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Federal Department of the Environment, Transport,
Energy and Communications DETEC
**Federal Office for Spatial Development ARE**
Fundamental Policy Questions

# Forecasting home-based telecommuting in 2050

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# Who will work from home in Switzerland in 2050?

- Transport Outlook 2050 (www.are.admin.ch/transport-outlook)
  - **Assumptions**:
    - Working-age population: +10%, less than population growth (+21%) (2017-2050)
    - **40% of employees will work half of their time from home** in 2050
  - Output: -13% work-related trips in Switzerland

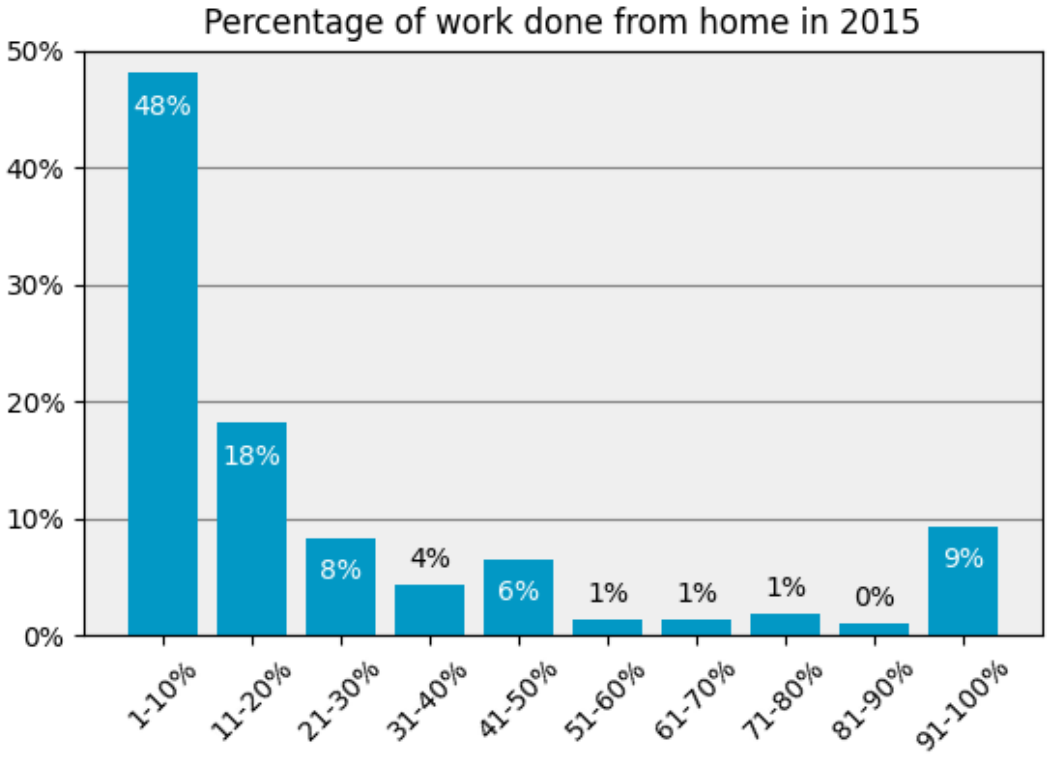
→ Can we build a model forecasting work from home?

# Data available

- **Mobility and Transport Microcensus**
  2010, 2015, 2020 and – soon – 2021
  - “Can you do some of your work from home”? 28% yes (2015)
  - “What percentage of your professional activity do you carry out at home?”

- **Synthetic population**
  for the reference year 2017

- **Forecasted synthetic population**
  for 2030, 2040 and 2050




Basis: 2 624 persons working from home at least 1% of the time.

