# Preferred citation style

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# Catchment areas, social network geographies and travel: A conceptual model

KW Axhausen

IVT
ETH
Zürich

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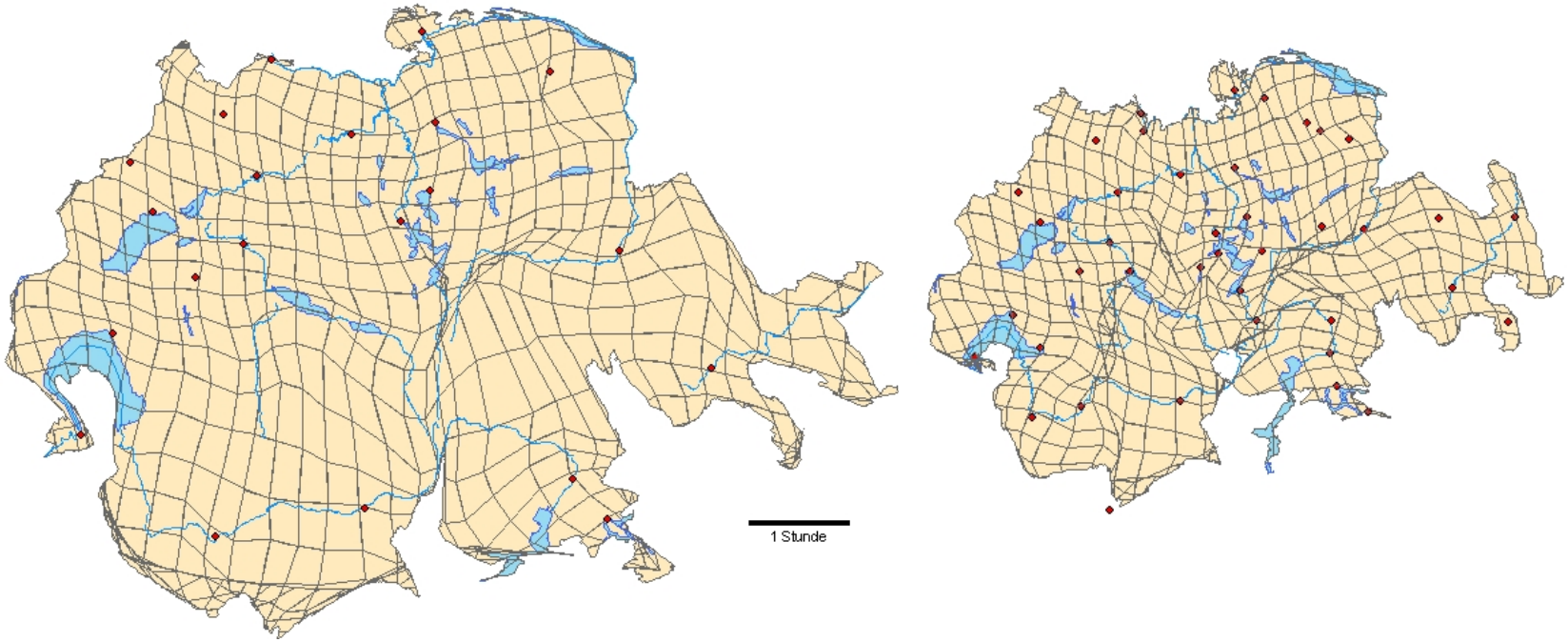
Institut für Verkehrsplanung und Transportsysteme
Institute for Transport Planning and Systems

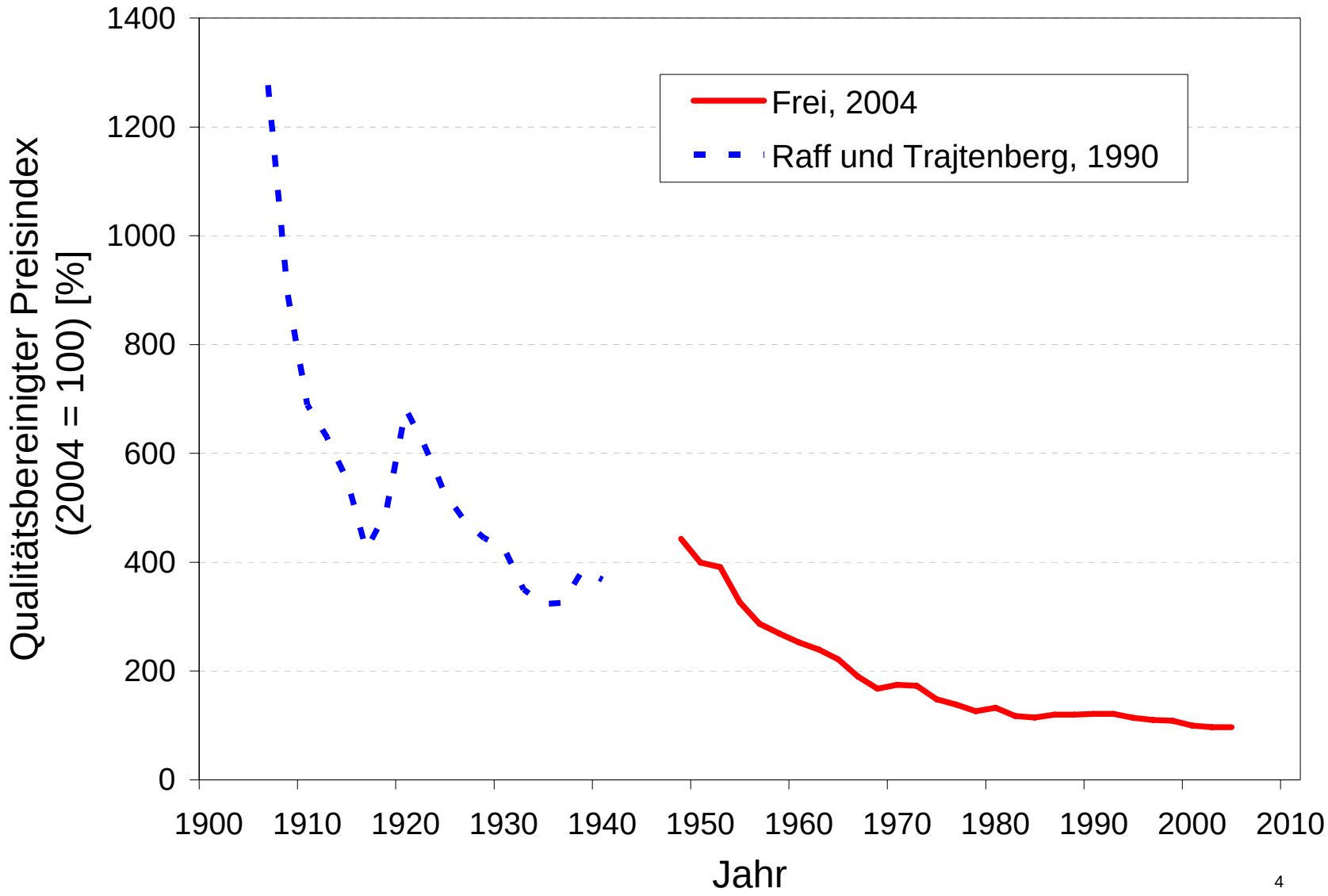
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

