Car Sharing (CS) in Switzerland (CH)

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(2)
Definitions & State of Research

State of Research

Definition

- According to Shaheen et al. (2015: 520), "**Car Sharing** is generally defined as short-term vehicle access among a group of members who share a vehicle fleet that is maintained, managed, and insured by a third-party organization'".
  - conventional (2-way)
  - free-floating (1-way)
- **Peer-to-peer car sharing** involves short-term access to privately owned vehicles. Growth in this market niche has been rather modest (Shaheen and Cohen 2013).

Socio-demographics

- CS users are described as young, urban, well-educated (Brook 2004; Harms and Truffer 1998; Lane 2005; Millard-Ball et al. 2005a, b) and predominantly male (Kawgan-Kagan 2015; Klintman 1998; Kopp et al. 2015)

State of Research II

Profile

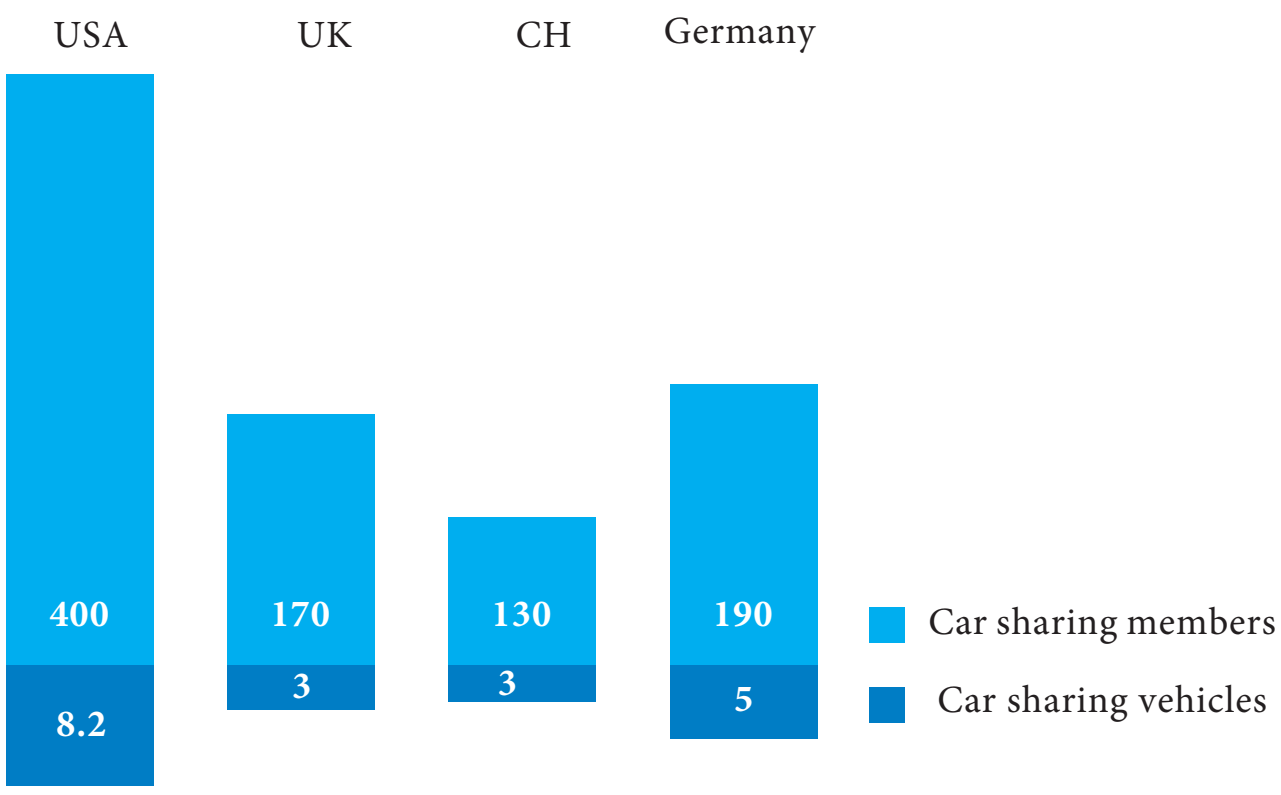
- CS users often come from small households and have a low rate of car ownership (Habib et al. 2012).
- A majority of car sharing members use the vehicles for short-distance urban trips ($\bar{x}$ = 14 km) (Costain et al. 2012; de Lorimier and El-Geneidy 2013; Firnkorn and Müller 2011).
- CS users are taking less than three trips per month (Brook 2004; Costain et al. 2012; Millard-Ball et al. 2005a, b; Morency et al. 2011).

State of Research III

Sustainability

- Various studies have documented the positive environmental impacts of car sharing, including reductions
  - in greenhouse gas emissions (Martin and Shaheen 2011),
  - vehicle-kilometers traveled (Martin and Shaheen 2011) and
  - car ownership (Baptista et al. 2014; Klincevicius et al. 2014; Martin et al. 2010; Millard-Ball et al. 2005a, b; Shaheen and Cohen 2013).
- Car sharing helps to reduce congestion and the demand for parking spaces and encourage more efficient resource use. For these reasons, many countries have adopted car sharing as a means to achieve sustainable mobility (Millard-Ball et al. 2005a, b).

CS : Top 4



in thousand

Note: CH 2005: 62'000 members, CH 2017: 130'000 members
Source: Germany, USA, UK: Frost & Sullivan (Year: 2011; USA: 2010)
CH: Swiss Mobility and Transport Microcensus 2015, Mobility
Figure: Ohnmacht (2014)

Source: Ohnmacht (2014)

(1)
Facts & Figures: CS in CH

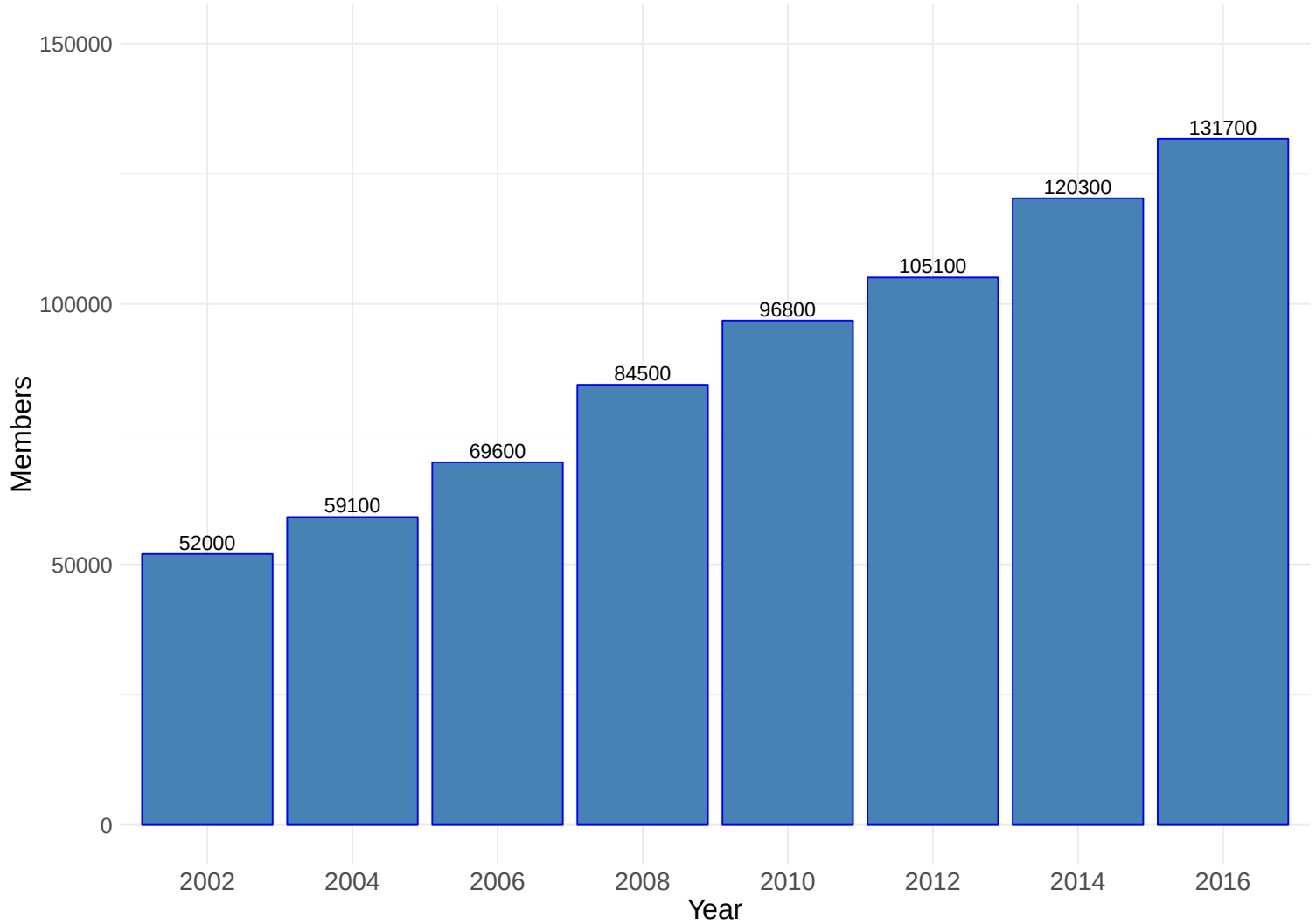
Growth Theory?
Profile of CS Users?

CS in CH

Mobility

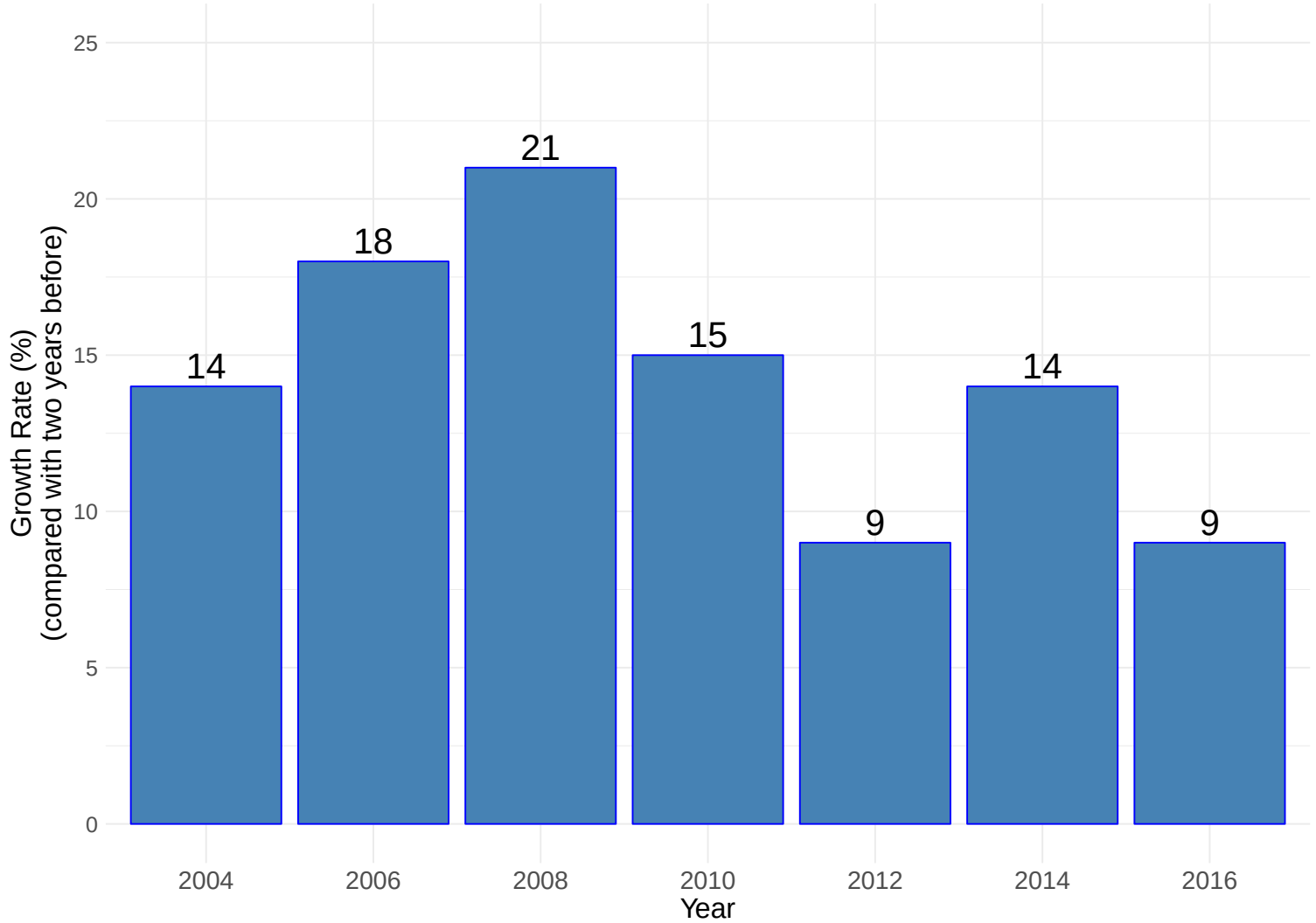
- Switzerland was the first country to introduce early forms of car sharing (SEFAGE, 1948) and the first to set up an efficient car sharing scheme (MOBILITY, 1997) (Shaheen et al. 2015).
- With 131,700 members and 1500 stations (Mobility Car Sharing Switzerland 2017), Mobility is considered to be the largest car sharing organization in Europe (Glover 2017, p. 185).
- Unlike other car sharing companies, which are privately owned, Mobility is a cooperative system (a sense of belonging to a community) (Suter and Gmür 2014).

