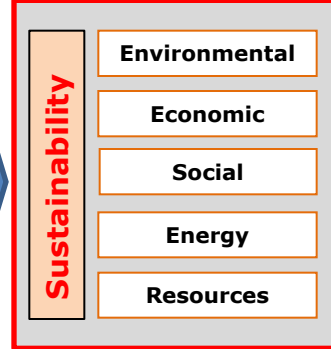
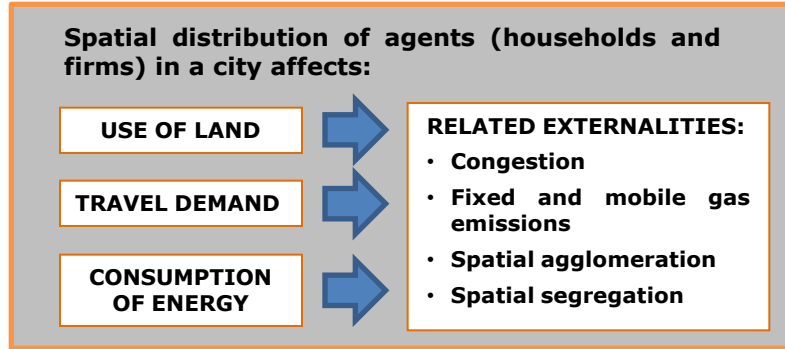


## Motivation

The spatial distribution of agents and activities in a city generates externalities that have an effect on sustainability. Land use models help to forecast the future state of cities. Location choice is one of the most important elements to model.



## The real estate market

Is where agents interact and compete for different locations. It's characterized by having inelastic demand (all agents need to locate somewhere) and quasi-unique supply (locations have unique spatial attributes). This generates conflicts that are solved through market prices that discriminate agents and locations

**Bid approach to location choice:** Locations ( $i$ ) are traded in auctions where agents ( $h$ ) bid their willingness to pay ( $B_{hi}$ )

$$B_{hi}^t = f(x_h, z_i^t) \quad x_h : \text{attributes of agents} \quad z_i^t : \text{attributes of locations}$$

Both spatial distributions ( $P_{h/i}$ ) and prices ( $r_i$ ) are defined by the outcome of the auction

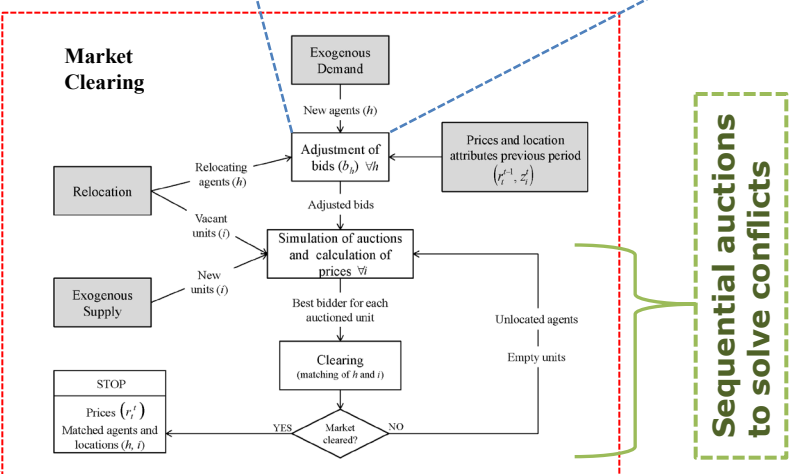
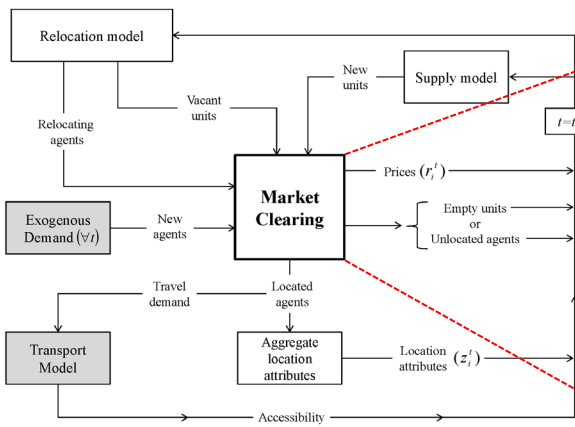
Best bid probability:  $P_{h/i}^t = \frac{\exp(\mu B_{hi}^t)}{\sum_{g \in H} \exp(\mu B_{gi}^t)}$       Market price:  $r_i^t = \frac{1}{\mu} \ln \left( \sum_{g \in H} \exp(\mu B_{gi}^t) \right)$  (expected maximum bid)



**Market clearing:** Agents are assumed to observe the market prices in previous periods and adjust their expectations. This is translated in an adjustment ( $b_h$ ) of their bid level, as a result of trying to ensure location.

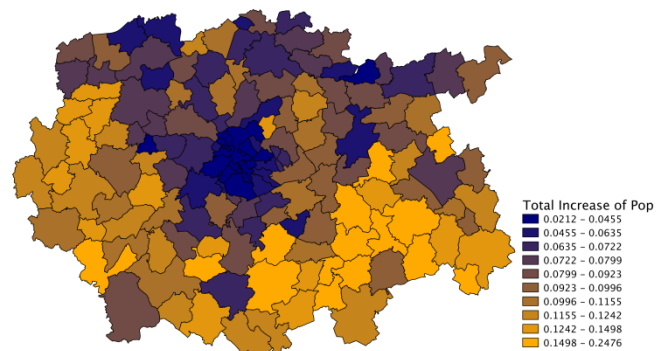
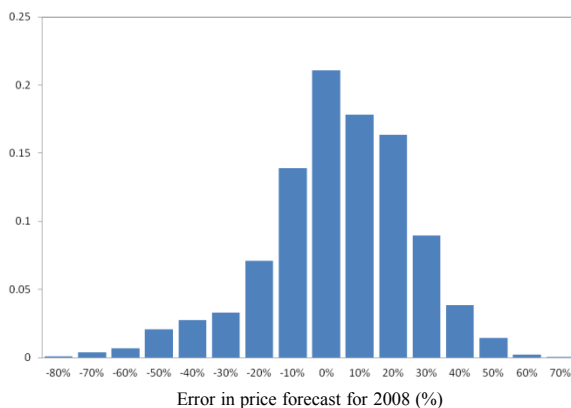
$$\sum_i P_{h/i}^t = 1 \quad \Rightarrow \quad b_h^t = -\ln \left( \sum_{i \in S} \exp(\mu (b_{hi}(z_i^t) - r_i^{t-1})) \right)$$

## New framework for comprehensive land use modeling:



## Results: validation for Brussels (2001-2008)

Real estate prices and location of agents is forecasted for the city of Brussels<sup>1</sup> in year 2008, starting from 2001. Results are compared with observed values. The model captures the dynamics of the real estate market, forecasting non uniform changes in prices and changes in the spatial distribution of socioeconomic attributes that are consistent with observations.



<sup>1</sup> In the context of the SustainCity project ([www.sustaincity.org](http://www.sustaincity.org))