

Preferred citation style

Bodenmann, B.R., P. Schirmer, C. Zöllig (2011) SustainCity: Zurich Case Study, presentation at the *UrbanSim Workshop*, Athens, July 2011.

SustainCity: Zurich Case Study

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UrbanSim Workshop
Athens, July 2011

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Swiss Federal Institute of Technology Zurich

Content

1. **SustainCity**
2. Zurich case study
3. Results of related work
 - a. Residential location choice
 - b. Firm's location choice
4. Conclusions

SustainCity

Micro-simulation for the prospective of sustainable cities in Europe

- part of the **7th Framework Programme for Research of the European Commission**
- January 2010 to December 2012
- Co-ordinator: **Prof. Kay W. Axhausen** (IVT, ETHZ)
- Scientific co-ordinator: **Prof. André de Palma** (ENSC)
- www.sustaincity.eu



SustainCity: Aim

- to address the modeling and computational issues of integrating modern **mobility simulations** with the latest micro-simulation **land use models**
- to advance the state-of-the-art in the field of the microsimulation of **prospective integrated models of Land-Use and Transport (LUTI)**

On the modeling side, the main challenges are

- to integrate a **demographic evolution module**
- to add an **environmental module**
- to improve the **overall consistency** and
- to deal with the **multi-scale aspects** of the problem: several time horizons and spatial resolutions

SustainCity: Partners

Swiss Federal Institute of Technology Zurich (ETHZ)
Ecole Normale Supérieure de Cachan, France (ENSC)

Institut National d'Etudes Démographiques, France (INED)

Université Catholique de Louvain, Belgium (UCL)

Katholieke Universiteit Leuven, Belgium (KUL)

STRATEC SA, Belgium (STR)

National Technical University of Athens, Greece (NTUA)

Technical University Berlin, Germany (TUB)

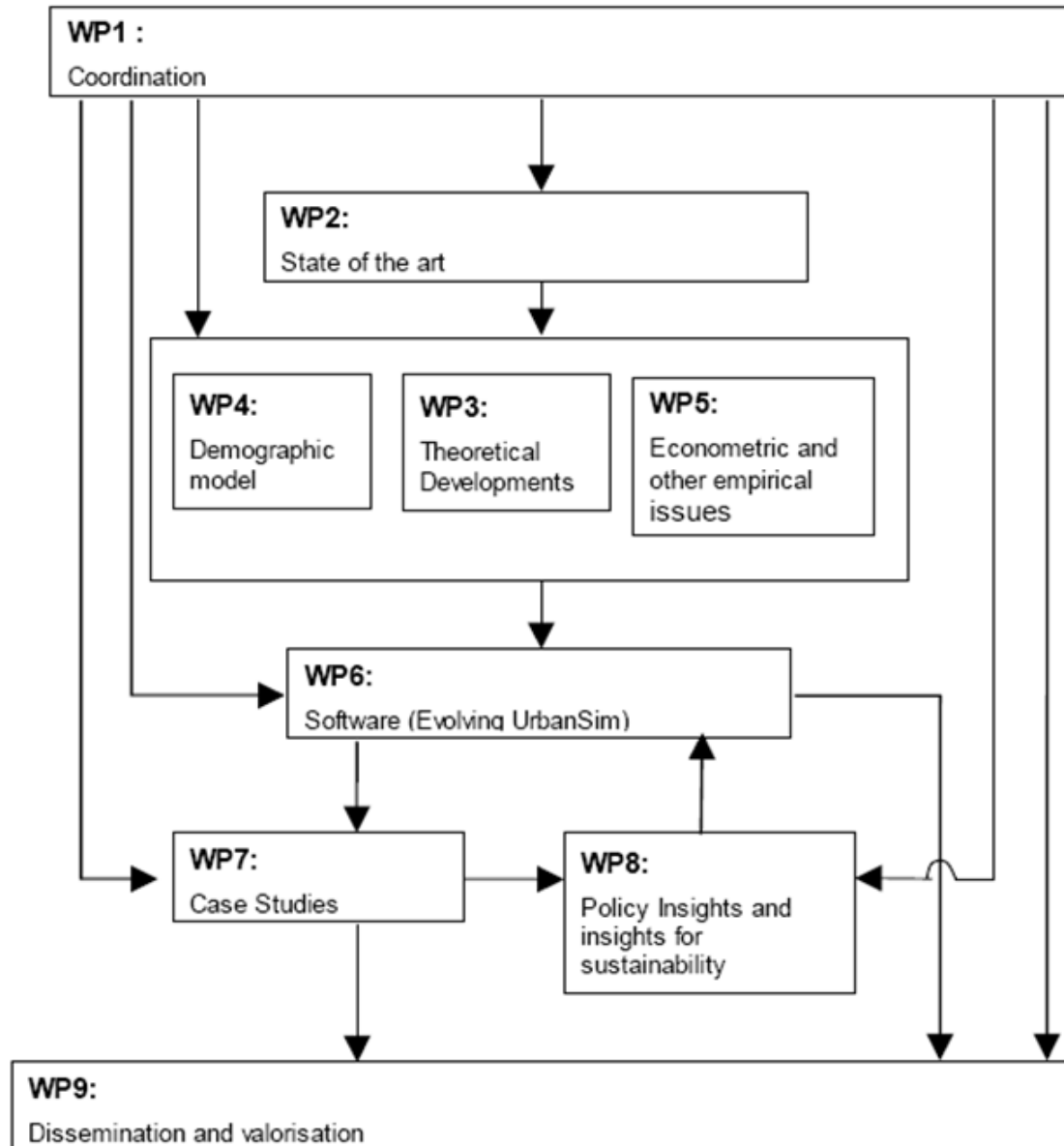
Ecole Polytechnique Fédérale de Lausanne, Switzerland (EPFL)

