



SustainCity: Development of an integrated UrbanSim-MATsim model of Brussels

iTeam meeting
July 16, Lisbon

Outline

- The SustainCity project
 - Quick review of UrbanSim
 - Improved platform: UrbanSimE (Europe)
- Brussels case study
 - Prototype model
 - Data collection
 - Software issues
- Further work

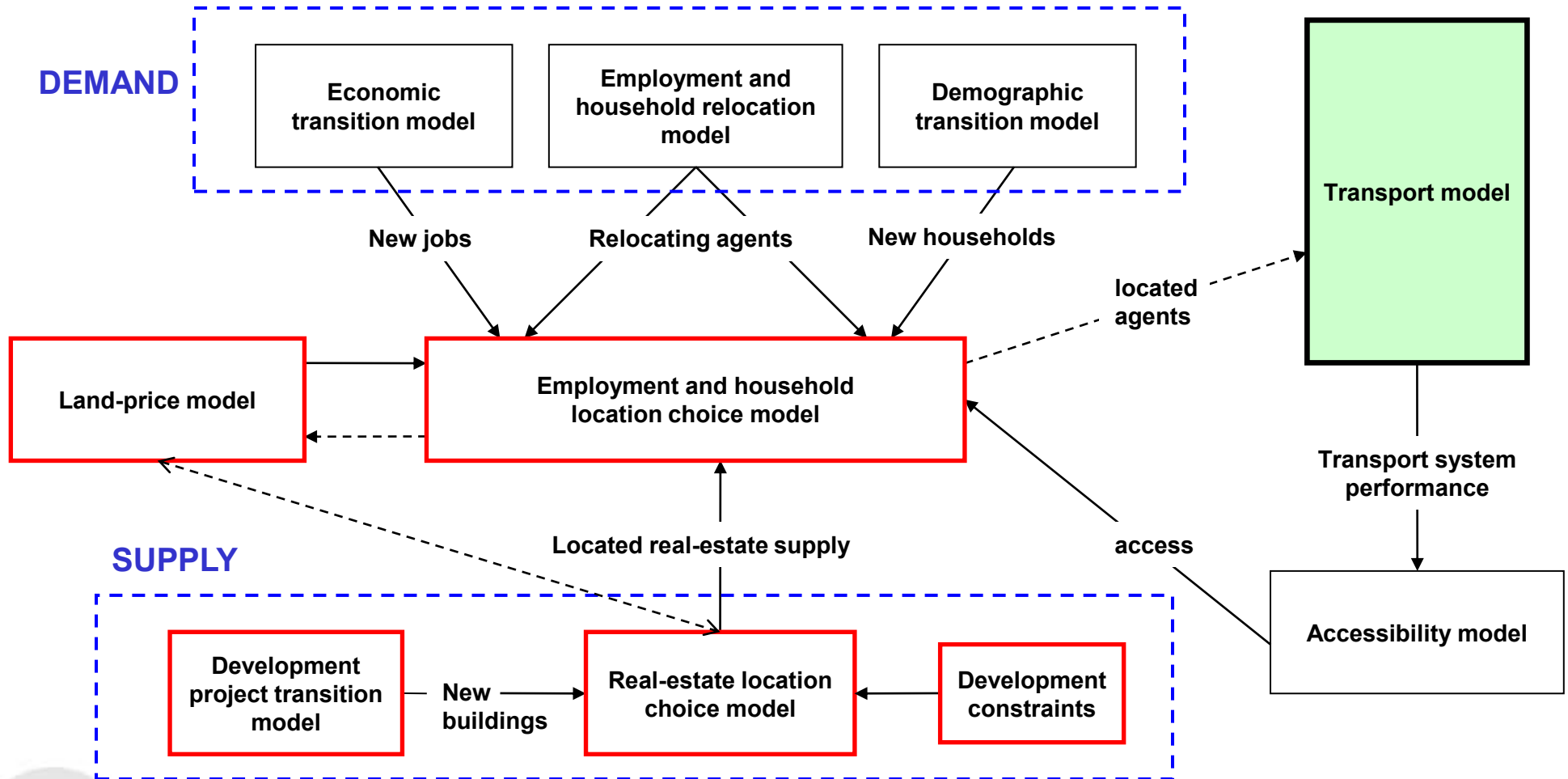
SustainCity

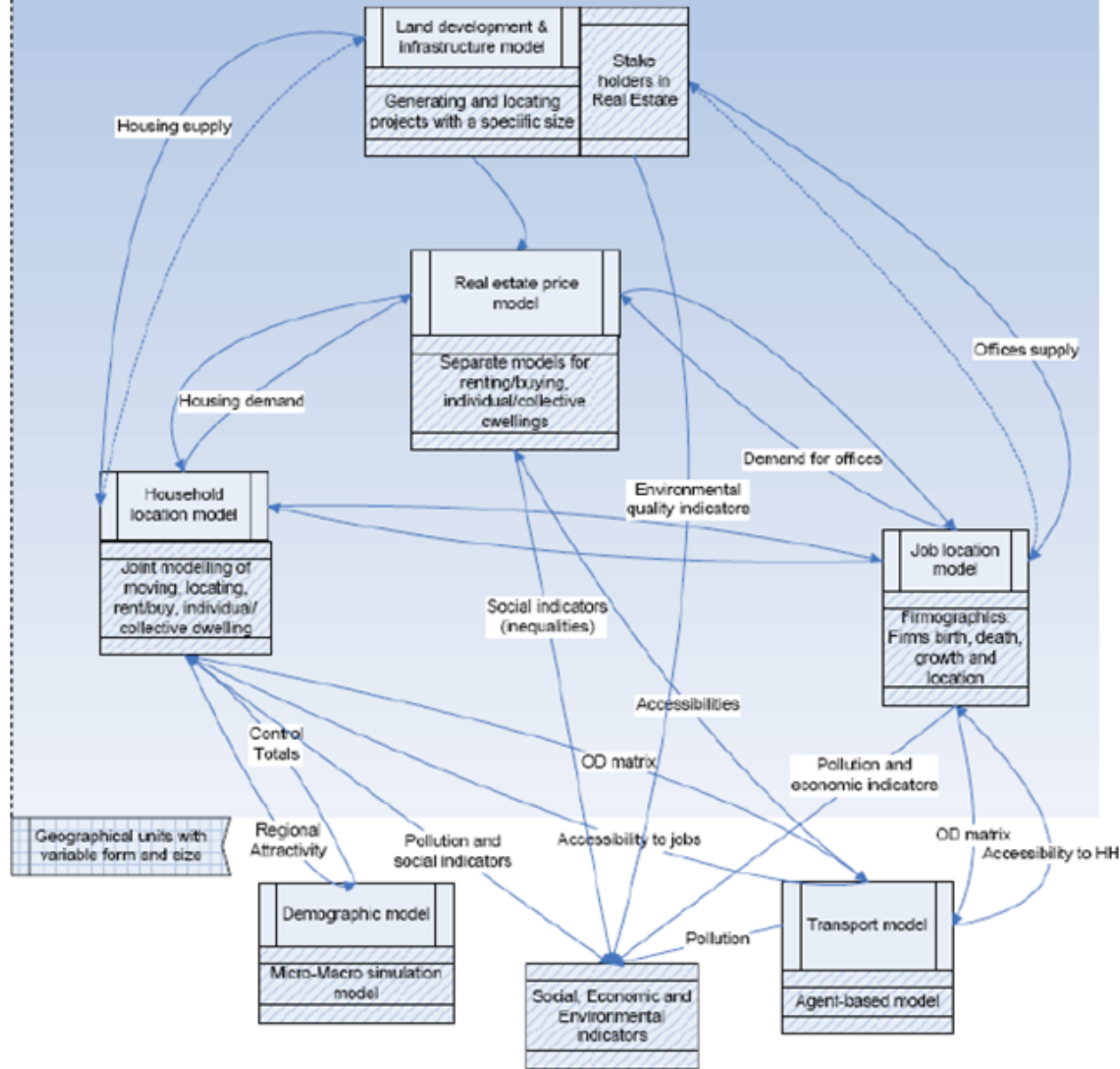


- Funded by the European Union (FP7 Cooperation Work Programme)
- Collaborative project between 11 universities from 7 countries
- Objectives:
 - To advance the state of the art of urban simulation models
 - To improve their diffusion among planners and decision-makers
 - To develop an European-adapted version of the urban microsimulation tool UrbanSim and to implement it in three European case studies

- Land use microsimulator (developed by Paul Waddell et al.)
- Open source
- High level of disaggregation:
 - Individual agents (households, firms)
 - Spatial units (zones, gridcells, parcels)
- Very flexible
 - Structure allows for new models or improvement of the actual ones
 - In theory: easy to implement on any city (given the data)
 - In practice: not so easy

UrbanSim





Improvements in UrbanSimE

- New demographic model, based on microsimulation and agent based models:
