Analysis of automated driving diffusion: Diffusion paths into the German car market

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In collaboration with:

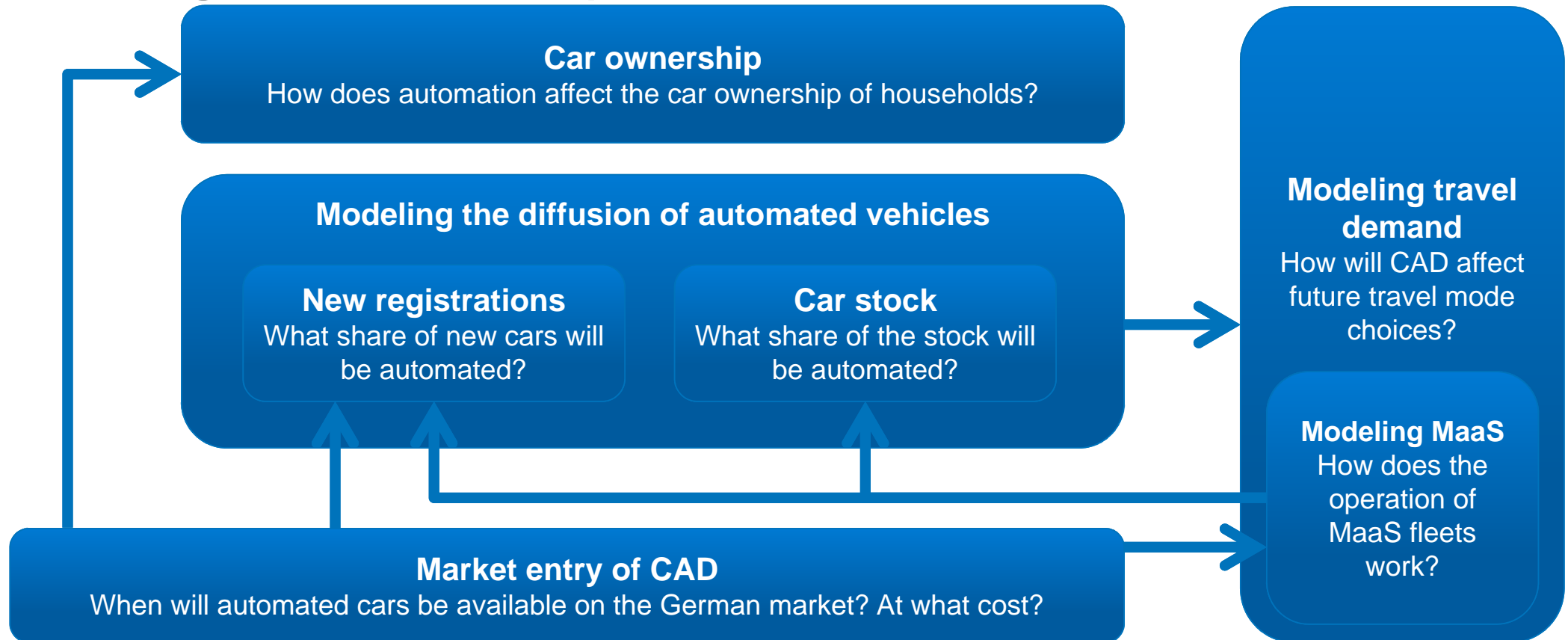Nina Thomsen, Dennis Seibert (DLR)

Prof. Tobias Kuhnimhof, Michael Schrömbges (RWTH)

Dr. Thomas Meissner (BMW)

Wissen für Morgen

Modeling the diffusion of connected automated driving (CAD) is based on answering several research questions

Car ownership
How does automation affect the car ownership of households?

Modeling the diffusion of automated vehicles

New registrations
What share of new cars will be automated?

Car stock
What share of the stock will be automated?

Modeling travel demand
How will CAD affect future travel mode choices?

Modeling MaaS
How does the operation of MaaS fleets work?

Market entry of CAD
When will automated cars be available on the German market? At what cost?

Different scenarios consider the diffusion of CAD through the private car and the MaaS vehicle market

1.

Diffusion of CAD through automated **private cars** only.

2.