Bocconi University, Italy (BU)

Université de Cergy Pontoise, France (UCP)

University of California, Berkeley USA (UCB)

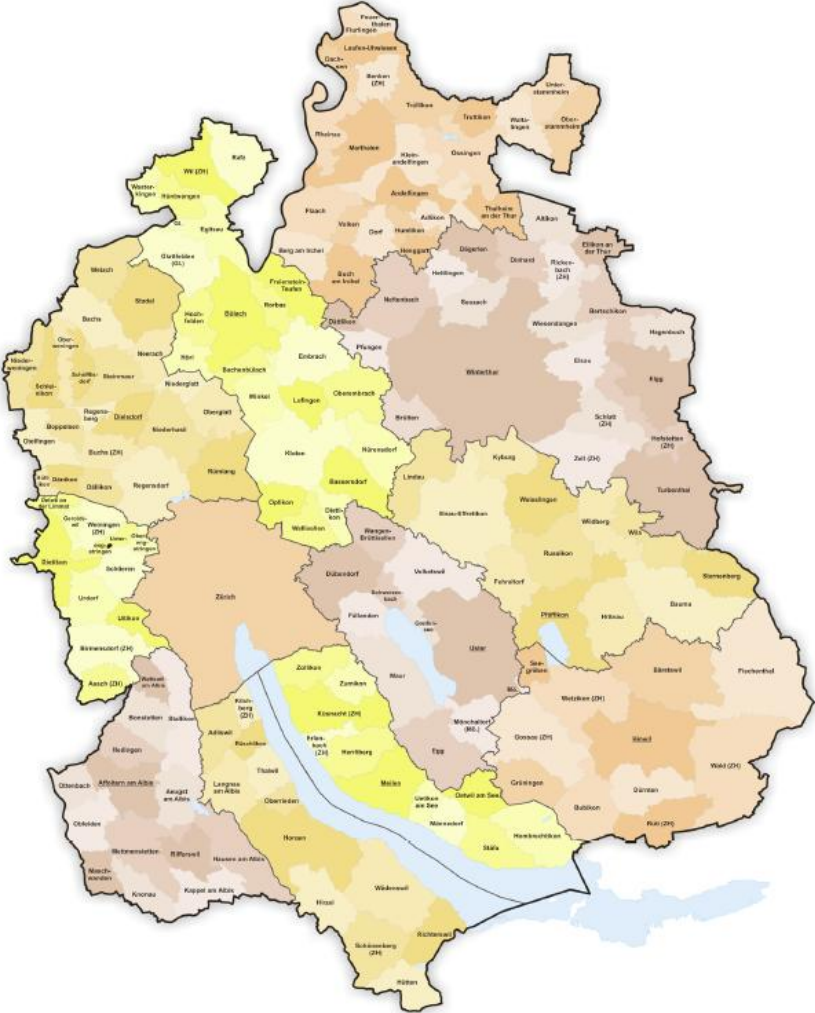
SustainCity: Work Packages



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Canton Zurich



(Source: wikipedia.org, 2011)