 - individual characteristics (age, sex, marital status)
 - identification number of his/her household
 - identification numbers of related individuals (current and previous partners, children, parents)

Improvements in UrbanSimE

- Integrated microsimulation transport model

MATSim (Brussels and Zurich)

Metropolis (Paris)

- Route choice and departure-time choice adjustments as reaction to congestion
- MATSim: one on one mapping between simulated travelers and individuals in the household
 - High data requirements

Improvements in UrbanSimE

- Residential choice and household behavior
 - Household relocation choice
 - Rent / buy decision
 - Intra-household decisions
 - Sampling of alternatives / choice set generation
 - Bid-rent approach
 - Prices estimated as expected maximum bid
 - Possibility to include (pseudo) market clearing conditions

Improvements in UrbanSimE

- The role of stakeholders
 - Groups of agents that lobby for housing policies and land use regulation
 - Social housing corporations
 - Social housing
 - Rent subsidies
 - Rent control
 - Private home owners
 - Restricted land use
 - Restricted real estate development
- Effects on real estate developments and prices

Improvements in UrbanSimE

- Firm location and re-location choice (“firmographics”)
 - Model for the birth, growth and death of firms
 - Model for re-location and location choice of firms
 - Possible attributes:
 - Production factors (cost of labour, land, etc)
 - Economic environment (proximity to other firms, scale and scope economies)
 - Policy environment

Improvements in UrbanSimE

- Real estate supply model
 - Model R-E developers as agents (profit maximizers)
 - Level of myopia (foresight of future states of the market?)
 - Dealing with demand/supply surplus
 - In general: incorporate stronger economic underlying assumptions

Improvements in UrbanSimE

- Econometrics
 - Spatial correlation
 - Spatial heterogeneity
 - Endogeneity
- Approaches to try:
 - Geographically weighted regression models
 - Spatial autocorrelation models
 - Methods to account for endogeneity (Guevara and Ben-Akiva, 2006)

Brussels case study

Brussels Metropolitan area

- ~ 4 300 km²
- 2.9 millions inhab.
- 1.2 million jobs (2001)

Brussels-Capital Region

- 1 million inhabitants
- 650 000 jobs

Zoning system:

- 135 municipalities (“communes”), among which a few are subdivided
- 152 zones
- 5000 “statistical zones”

THE URBAN ZONES OF THE REGIONS IN THE STUDY AREA

The urban zones:

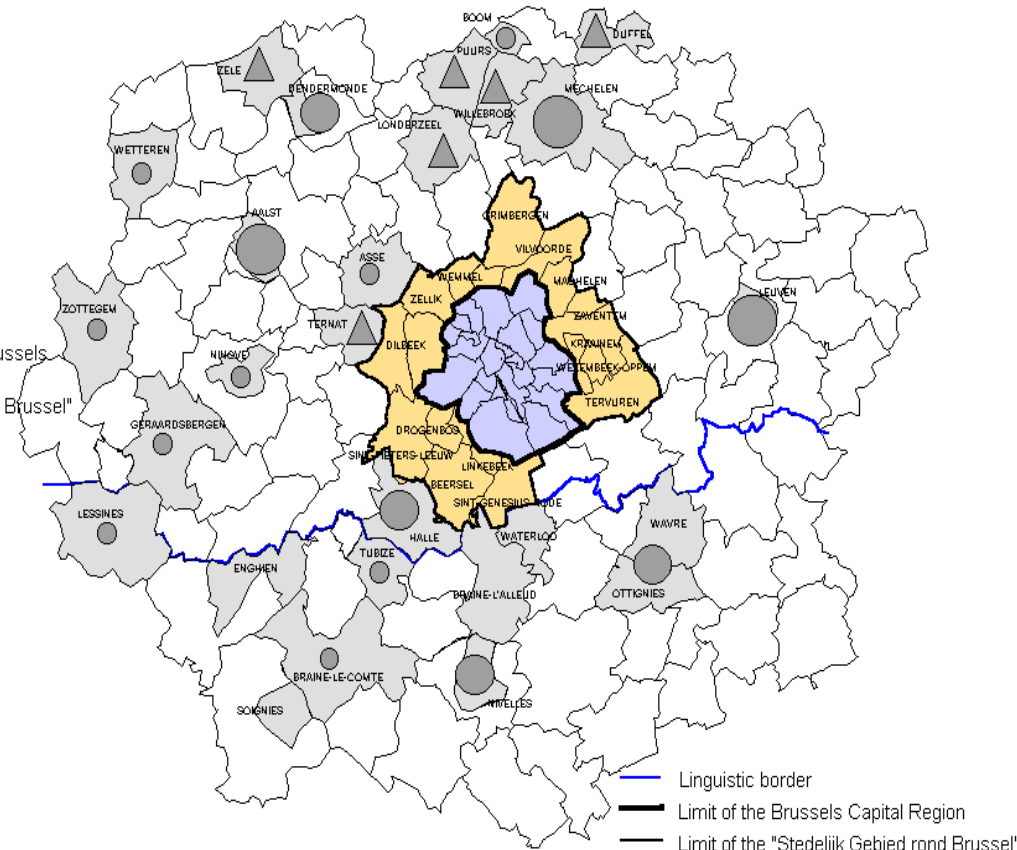
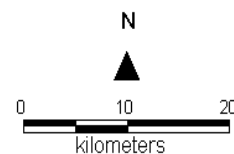
Urban hierarchy:

- Regional city
- Small structuring city
- Small provincial city

- Urban zone of the Brussels Capital Region
- “Stedelijk gebied rond Brussel” (Flemish Region)
- Other urban zones

Economic poles:

- Economic node

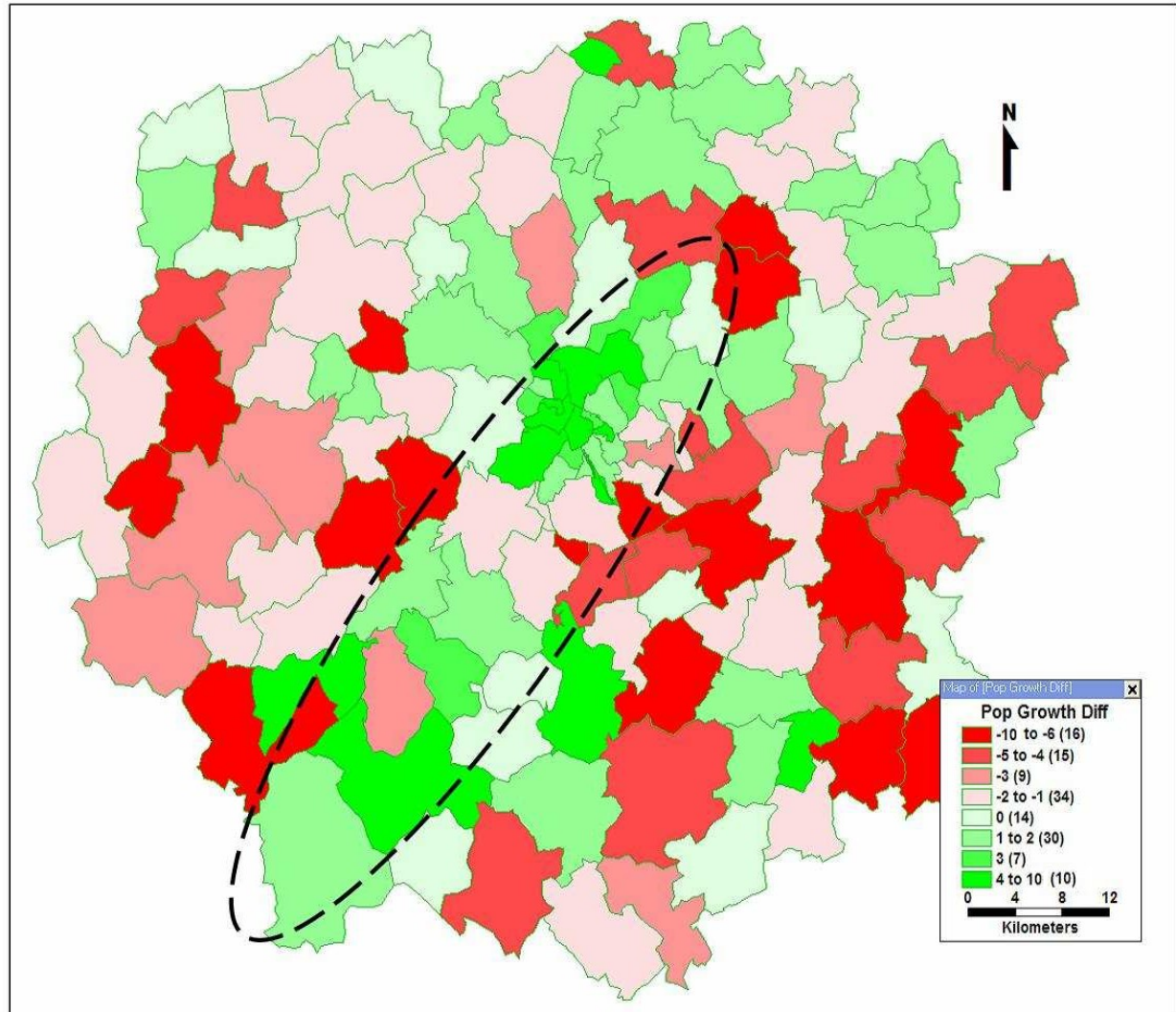


Brussels case study -Prototype

- Prototype UrbanSim model for Brussels
 - Patterson and Bierlaire (2010). Development of Prototype UrbanSim Models, Environment and Planning B
 - Developed in relatively short time
 - Simplified model
 - Using aggregated and synthesized data