Diffusion of CAD through automated **MaaS vehicles in large cities** (and through automated private cars).
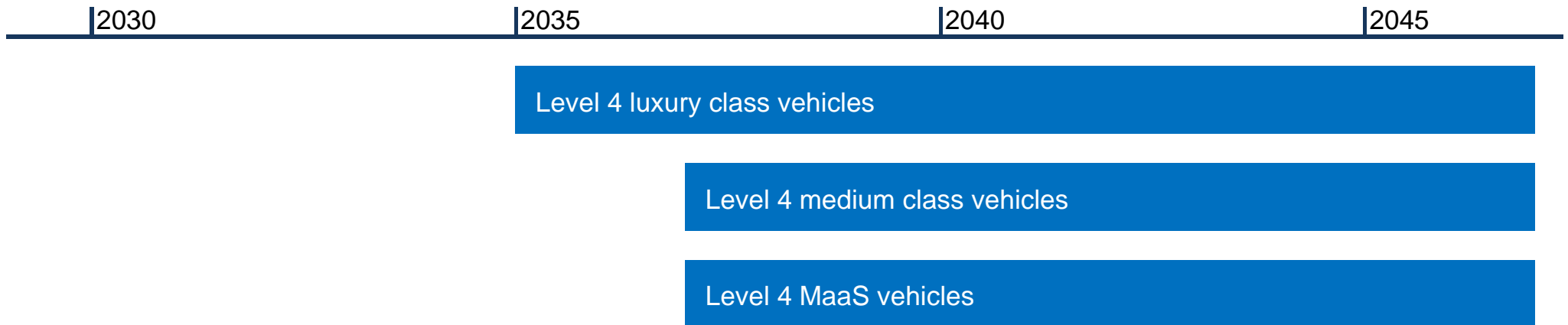
3.

Diffusion of CAD through automated **MaaS vehicles in rural areas** (and through automated private cars).

Model assumptions on the entry of level 4 automated vehicles into the German market are derived from interviews with industry experts

| 2030 | 2035 | 2040 | 2045 |

Level 4 luxury class vehicles

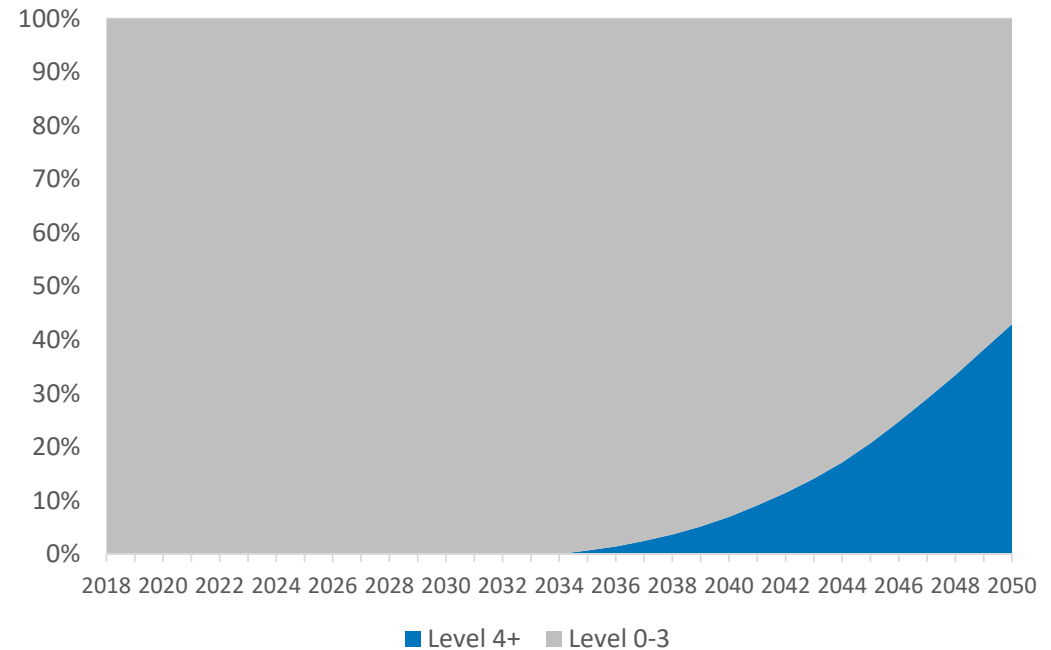Level 4 medium class vehicles

Level 4 MaaS vehicles

Given market entry and additional costs of automated private cars their share in the stock will be around 43% in 2050 (scenario without MaaS)

