Exploring the impact of household interactions on car use for home-based tours

A multilevel analysis of travel mode choice in the Netherlands

NECTAR Conference
Ann Arbor, Michigan
14-16 June 2015

UNIVERSITY OF TWENTE.

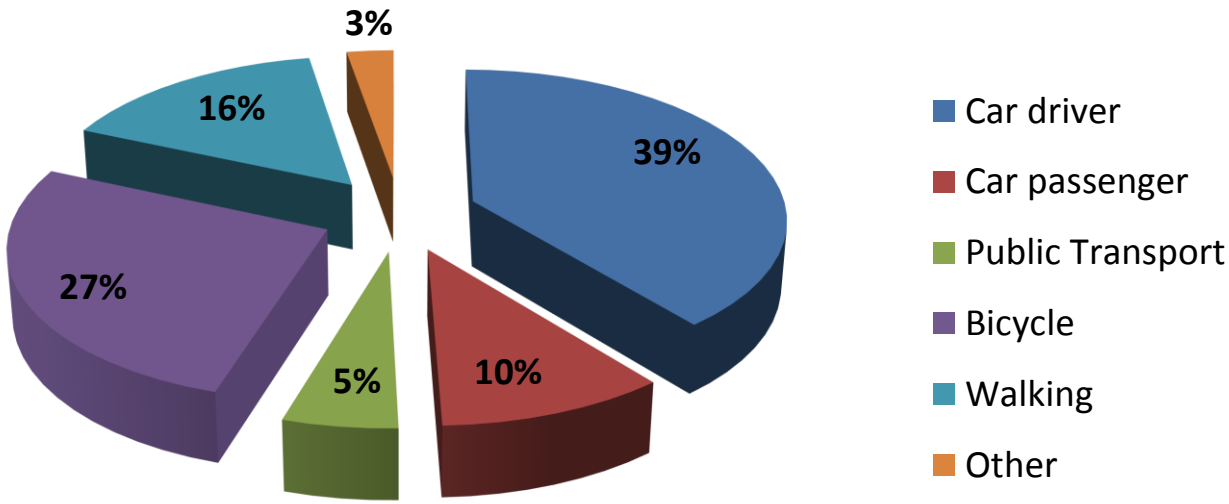
adviseurs mobiliteit
Goudappel Coffeng

UNIVERSITY OF TWENTE.