# Time-scaled “road”-Switzerland (1950 and 2000)

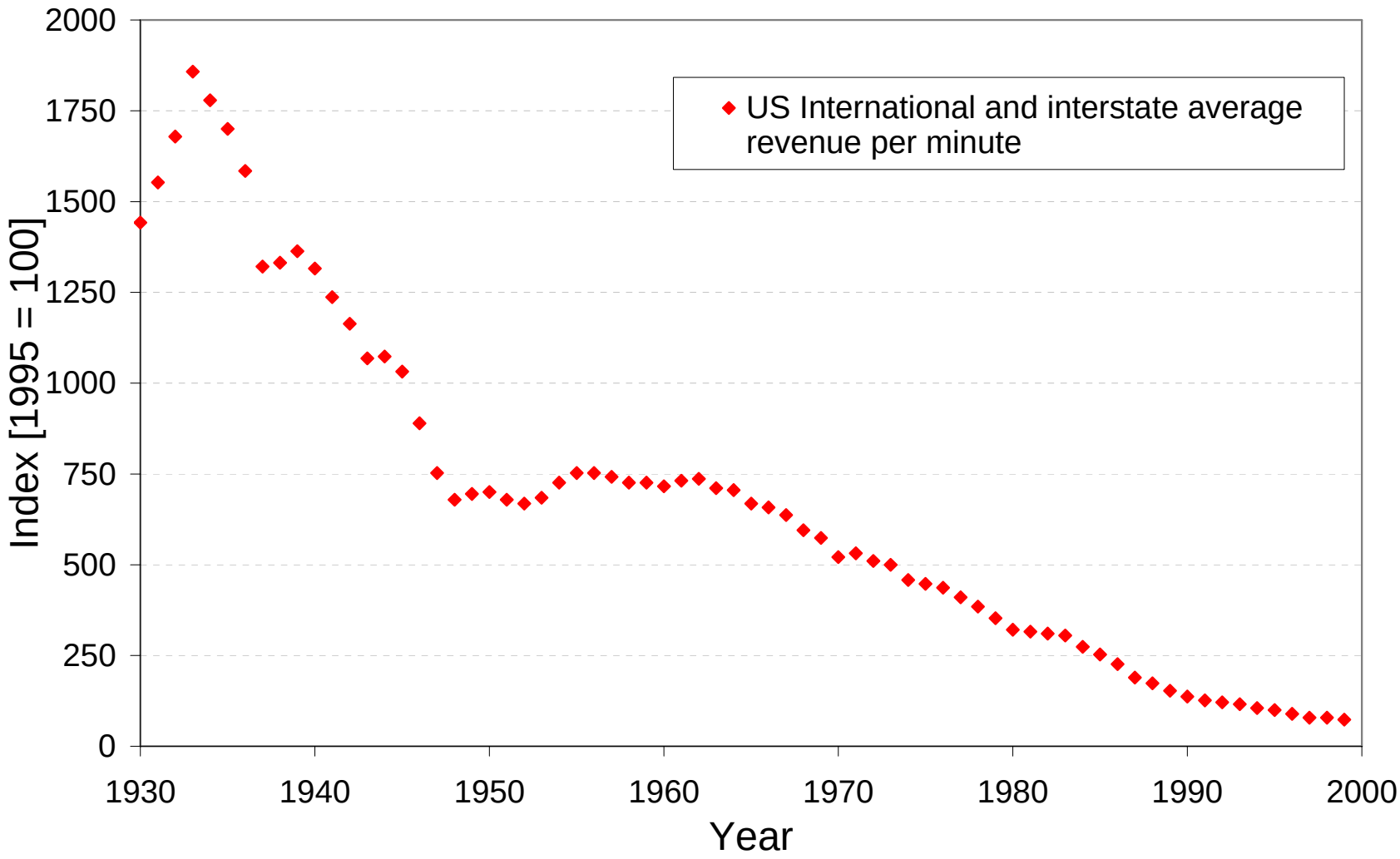



Scherer, 2004

# Quality – adjusted prices for cars

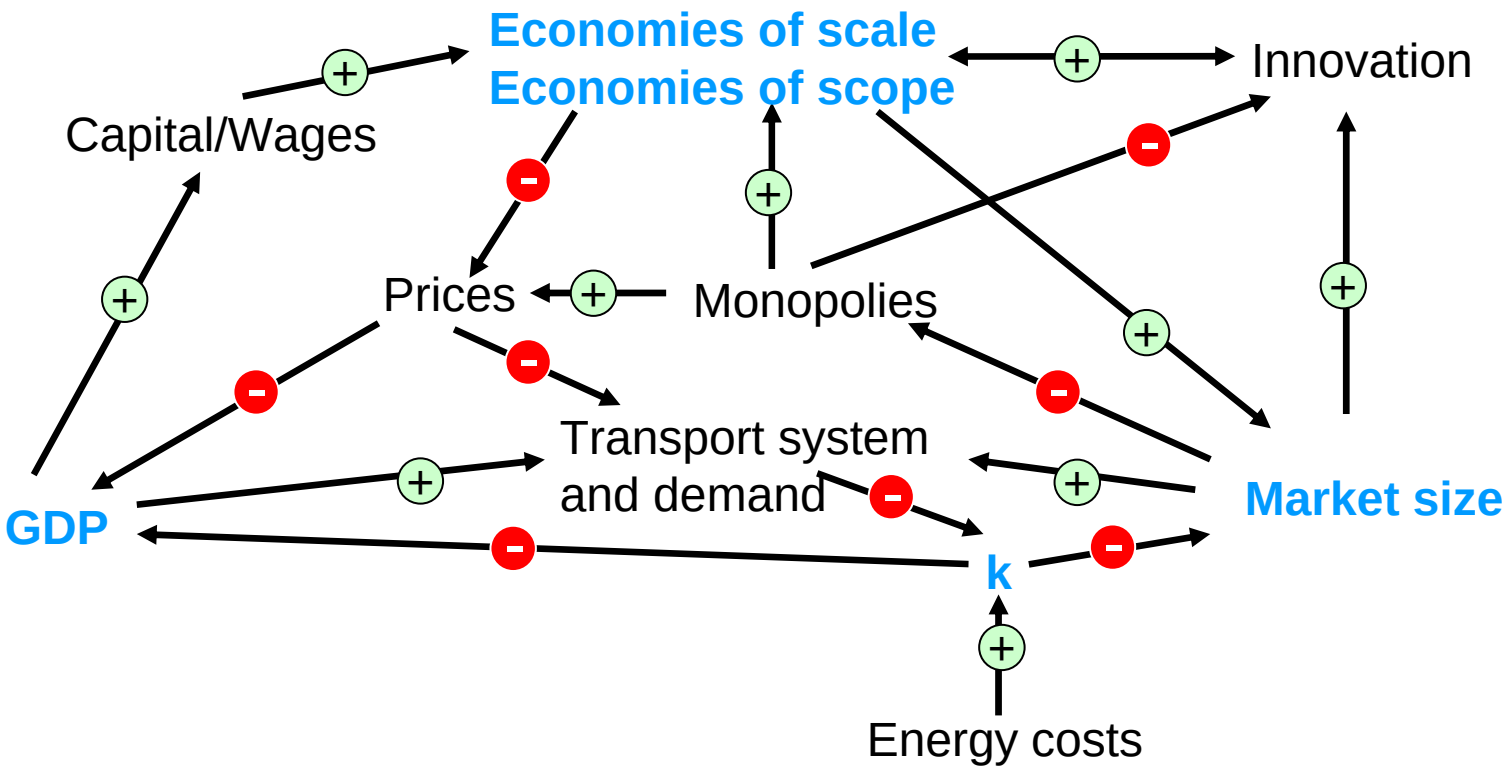


# Price deflation for telecommunication




Nach FCC (2001)

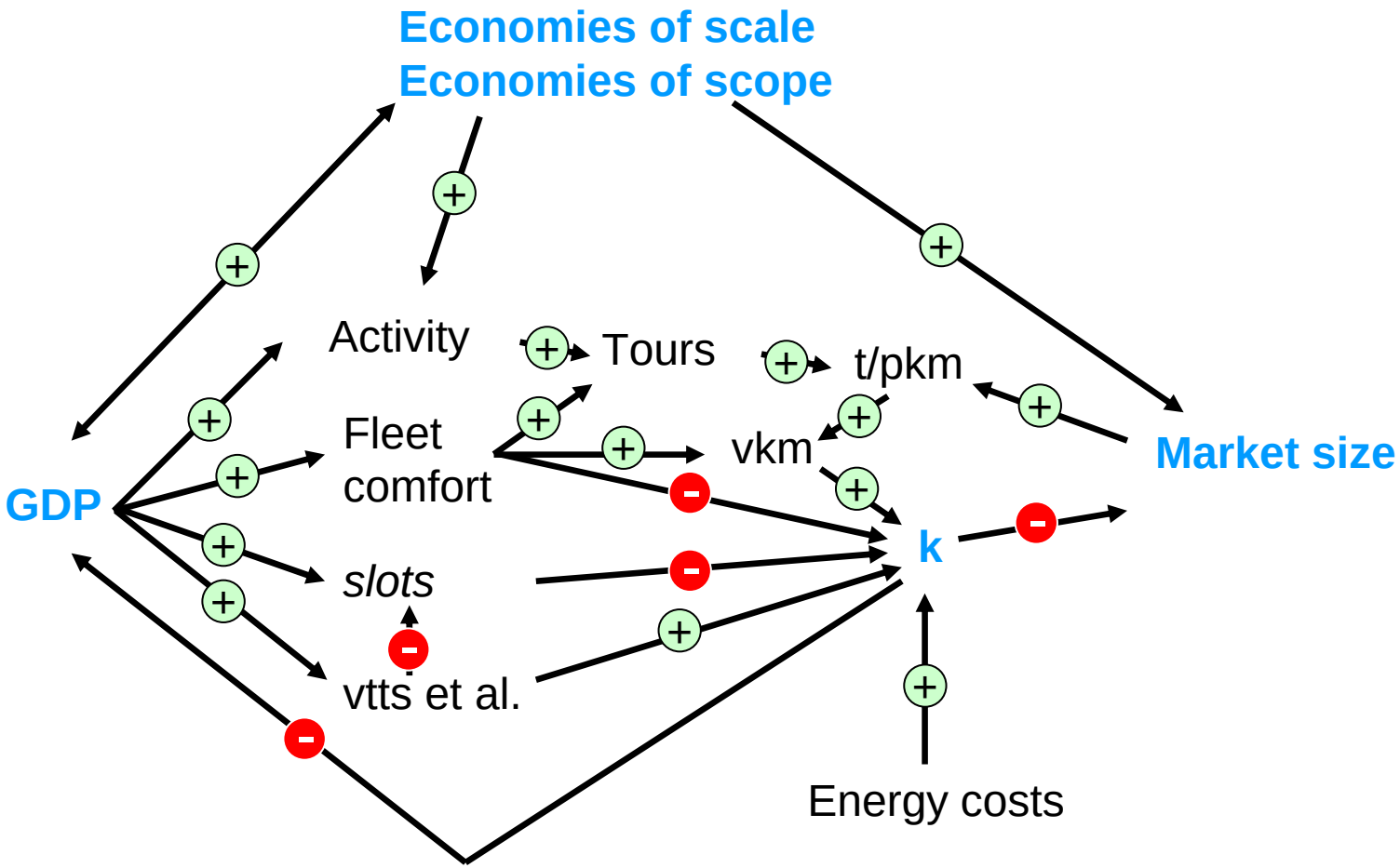
# Size of goods markets and productivity: A hypothesis




⊕ Elasticity > 0
⊖ Elasticity < 0

k: Generalised costs of travel (excluding externalities)

# Size of goods markets and productivity: A hypothesis

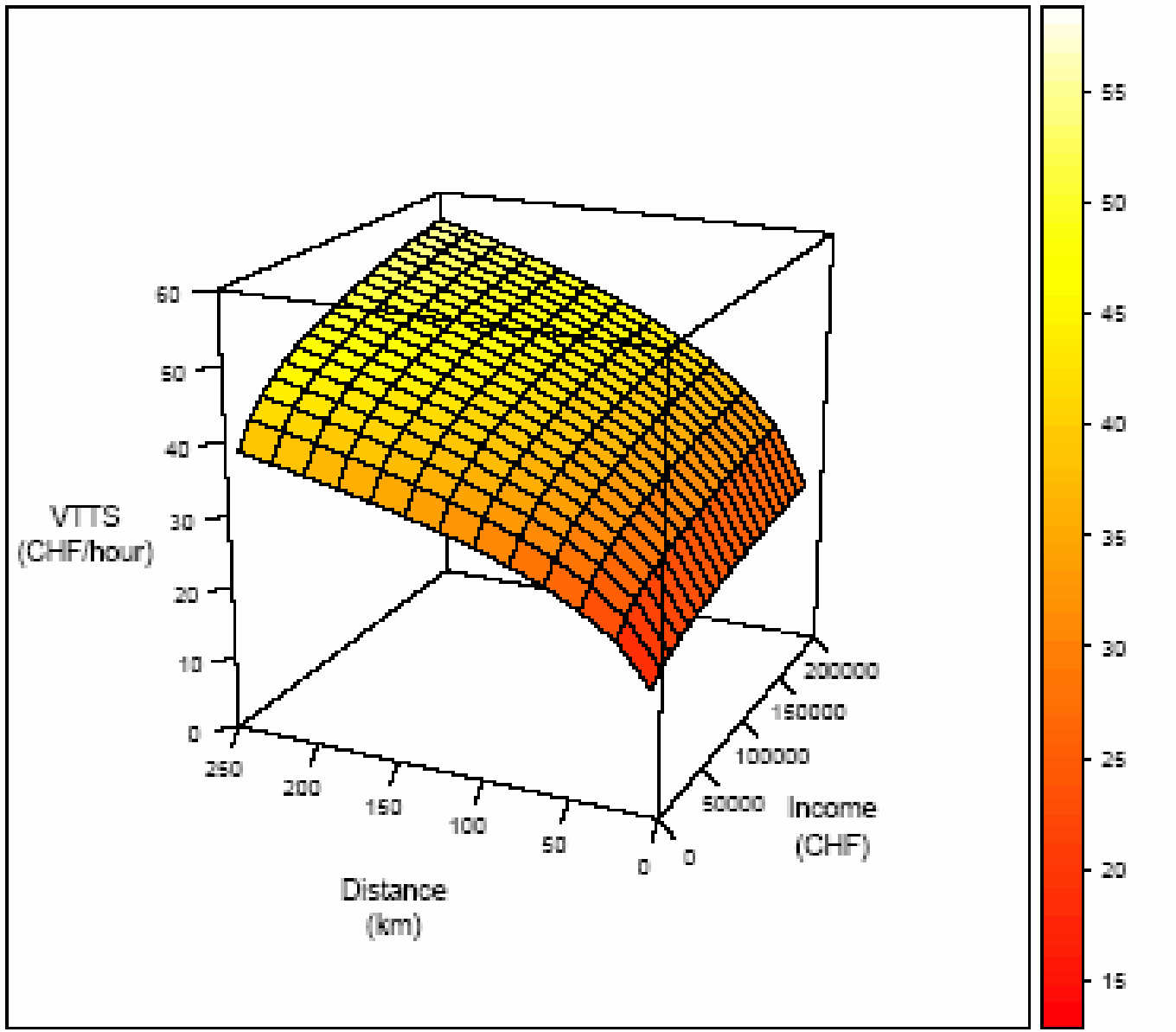



⊕ Elasticity > 0

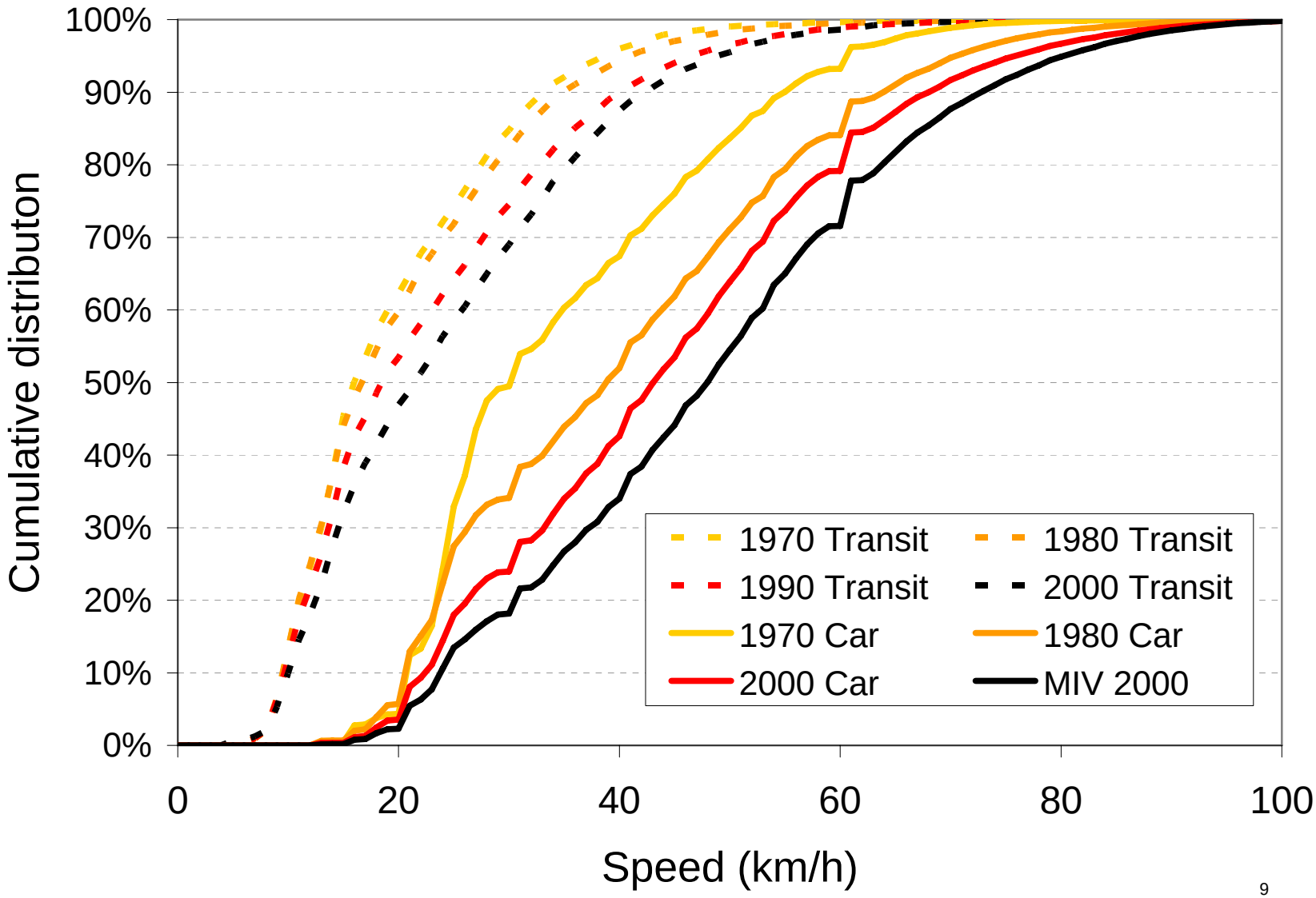
⊖ Elasticity < 0

Slots: possibilities to move goods or people
For a given infrastructure and commercial and private fleet