Mobility Car Sharing Memberships (includes private and business)



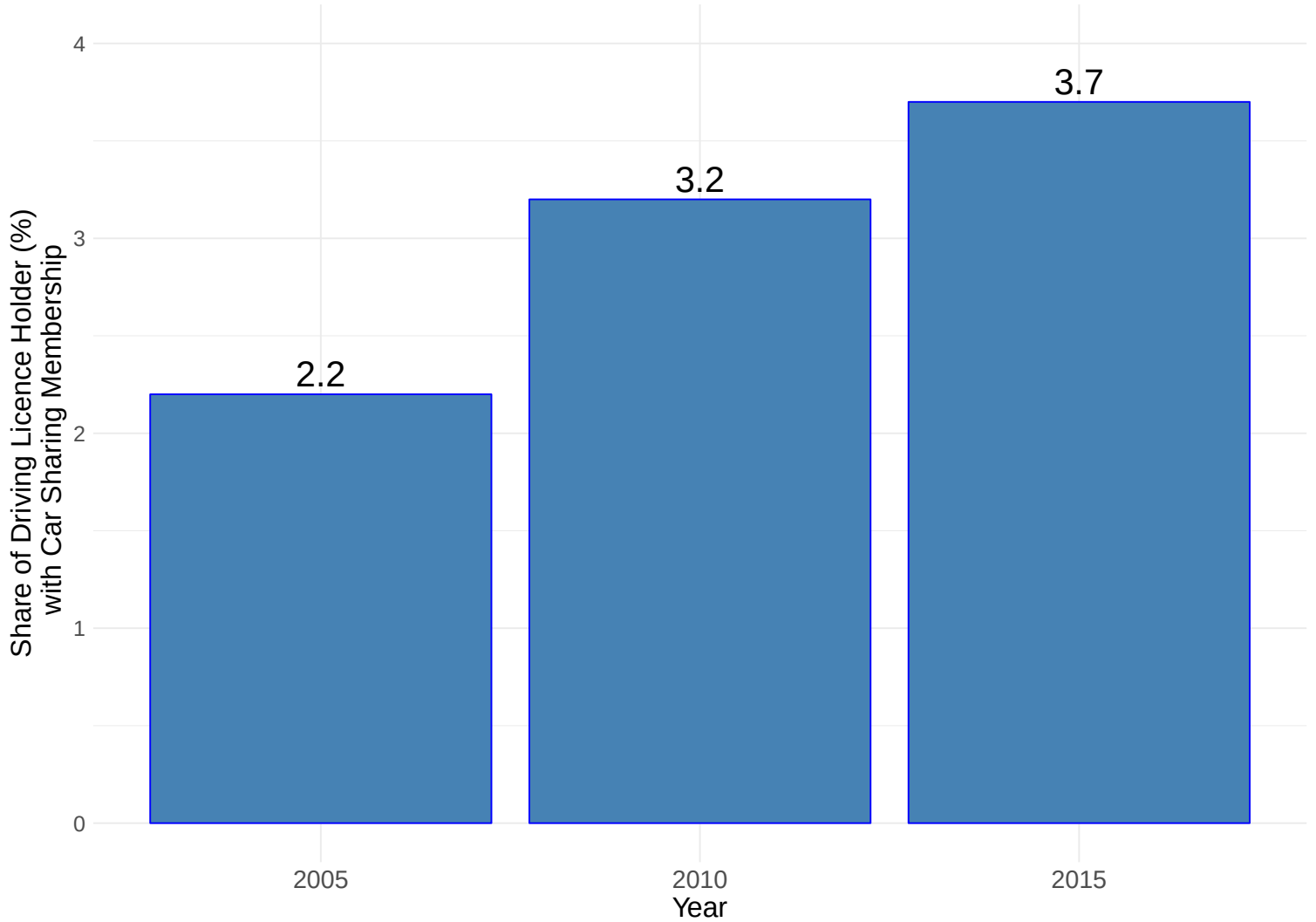
Source: Mobility, Heim (2017)

Mobility Car Sharing Memberships Growth Rates (includes private and business)



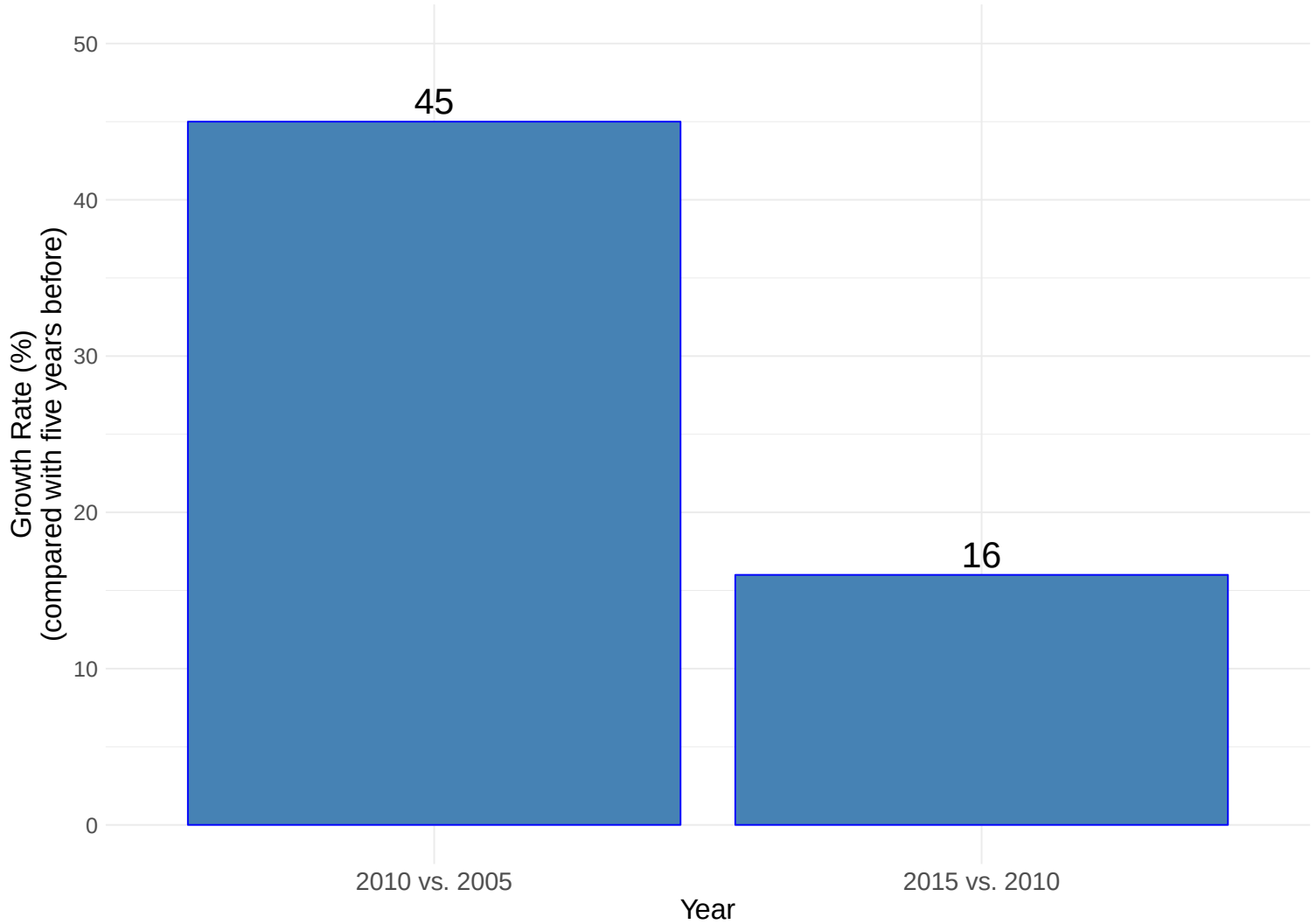
Source: Mobility, Heim (2017)

Share of Driving Licence Holders With Car Sharing Membership (i.e. Sharoo, Mobility)



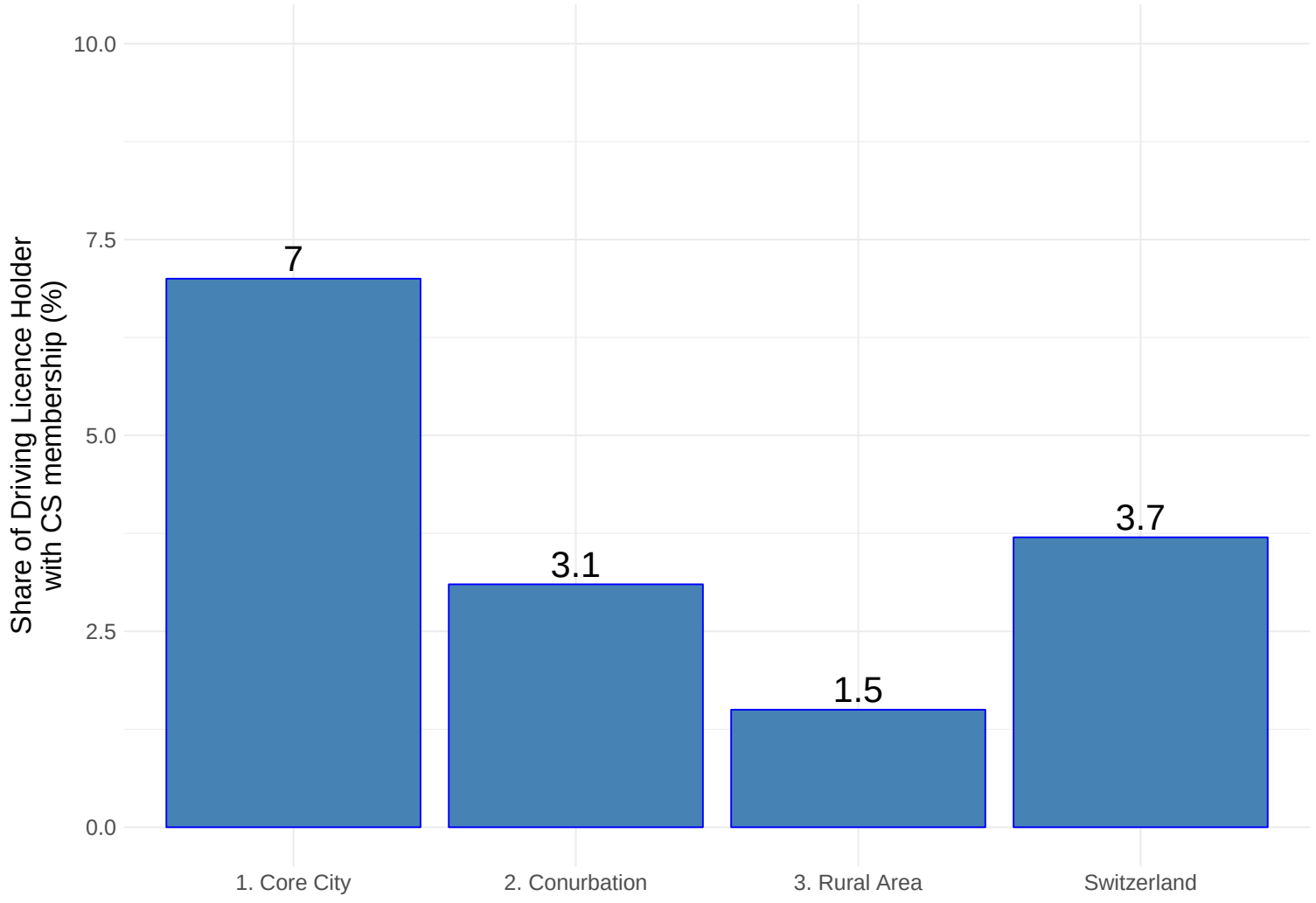
Source: Swiss Mobility and Transport Microcensus, FSO/ARE (2005, 2010, 2015)

