technische universität
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Carbon dioxide emissions in daily and long-distance travel

Sustainable Cities?

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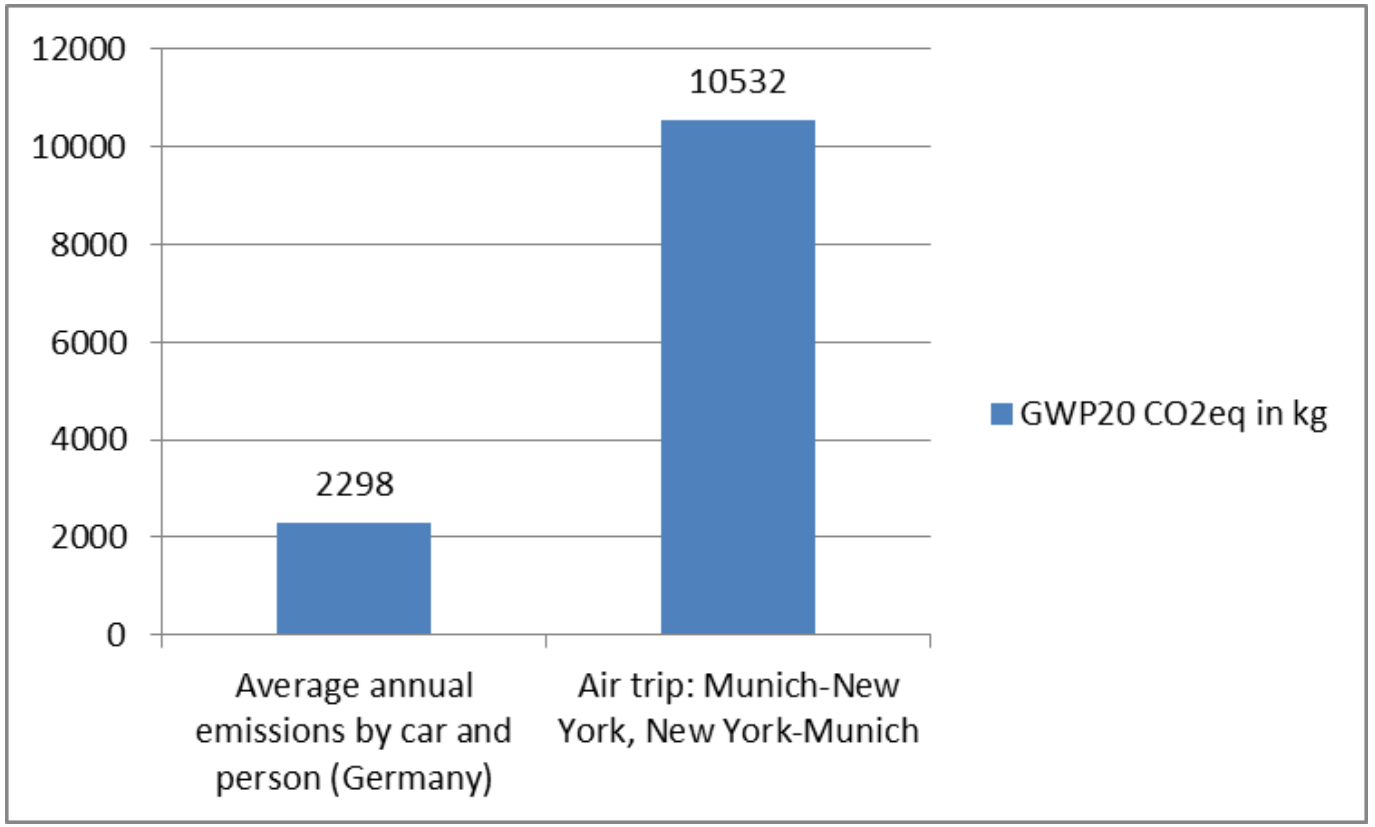
Mobil.TUM at 20.05.2014

Climate impact of air travel



Positive trends in the cities: shorter distances and multimodality

- Urban dwellers cover shorter distances in daily travel
- Density is a prerequisite for viable, attractive public transport system
- Less car use in urban areas

→ ***Less emissions produced by inhabitants of dense, mixed land-use, urban areas in daily travel***

What about long-distance travel?...

