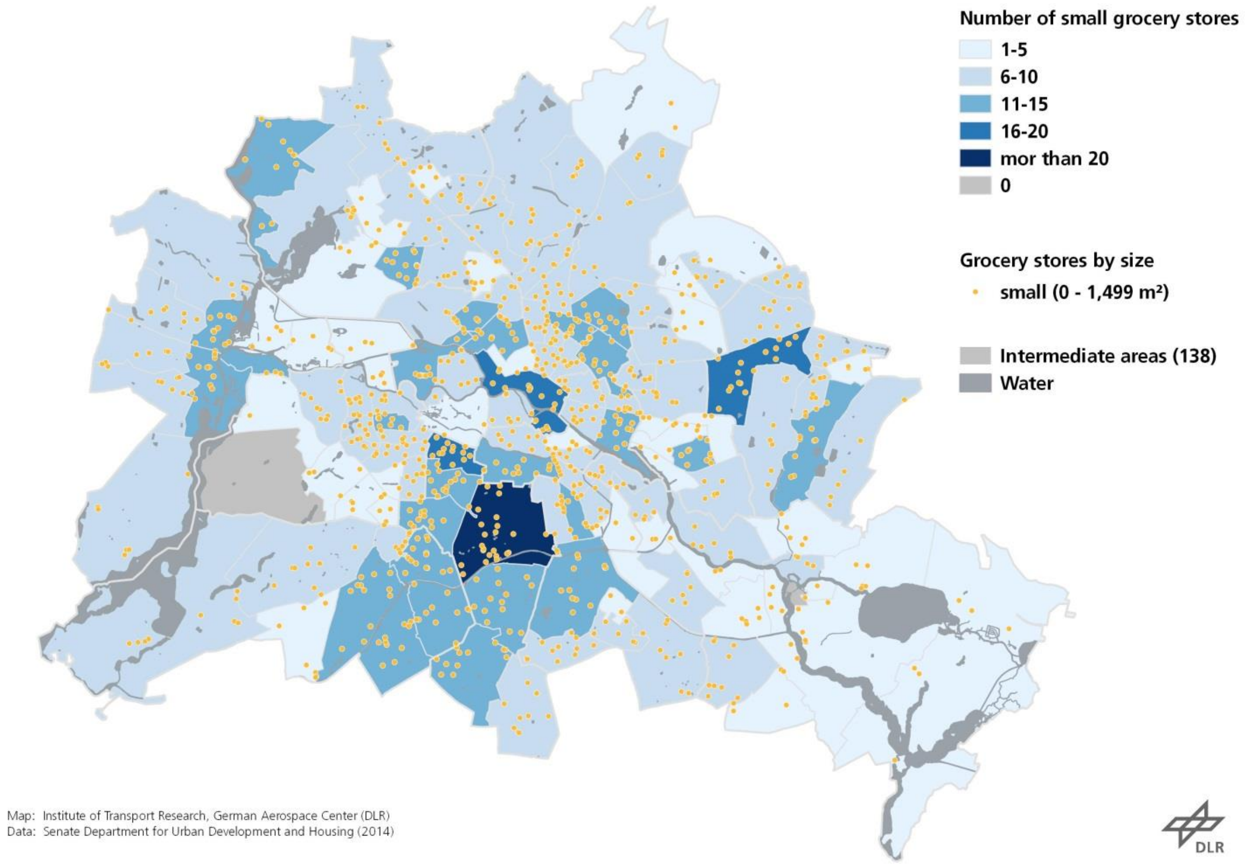
Case study
Number of small grocery stores