# Response: VTTS (free-flow)



# Response: Swiss commuting speeds since 1970



# First summary

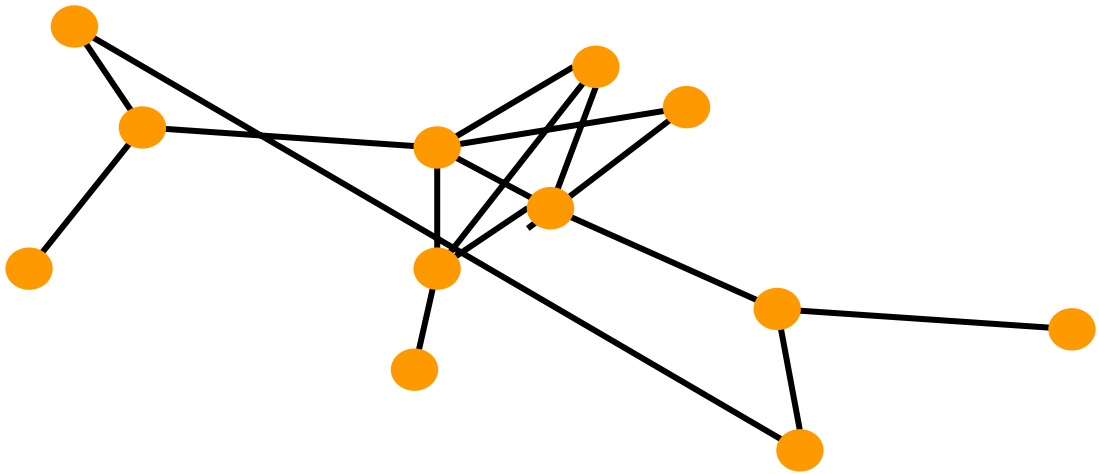
- On-going reduction in the generalised cost of travel
- Expanded market areas and improved economic productivity

# Social networks

# Definition of a social network

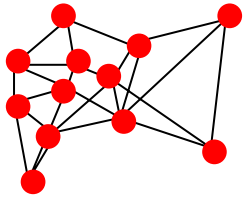
The topology of a social network describes

- Which person/firm (node) is linked to which other persons/firms
- By contacts (links) of a certain quality (impedance or cost)

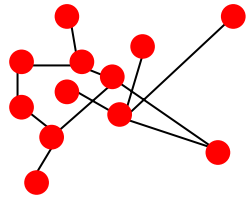


Closeness ~ 1/Impedance

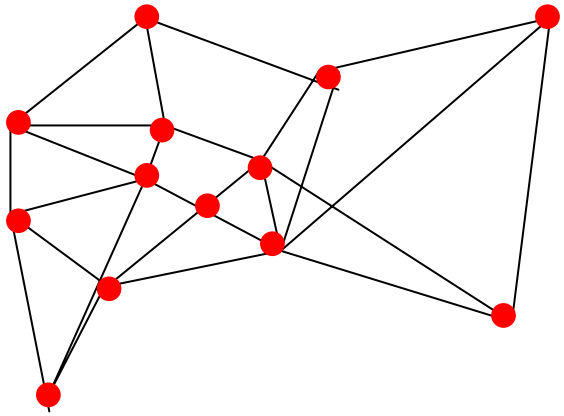
# Spatial density and social connectivity



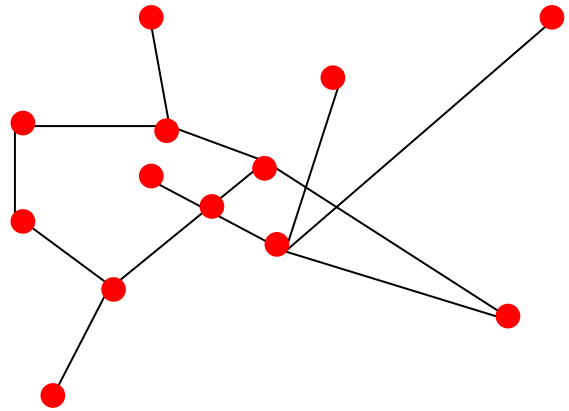
Dense/tight



Dense/loose



Sparse/tight



Sparse/loose

# Travel and social networks

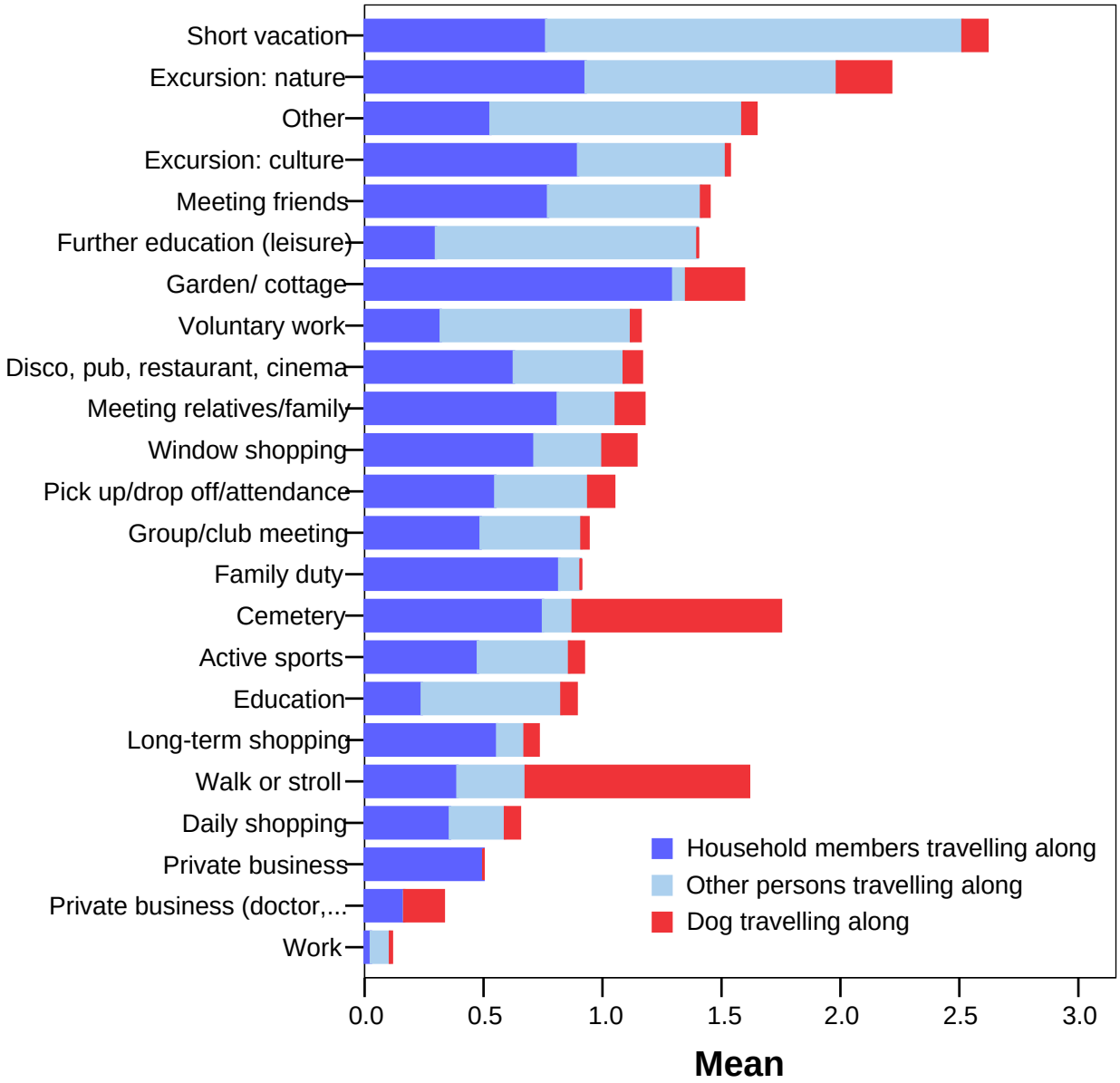
Maintenance of the networks requires:

- Face to face contacts
- Balanced by other forms of contacts

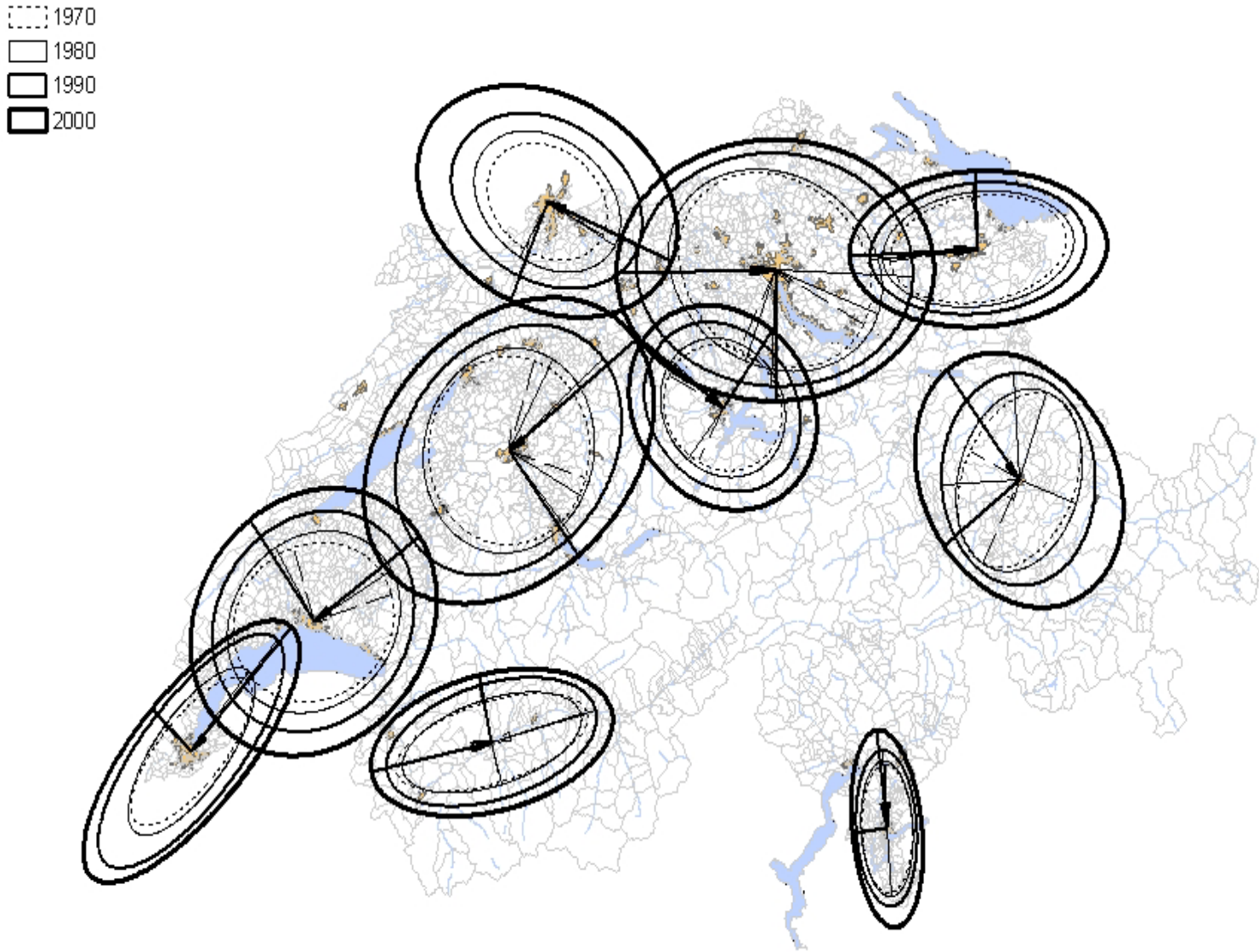
- Travel ~ Physical spread of the contacts