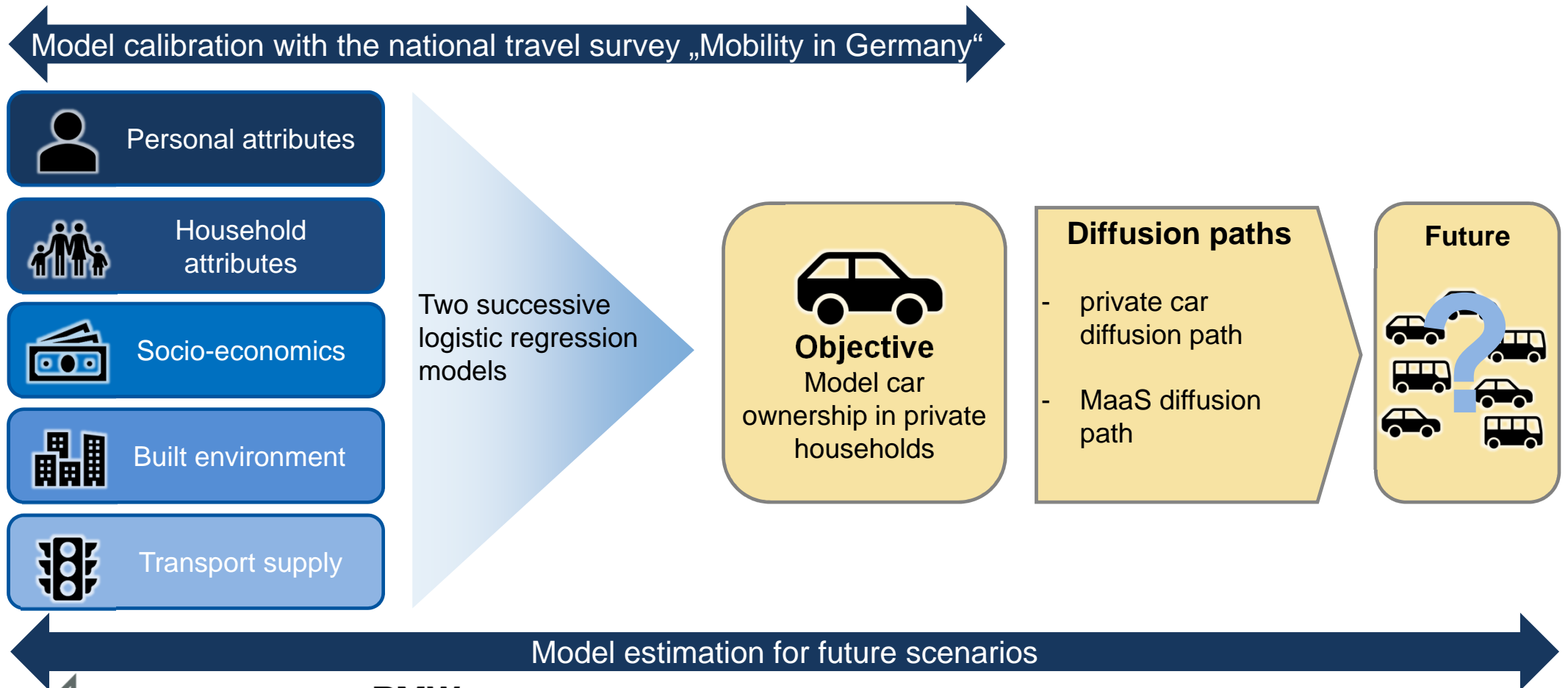**Selected results:** Diffusion of CAD through automated private cars only