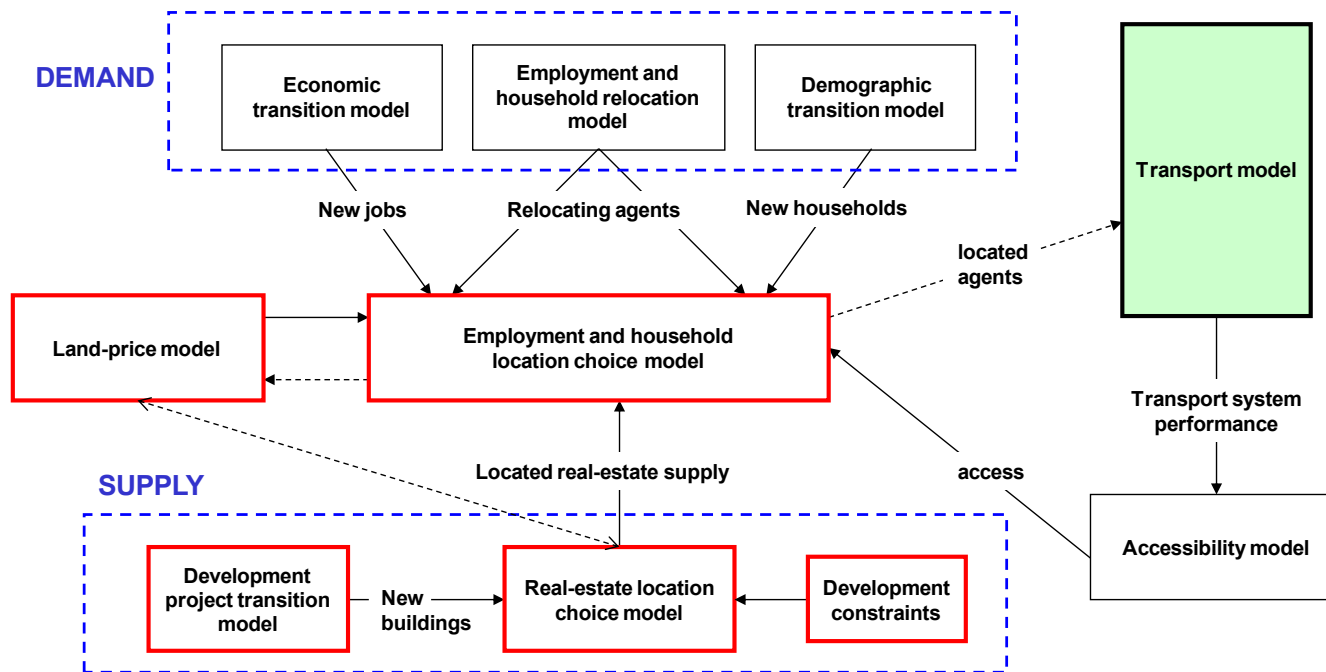
Brussels case study - Prototype

Difference between
observed and predicted
population growth
by comune
(2000 – 2007)



Brussels case study - Data collection

- The “6 Tables”



- Zones
- Households
- Jobs
- Buildings
- Development event history
- Development Constraints

Brussels case study - Data collection

- Calibration year: 2001
- Sources
 - Census (2001)
 - National register of population
 - Social security database
 - Register of self employed people
 - National economic survey
 - Land use master plan
 - Cadastral register of buildings

Brussels case study - Data collection

- Problems
 - Different levels of aggregation in each data source
 - Scarce data for validation
 - Not enough historic data
 - Bureaucracy
 - Census: 6 months process

Brussels case study - Software

Difficulties:

- Installation.
- Connection with database
- Written in Python, Java and C++

- Implementation of a new project
 - From scratch → complex configuration is required
 - Based on an existing project → consistency in data structure

 - Brussels is “built” over the San Antonio model

Conclusions

- Implementing urbansim can be a complicated task
 - Strong data requirements
 - Software familiarization costs
- Further work
 - Experimental development of methodological improvements in a first stage
 - Estimation
 - Validation
 - Dissemination

Thank you

Partners

Swiss Federal Institute of Technology Zurich	ETHZ	Switzerland
Ecole Normale Supérieure de Cachan	ENSC	France
Institut National d'Etudes Démographiques	INED	France
Université Catholique de Louvain	UCL	Belgium
Katholieke Universiteit Leuven	KUL	Belgium
STRATEC	STRATEC	Belgium
National Technical University of Athens	NTUA	Greece
Technical University Berlin	TUB	Germany
Ecole Polytechnique Fédérale de Lausanne	EPFL	Switzerland
Bocconi University	BU	Italy
Université de Cergy Pontoise	UCP	France