Policy brief: New behavioural insights; Estimation results for selected case studies

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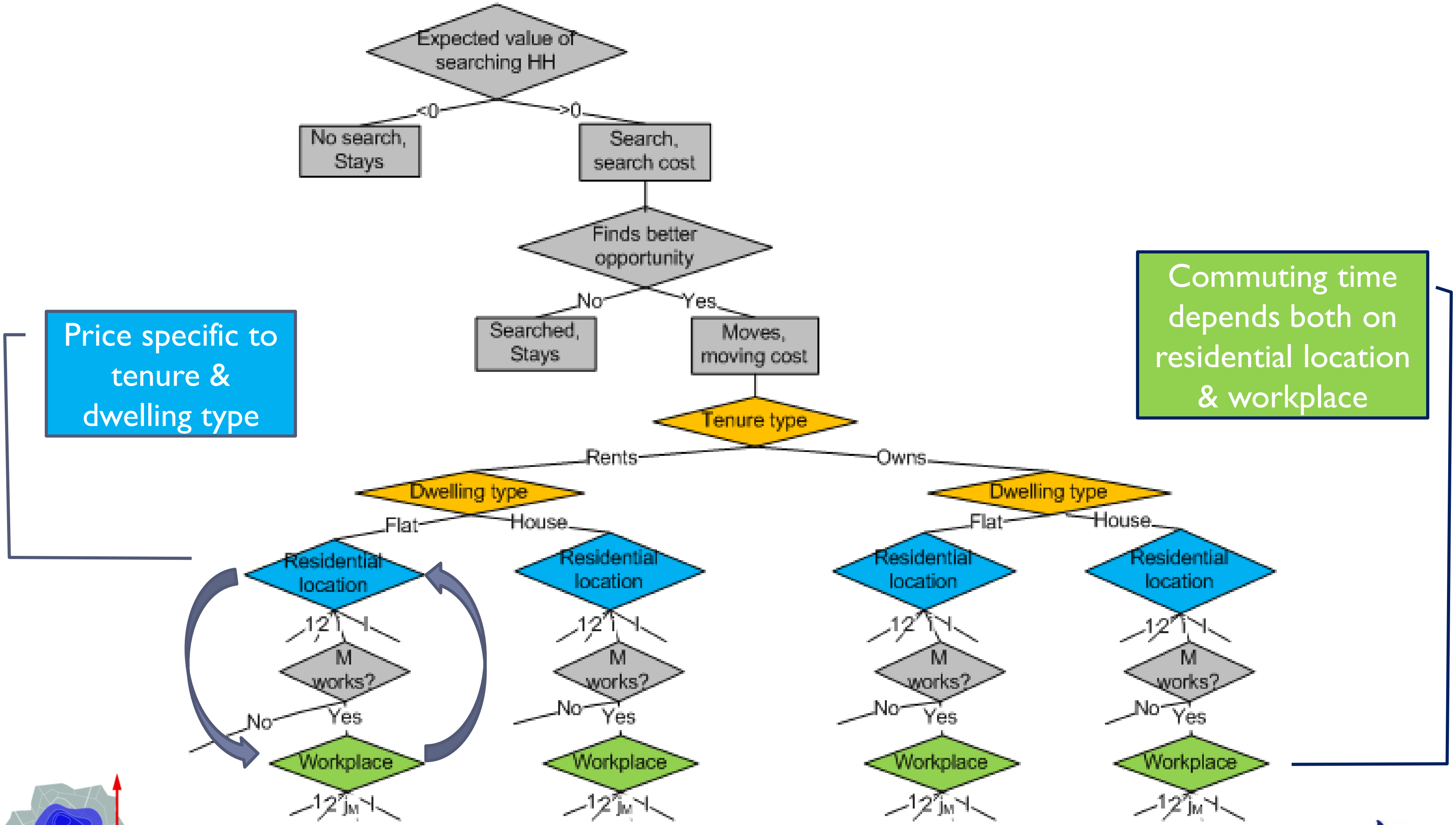
General methodology for analyzing behavioral insights, and Outline of the talk

- General overview of nested decisions
  - Forward looking (anticipates lower level choices), conditional on upper level choices
  - One decision maker (singles/one-worker HH/unitary model)
  - Collective decision: multiple decision makers within HH
- Development and estimation of models relevant given available data and economic considerations
  - No restriction on the possibility to implement them in UrbanSim
- Implementation of these models in UrbanSim
  - Evolving UrbanSim to meet requirements of models
  - Evolving models to meet simulation constraints
- Selection of specific models focusing on specific parts of the nested decisions in Paris case study
  1. Joint residential location-job location-job type
  2. Borrowing constraints and nested tenure status/dwelling type/HH location
  3. Collective decision-making within household (residential location)
- Conclusion, ongoing and future developments

Full decision tree, individual level, residential location before workplace



Model 1: Residential location, job location, job type & individual-specific accessibility