Swiss Car Sharing-Memberships - Growth Rates (i.e. Sharoo, Mobility)



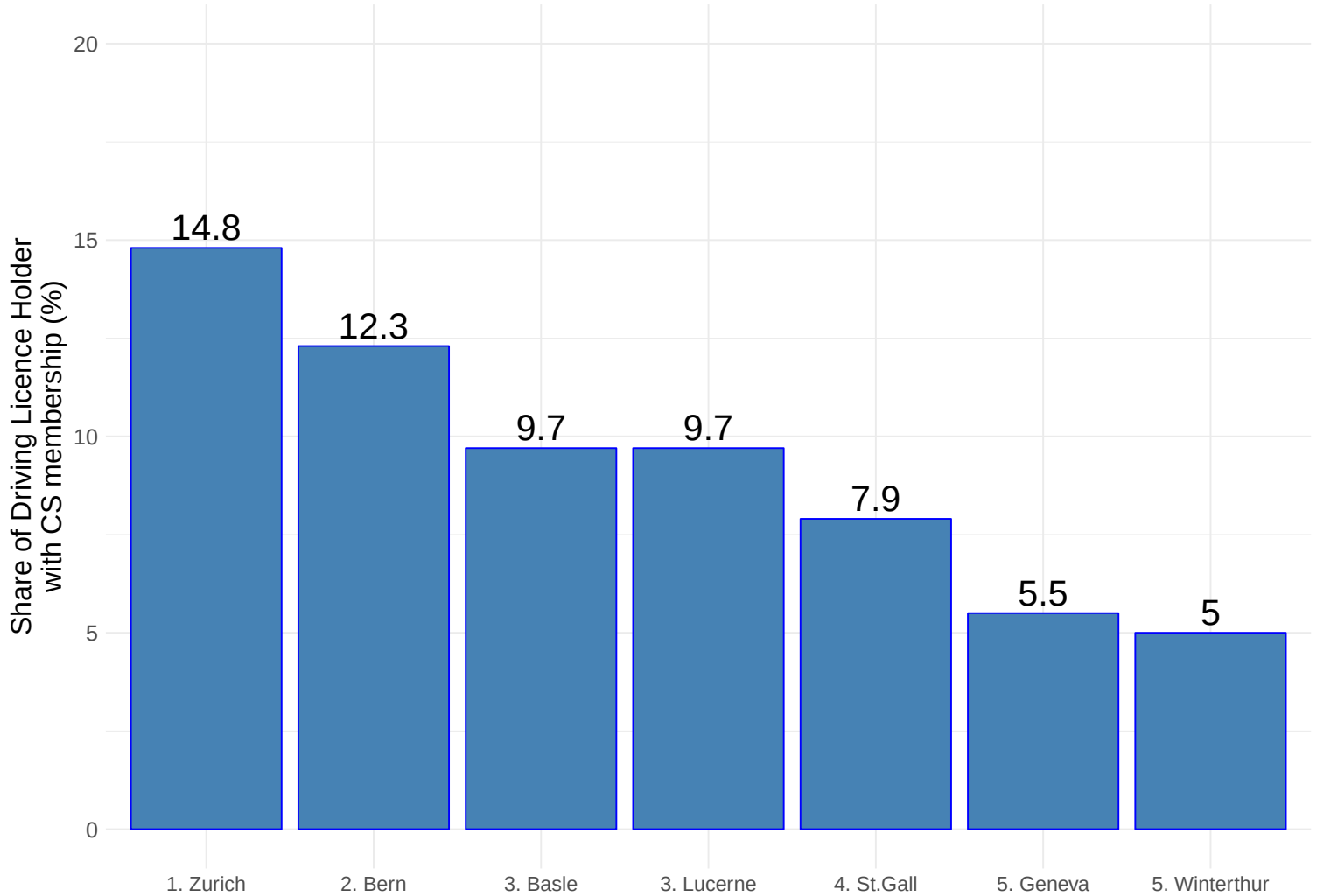
Source: Swiss Mobility and Transport Microcensus, FSO/ARE (2005, 2010, 2015)

Swiss Car Sharing-Memberships (i.e. Sharoo, Mobility) by Spatial Categories



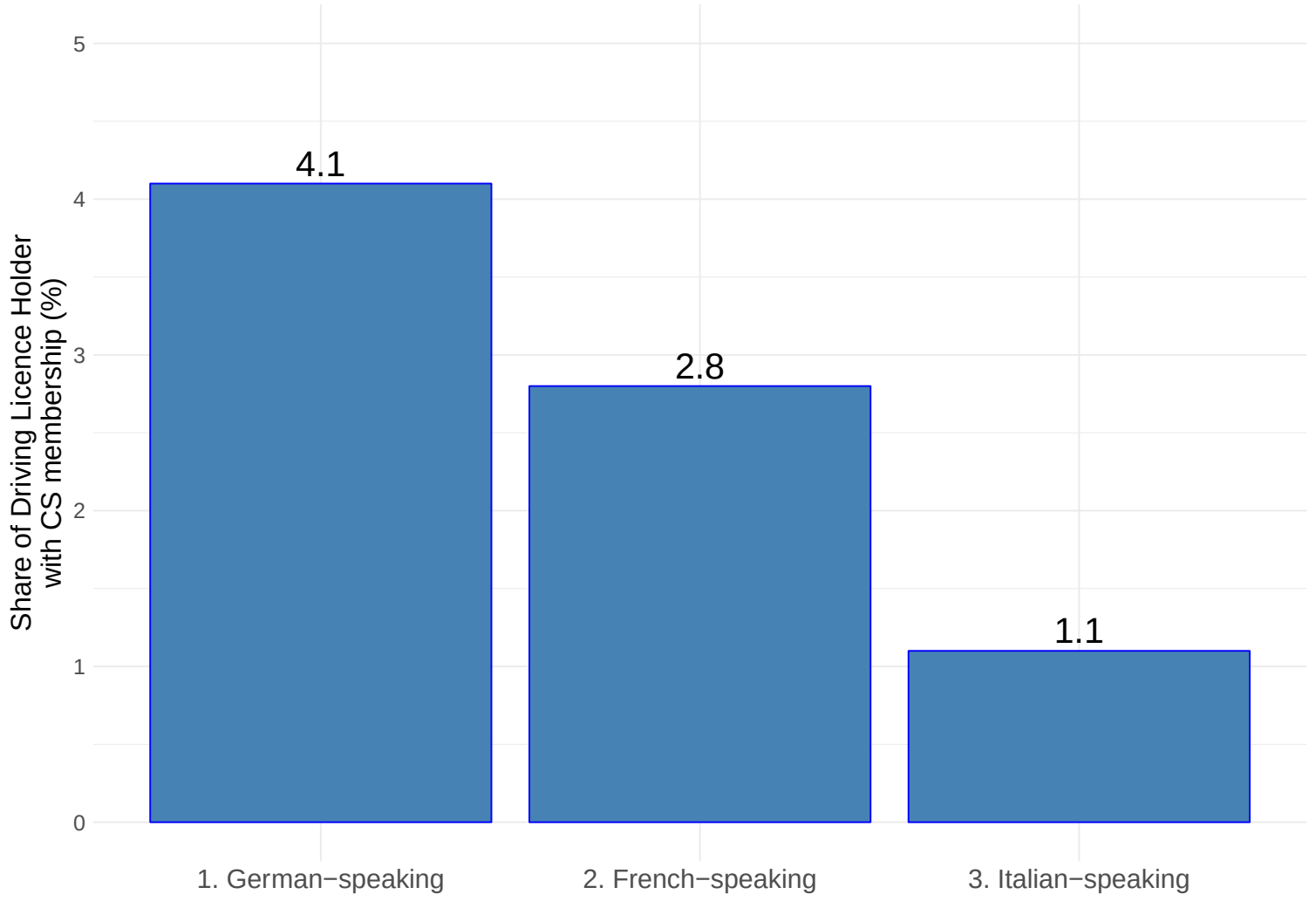
Source: Swiss Mobility and Transport Microcensus, FSO/ARE (2015)

Swiss Car Sharing-Memberships (i.e. Sharoo, Mobility) by Swiss Cities



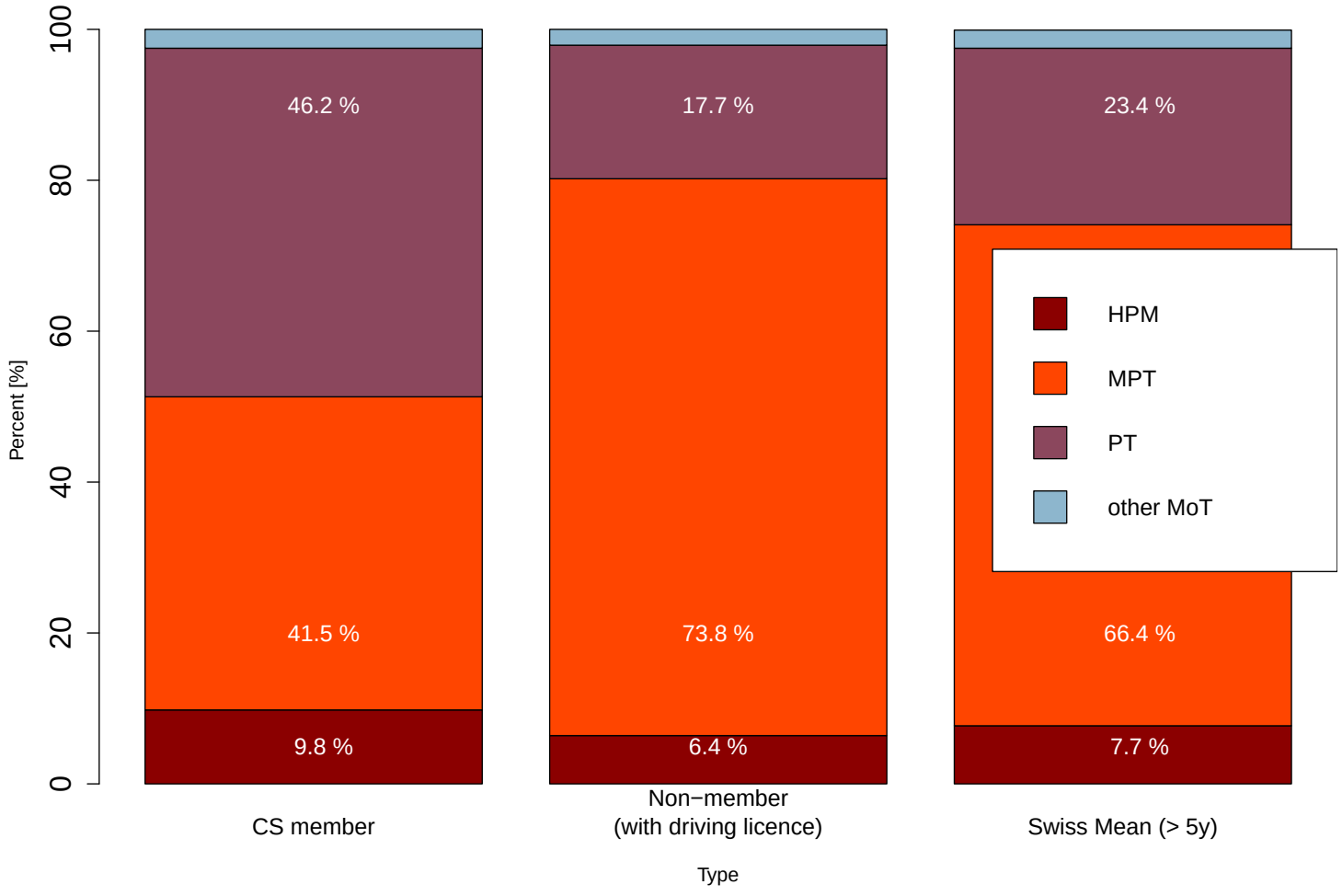
Source: Swiss Mobility and Transport Microcensus, FSO/ARE (2015)