Source: FSO, ARE - Mobility and Transport Microcensus (MTMC)

# Synthetic population

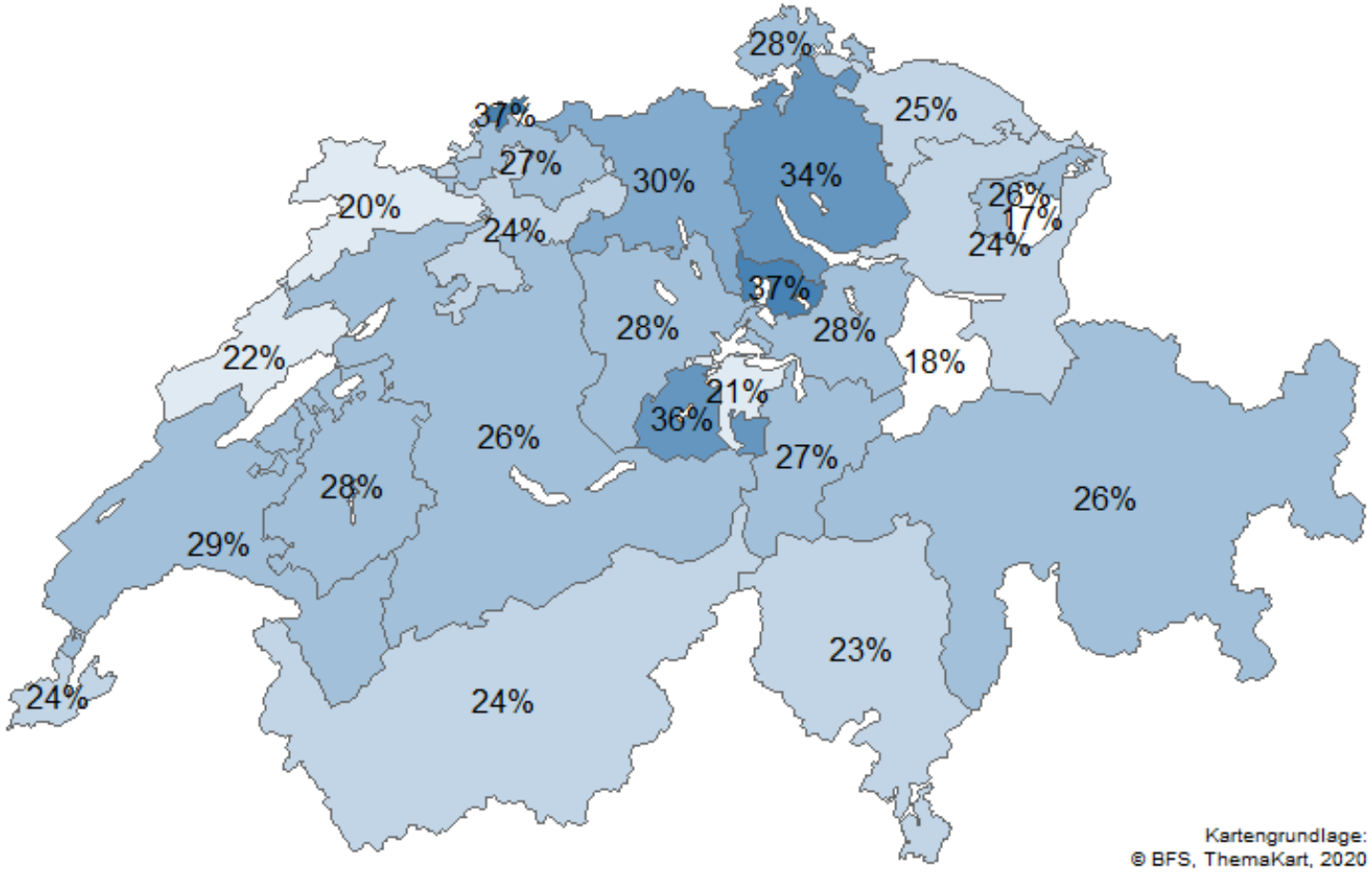
**2017**

- Georeferenced dataset of the full **Swiss resident population** grouped in households
- Contains age, sex, education level, nationality, income, mobility resources, etc.
- Coordinates of households & businesses, age & sex, household size: **register data**
- Other attributes: added by simulation using an agent-based land use model, reproducing aggregate data on language, education level, work-related attributes, …