New registrations by automation level
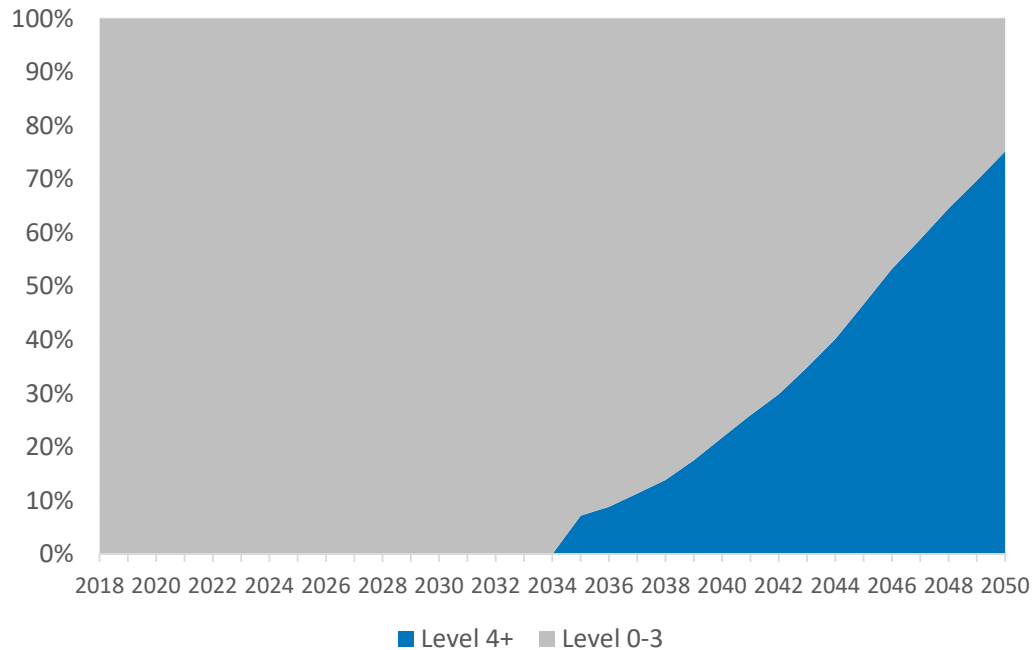
Car stock by automation level

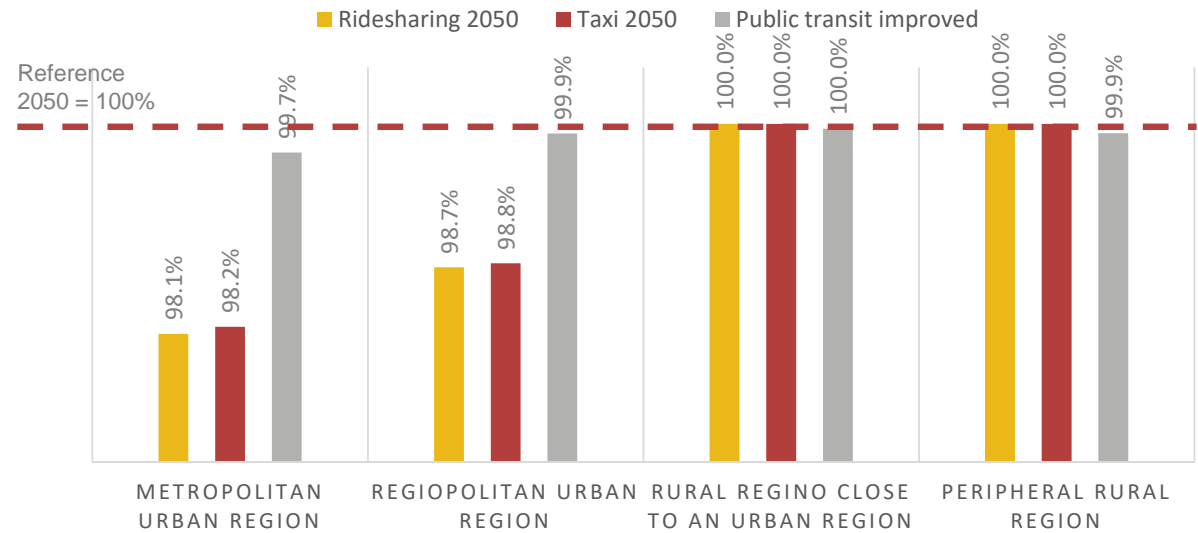# A discrete choice model for car ownership in households is being developed