- Trade-off between loosing contacts and “social” capital and investing in new contacts closer to home

# Average size of travel party (2003 Thurgau)

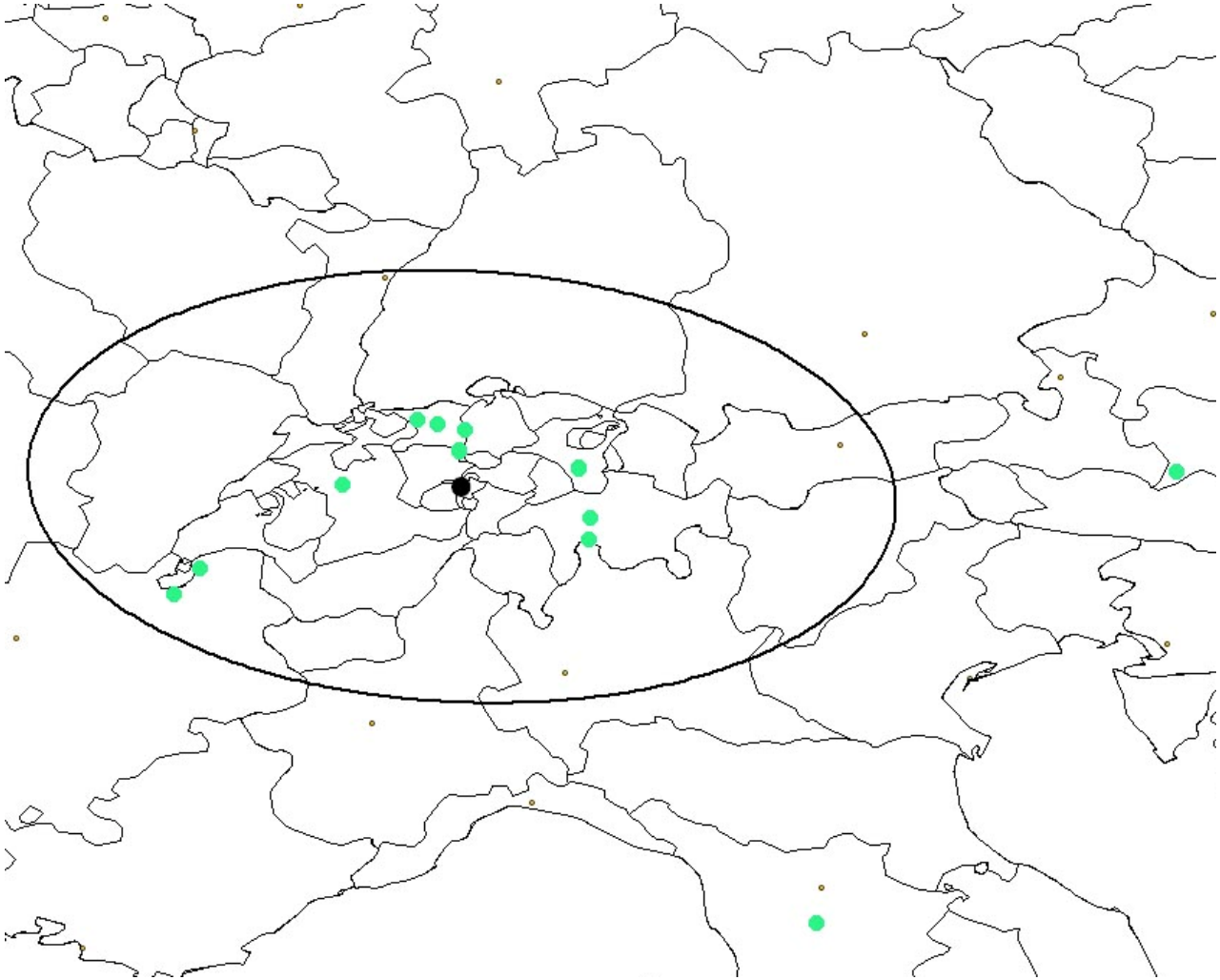


# In-commuter sheds of the ten largest Swiss towns




Nach Botte, 2003

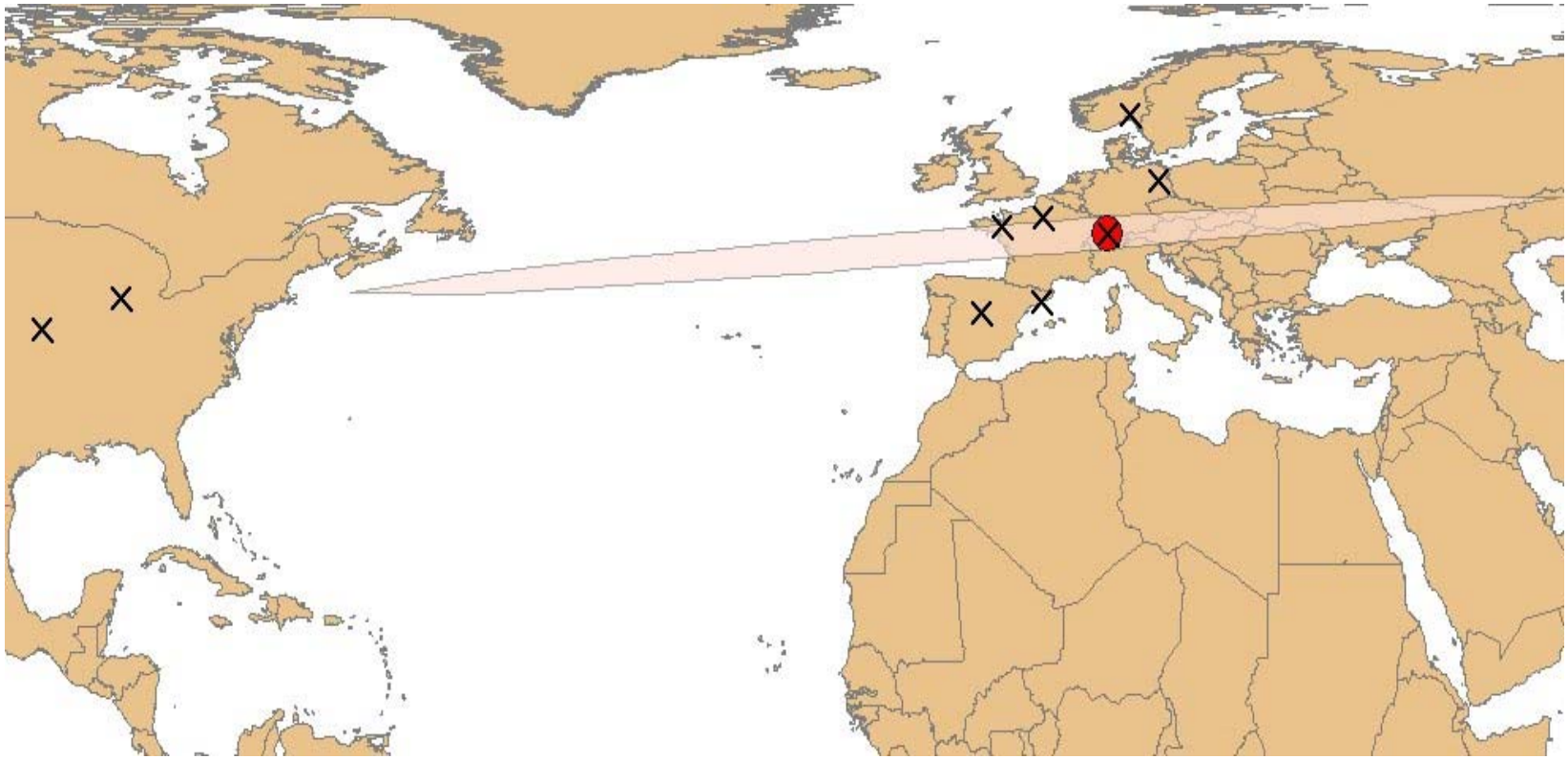
# Example of a social network geography



Female, 28,
4 moves,
Public
transport user

Ohnmacht, 2004

# Example geography of a 35 old female



# How to measure ?

Team:

- S. Schönfelder, IVT

- M. Balmer, IVT
- R.K. Rai and V.S. Vaze, IIT interns

Funding: ETH research fund

# How to measure ?

Parametric:

- 95% confidence ellipse (form and type of distribution)

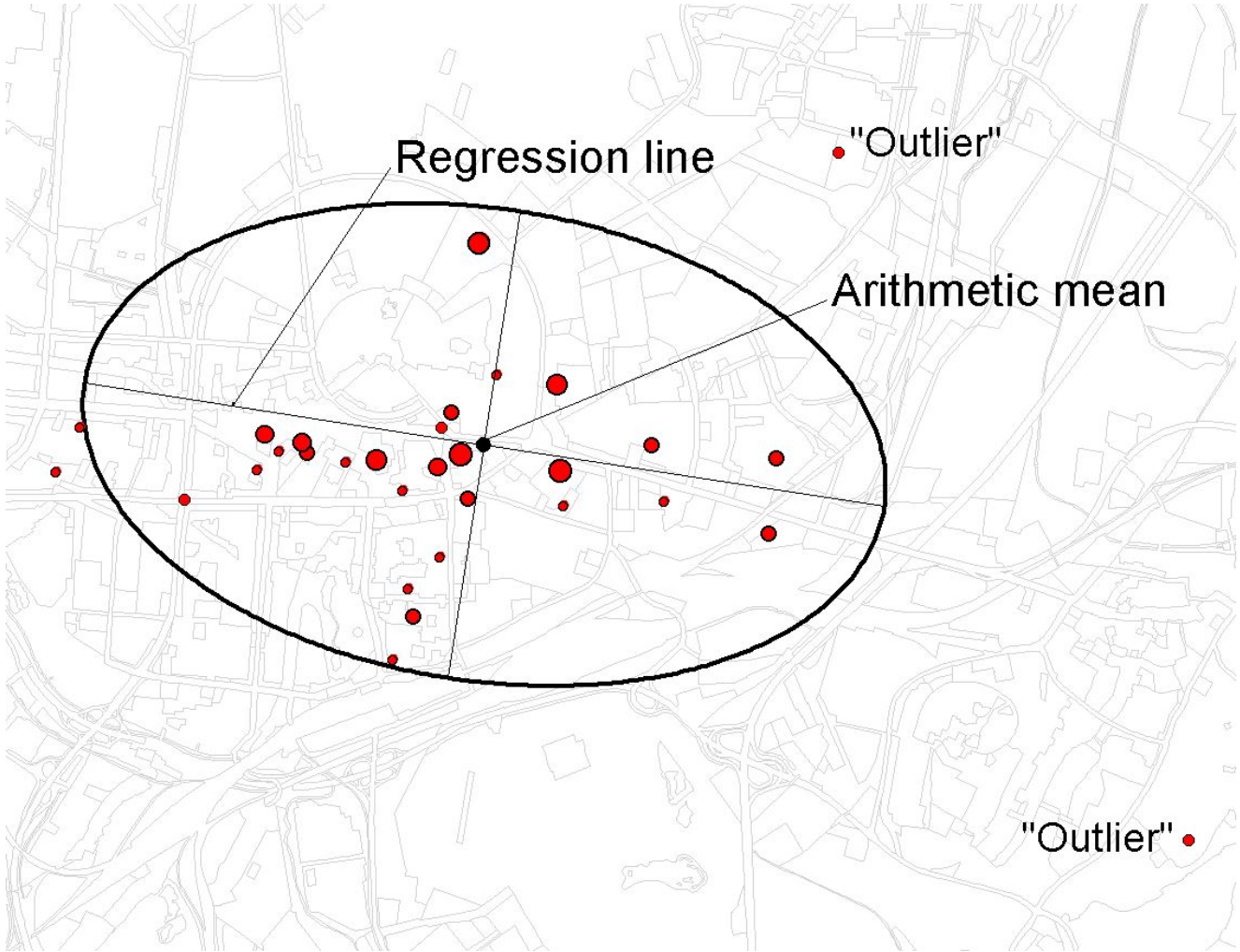
Semiparametric:

- Inclusion geometries (form of geometry)
- (Weighted) shortest path networks (structure of path)
- (Percentage) Minimum convex poligons (convexity)
- Kernel density estimator (form of estimator)
- Mean harmonic home ranges (form of estimator)

Non-parametric

- Observed path geometries

# Measures: Confidence ellipse



# Measures: Kernel densities


Schönfelder, 2006

# Measures: Inclusion geometries

Find:

$\min A_i(\beta_{i1} \ldots\ldots \beta_{in})$

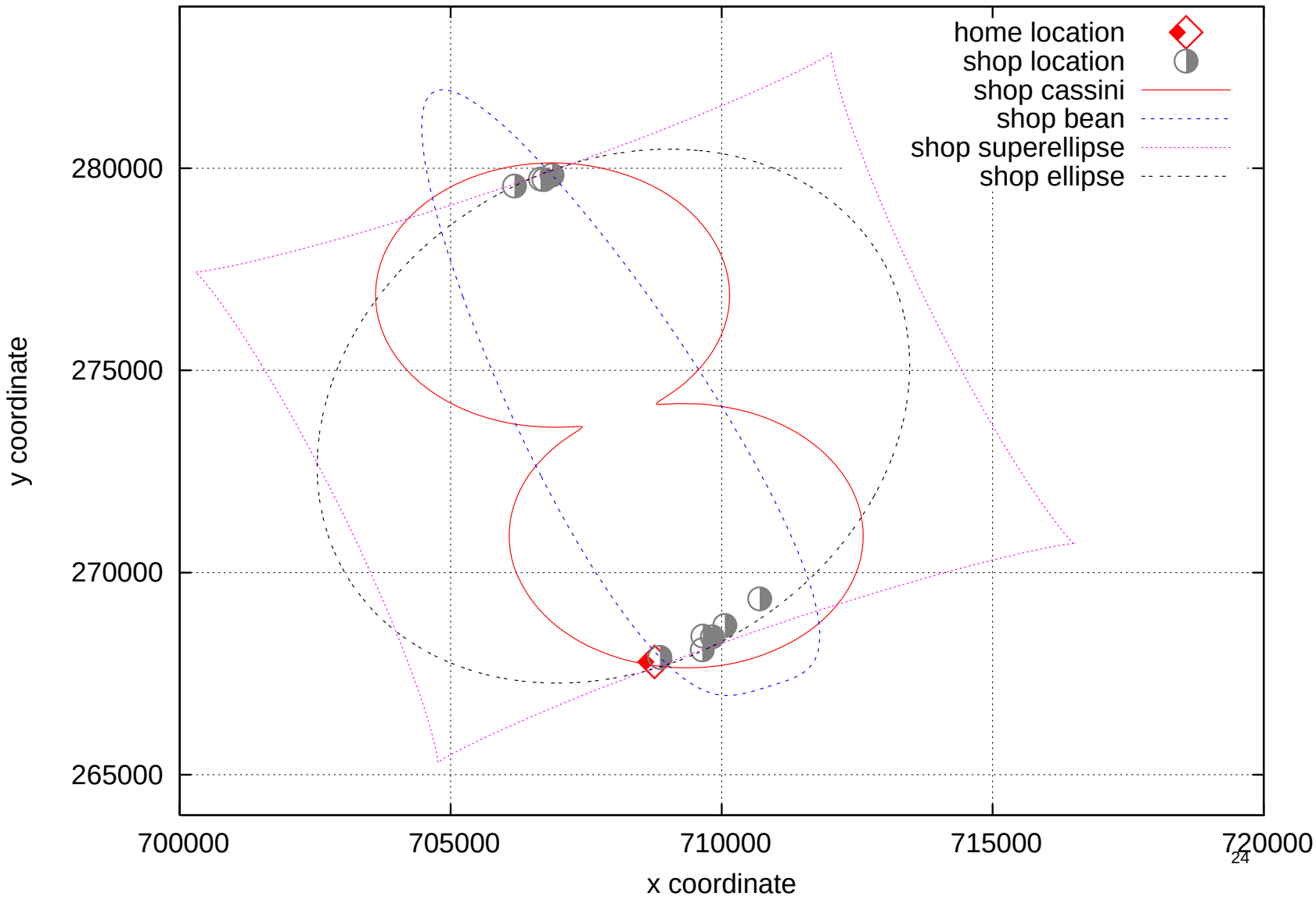
s.t.

Area $A_i$ covering p% of all observed points

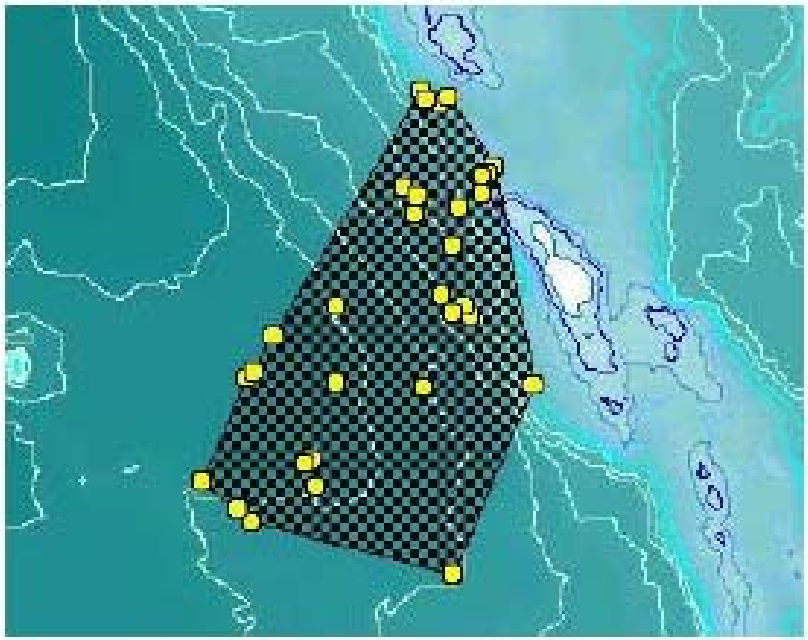
with:

i : Type of geometry (Ellipse, bean, Cassini ...)
p : Predetermined share, e.g. 95%