**2030, 2040 & 2050**

- Land use model using the official population scenarios for Switzerland

# Can you do some of your work from home?




Mobility and Transport Microcensus 2015

# Choice model of home-based telecommuting

- Binary logit model:
  - Some home-based telecommuting
  - Not working from home at all

- Sample:
  - 8997 persons in 2015
  - 1289 persons in 2020

| Attributes tested in the model |
| --- |
| Level of education, sex, age |
| (Nationality) |
| Structure of the household (5 categories) |
| Public transport connection quality (home & work) |
| Urban/rural typology (home & work) |
| Crow-fly distance from home to work |
| Business sector in which the person works |
| Having several part time jobs |
| Income of the household |
| Function in the company |
| Rate of part-time work |
| Language of the interview |
| Mobility ressources (PT season tickets, car avail.) |

# Estimation results, 2015

Green: parameter > 0
Red: parameter < 0

- **Work related factors**
  - Working in finance, gastronomy, retail, wholesale, production & service
  - Working in public admin & education
  - Independent/executives
  - Working full time

- **Socio-economic factors**
  - Interview in German, high income, university education, couples without children
  - ~~CHE, DEU, FRA, ITA and NW Europe nationality → significant but removed~~
  - Age as a piecewise linear function: 19-30
  - Owning a GA travelcard (= owner travels by PT for free)

- **Spatial factors**
  - Large home-work distance, bad public transport (home)

# Validation

- **Internal validation 2015**
  - 10x 80-20% decomposition, estimation on 80% → application on 20%
  - Observed: 29.1% vs Predicted: 29.3%

- **Testing temporal stability 2015 → 2020**
  - Estimation with 2015, forecasting 2020
  - Observed: 33.7% vs Predicted: 32.2%

# Joint estimation 2015 - 2020

Results significantly different between years:

| | Estimation 2015 | Joint estimation 2015-2020 | |
|---|---|---|---|
| | Value 2015 | Value 2015 | Value 2020 |
| Couples without children | -0.16 ** | -0.16 ** | **0.41 ** ** |
| Public transport quality at home: worst | 0.19 ** | 0.19 ** | **0 (fixed)** |
| GA travelcard & no car | 0 (fixed) | 0 (fixed) | **1.03 *** |
| Workplace location: intermediate | 0 (fixed) | 0 (fixed) | **-0.44 *** |
| | | | |
| *All 28 other parameters* | *1 estimate* | ***1 joint estimate*** | |