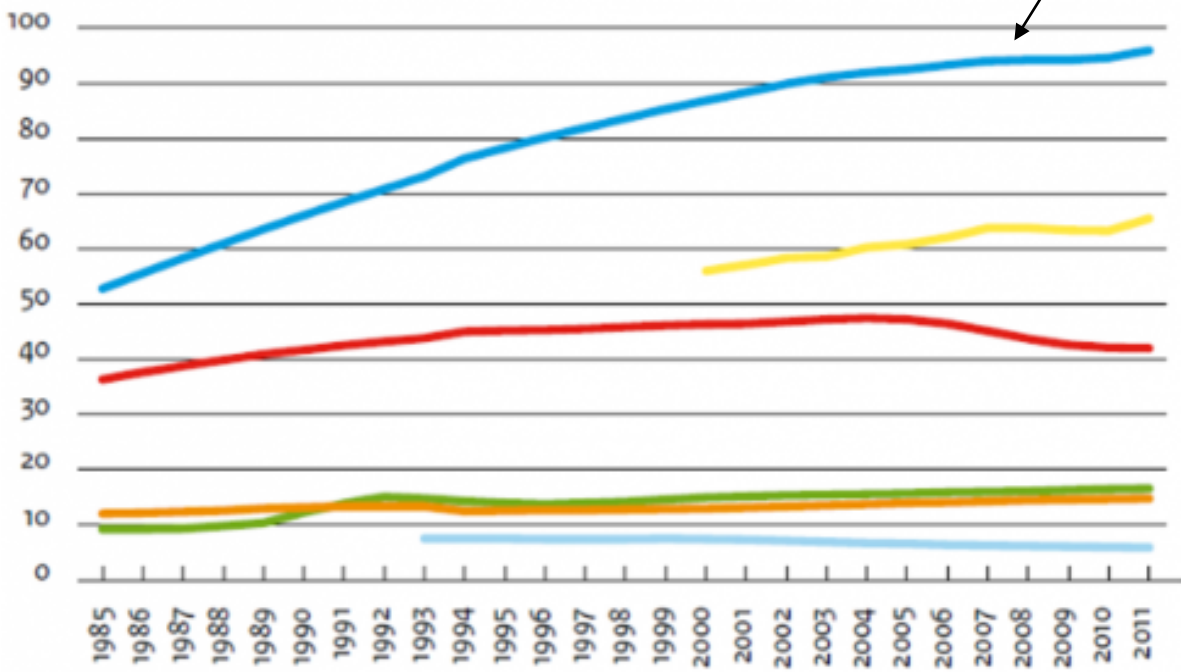
adviseurs mobiliteit
Goudappel Coffeng

UNIVERSITY OF TWENTE.

adviseurs mobiliteit Goudappel Coffeng



Car use in the Netherlands 1985-2012 (billion kilometers)



UNIVERSITY OF TWENTE.

adviseurs mobiliteit Goudappel Coffeng

Growth car use

- More people
- Changes in age structure (more elderly)
- Increase in women's labor market participation
- Increase of car ownership
- Increase of having driving license

UNIVERSITY OF TWENTE.

adviseurs mobiliteit Goudappel Coffeng

Growth car use

- More people
- Changes in age structure (more elderly)
- Increase in women's labor market participation
- Increase of car ownership
- Increase of having driving license

Changing position of the car within multi-person households

MORE HOUSEHOLD INTERACTIONS

UNIVERSITY OF TWENTE.

adviseurs mobiliteit Goudappel Coffeng

Household interactions

- **Resource and allocation usage**
  - For example one car in a multiple person household
- **Task and time allocation**
  - Coordination tasks such as bringing the children to school or doing the groceries
- **Jointly activity allocation**
  - Household and non-household members share activities and travel together
- **Life-events**
  - Changing jobs, having children form a trigger for changes in travel activity patterns

UNIVERSITY OF TWENTE.

adviseurs mobiliteit Goudappel Coffeng

Data requirements

- **To study household interactions we need to know:**
  - Household characteristics
  - If household members travel together
  - Which activity this was for
  - Life-events -> time-dimension

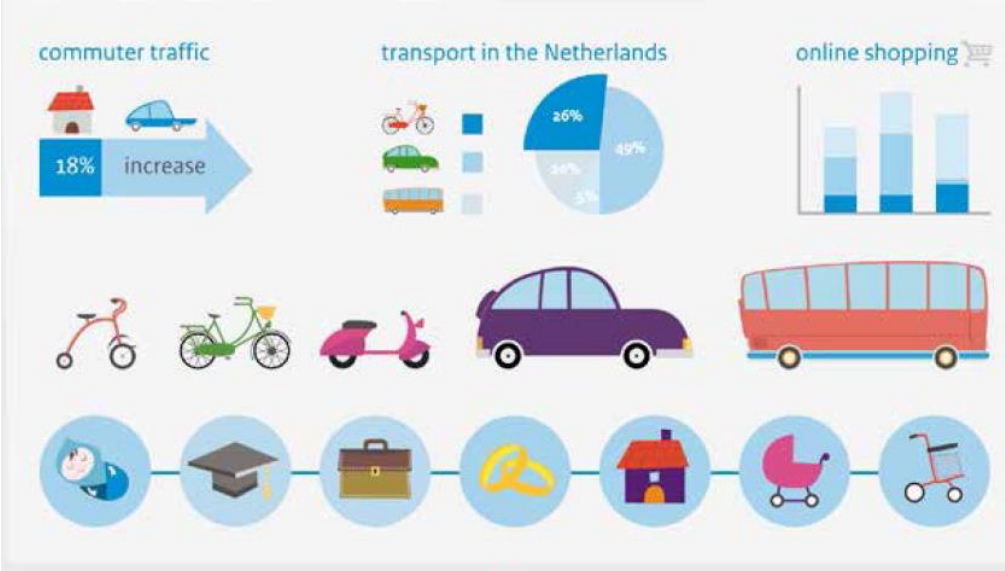
- **New Mobility Panel the Netherlands meets all these requirements**

