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Interactions of travel behaviour, accessibility and personal characteristics: The case of the Upper Austria Region

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Starting Point

The **spatial structure** has many dimensions:

- access to the central-place system
- access to work, shopping and leisure facilities
- provision of infrastructure facilities
- public transport supply
- settlement structure
- topography

But **certain configurations** are stable, e.g.:

- urban blocks
- detached house-settlements
- rural structures (great farms)

Research question

➔ Individual living environments offer different opportunities with regards to work, shopping and leisure activities.

- How do different living environments affect traffic, especially mode choice?
- Is the individual travel behaviour influenced by the spatial structure and/or personal characteristics?

Research Background

At a very general level two different positions:

- The impact of the spatial structure on travel behaviour is rather small.
- Travel behaviour is dependent on the spatial structure.

Main reasons for this contradiction:

- Differences in the selection of the spatial, personal and travel behaviour variables

Three pillars

- Study area
- Travel survey
- SEM-method

Study Area

Upper Austria - one of the nine Austrian provinces - was selected for two main reasons.

- **Availability of suitable travel survey data**: Quantitatively rich and detailed survey
- **‘Small Austria’**: All regional types which can found in Austria also can be found in Upper Austria.

Upper Austria

Upper Austria

Upper Austria has a size of 12.000 km^2 and about 1.3 million inhabitants.

Upper Austria consists of 15 districts, three cities with district status (Linz, Wels and Steyr) and 445 municipalities.

The spatial structure of Upper Austria is described by municipality-based measures, by one household based measure and by accessibility measures.

Municipality-based Measures

	Mean	Min.	Max.
Inhabitants	3 081	245	208 727
Distance to district capital	17	0	59
Distance to Linz	46	0	143
Number of reachable facilities	3.9	0	8
Share of farms	19	0	69
Share of commuters	62	15	84
Share of working women	36	25	50

Accessibility measures

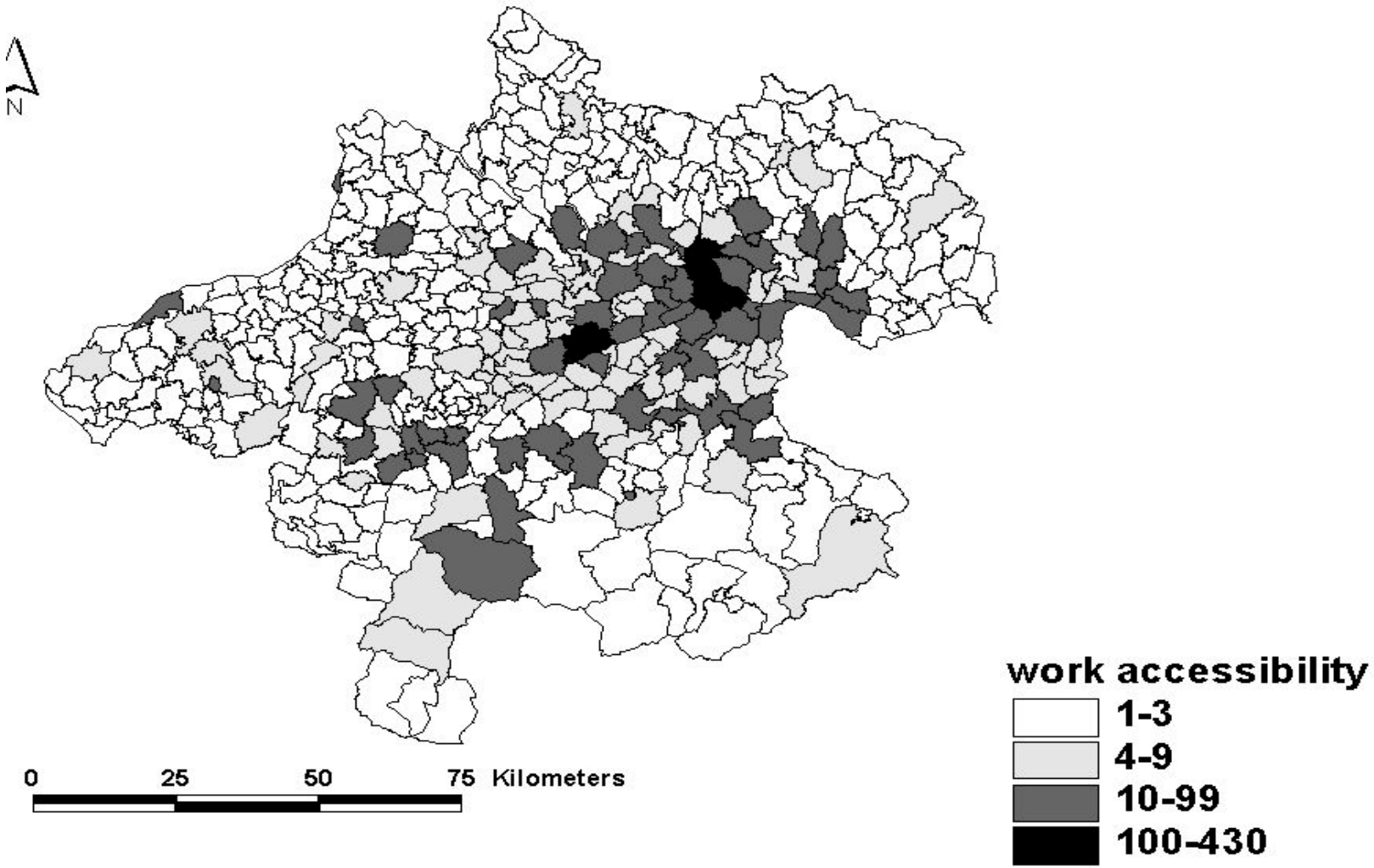
Wide range of possible definitions, e.g. ‘the potential of opportunities for interaction’, and several approaches to operationalise accessibility.