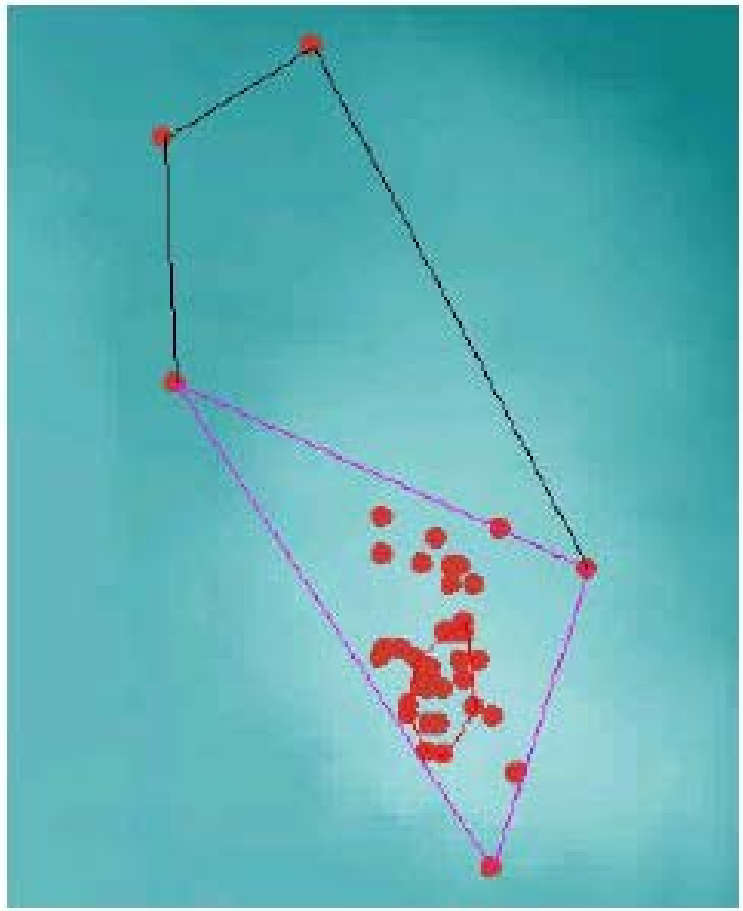
# Measures: Inclusion geometries



# Measures: Minimum convex poligons (MCP)

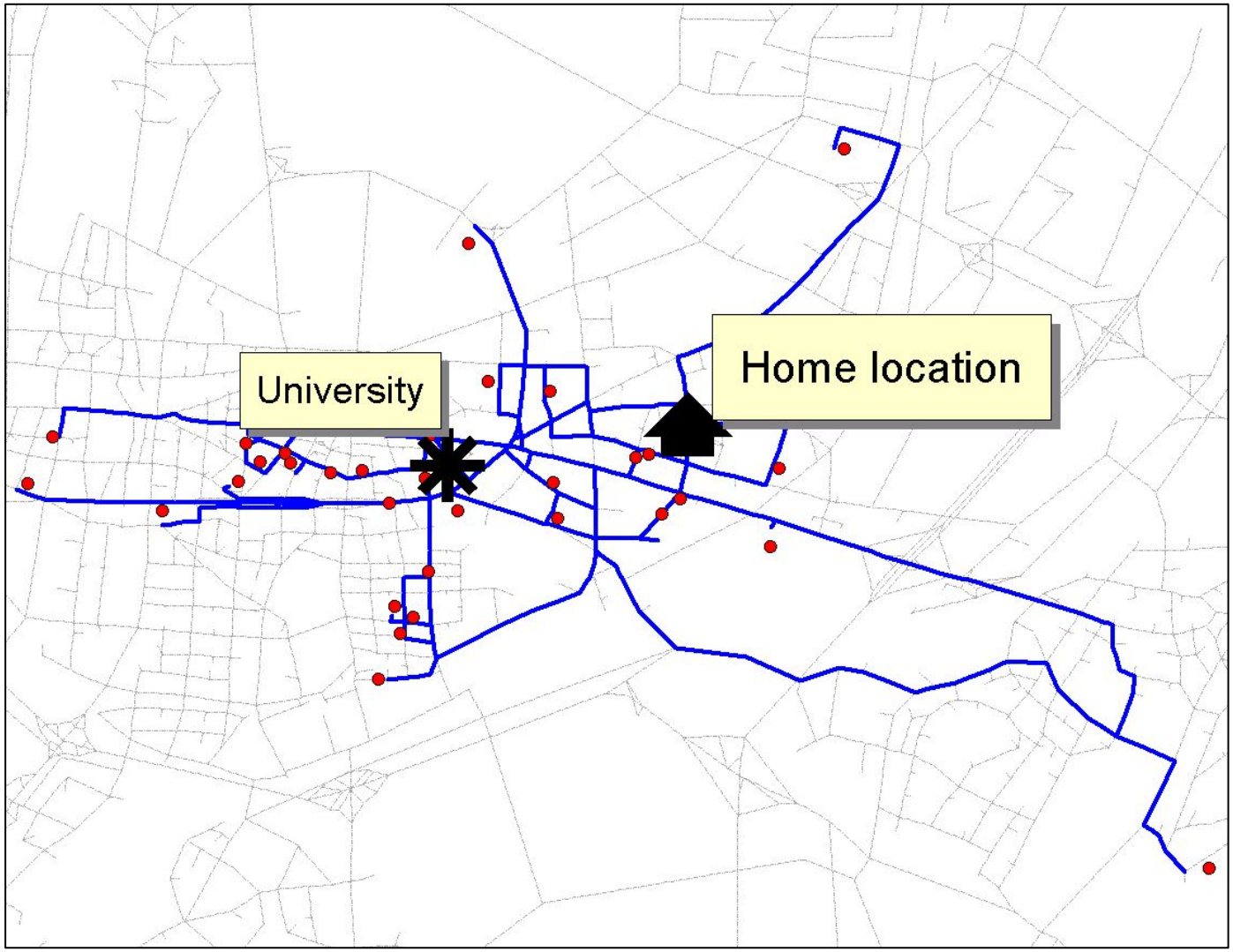


MCP

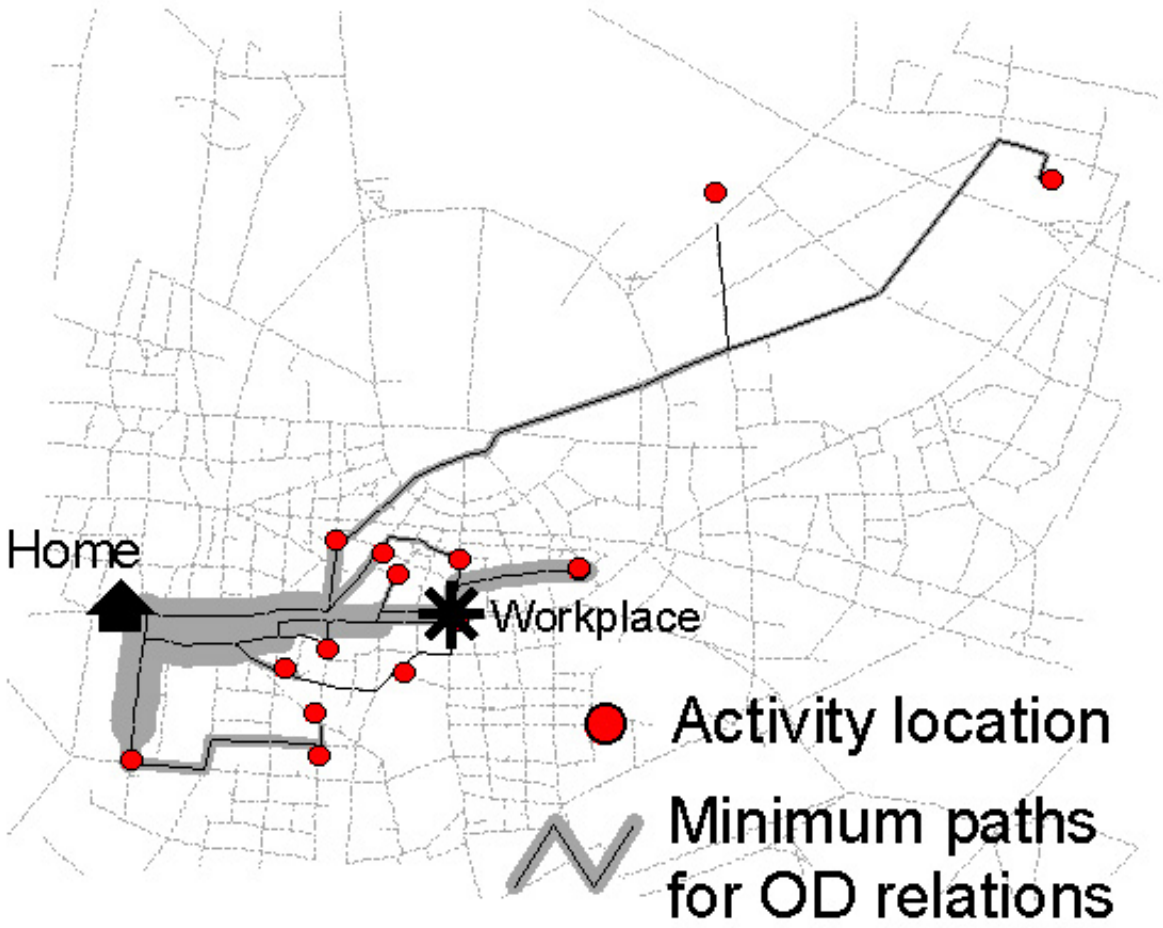


Percentage MCP

# Measures: Shortest path network



# Measures: Weighted shortest path network



# Survey work

Team:

- A. Frei, IVT
- T. Ohnmacht, Universität Basel/FH Zentralschweiz, Lucerne

- J. Larsen, Roskilde University
- J. Urry, Lancaster University

Funding: ifmo, DfT, BBW/Cost, SNF

# Items to capture the social network geographies

- Name generators
- Name interpreters
  - Type and length of contact
  - Frequency by mode of contact
  - Home location
  - Second homes
  - Detailed descriptions of face-to-face contacts

# Items to characterise the mobility biography

- Home and second home locations

- Work and school locations

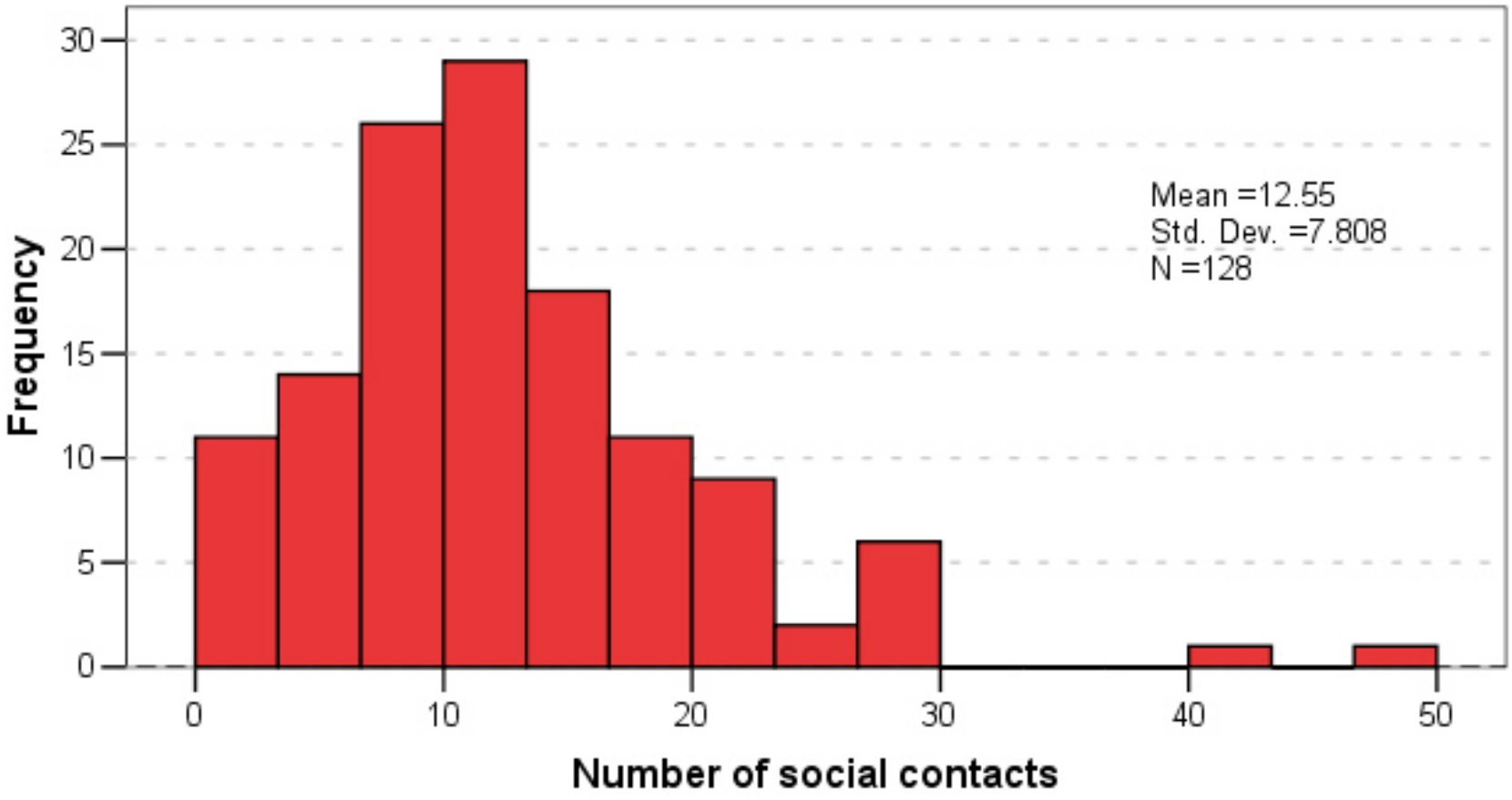
- Household composition
- Mobility tools
- Main mode (to work/school)
- (Major holidays)

- Personal income
- Household income

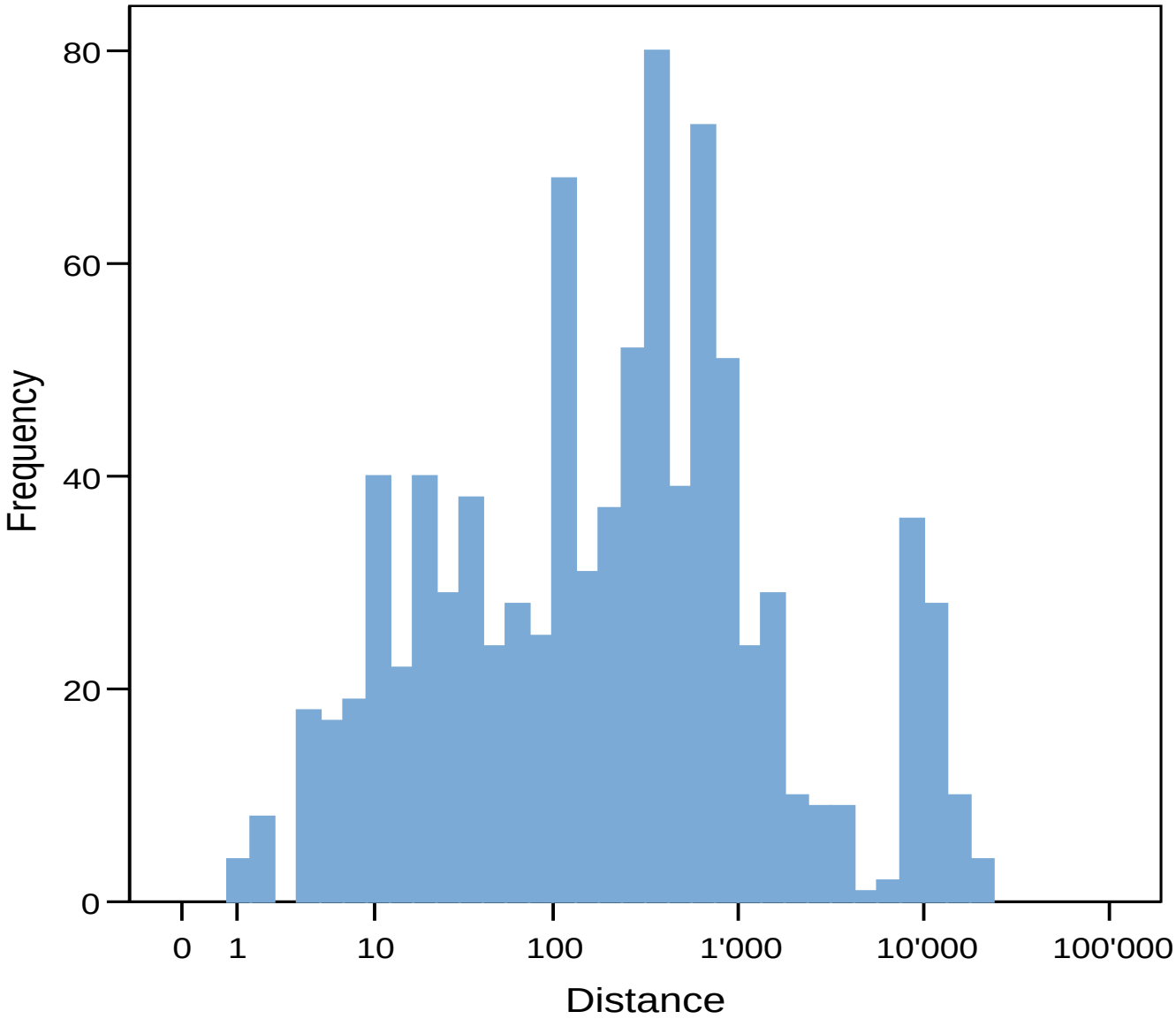
# Response behaviour in the Cost/ifmo surveys

| Phase | Pretest | Main study | Share of total | Share of reached by phone |
|---|---|---|---|---|
| Sample | 150 | 4’200 | 100% | |
| Wrong address | 0 | 56 | 1.3% | |
| Not reachable by phone | 36 | 1’486 | 35.3% | |
| Reached by phone | 113 | 2’714 | 64.6% | 100% |
| Recruited | 14 | 318 | 7.5% | 11.7% |
| Interviewed | 13 | 305 | 7.3% | 11.2% |
| Post-interview questionnaire returned | 13 | 294 | 7.0% | 10.8% |