Swiss Car Sharing-Memberships (i.e. Sharoo, Mobility) by Language Region



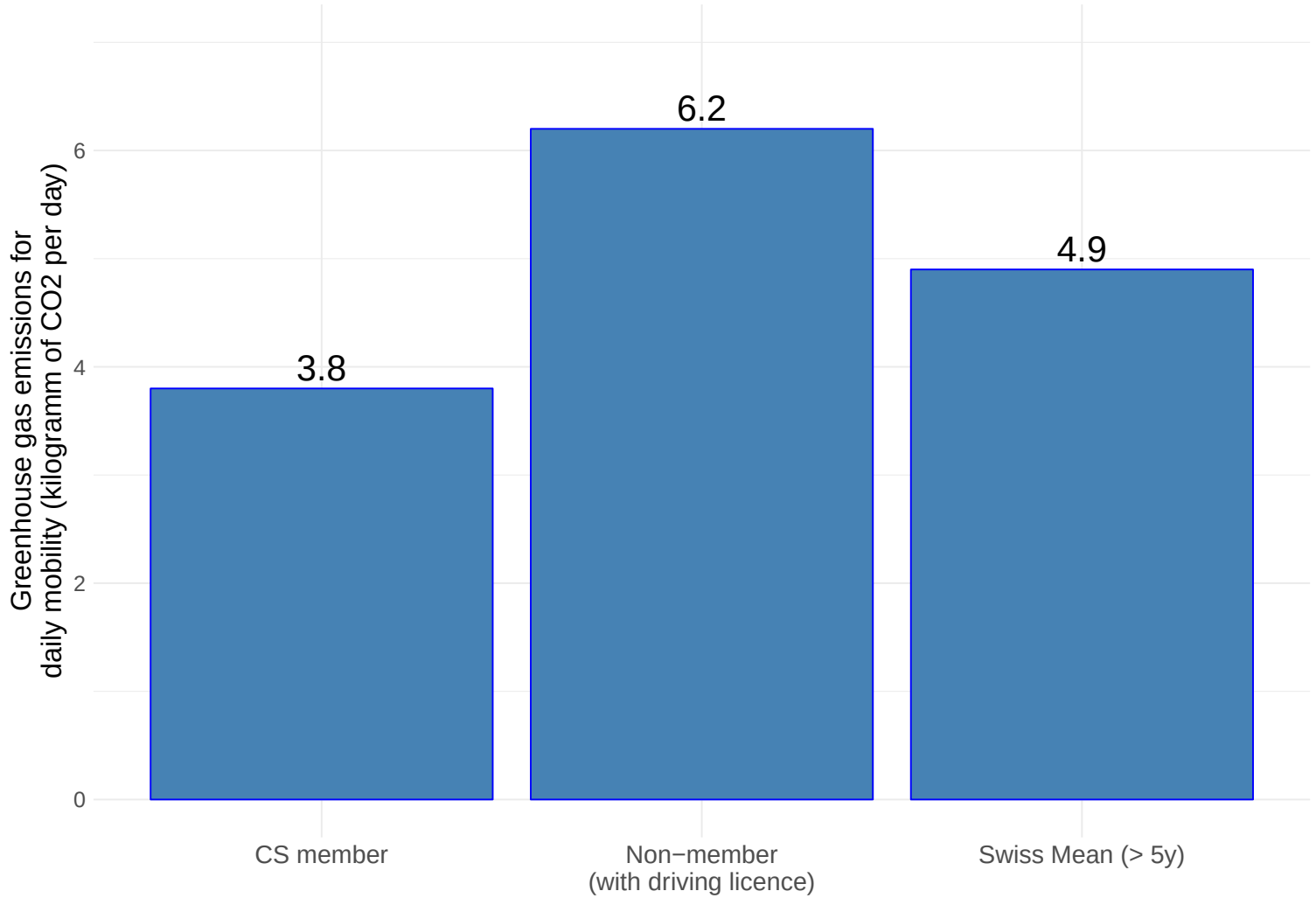
Source: Swiss Mobility and Transport Microcensus, FSO/ARE (2015)

Daily Distance Traveled by Mode (Shares)



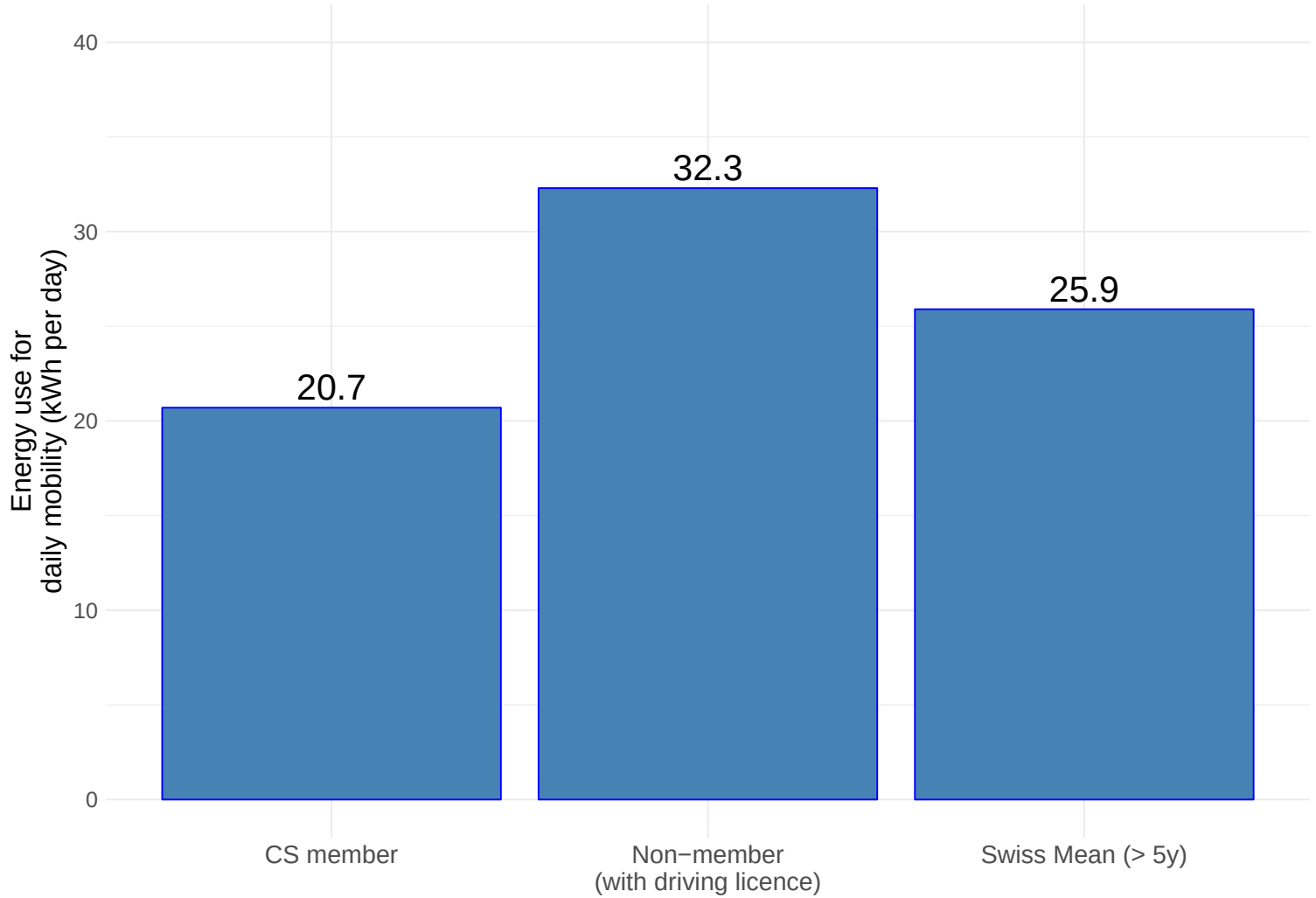
Source: Swiss Mobility and Transport Microcensus, FSO/ARE (2010)

Greenhouse Gas Emission for Daily Mobility (kg CO_2 per day per person)



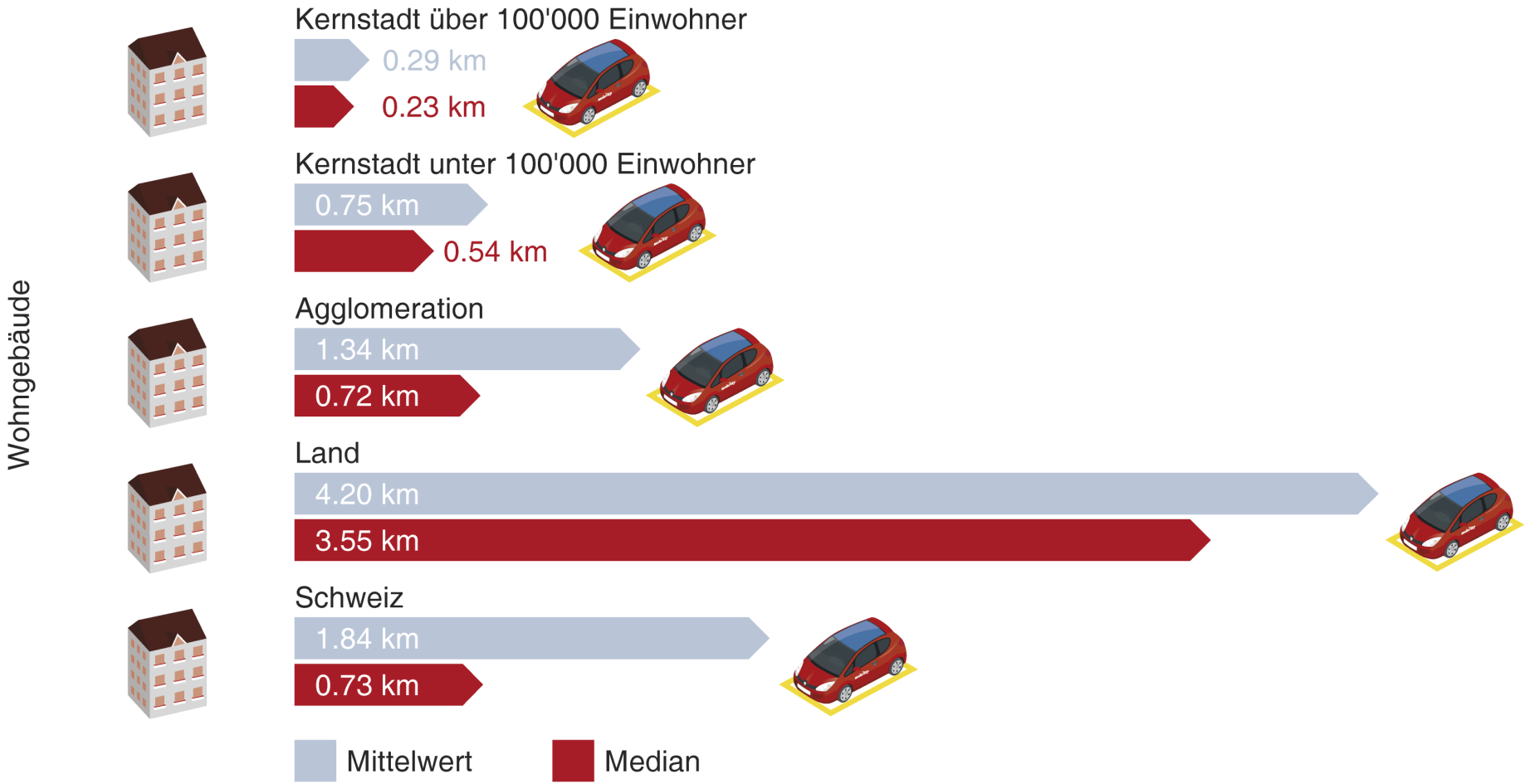
Source: For calculations see Ohnmacht et al. (2016)

Non-renewable Primary Energy for Daily Mobility (kWh per day per person)



Source: For calculations see Ohnmacht et al. (2016)

Routing Distance to next Car Sharing-Station



Source: For calculations see Ohnmacht et al. (2016)

Findings I

Growth Theory with Regard to Sharing Economy and Car Sharing?

- From 2005 to 2015, car sharing membership almost doubled in Switzerland. However, the percentage of driving-licence holders who are members is still low, at just 3.7% (FSO/ARE 2017).
- Given the first signs of market saturation due to the slower (percentage) growth of car sharing members from 2014 to 2016 (Mobility Car Sharing Switzerland 2017) and the near-leveling of car sharing membership between 2010 (3.3%) and 2015 (3.7%) (FSO/ARE 2012, 2017), deciding where to offer car sharing is a difficult challenge for companies.

CS in favourable regions

- In general, core cities (especially Zurich and Bern)
- German-speaking Part of Switzerland

Findings II

Aspects of Sustainable Mobility

- Car-sharers use less Energy in daily mobility (than average Swiss Person / and Non-Members with driving licence)
- Car-sharers travel longer distances with human powered mobility (than average Swiss Person / and Non-Members)
- Car-sharers travel shorter distances with motorised individual transport (than average Swiss Person / and Non-Members)

Accessibility of a Car Sharing Location

- On average 230 meters to the next car sharing location from residential buildings (within core cities with more than 100'000 citizens).
- Median = 730m : 50% of the residential buildings are above and 50% are below

(3)
Effects of CS on Energy for Daily Mobility

What is the effect of Car-Sharing on Energy Consumption for Daily Mobility?