Zurich Case Study: Special aims

Simulation at parcel level

Tools for import/export from/to database

Synthetic population

Land developers

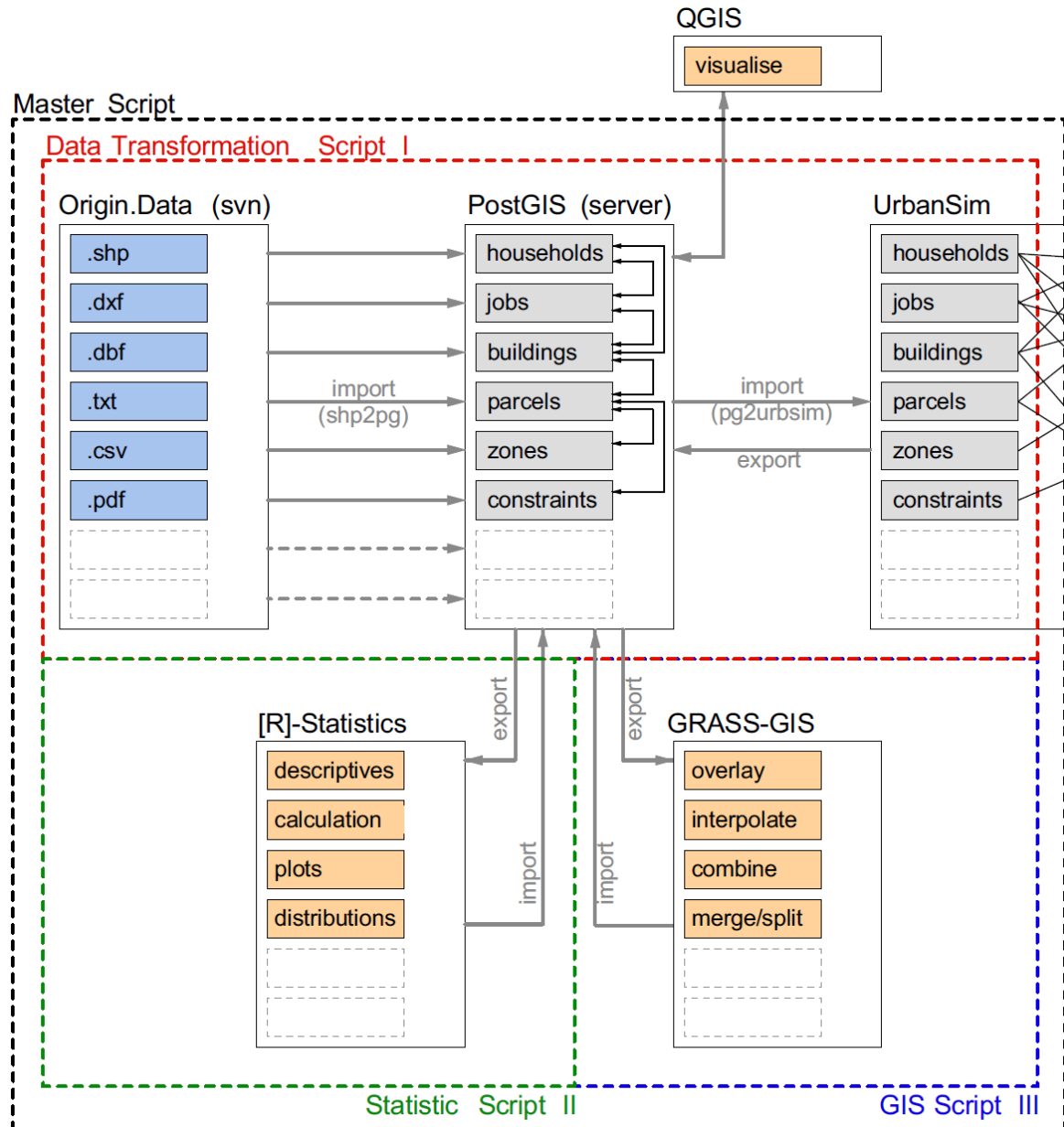
Urban Patterns

Modelling firmographic events

Data

Entity described	Number of objects	Data set	Spatial resolution	Date
Buildings	255801 (2010)	GWR-BFS	Addresses and coordinates [m]	2004-2010
	212497 (2010)	GWR-ARV	Coordinates [m]	2010
	286468 (2000)	GVZ	Addresses	2010
	534594 (2010)	Vector 25	Polygon in projected coordinate system	2010
Appartments	671169 (2010)	GWR-BFS	Building (via EGID)	2004-2010
	478378 (2010)	GWR-ARV	Building (via EGID)	2010
Entrances	261650 (2010)	GWR-BFS	Addresses and coordinates [m]	2004-2010
	237481 (2010)	GWR-ARV	Coordinates [m] (and addresses)	2010
New buildings	40849 (2000-2010)	GVZ	Addresses	2001-2010
Development projects	57734 (2010)	GWR-ARV	Building (via EPROID)	1967-2015
	60056 (1998-2012)	Documedia	Addresses	1998-2012
Parcels	367314 (2010)	Cadastral plans	Polygon in projected coordinate system	2005, 2007-2010
Soil coverage	837732 (2010)	Cadastral plans	Polygon in projected coordinate system	2005, 2007-2010
Households and persons	1267478 (2000)	Population census	Coordinates [100 m]	2000 (2010 expected)
	5837 (2005)	Mobility micro cen	Coordinates [100 m]	2000, 2005
Enterprises (locations)	75107 (2010)	Enterprise census	Coordinates [m]	2001, 2005, 2008

Data processing scheme



UrbanSim Models (over-over-simplified version)

Household Location Models

Household Transition Model

Household Location Choice Model

Employment Location Models

Employment Transition Model

Employment Location Choice Model

UrbanSim Models (over-simplified version)