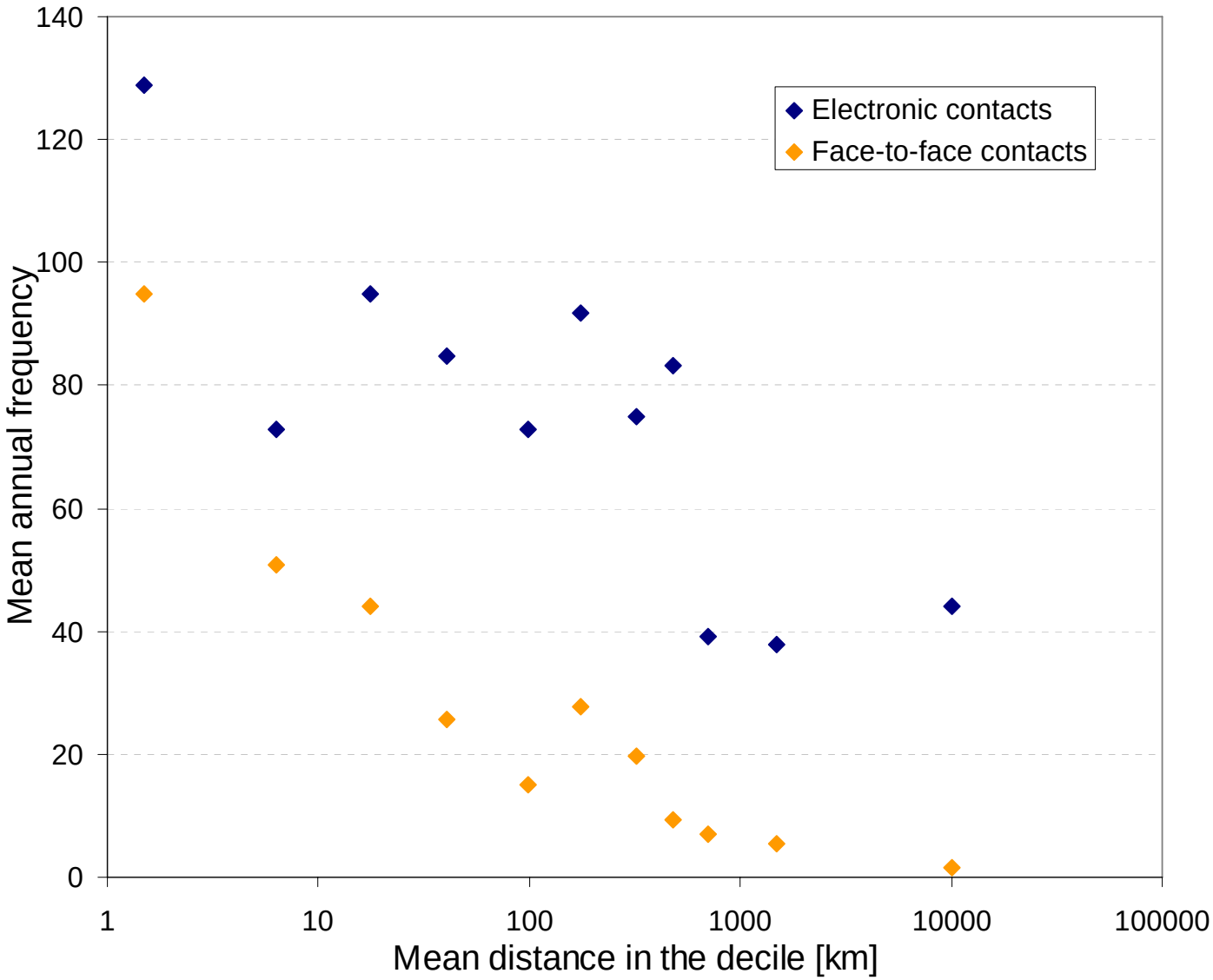
# Contacts


Frequency
30
25
20
15
10
5
0
0
10
20
30
40
50
Number of social contacts
Mean =12.55
Std. Dev. =7.808
N =128