How can it be quantified for the 2000-Watt Site Certificate?

Background

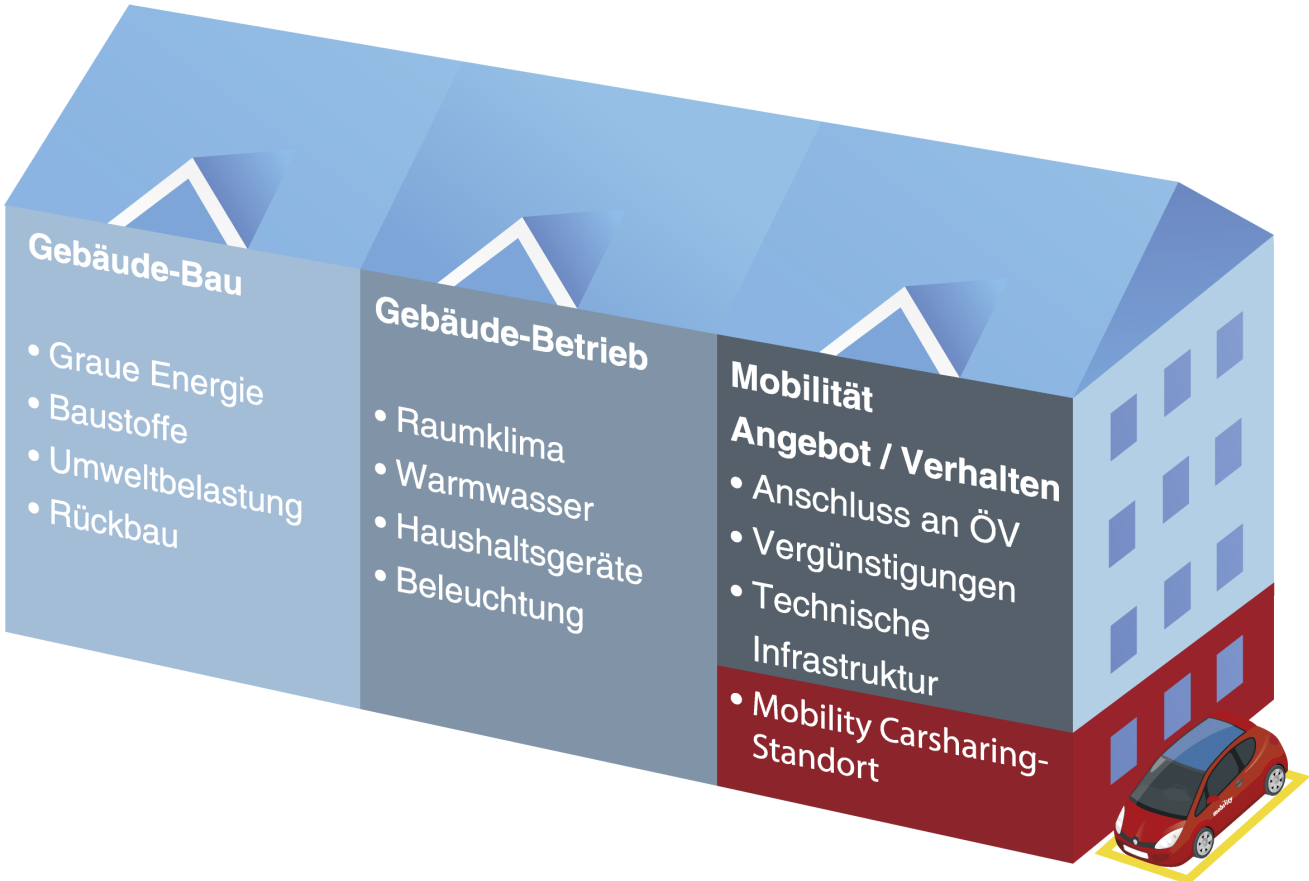
The 2000-Watt Society (aim: 2050): Worldwide 2500 Watt, Switzerland 5500 Watt

- The 2000-Watt Site Certificate was developed as part of the *EnergieSchweiz* programme
- The *2000-Watt Site* certificate allows for the first time to evaluate large site developments in terms of building quality, density, mixed usage and mobility.

SIA-Energy Path for Efficiency for Buildings

- Evaluation process of a site's sustainability
- Swiss Association of Engineers and Architects (SIA)

Three Pillars of Sustainability in Residential Building I



Source: Ohnmacht et al. (2016) & Mobility

Three Pillars of Sustainability in Residential Building II

Construction

- High density, compact building concept
- Reduced basement floors/parking
- Low-grey-energy choice of constructions and material

Operation

- Insulation standards, extensive solar power installations
- Central supply for heating and cooling
- Use of waste heat and renewable energy

Mobility

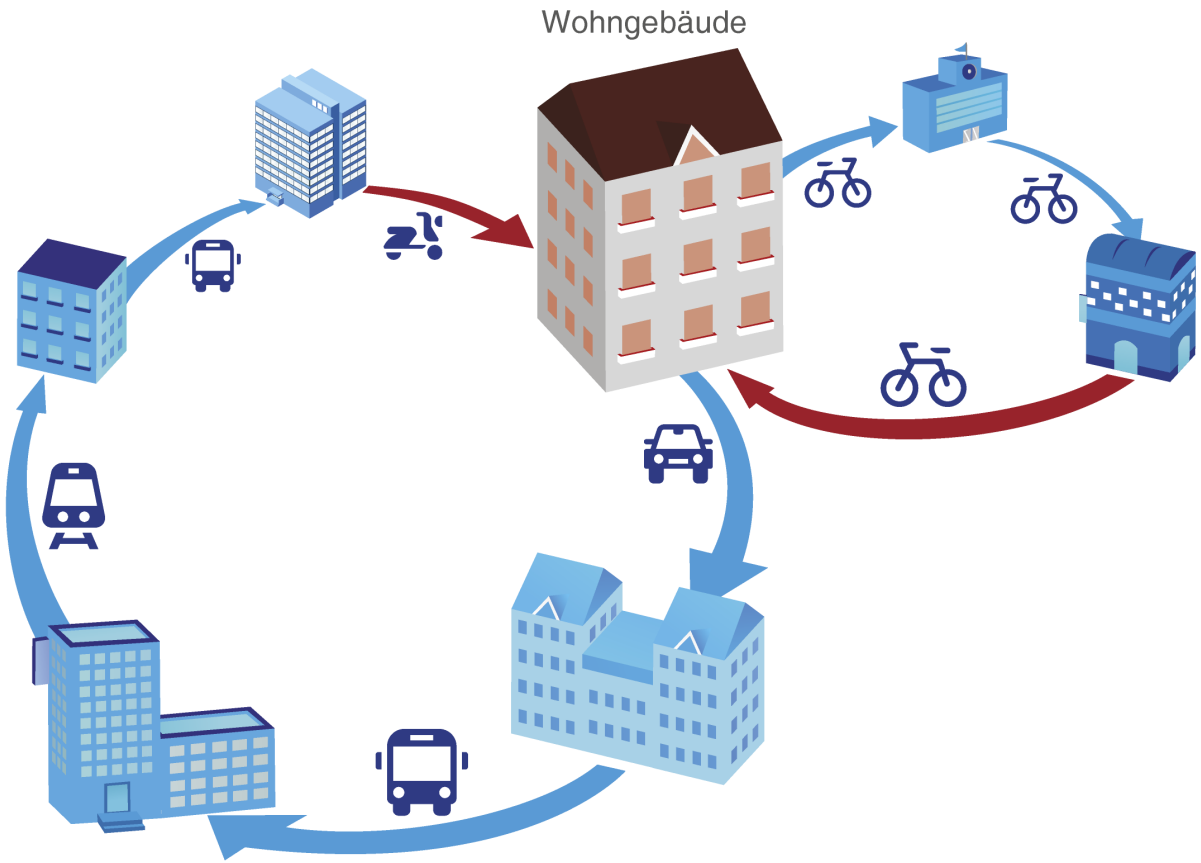
- Public transport connections (own train station)
- Electromobility (service stations, etc.)
- Car sharing

The 2000-Watt Site Certificate

Certified Sites

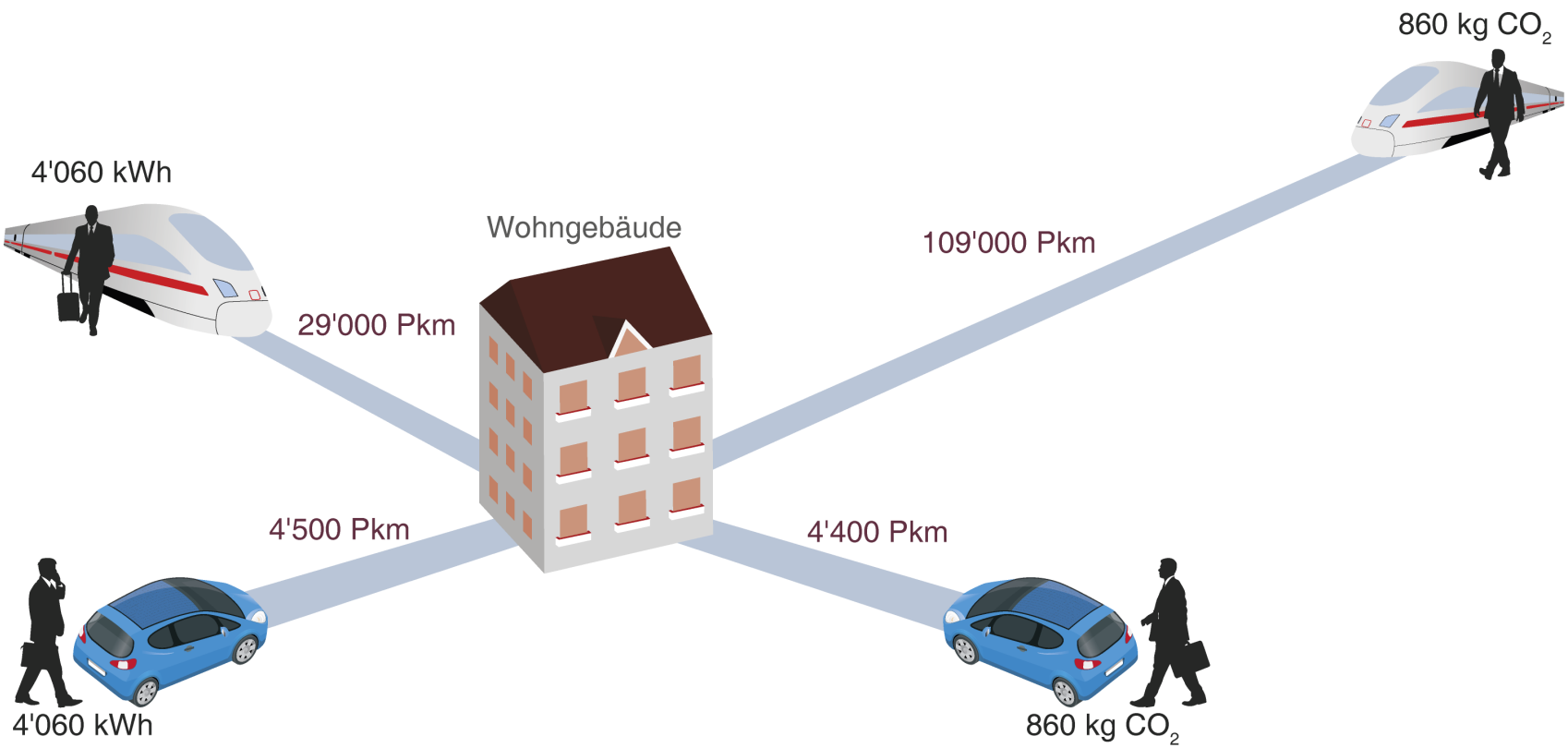
- 5 in operation, 14 under development, 250 in the near future, 900 in the long run
- e.g. Greencity (ZH), Burgunder (BE), Kalkbreite (ZH)

Matching Energy in Mobility to Residential Buildings



Source: Ohnmacht et al. (2016) & Mobility

Energy Use in the Domain of Mobility (related to residential buildings)