Household Location Models

Household Transition Model

Household Relocation Model

Household Location Choice Model

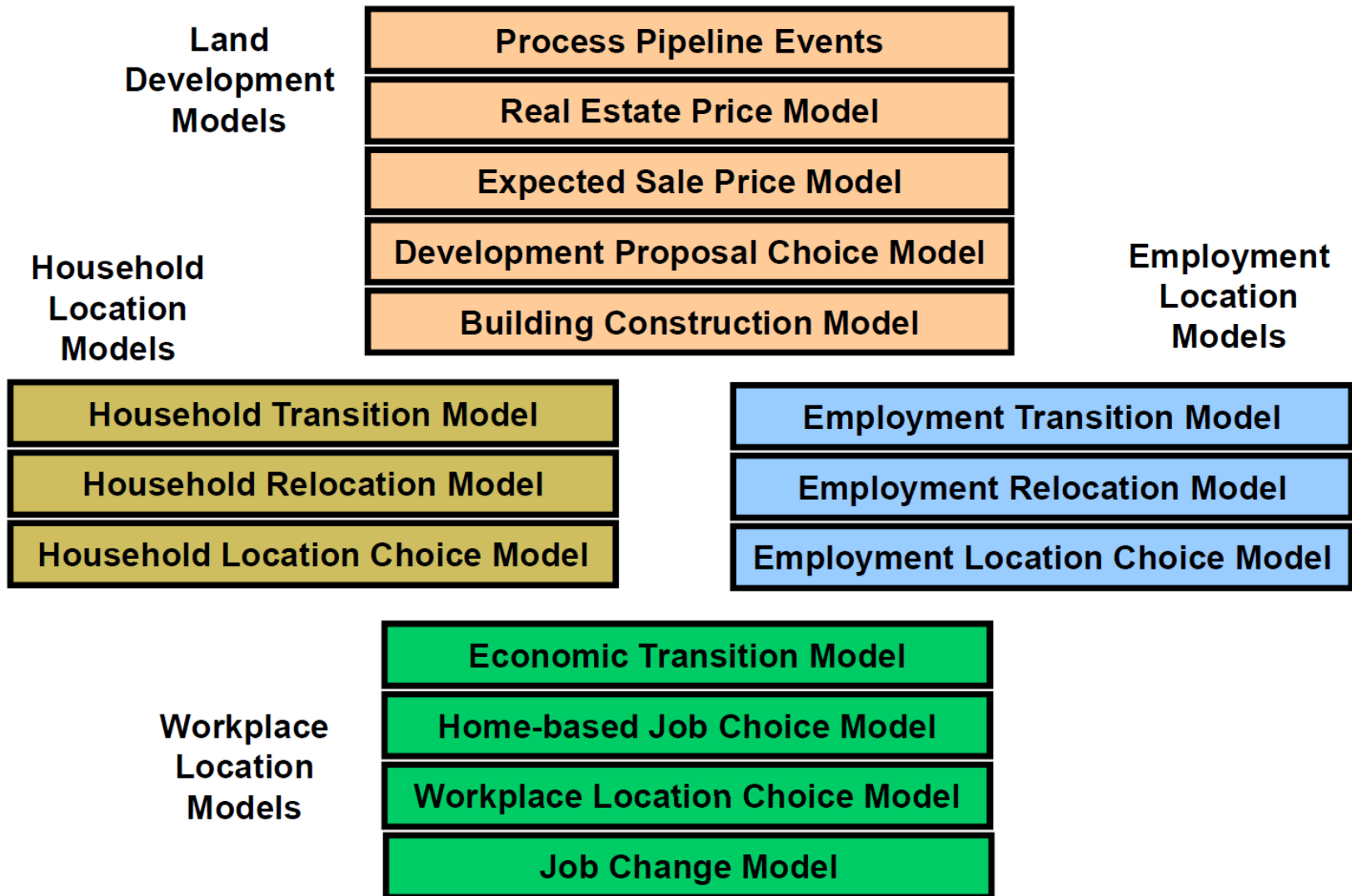
Employment Location Models