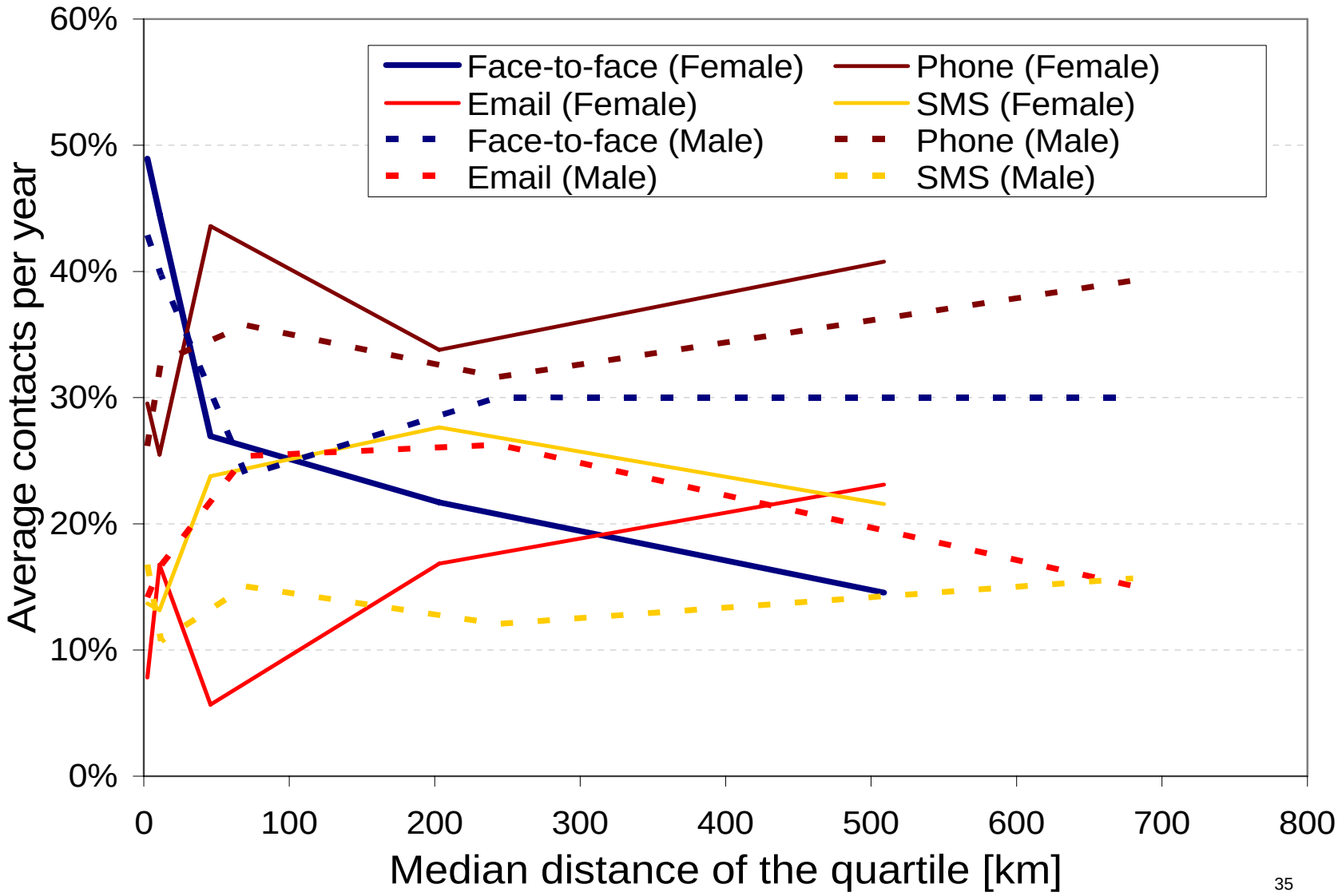
# Distance distribution



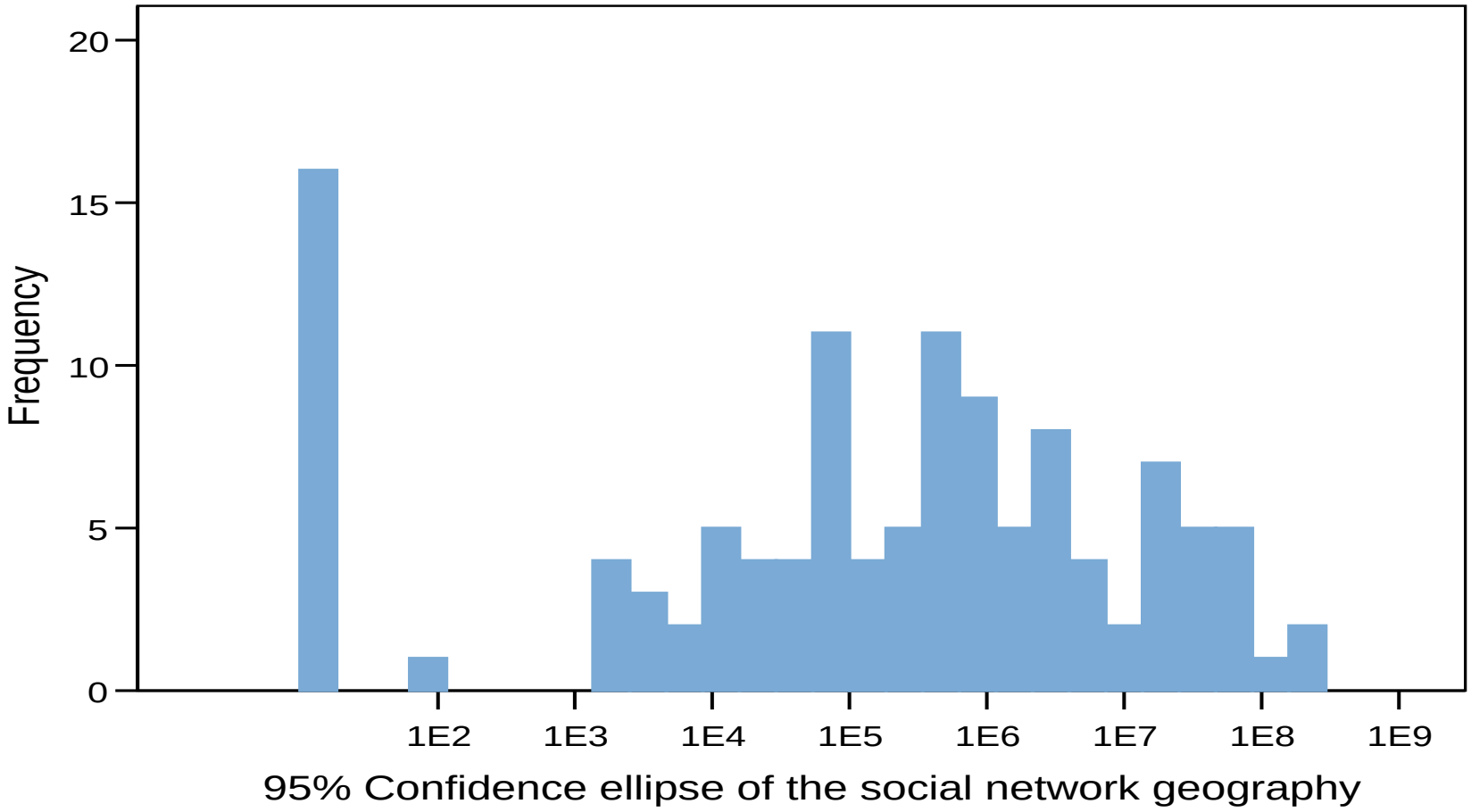
# Contact frequency by mode



# Market share by contact mode



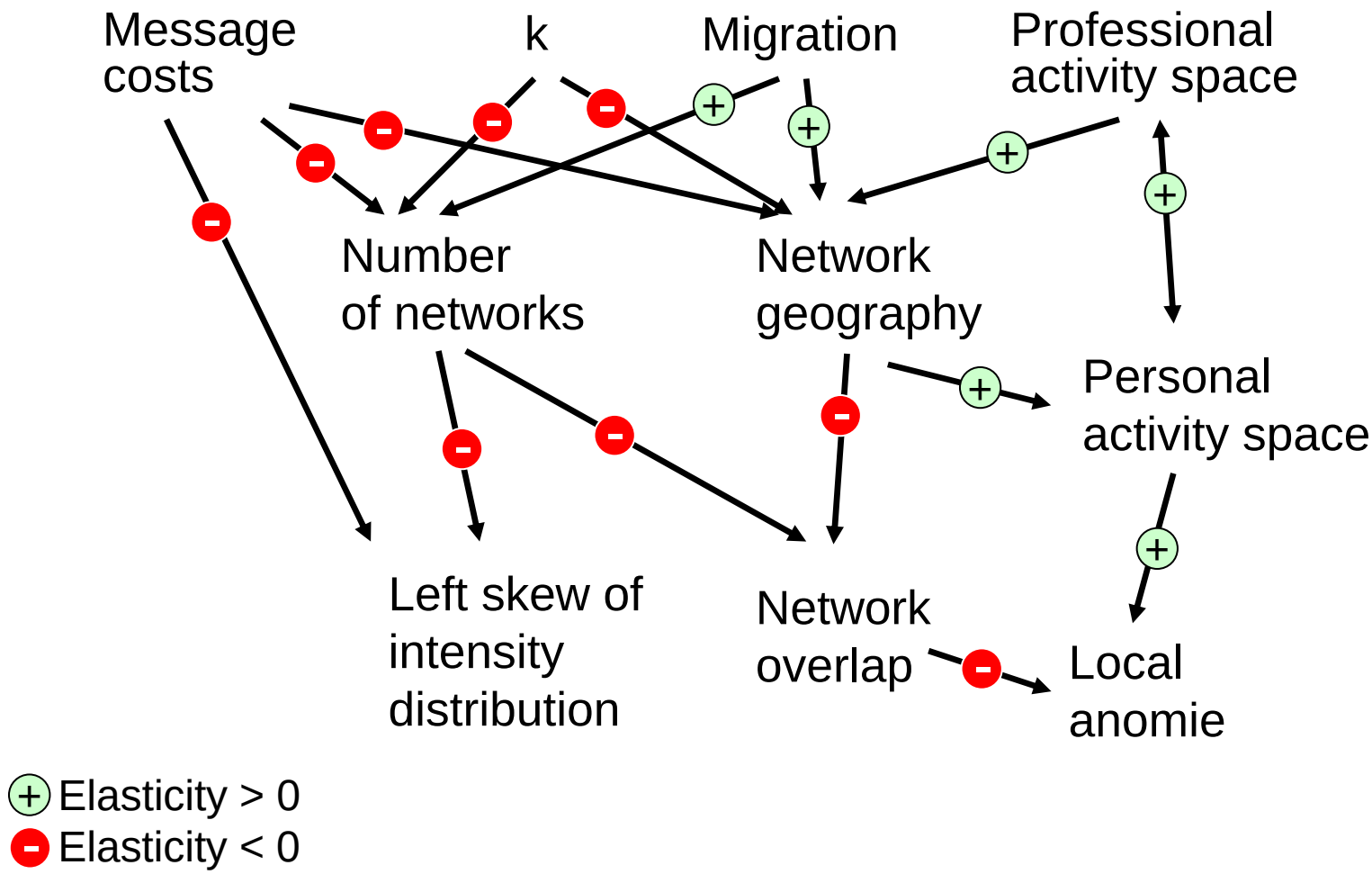
# Distribution of the social geographies




Japan: 378; U.S.A: 9’629 [$10^3$ $km^2$]

# Future trends: Hypotheses

# Hypotheses


Message costs
k
Migration
Professional activity space
Number of networks
Network geography
Personal activity space
Left skew of intensity distribution
Network overlap
Local anomie
+ Elasticity > 0
- Elasticity < 0

# Expected impacts: Improved welfare

The social networks should be more homogeneous and therefore more productive for their members

But, the selectivity excludes the „less attractive“ persons who are disadvantaged through a reduced ability to travel or a reduced ability to participate in activities

But, the dependence on commercial or state-provided services for “care” increases

# Next steps

# Changing our unterstanding of travel

- Budget constraints
- Capability constraints

- Generalised costs of the schedule

    - Generalised cost of travel
    - Generalised cost of activity participation

        - Risk and comfort-adjusted weighted sums of time, expenditure and social content

# Research issues

- Measurement of the activity spaces (geographies, markets)
- Estimate of historical activity spaces ...

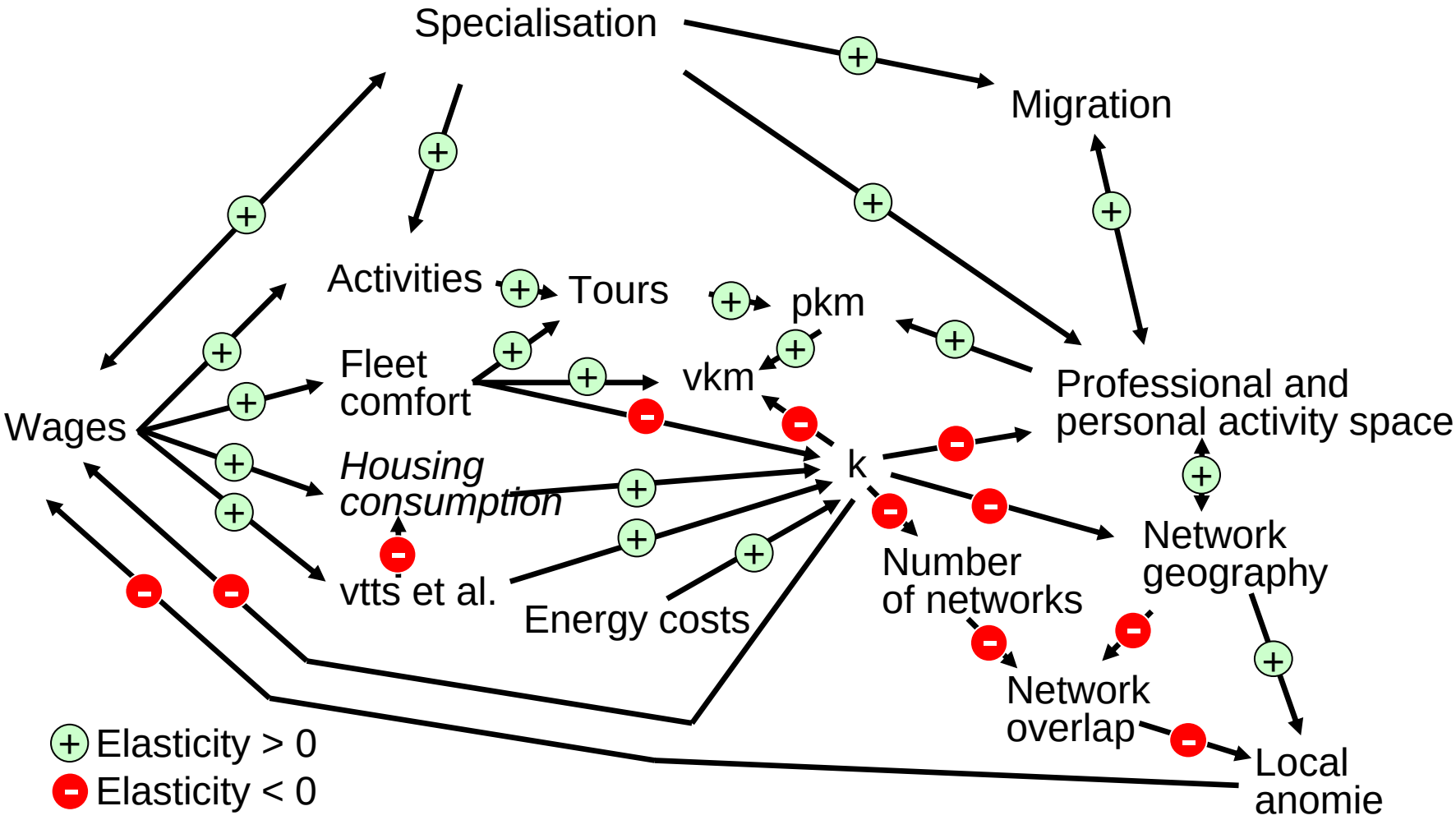
- Taste differences in network form and geography
- Social/cultural preferences for network form and geography

- Stability of the geographies under pressure
- Elasticities to policy (or environmental) change
- Time until trend change

# Policy questions

- Is „happiness“ still growing ?
- How large are the social externalities ?
- How stable is the overall system under pressure ?

# The hypotheses summarized



# Literature and references

See

**www.ivt.ethz.ch**

# Appendix: Dynamics of social networks

# Social networks: Hypotheses

[1] The size of the social network geography is inversely proportional to the generalised costs of travel and communication

[2] The number of contacts individuals maintain is inversely proportional to the generalised costs of travel and communication

[3] The probability of being linked to a member of one's network through multiple networks increases with the spatial density of one's contacts

[4] The distribution of effort on non-household members will become more left skewed as the spatial social network tightness decreases

[5] The knowledge about the contacts of contacts in a social network is proportional to the generalised costs of travel and communication

# Social networks: Hypotheses (2)

[6] The activity space of an individual is proportional to its social network geography

[7a] The size of the local activity space of an individual stabilises after an initial exploration.

[7b] The size of the total activity space will grow in line with the growth of social network geographies.

[8] The reliance on commercial or publicly funded personal services increases proportionally with the geography of social networks

[9] The welfare of the individuals should increase inversely proportional to the generalised costs of travel

# Appendix: Preliminary results (Cost/ifmo – survey)

# Poisson regression of the number of social contacts

| Variable | Mean | St. dev | Beta | Standard-ised beta | Sign. |
|---|---|---|---|---|---|
| Constant | - | - | 3.753 | - | 0.000 |
| Age [years] | 45.68 | 19.08 | -0.051 | -0.124 | 0.000 |
| $Age^2/1000$ [$years^2/1000$] | 2.44 | 0.09 | 0.401 | 0.102 | 0.000 |
| Data_horizon [y/n] | 0.19 | 0.39 | -0.289 | -0.015 | 0.000 |
| Data_COST 355 [y/n] | 0.57 | 0.50 | -0.256 | -0.016 | 0.000 |
| Number of relocations [n] | 5.82 | 2.74 | 0.037 | 0.013 | 0.000 |
| University degree [y/n] | 0.28 | 0.45 | 0.116 | 0.007 | 0.045 |
| N | 128 | | | | |
| Adjusted $R^2$ | 0.16 | | | | |

# Probit results of contact modes

| Variable | Category | Market shares of contact modes | | | |
|---|---|---|---|---|---|
| | | Face-to-face | Phone | Email | SMS |
| Age | | -.004 | .004 | .006 | -.007 |
| Sex: Male | | -.127 | - | .624 | -.526 |
| Educ-atio | Compulsory school | -.251 | .186 | .306 | -.481 |
| | Apprenticeship | -.171 | .254 | -.278 | .086 |
| | Baccalaureat | Reference | Reference | Reference | Reference |
| | Professional tertiary | -.384 | .329 | .106 | -.092 |
| | University degree | -.628 | .915 | - | -.587 |
| Type of contact | Others and friends | .197 | -.625 | -2.126 | -.459 |
| | Family and partner | - | -.402 | -2.344 | -.355 |
| | Work mates | .600 | -1.055 | -1.907 | -.779 |
| Ln (distance) | | -.108 | - | .132 | 0.31 |
| Income | | .028 | -.048 | .075 | -.053 |
| Income * Male | | .048 | -.021 | -.138 | .106 |
| Adjusted $R^2$/$Chi^2$ | | 10046 | 10235 | 13548 | 11690 |
| N | | 381 | 381 | 381 | 381 |

# Tobit results of social geography size

| Variable | Mean | St. dev | Beta | Standard-ised beta | Sign. |
|---|---|---|---|---|---|
| Data_ifmo [y/n] | 0.26 | 0.43 | 2.309 | 0.184 | 0.048 |
| Male [y/n] | 0.57 | 0.50 | 2.293 | 0.212 | 0.021 |
| Age [years] | 44.72 | 18.92 | -0.078 | -0.277 | 0.002 |
| University degree [y/n] | 0.28 | 0.45 | 2.286 | 0.192 | 0.047 |
| Car ownership [y/n] | 0.52 | 0.50 | 3.842 | 0.358 | 0.000 |
| Annual or monthly public transport ticket [y/n] | 0.90 | 0.32 | 6.585 | 0.398 | 0.000 |
| Number of relocations [n] | 5.87 | 2.74 | 0.634 | 0.325 | 0.000 |
| N | 117 | | | | |
| Adjusted $R^2$ | 0.48 | | | | |