→ Using the **most recent (joint) estimates**

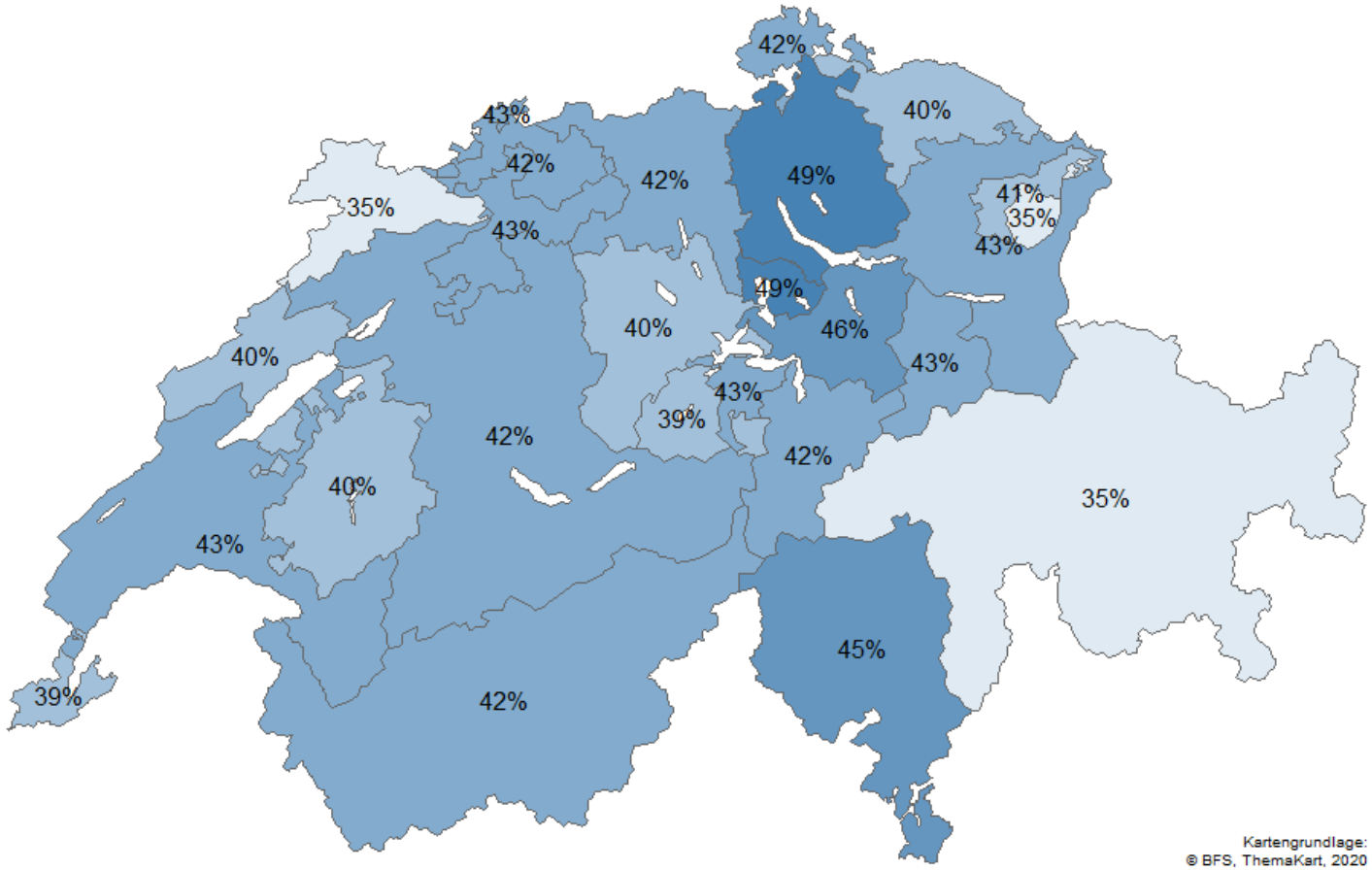
# Calibration of the constant & external validation

- **Calibration of the constant**
  - Alternative specific constant calibrated against observed proportions in the Mobility and Transport Microcensus (MTMC)
  - Apply Train, 2003 on the employees of the MTMC
- **External validation**
  - Observed (MTMC 2015): 28.1% vs Predicted (Synthetic Population 2017): 25.7%

# Calibration of the constant for forecasting

- **Re-calibration of the constant**
  - Alternative specific constant calibrated against the observed proportion in the Mobility and Transport Microcensus
  - Apply Train, 2003, this time on the employees of the synthetic population 2017

# Can you do some of your work from home? (2050)



# Limitations

- Does not include the possible long-term effect of the COVID-19 pandemic
- Does not include possible technological developments

# Future work

**System of models**

- Build a **model of the percentage of work made at home** (e.g. fractional regression)
- Integrate both results in a model of the number of trips (ordered logit), both for work and for recreational purposes (possible rebound effect)
- Integrate results in the national passenger transport model

**Data**

- Use the data of the Mobility and Transport Microcensus 2021 (with COVID-19)

**Model for home-based telecommuting**

- Improve the specification of the model, e.g. including measures of accessibility
- Test a model by day of the week
- Deal better with missing data and different income definitions

# Conclusion

- 35-49% of employees living in Switzerland will be able to work at least some time from home in 2050 (model says)
- Quantitative, disaggregate & spatially differentiated approach for forecasting ability to work from home
- Reproducibility
  - Data of the Mobility and Transport Microcensus are available to researchers
  - Point data of the synthetic population are not
  - Code of the model: github.com/antonindanalet/home_office_in_microcensus