Employment Transition Model

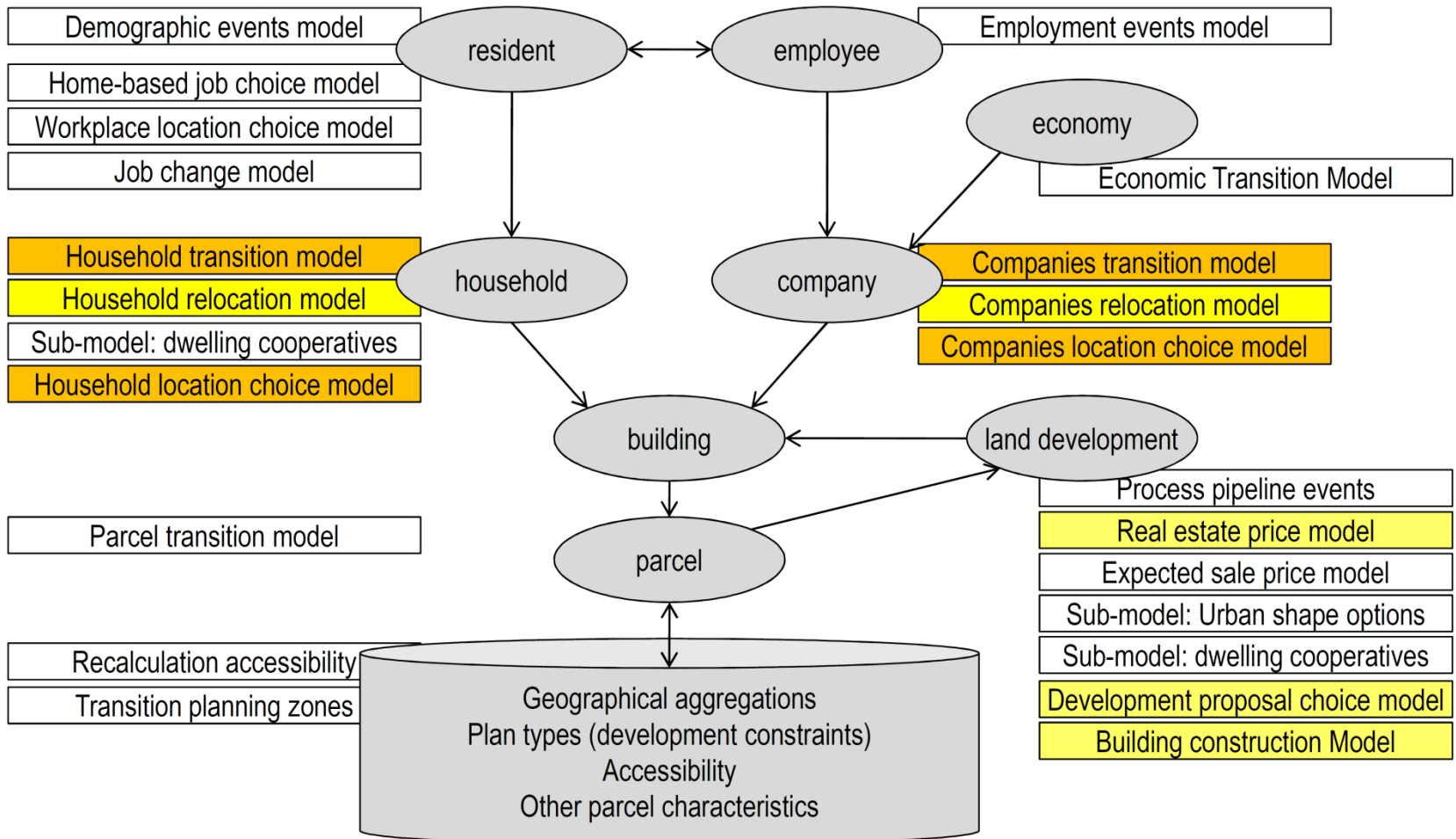
Employment Relocation Model

Employment Location Choice Model

UrbanSim Models (full parcel version)