Source: Ohnmacht et al. (2016) & Mobility

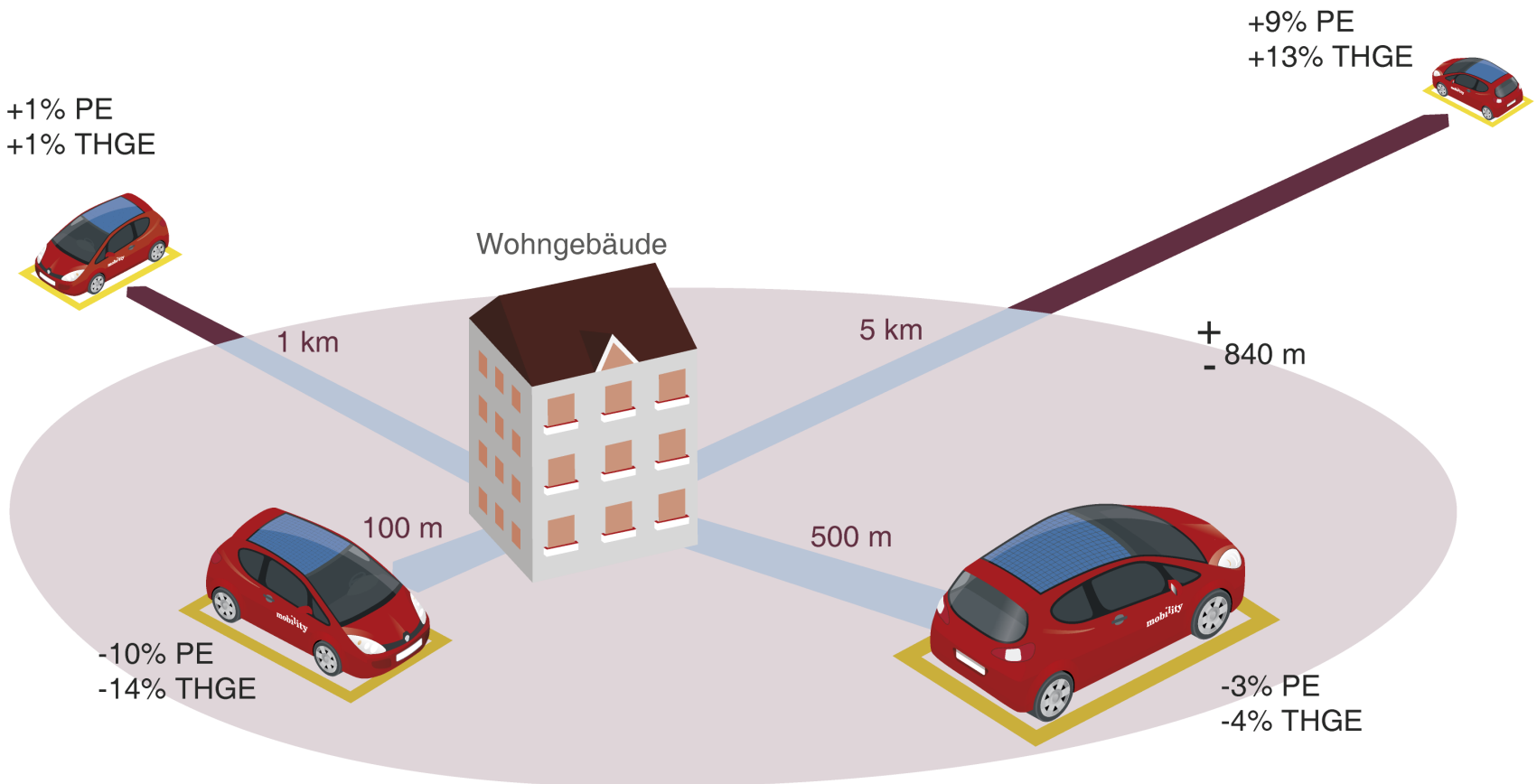
Coefficients to Predict Greenhouse Gas Emissions for Daily Mobility

Table: Coefficients to Predict Greenhouse Gas Emissions for Daily Mobility

	Einflussvariablen	Wertebereich	Auftreten b1	Sig	Werte b2	Sig
	Konstante		-0.50	***	-1.01	***
1	Referenz: Kernstadt über 100 000 Einwohner					
	Kernstadt bis 100 000 Einwohner	1=Ja, 0=Nein			0.29	***
	Agglomeration	1=Ja, 0=Nein			0.39	***
	Land	1=Ja, 0=Nein			0.45	***
2	Parkplätze am Wohnstandort	Anzahl Parkplätze	0.06	***	0.05	***
3	Verfügbarkeit Personenwagen	1=Ja, 0=Nein	0.81	***	0.94	***
4	Distanz zum nächsten Detailhandel	0.1-10km	0.07	***	0.07	***
5	Distanz zum nächsten Mobility-Standort	0-40km			0.07	***
6	Verfügbarkeit ÖV-Dauerabo	1=Ja, 0=Nein			-0.49	***
7	Referenz: Naherholungsintensität (tief)					
	Naherholungsintensität (mittel)	1=Ja, 0=Nein	-0.01	**	-0.07	***
	Naherholungsintensität (hoch)	1=Ja, 0=Nein	-0.05	**	-0.10	***
8	Referenz: ÖV-Güteklasse, Basis: E					
	ÖV-Güteklasse DC	1=Ja, 0=Nein			-0.03	**
	ÖV-Güteklasse AB	1=Ja, 0=Nein			-0.06	**
9	Referenz: Haushaltseinkommen CHF bis 4'000 Franken (tief)					
	CHF 4'000 bis 10'000 (mittel)	1=Ja, 0=Nein	0.54	***	0.11	***
	Über CHF 10'000 (hoch)	1=Ja, 0=Nein	0.89	***	0.21	***
	Beobachtungen		62720		42927	
	R^2				0.12	

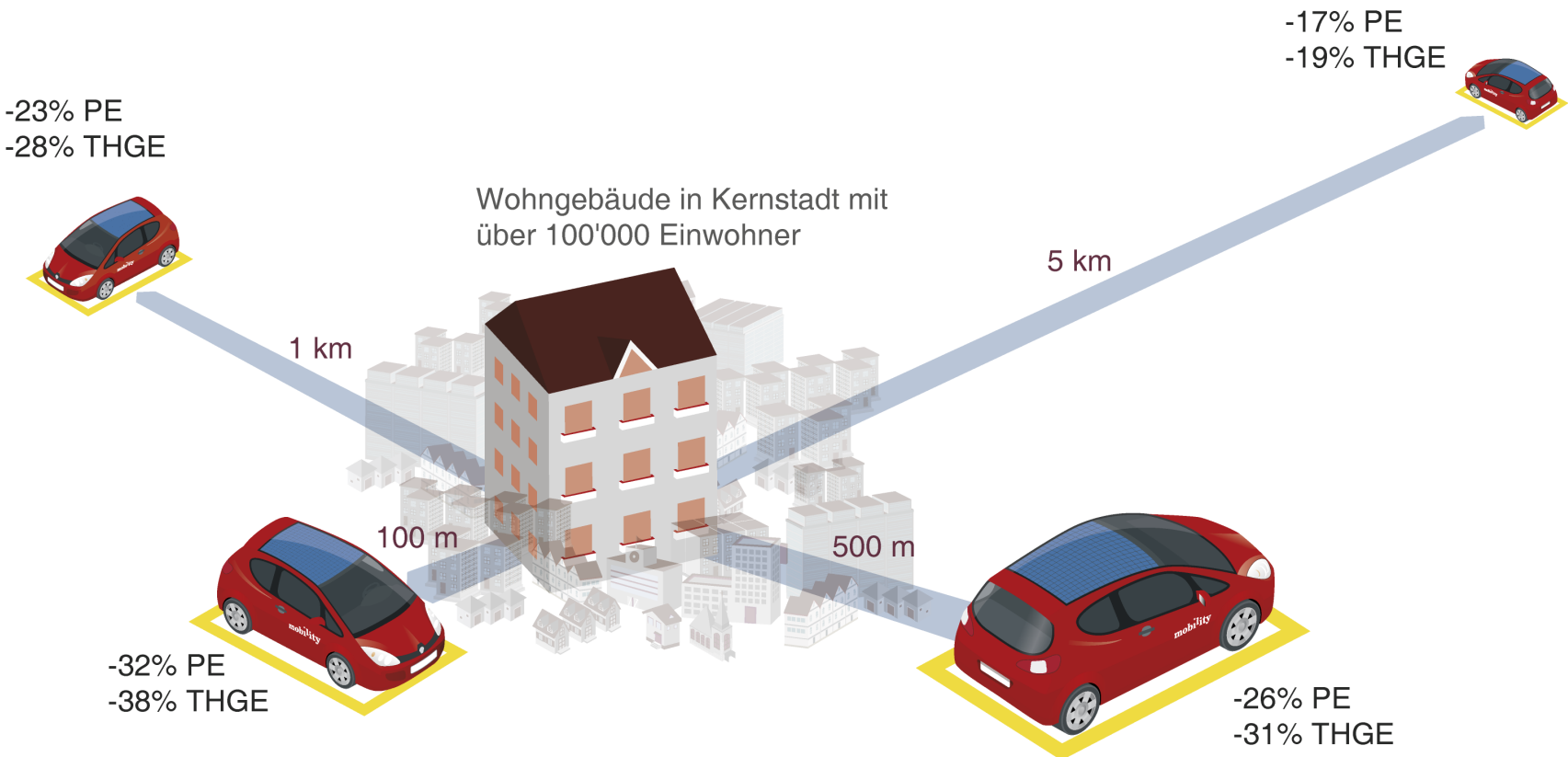
b1 / b2 = unstandardisierte Regressionskoeffizienten (Beta)
Sig = Signifikanzen: *p<0.15; ** p<0.1; ***p<0.05
Auftreten = Auftretenswahrscheinlichkeit (Logit)
Werte = Wertebereichmodell (Log-Lineare Regression)

Effect of **CS-Location** on Energy Use (Daily Mobility)



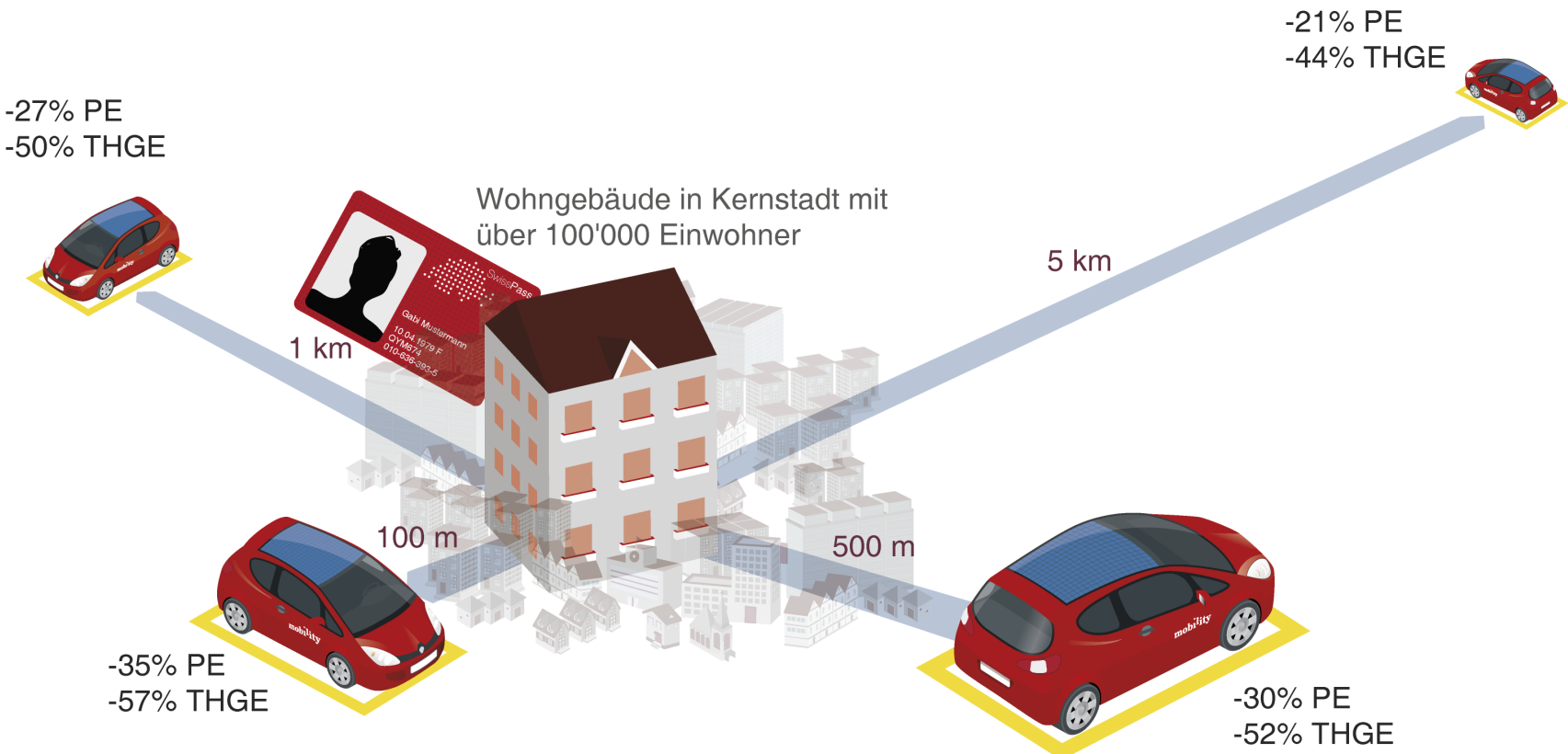
Source: Ohnmacht et al. (2016) & Mobility