Model calibration with the national travel survey „Mobility in Germany"

Personal attributes

Household attributes

Socio-economics

Built environment

Transport supply

Two successive logistic regression models

Objective
Model car ownership in private households

Diffusion paths

- private car diffusion path

- MaaS diffusion path

Future

Model estimation for future scenarios

DLR   ISB Chair and Institute of Urban and Transport Planning | RWTH AACHEN UNIVERSITY   BMW GROUP

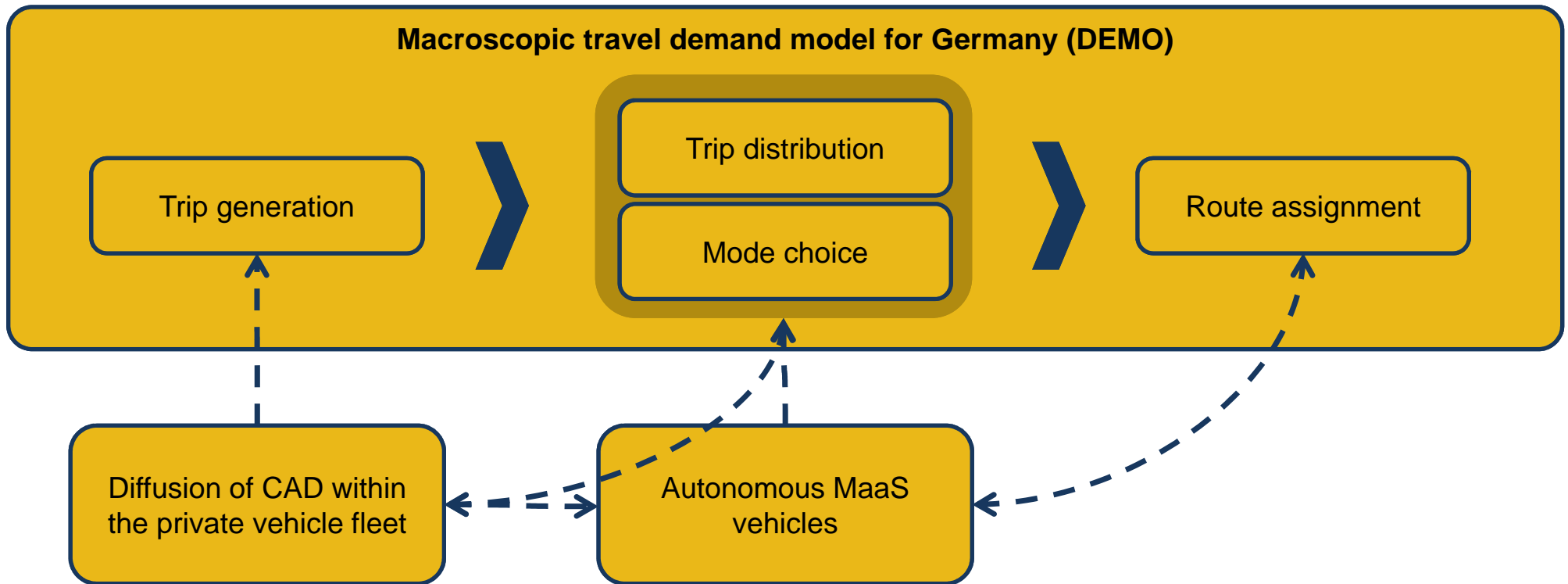# Impact of autonomous MaaS on car ownership – first results

MaaS diffusion path

- MaaS is implemented as ridesharing or taxi mode in urban areas
- Ridesharing (yellow) or taxi mode (red) lead to decrease of up to 2% of vehicle stock

SIZE OF VEHICLE STOCK IN DIFFERENT REGIONS
(REFERENCE 2050 = 100%)

■ Ridesharing 2050   ■ Taxi 2050   ■ Public transit improved

Reference
2050 = 100%

Region	Ridesharing 2050	Taxi 2050	Public transit improved
METROPOLITAN URBAN REGION	98.1%	98.2%	99.7%
REGIOPOLITAN URBAN REGION	98.7%	98.8%	99.9%
RURAL REGINO CLOSE TO AN URBAN REGION	100.0%	100.0%	100.0%
PERIPHERAL RURAL REGION	100.0%	100.0%	99.9%