UNIVERSITY OF TWENTE.

adviseurs mobiliteit Goudappel Coffeng

Short impression

Mobility Panel Netherlands

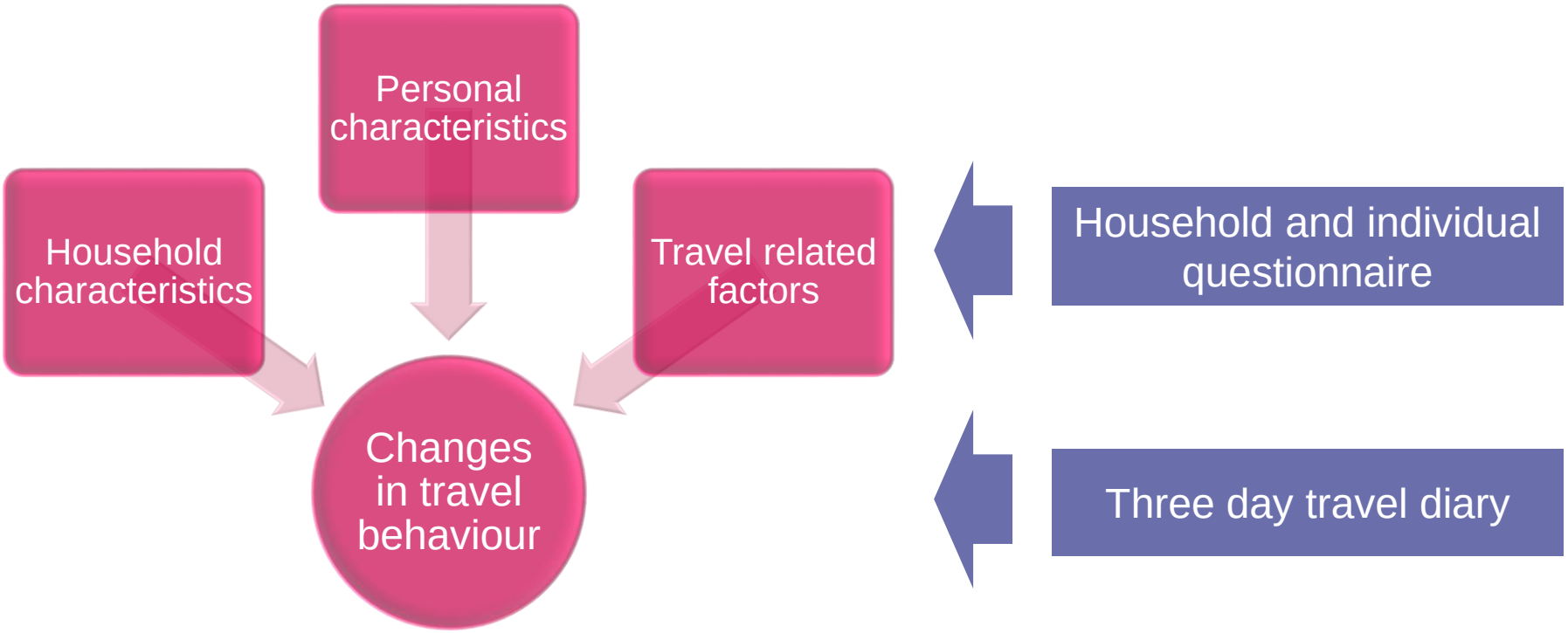


UNIVERSITY OF TWENTE.

adviseurs mobiliteit Goudappel Coffeng

Main objective

To map changes in travel behaviour of a specific group of people and households (e.g., young adults, families with small children, elderly) over an extended period of time



UNIVERSITY OF TWENTE.

adviseurs mobiliteit Goudappel Coffeng

Characteristics MPN

- Largest existing mobility panel
- Multiple year panel
- Household panel
- Multi-day diary
- Location based diary
- Retrospective questions
- Every two year additional questions about ICT-use and attitudes