The following formulas are used here:

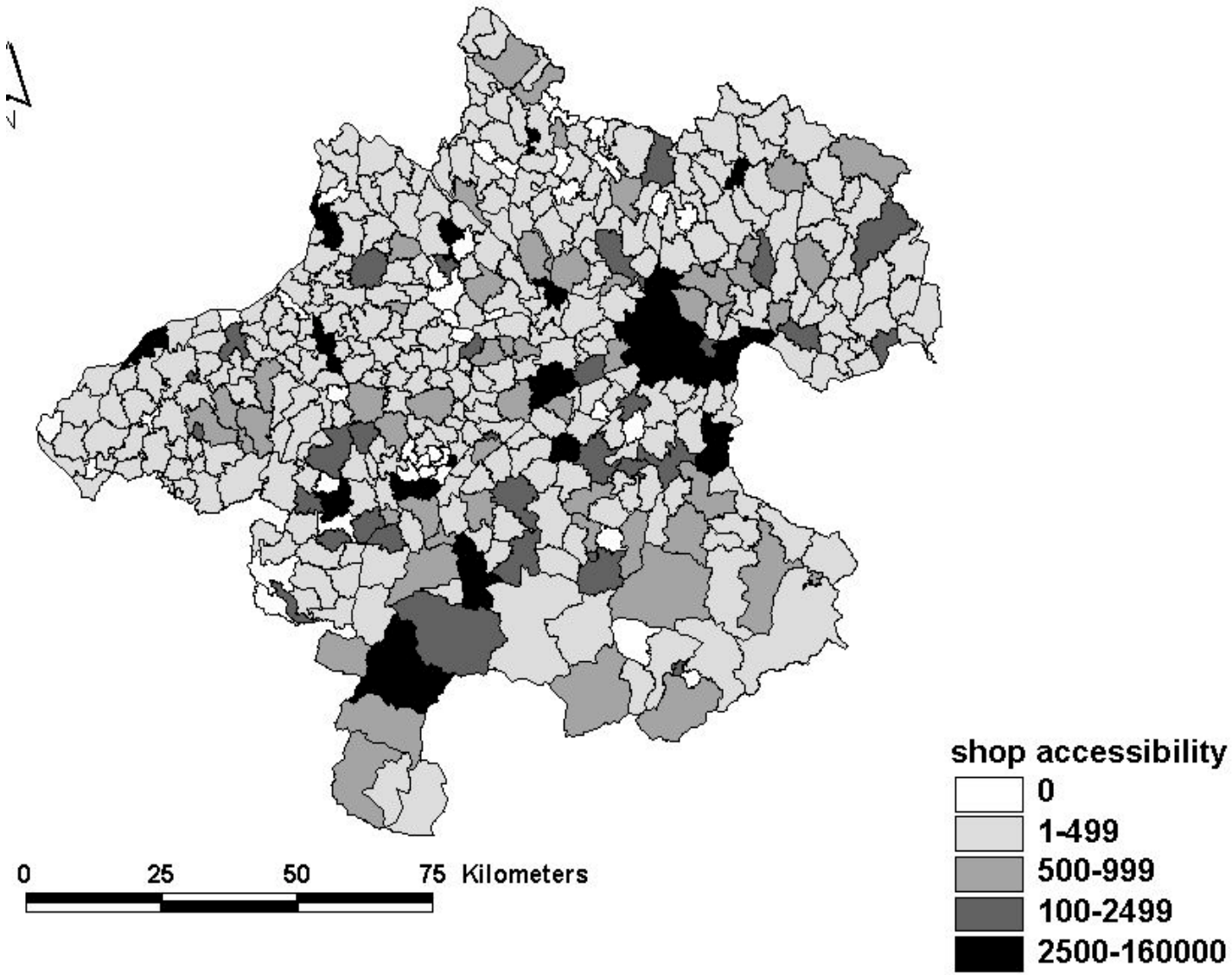
$$ShopAcc = \sum_j A_j . e^{-\alpha * c_{ij}}$$