A german-wide transport demand model is being extended, to analyze the impacts of automation on travel demand

Macroscopic travel demand model for Germany (DEMO)

Trip generation

Trip distribution

Mode choice

Route assignment

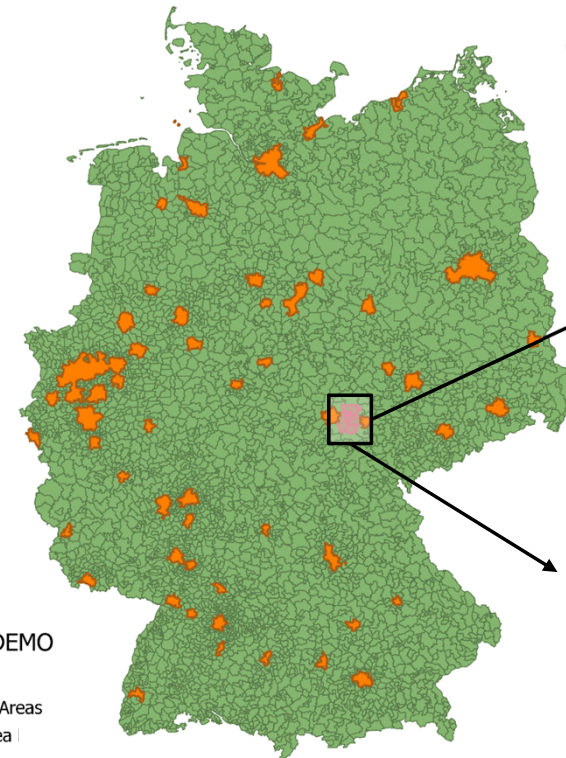Diffusion of CAD within the private vehicle fleet

Autonomous MaaS vehicles

# Impact of autonomous MaaS on transport demand – first results

- MaaS services are available in 55 service areas across Germany.
- Simulations for a test region (marked in pink) show:
  - Taxi (7%) are preferred to shared MaaS trips (5%).
  - If all MaaS trips must be shared, MaaS accounts for 6% of all trips.
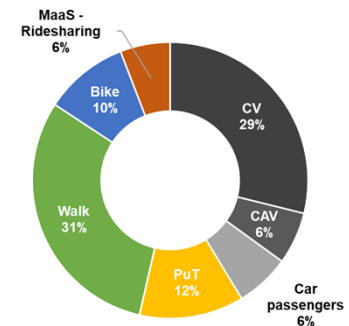 - MaaS vehicles lead to increased activity on roads and influence travel times and distances.

Exemplary results from a regional model
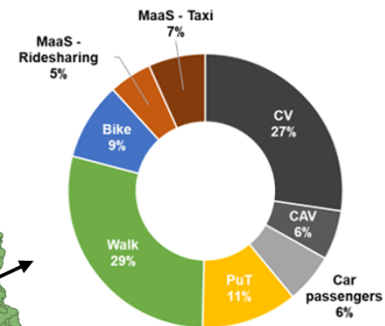
MaaS incl. taxi

MaaS all ride-sharing

MaaS in DEMO
- TAZ
- Service Areas
- Test Area

Evaluation of the consequential effects of CAD diffusion scenarios

1.

Definition of evaluation criteria to assess the consequential effects of CAD diffusion scenarios.

2.

Evaluating the importance of different CAD diffusion scenarios for a sustainable mobility transition.

3.

Presentation of the central results together with those of the Japanese partners as a joint book publication.

Conclusion and outlook

- With this project we are applying a unique and solid model chain to adequately display different likely diffusion paths of automated vehicles into the German market and their effects on sustainability and the industry.

- The applied model chain enables us to shed light into the discussion (in Germany), whether and under which conditions automation might contribute to a sustainable mobility transition.

- The Japanese-German collaboration:
  - The joint reflection of assumptions, scenarios and model approaches is very beneficial for the project activities.
  - Comparisons on CAD diffusion in Japan and Germany given structural similarities but also geographical, social and regulatory differences are helpful for the development and implementation of CAD.

Thank you for your attention!

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