UNIVERSITY OF TWENTE.

adviseurs mobiliteit Goudappel Coffeng

Research question

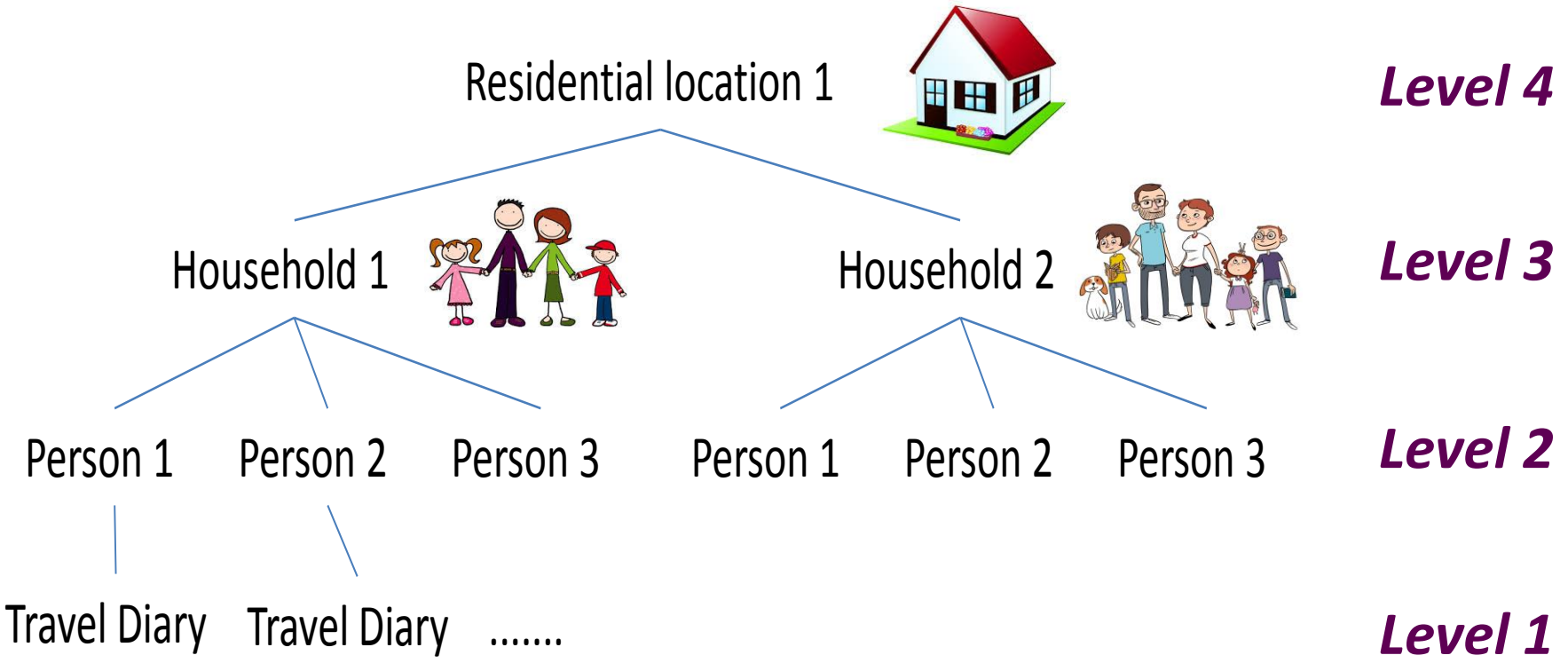
Is there a relationship between tour characteristics and travel mode choice and to what extent explain individual, household and spatial characteristics and interactions between these levels the likelihood to choose the car for home-based tours?