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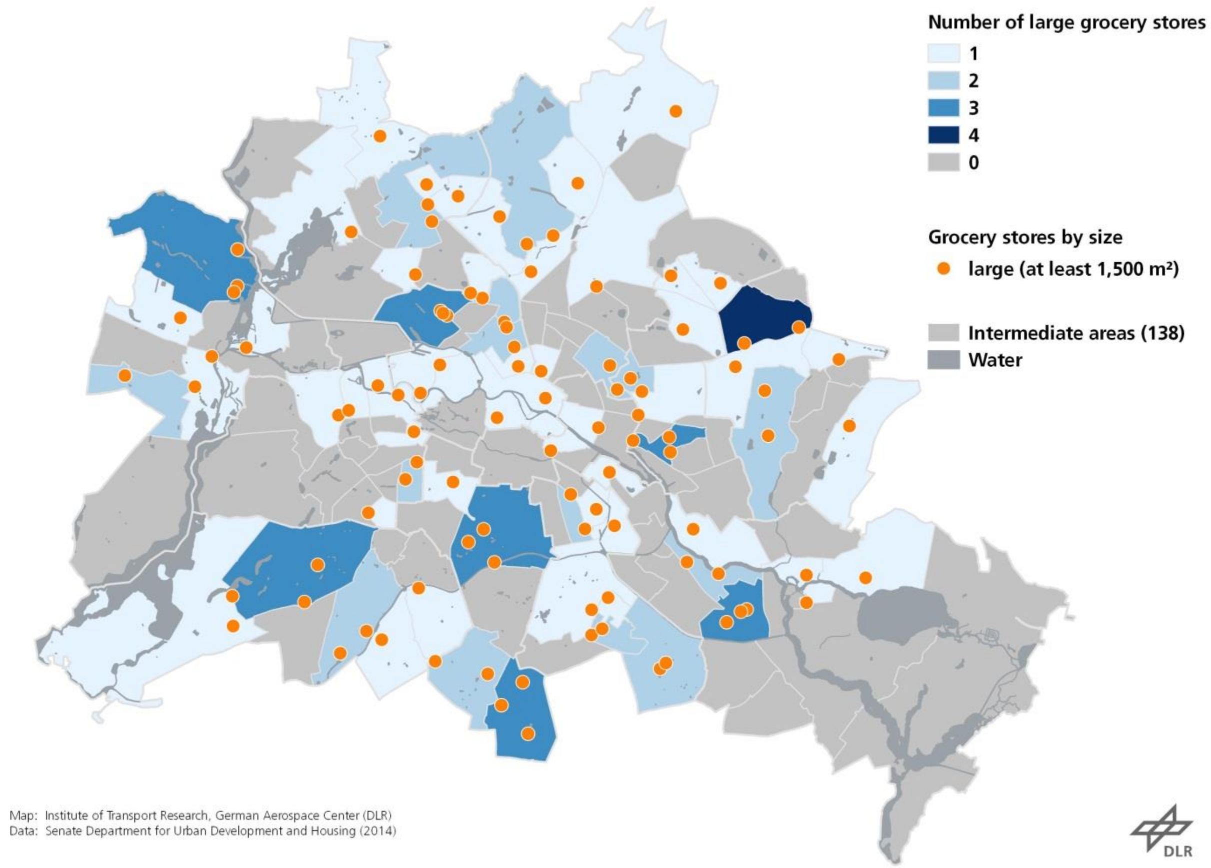
Case study

Number of large grocery stores



Case study
Variable selection by explained variance

Small grocery stores (1,049)

Variable	R^2
Population size	**0.57**
Number of central retail*	**0.35**
Number of retail*	0.23
Number of transit stops	**0.21**
Average number of vehicles	**0.18**
Number of bus stops	0.17
Number of subway stops	0.14
Purchasing power	0.02
Distance coopetitors	0.01
Distance competitors	0.00

Large grocery stores (103)

Variable	R^2
Number of transit stops	**0.10**
Population size	**0.09**
Number of bus stops	0.09
Number of com. rail stops	0.05
Distance competitors	0.04
Distance coopetitors	0.00
Purchasing power	0.00

* excludes grocery stores

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Case study
Regression model for small grocery stores

1,049 stores in 137 zones

Variable	Estimate	z-value
Constant	1.223	15.539
Number of transit stops	0.001673	0.545
Population size	0.00002368	6.087
Average number of vehicles	0.0002363	1.102
Number of central retail	0.0005446	0.579

Null deviance	277.79
Residual deviance	125.58
P-value	0.64

Case study

Regression model for large grocery stores

103 stores in 137 zones

Variable	Estimate	z-value
Constant	-1.182	-4.757
Number of transit stops	0.01567	2.155
Population size	0.000017	2.001

Null deviance	157.58
Residual deviance	139.8
P-value	0.35

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Results
Hypothesis check

	Expected	Model small	Model large
Accessibility	+	+	+
Demand	+	+	+
Income	o/+	o	o
Coopetition	+	o	o

Conclusions and outlook

- The location of grocery retailers is theoretically associated with attributes representing the interactions between the retailer and other agents: accessibility, demand, supply, competition, environment, regulation and others.
- The number of grocery stores in a zone is correlated with several demand and accessibility variables.
- It increases with the number of persons living in that zone and the number of transit stops (regardless the store size).
- This kind of analysis cannot find a significant association between number of stores and variables operationalizing competition or environment.
- Predicted number of stores will be used in scenarios of increased online retail by changing the population size.

- Several constructs can only be analyzed by a disaggregate model considering the true location within a discrete choice model framework.

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Thank you

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