- Urbanites travel more frequently and cover longer distances
  - longer leisure trips
  - frequent holiday trips
  - more business trips

- Frequency of air travel increases with population density

→ ***more emissions produced by inhabitants of dense, mixed land-use, urban areas in long-distance travel?!***

Hypotheses

		Emissions from daily travel	Emissions from long-distance travel
Socio-economic attributes	Male	↑	↑
	Employed	↑	↑
	Higher educational level	↑	↑
	Higher household income	↑	↑
	Car in household	↑	↑
	Multi-person household	↑	↑
Spatial attributes	Agglomeration	↓	↑
	Mixed land-use	↓	↑

Data: Mobility in Germany (MiD) of 2008

Dataset		
Number of respondents	60.713	with proxy-interviews
Number of households	25.922	
Sample Size for the analysis	30.354	without proxy-interviews, conscripts, persons under 18, persons with missing values in daily or long-distance travel,…
Daily travel dataset		one day trip diaries
Emission-producing persons (daily travel)	21437 (70.6%)	
Long-distance travel dataset		long-distance trips (>100km) with an overnight stay in the last three months > only the last three trips are reported in detail
Emission-producing persons (long-distance travel	15053 (49.6%)	

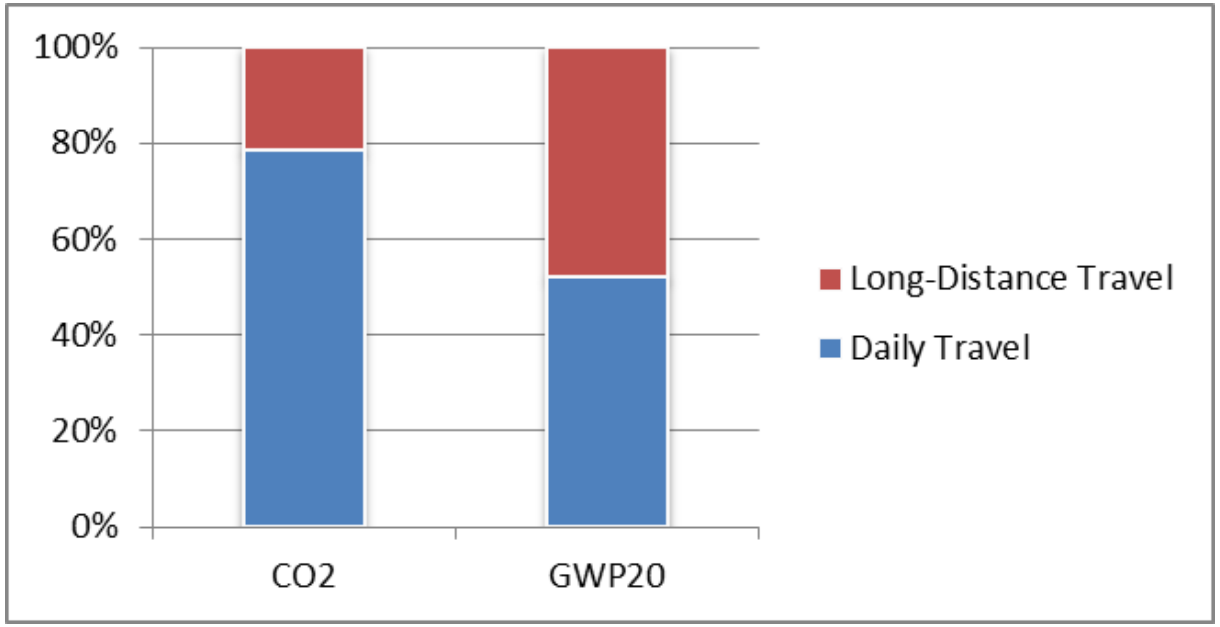
Methodology

- Two Step Regression Model for daily and long-distance travel
  - Selection (Logit)
  - Outcome (OLS-transformed (LN))