Zurich Case Study: Model structure 2



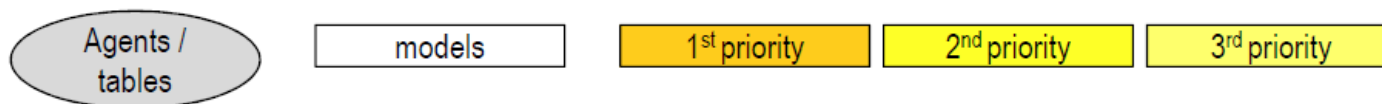
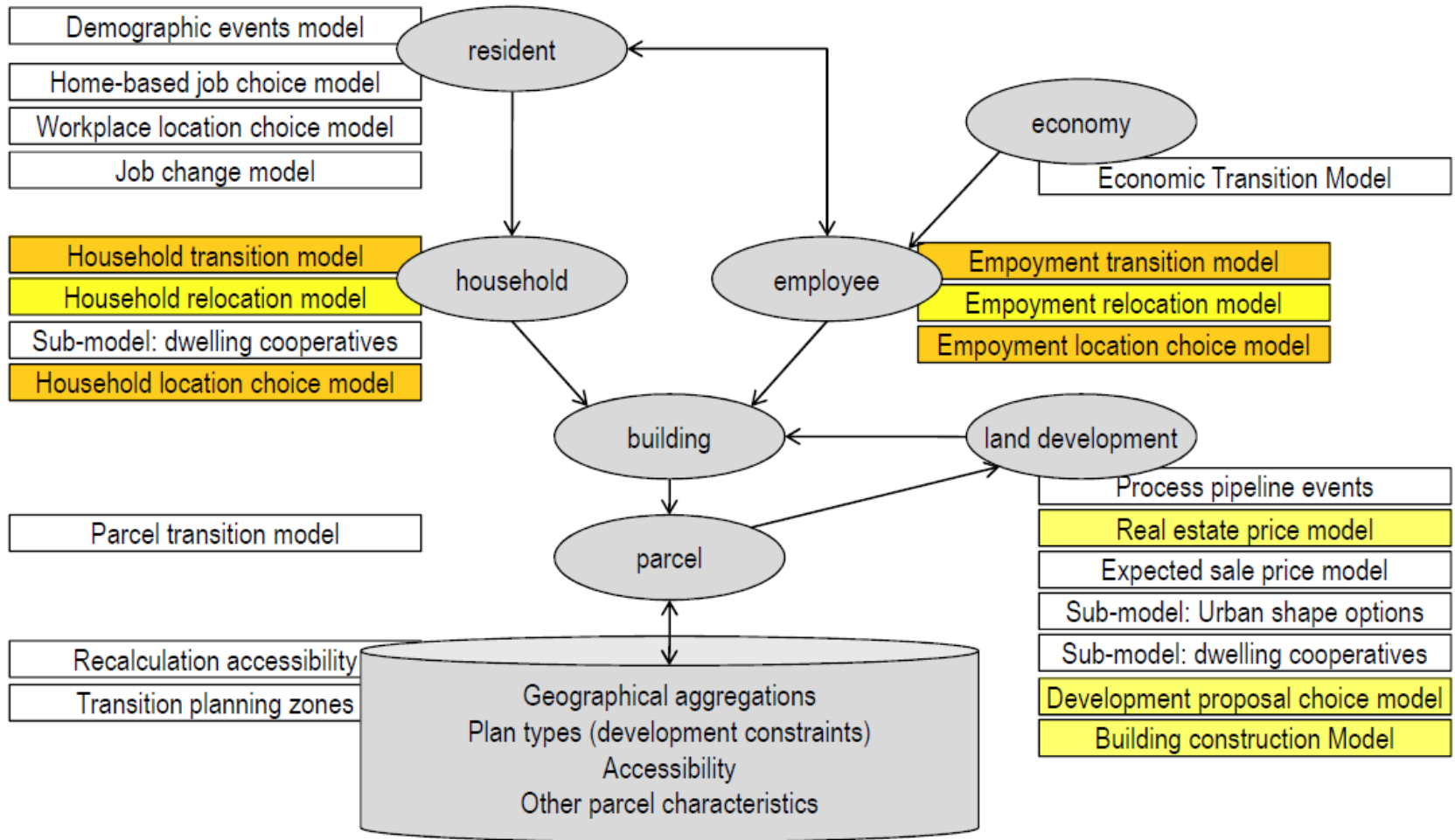
models