Effects of **CS-Location** and **Urban Area** on Energy Use (Daily Mobility)



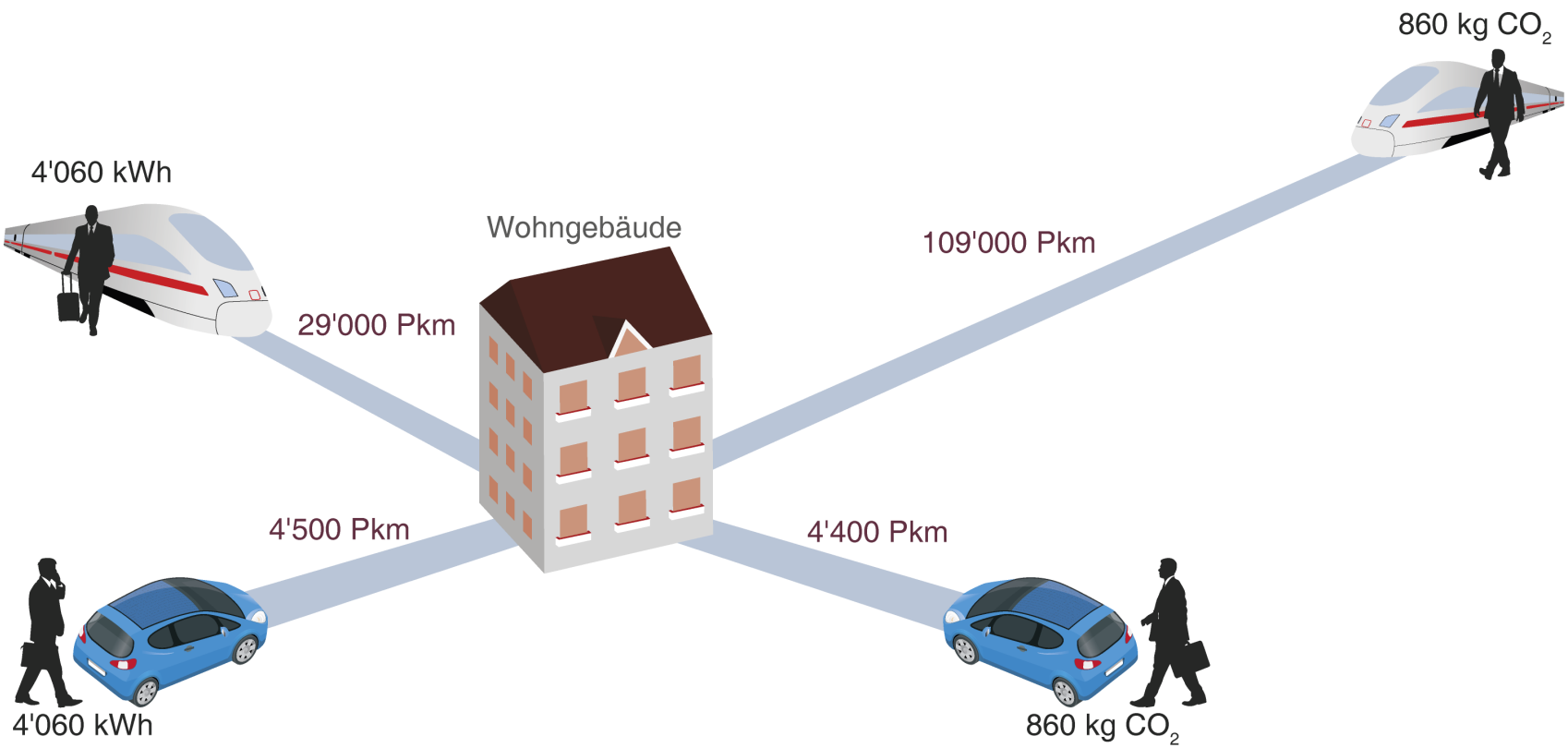
Source: Ohnmacht et al. (2016) & Mobility

Effects of **CS-Location**, **Urban Area** and **PT Ticket** on Energy for (Daily) Mobility



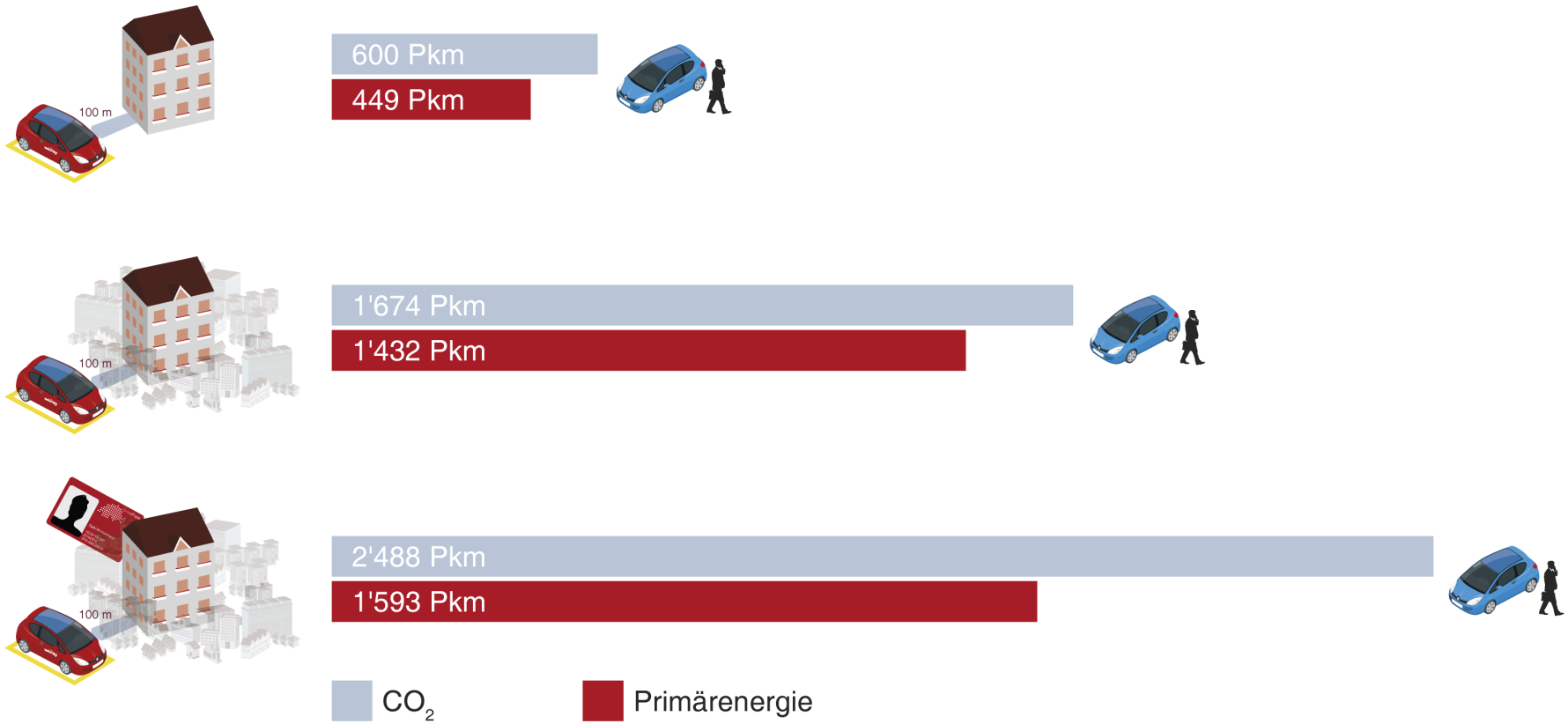
Source: Ohnmacht et al. (2016) & Mobility

Energy Use in the Domain of Mobility (related to residential buildings)



Source: Ohnmacht et al. (2016) & Mobility

Energy Reduction based on **CS-Location**, **Urban Area** and **PT Ticket**



Source: Ohnmacht et al. (2016) & Mobility

(4)
Location-Choice Modelling for CS

Deciding where to offer car sharing is a difficult challenge.
Location choice modelling can detect favourable regions to increase membership.

Transportation
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Carsharing in Switzerland: identifying new markets by predicting membership based on data on supply and demand

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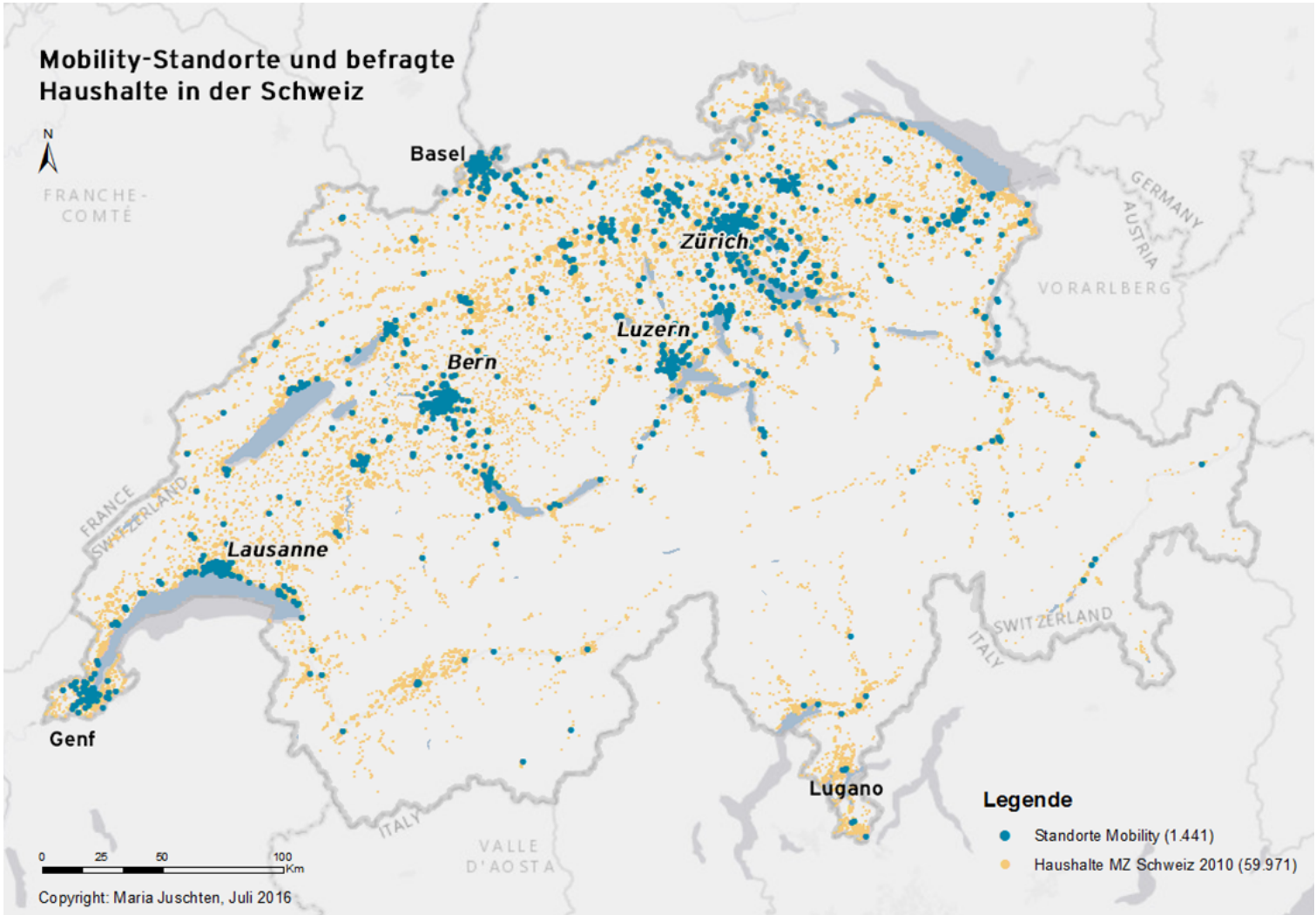
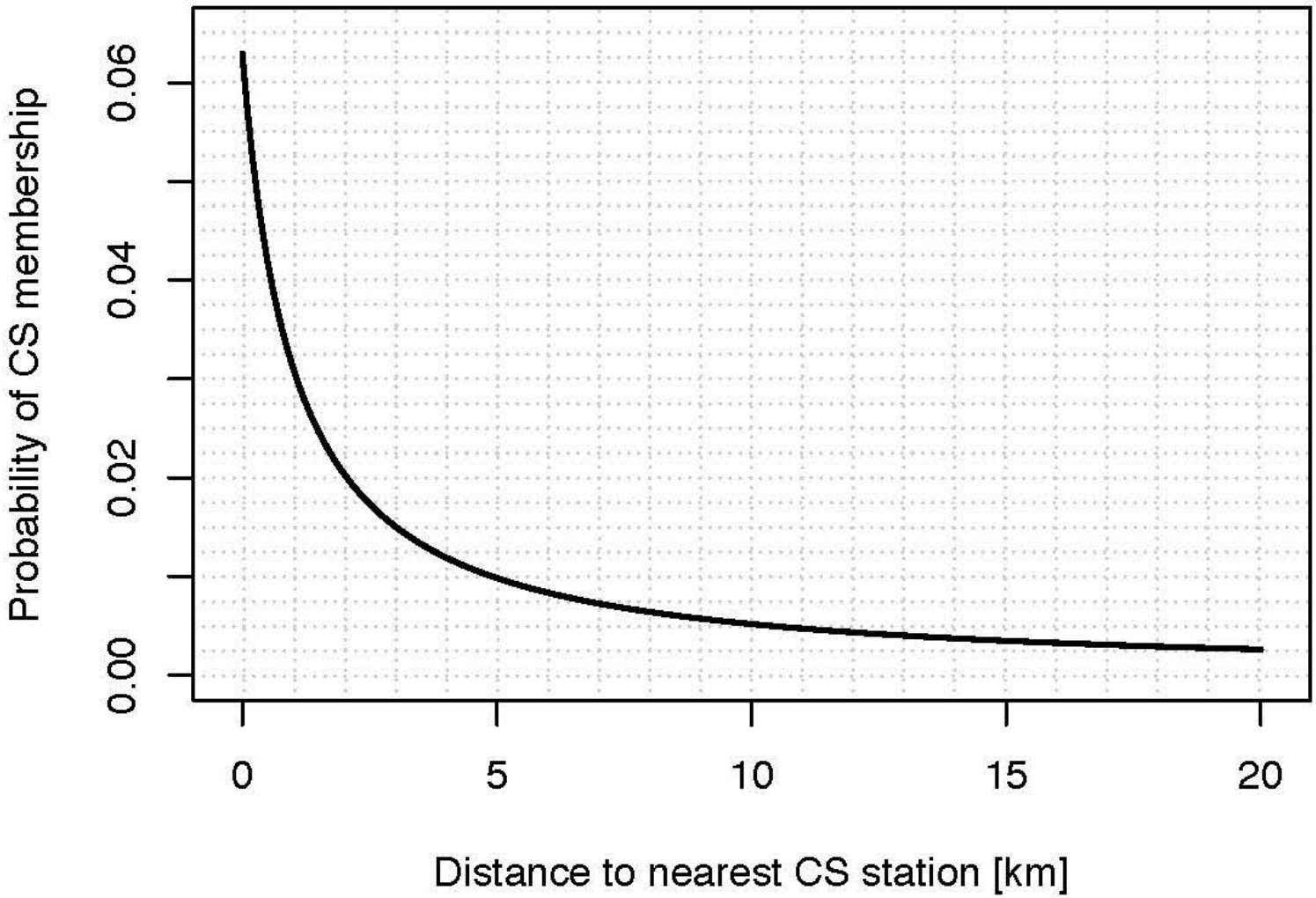
Published online: 04 September 2017