$$WorkAcc = \sum_j \frac{J_j . d_{ij}^{-\beta}}{\sum_k W_k . d_{kj}^{-\beta}}$$

Spatial distribution of the work accessibility



Spatial distribution of the shopping accessibility



Travel Survey

Organisation

- Realisation: during the autumn of 1992
- Survey design and protocol: similar to German KONTIV
- Information about the person and the household
- One day trip diary
- Sampling: every third household
- Return rate: on average 70%

Database

- 899 000 trip records
- 328 000 person records
- 124 000 household records

SEM-method

General: regression- and factor-analysis are special cases

SEM-model without latent variables has one component:

$$\eta = B\eta + \Gamma\xi + \zeta$$

Model results:

- direct and total effects
- model fit
- R^2s

Model-hypotheses

Car-ownership:

Car-ownership is mainly influenced by personal characteristics.

Mode choice:

Mode choice is influenced by the commitment to a mode and by the travel situation expressed by the accessibility measures.

Travelled distances :

The distances travelled are influenced by the supply in the home-municipality and by the distance to the district capital.

Structure of the model

Person- and household-variables:

employment, gender, number of children, number of reachable facilities

Spatial variables:

distance to district capital, share of farms, share of working women, share of commuters, supply in respective municipality (size of shop base or number of workplaces), accessibility measure

Endogenous variables:

car-ownership, number of walk trips, number of public transport trips, number of car trips, travelled distances