1st priority

2nd priority

3rd priority

Zurich Case Study: Model structure 1



Zurich Case Study: Status

- First run with dummy variables done
- First run with simplified model summer 2011

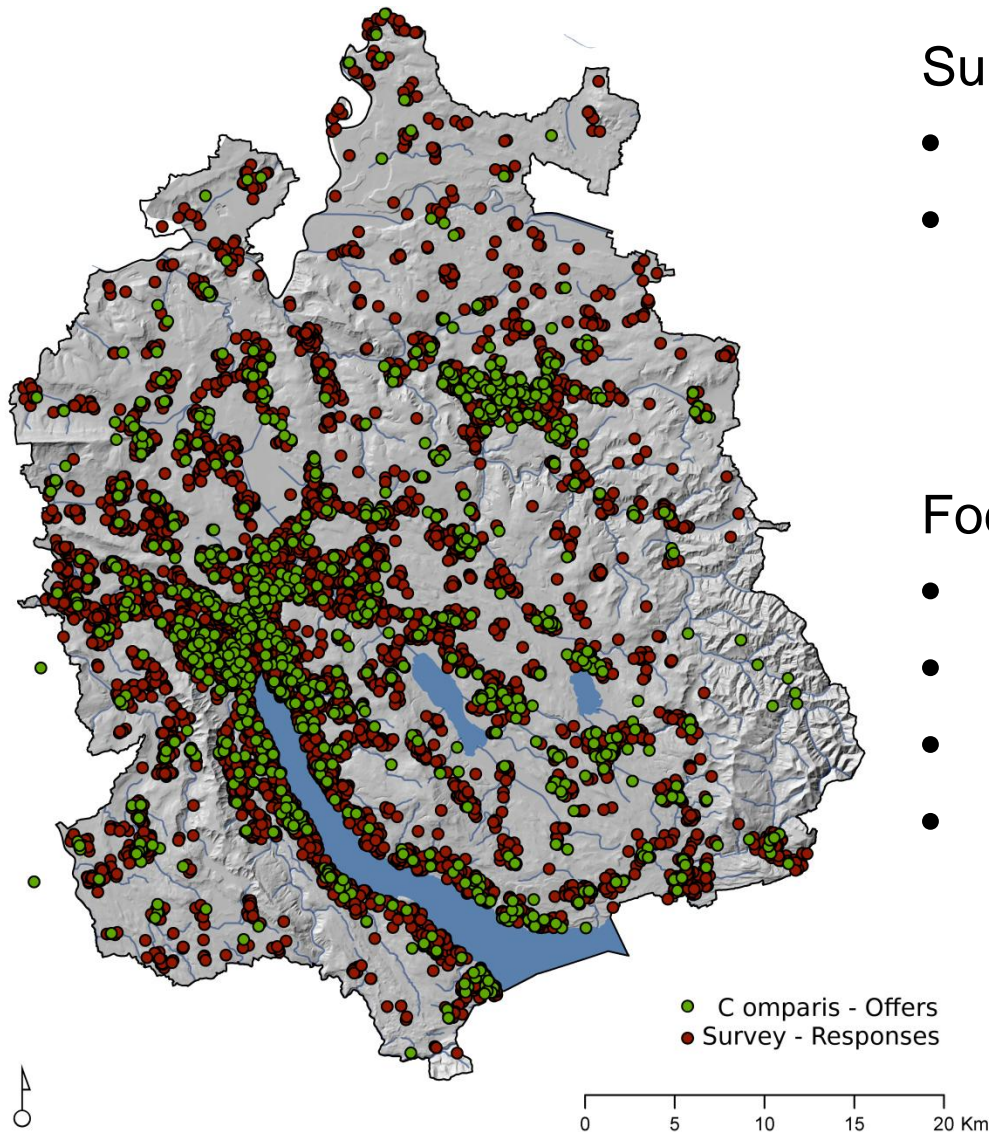
- First run with overall model December 2011
- Analyses with UrbansimE from March 2012

- End of project SustainCity December 2012

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HH location choice: Discrete choice model



Survey in the canton of Zurich

- 1030 responses
- 5500 alternatives from www.comparis.ch

Focus on

- household
- current/previous residence
- social network
- type of lifestyle



(Schirmer et al., 2011)