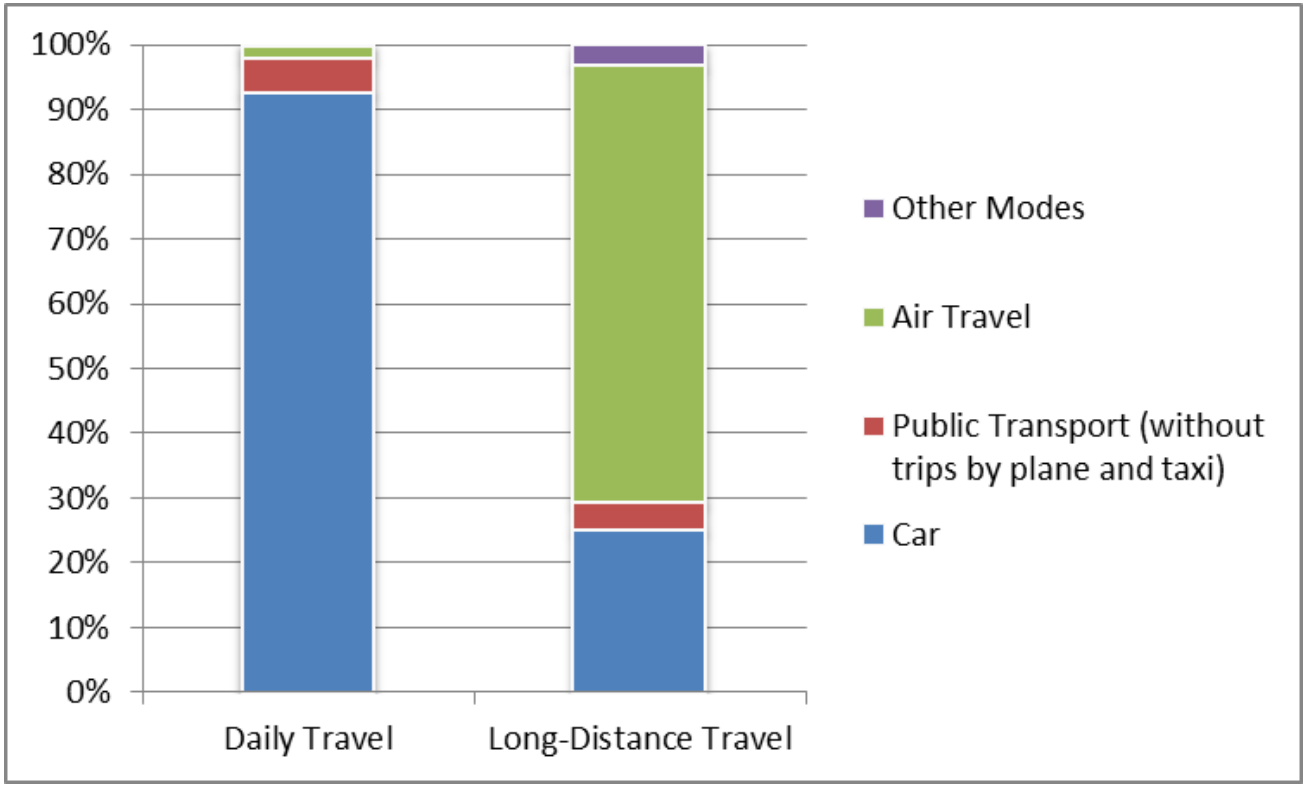
- Descriptive Level: OLS regression with untransformed dependent variable

- Dependent Variables
  - CO2-Emissions (one year period)
  - GWP (global warming potential) over a 20-year period

Proportion of daily and long-distance travel



CO2-emissions by transport mode in daily and long-distance travel



Results (socioeconomic and demographic attributes)

		Emissions from daily travel	Emissions from long-distance travel
Socio-economic attributes	Male		
	Employed		
	Higher educational level		
	Higher household income		
	Car in household		
	Multi-person household		

Results (spatial attributes at the residence)

	Annual CO2-Emission in kg			Annual GWP20-Emission in kg		
	Total	Daily travel	Long-distance travel	Total	Daily travel	Long-distance travel
Sociodemographic and socioeconomic attributes (reduced table)						
Municipallity population size - ref.: <5,000 inhabitants						
5,000 - <50,000	-186 *	-190 *	3	-108 *	-148 *	40
50,000 - <100,000	-292 *	-345 *	53	-54 *	-304 *	250
100,000 - <500,000	-360 *	-360 *	0	-304 *	-301 *	-3
500,000 - <1,000,000	-227	-422 *	195 *	451	-386 *	837 *
>= 1,000,000	-423 *	-708 *	285 *	590	-674 *	1264 *
Other spatial attributes (reduced table)						

* significant value in at least one of the two regression model (selection or outcome

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Density grade of the region (only municipallities <500,000 inhabitants) - ref.: Rural areas						
Urbanised area	-49	-126	77	237	-139	376
Agglomerations	45 *	-66	110 *	424 *	-34	458 *
Other spatial attributes (reduced table)						

* significant value in at least one of the two regression model (selection or outcome

Conclusion and Thoughts

- Urbanites have not a better climate balance than rural population
- Urbanity may strengthen people's willingness to undertake long-distance trips especially by air

- In general: greater attention should be paid to long-distance travel
- Possible strategies:
  - Improvement in technology
  - Changes in mobility behaviour
    - Travel Reduction
    - Transport Mode Shift
    - …

    → But: high psychological reliance on leisure travel

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