Estimation procedure

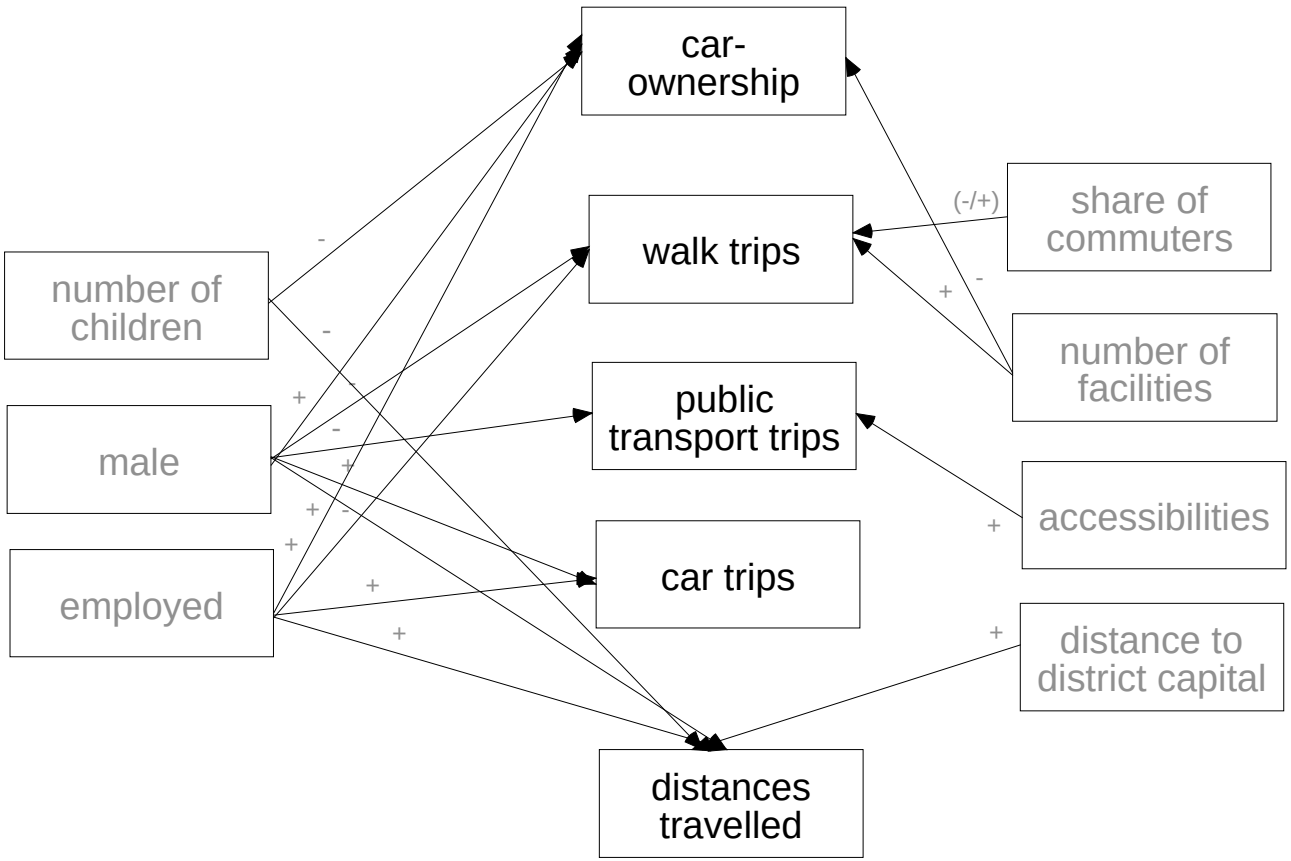
Two models were estimated:

- shopping model
- work model

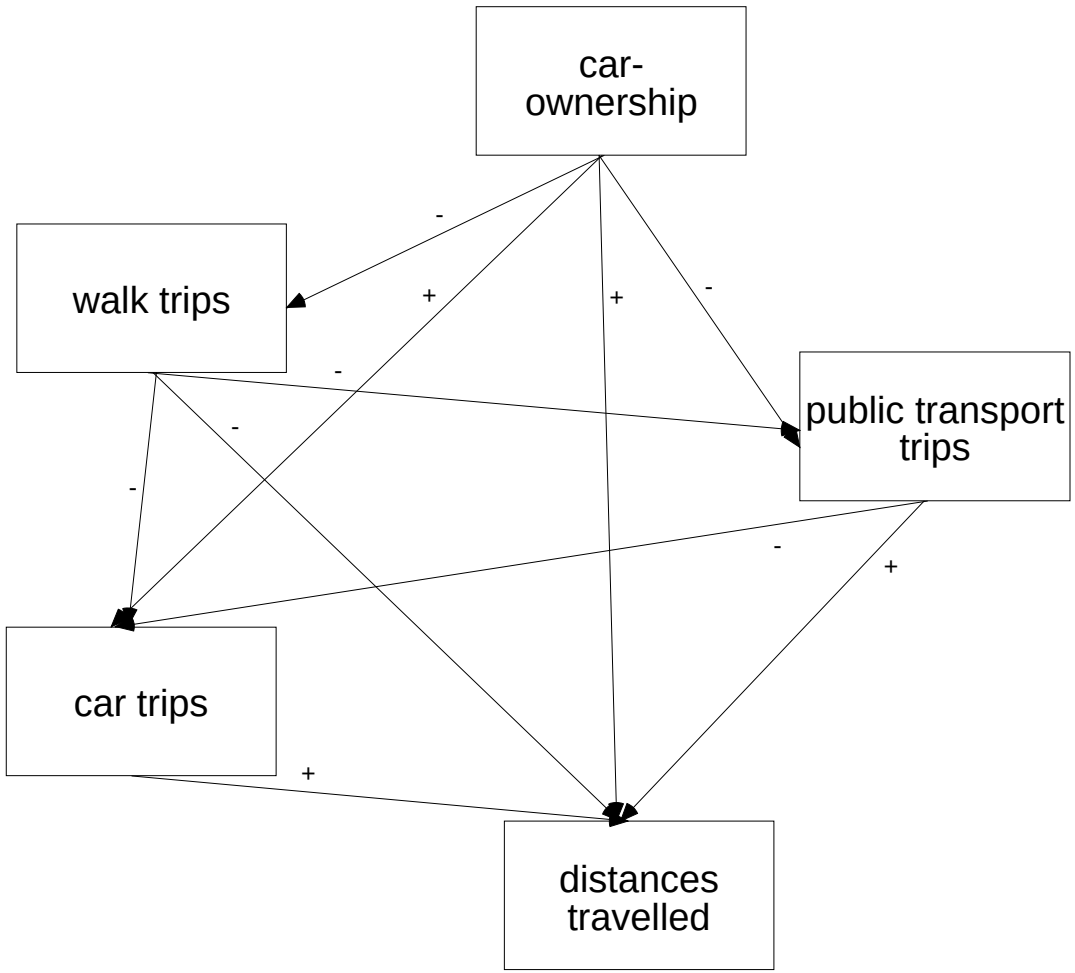
5% random samples of all mobile persons older than 17 with shopping trips (3.007 persons) respectively work trips (4.418 persons).

Modifications were only made within the Γ-matrix.

Model results - effects within the exogenous side



Model results - effects within the endogenous side



Assessment of hypotheses

Car-ownership is mainly depending on personal characteristics.

Mode choice is strongly influenced by car-ownership. A good supply tends to increase the use of public transport.

For the **travelled distances** the other endogenous variables as well as the variables gender and employment are decisive. The distance to the district capital is the most important spatial variable.

Additional findings

Similarities between the models: Mode choice for the two different purposes is influenced by similar variables to a similar extent, but differences in the absolute values.

Importance of personal characteristics: Personal attributes have much more and stronger effects on travel behaviour than the chosen spatial variables.

Effects of the accessibility measures: A high accessibility of work places respectively shops only promotes the usage of public transport.

Conclusions

The conclusion that travel behaviour is space-independent may not be warranted for two reasons:

- The historical development is not considered.
- The municipality-based indices are too rough.

The results give hints to possible policy variables :

- Number of reachable facilities
- Distance to district capital
- Share of commuters (accessibility of workplaces)

Future research

This study could be extended in several directions:

- Dynamic dimension, especially the choice of a home location
- More household-based spatial variables
- Detailed description of the public transport supply
- Consideration of the commitments to other modes