HH location choice: Estimated parameters

Parameter	β	t-test	p-value
ratio rent/income	-5.510	-11.070	
log(net-area per household-member)	0.982	8.010	0.00
distance to workplace [km]	-1.590	-2.760	0.01
Distance to social contacts	-8.160	-1.810	0.07
Exponent of distance to workplace	0.374	4.720	0.00
Exponent of distance to social contacts	0.223	2.660	0.01
portion of households of same size (r=1km)	0.016	1.770	0.08
traveltime (by car) to Bürkliplatz in min	0.020	4.380	0.00
log(accessibility of PT ⁶) * dummy „no car“	0.410	3.770	0.00
log(accessibility of PVT ⁷) * dummy „car available“	-0.298	-3.990	0.00
population density in r=1km [Personen/ha]	0.010	4.370	0.00
rent vacancy in municipality	-0.106	0.052	0.04
number of observations			683
ρ^2			0.2128

(Schirmer et al., 2011)

Firm location choice: Discrete choice model

Commercial Registers

Cantons of St.Gallen and Appenzell
1991-2006
21'000-32'000 companies per year

Business Register (BUR)

Swiss Federal Statistic Office FSO
2003-2006
29'000-31'000 companies per year

Alternatives

Swiss municipalities



COMMERCIAL REGISTER OF CANTON APPENZEL AUSSER RHODEN

Identification number	Legal status	Entr...
CH-300.3.012.284-7	Limited or Corporation	30.0



All datas

In	Ca	Business name
1	7	Realbau AG für Immobilien- und Projektmanagement
7		regioConcept AG

In	Ca	Share capital (CHF)	Paid in (CHF)	Shares
1		200'000.00	200'000.00	200 Namenaktien zu j

In	Ca	Purpose
1	7	Planung und Realisierung von Bauvorhaben aller Art, Verwaltung, K von Immobilien. Sie kann sich an anderen Unternehmungen beteilig schäfte abschliessen, die direkt oder indirekt mit ihrem Hauptzweck gen.
7		Zweck der Gesellschaft ist die Führung eines Dienstleistungsbetrieb und Verkehrsplanung, Architektur, Immobilienentwicklung und -verw mation sowie verwandte Tätigkeitsgebiete wie IT, Entwicklung, Bes beitung und Verkauf von Geodaten, kartografischen Produkten sow der Software. Die Gesellschaft kann Grundstücke erwerben, verwal sem, sich an andern Unternehmungen beteiligen und alle Geschäft die direkt oder indirekt mit ihrem Hauptzweck zusammenhängen.

In	Ca	Remarks
6		Mitteilungen erfolgen mit Brief, Telefax, E-Mail oder andern Übertra den Nachweis durch Text ermöglichen.
6		Gemäss Erklärung des Verwaltungsrates vom 23.06.2009 untersteh keiner ordentlichen Revision und verzichtet auf eine eingeschränkte
7		Die Übertragbarkeit der Namenaktien ist nach Massgabe der Statut

Firm location choice: Ranking of estimated parameters

all	Parameter	Manu- fact.	Whole- sale	Bus. service	Pers. service
1*	Alternative is a city	3*	2*	2*	1*
2*	Cantonal business development	2*	3*	3*	2*
3*	Tax burden for joint stock comp.	4*	4*	4*	4
4	Previous site is in a city	1*	1	1*	8
5*	Municipality with a rail connection	6*	5*	8*	3*
6*	Index of diversity in sectors	5*	9*	5*	11
7*	Population with graduate degree	8*	14*	5*	14
8*	highway connection	10*	6*	9*	6
9*	Tax burden for partnerships	7*	8*	7*	10
10*	Accessibility to employees	9*	10*	10*	5*
...
18	Land price for commerce	17	18	18	16

* Significant according to t-test

NL-Modell, observations: 10'700, LL(0): -51'400, LL(max) -31'200, Adj. Rho-square 0.392

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Conclusions

Modelling integrated land-use on micro-level

- provides **more options**
(e.g. modelling transitions of hh, firms, parcels)
- allows simulations not only of **effects**,
but also of **side effects** and **crowding-out effects**
- is **data-intensive** and **time-consuming**

Thank you for your attention



Questions Zurich Case Study

- how do we include the distance between the previous location and an alternative in the utility function (location choice for household or employees/firms)?
- how it is possible to introduce additional models in the UrbanSim structure (e.g. behaviour of developer or companies)?
- is there a strategy to deal with errors?

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