Multilevel approach

- Individuals within a specific household type and living in a specific neighborhood may have different travel patterns
- Most research: differences between households are not taken into account
- Variables on household level are disaggregated to variables on individual level and opposite
- Multilevel analysis deals with variation at different levels
- Multilevel analysis also helps to understand individual variation of travel behavior over time (longitudinal analysis)

adviseurs mobiliteit
Goudappel Coffeng

Hierarchical structure MPN

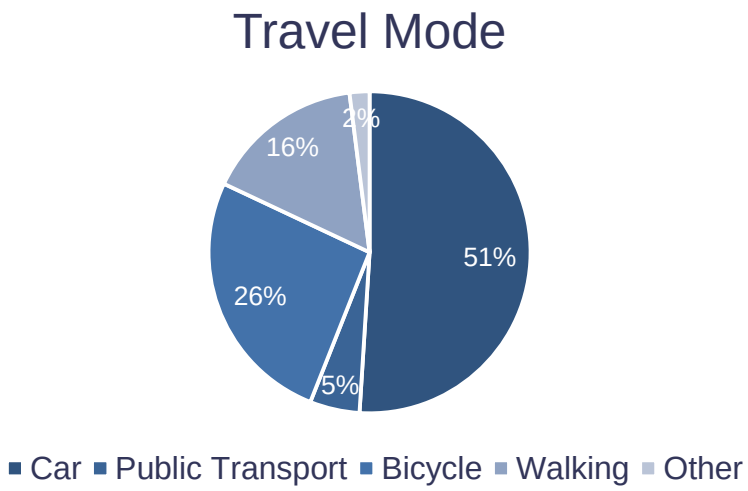


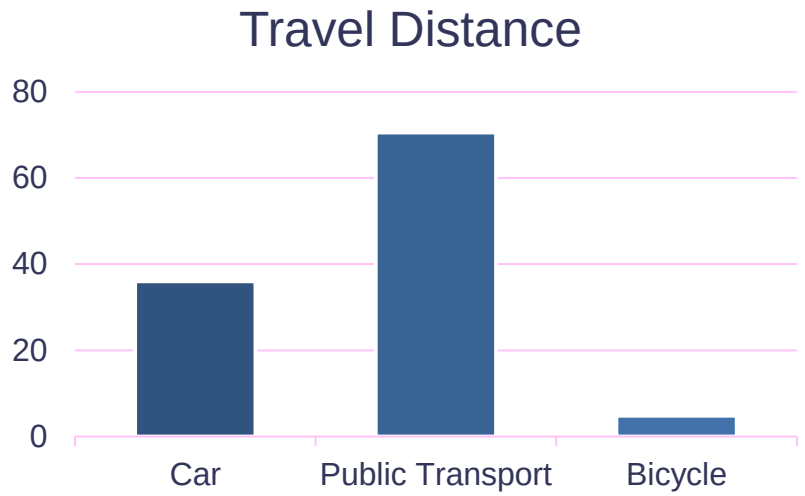
UNIVERSITY OF TWENTE.

adviseurs mobiliteit Goudappel Coffeng

Sample description: home-based tours

- 6,538 home-based tours
- 1,960 individuals
- 1,015 household (multi-person)