Data



Source: Juschten, Ohnmacht et al. (2017)

log(membership/1-membership) = distance to next CS-location



Source: Juschten, Ohnmacht et al. (2017)

Supply

Table. Logit Results for CS-Membership

	Model 1: Supply			
Variables	Coeff.	S.E.	t values	
Intercept	-3.650	0.077	-47.440	***
Supply				
- Number of CS stations within 5 km	0.055	0.006	8.830	***
- Negative information in description of CS stations (1=yes)	-0.108	0.023	-4.710	***
- Emotional car in nearest CS station available (1=yes)	0.350	0.124	2.820	***
- Micro-car in CS stations within 5 km available	0.100	0.039	2.570	**
- Maximum days of advance reservation in nearest CS station	0.010	0.005	2.120	*
- Distance to nearest CS station (log)	-0.493	0.071	-6.930	***
Observations (n)	43,948			
Final log likelihood	-5,539.336			
McFadden's rho-squared	0.062			

Note: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; $^{+}$ $p < 0.15$
Coeff. = Coefficient; S.E. = Standard Error; HH = Household

Source: Juschten, Ohnmacht et al. (2017)

Supply+Demand

Table. Logit Results for CS Membership

	Model 2: Supply + Demand			
Variables	Coeff.	S.E.	t values	
Intercept	-2.500	0.225	-11.130	***
= Logit of supply model	0.374	0.053	7.030	***
Demand				
Household (HH) members				
- Age^2 (mean-centered)	-0.005	0.001	-6.810	***
- Gender (women)	-0.260	0.061	-4.260	***
- Education (lowest-highest)	0.202	0.031	6.610	***
- Language region (German)	0.453	0.081	5.570	***
- Income (lowest-highest)	0.178	0.018	9.840	***
Mobility Tools				
- Number of cars/driving license in household	-0.743	0.154	-4.840	***
- Parking lot at workplace (yes)	-0.298	0.069	-4.310	***
- Parking lot at resident place (yes)	-0.315	0.085	-3.710	***
- Average stroke volume of cars in household	-0.001	0.001	-5.960	***
- Yearly mileage of car	-0.001	-0.001	-2.570	**
- Number of bicycles	0.143	0.019	7.350	***
- Public transportation tickets (yes)	0.026	0.005	5.120	***
Model Summary				
Observations (n)		43,948		
Final log likelihood		-4,691.612		
McFadden's rho-squared		0.206		

Source: Juschten, Ohnmacht et al. (2017)

Supply+Demand+Attitude

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Attitude (against – agree)	Coeff.	S.E.	t values	Coeff.
- Road pricing at peak times	0.553	0.240	2.310	*
- Higher price of public transport at peak times	0.693	0.234	2.970	***
- Higher costs for parking space	0.348	0.243	1.439	+
Model Summary				
Observations (n)		3,780		
Final log likelihood		-422.786		
McFadden's rho-squared		0.195		

Source: Juschten, Ohnmacht et al. (2017)

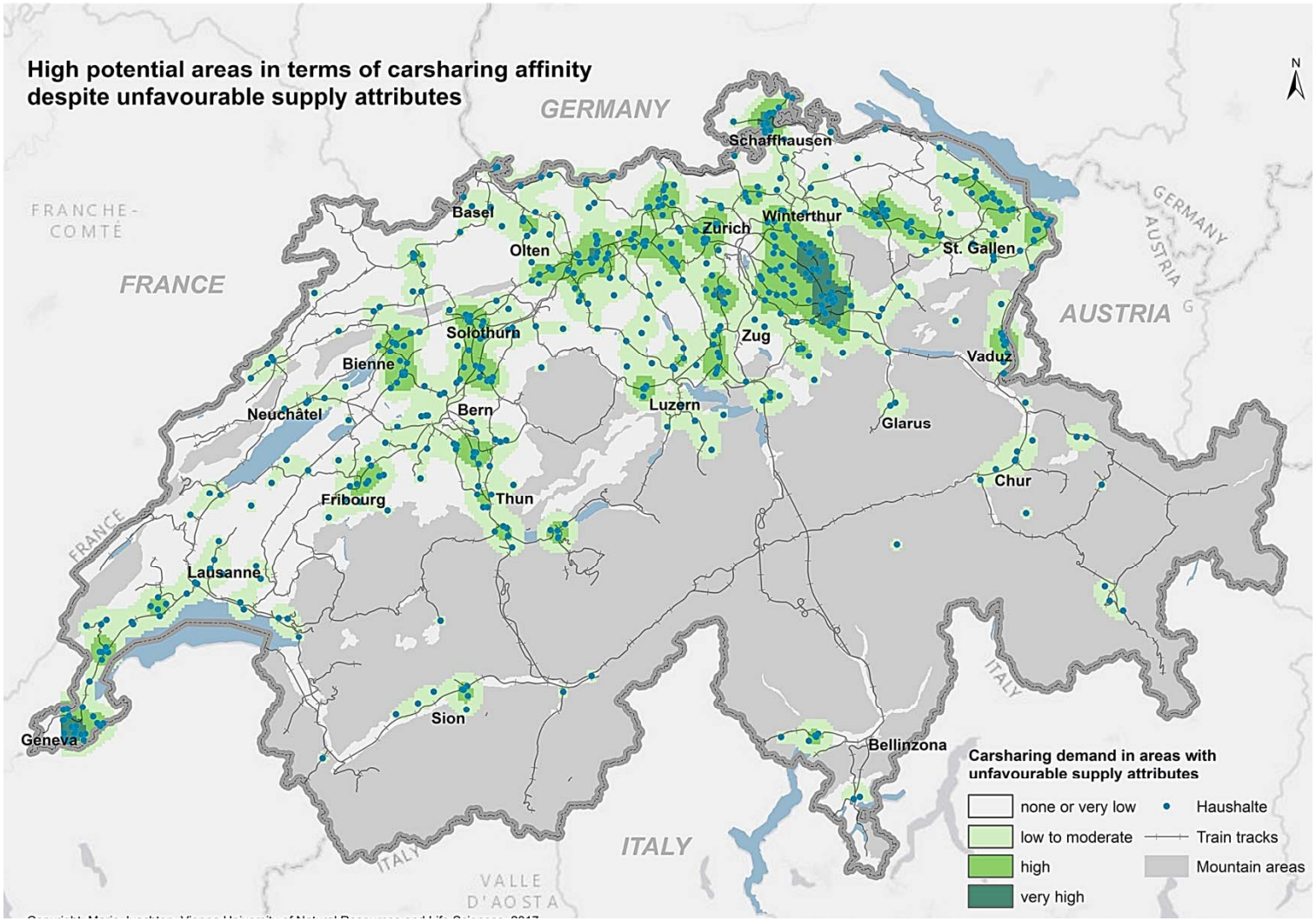
Supply+Demand

Table Matrix illustrating the four types of regional favorability

	Estimated favorability (potential based on supply attributes)	
	High	Low
Membership		
No	Group 1 (n = 11,649)	Group 2 (n = 30,985)
Yes	Group 3 (n = 739)	Group 4 (n = 575)

Source: *Juschten, Ohnmacht et al. (2017)*

Data



Source: Juschten, Ohnmacht et al. (2017)

Supply+Demand

Table Matrix illustrating the four types of regional favorability and their descriptive statistics

	Estimated favorability (potential based on supply attributes)	
	High	Low
Membership		
No	*Group 1*	*Group 2*
	Nearest railway track = 0.687 km	1.294 km
	Number of cars (mean) = 1.1 cars	1.5 Cars
	Public transport tickets = 66.7%	47.7% Public transport tickets
	Age (mean) = 51.1 years	51.1 years
Yes	*Group 3*	*Group 4 (see Fig. 1)*
	0.550 km	1.099 km
	0.4 Cars	1.1 Cars
	93.8% Public transport tickets	74.1% Public transport tickets
	43.6 years	46.3 years

Source: Juschten, Ohnmacht et al. (2017)

Findings

Supply

- Number of stations within a 5-km radius (+)
- Having both emotional car (BMW 1er) and micro (Smart Twinamic) models (+)
- Blocking the car for the near future (+)

Demand

- Higher levels of education and higher incomes
- Maximum at the age of 35 years
- Lack of private cars and of parking facilities at home
- Availability of bicycles and public transportation tickets
- In favor for road pricing and higher fee for PT during peak time (economic vs. lifestyle of sustainability)

Findings II

New potential markets

- We suggest better service facilities in conurbations, such as the Zürcheroberland and Pfannenstil regions.
- Even though the service quality is less attractive to car sharing users, these areas have many members.
- The potential areas are located close to railways, therefore multi- and intermodal lifestyles can be supported.
- These areas also have the potential to support car-free housing or car-free residential areas, which is a focus of recent transportation policy in Switzerland.

(5)
Summary

Summary & Further RQ

Rapid Growth & Mobility Turn?

- CS is a well-functioning niche
- Big growth, but CS are still only a minority (passive vs. active)
- Slower growth since 2010
- Potenial for market growth in conurbations

Sustainability

- Reduces energy/greenhouse gas emission in daily mobility
- Strong (additive) effects within urban area and permanent PT Ticket
- CS in newly linked to sustainable site development in the building sector

Further RQ

- Is free-floating CS a niche within a niche? Catch-a-Car in Basle, Geneva.

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