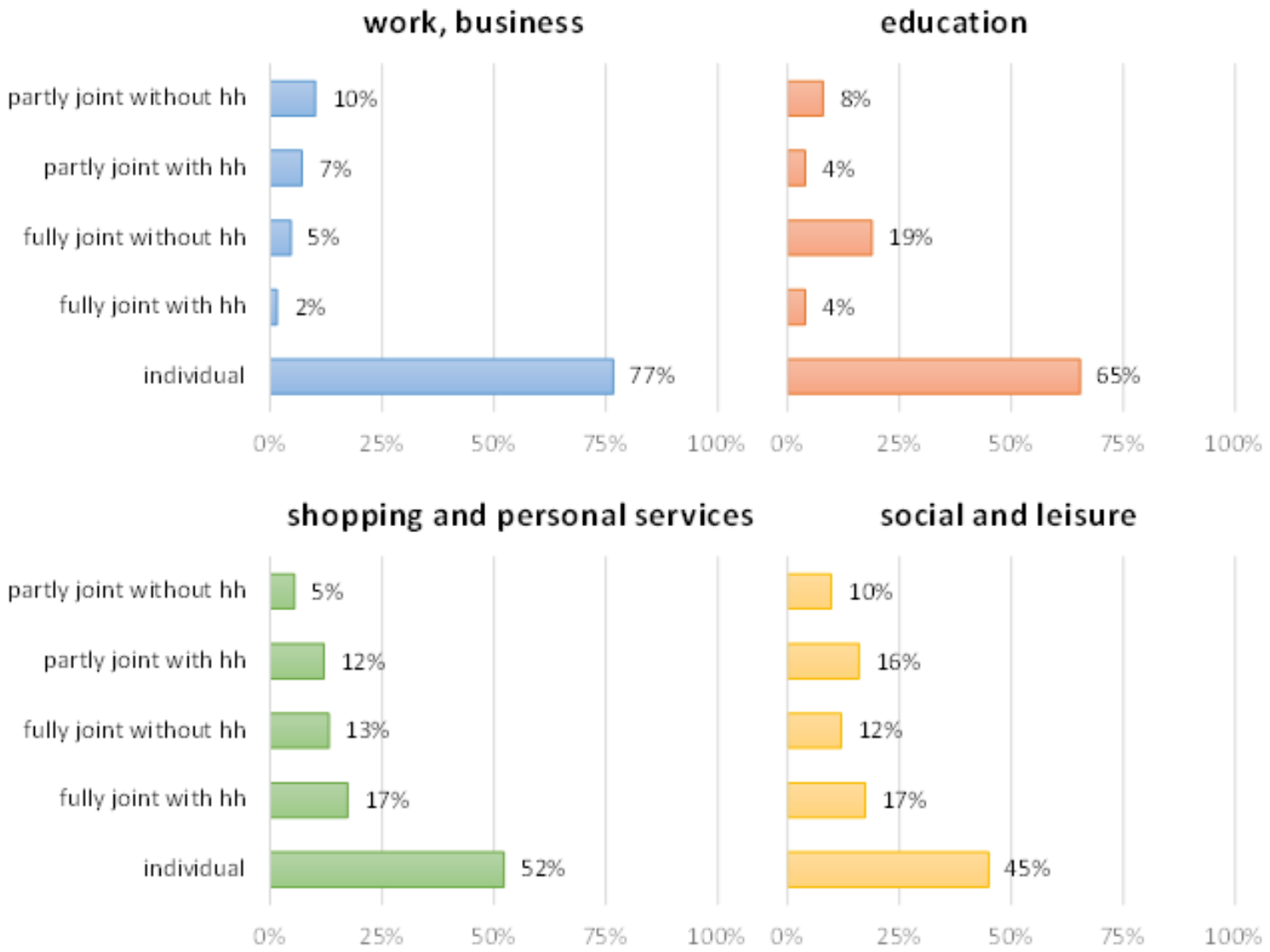




UNIVERSITY OF TWENTE.

adviseurs mobiliteit Goudappel Coffeng

Mode choice joint tours



Model specification

Multi-person households:

- **Intercept-only model (M1)**
- **Full model (M2)**

Multi-person households with income:

- **One or more incomes (M3)**
- **One income (M4)**
- **Two or more incomes (M5)**

Model estimation results

- **Variation in mode choice can be significantly explained by variability between households and individuals, thus justifies multilevel analysis**

- **Significant household interactions:**
  - If somebody travels together with a household member it is much more likely to use the car
  - Trip complexity has a positive impact on car use
  - Presence of young children makes it less likely to use the car
  - In multiple-person households with one or more income, intra-household interactions have a larger effect on car use

Further research

- **Scope of the analysis:**
  - Different models for different distance classes
  - Focus on home-based work tours to determine if other variables such as ICT-use or preferences are significant
  - Expanding with explanatory variables representing features of one or more household members (for example commuting distance of spouse)
- **Examine dynamics in travel behavior:**
  - Adding repeated measures (longitudinal data)
- **Analyzing more dimensions:**
  - Tour distance, activity duration

UNIVERSITY OF TWENTE.

adviseurs mobiliteit
Goudappel Coffeng

QUESTIONS?