Ignacio Inoa, Nathalie Picard, André de Palma,
forthcoming in *Mathematical Population Studies*

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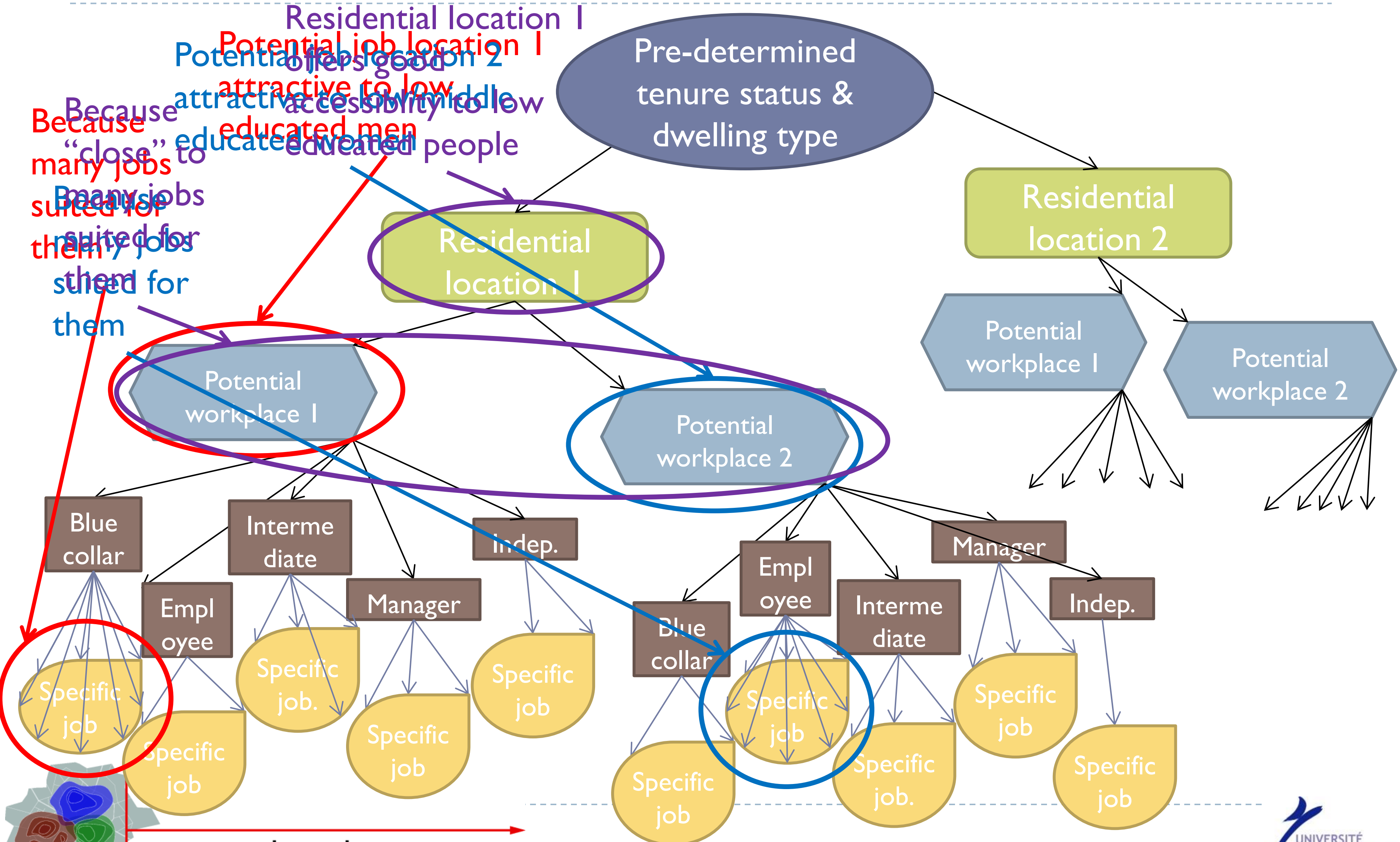
Decisions selected from the full tree



Model: Maximization of the utility

$$
\begin{aligned}
U_n(l,k,j,i) &= U_n^T(l,k) + U_n^W(j) + U_n^R(i) - C_n^{WR}(j,i) \\
&= V_n^T(k) + \varepsilon_n^0(l) + \varepsilon_n^1(k) + V_n^W(j) + \varepsilon_n^2(j) \\
&\quad + V_n^R(i) + \varepsilon_n^3(i) - C_n^{WR}(j,i) \\
&\qquad \forall \ (l,k,j,i) \in \mathcal{E}_n
\end{aligned}
$$

where:

- $U_n^T(l,k)$: utility specific to job l of type k
- $U_n^W(j)$: utility specific to (job) location j
- $U_n^R(i)$: utility of living in (residential) location i
- $C_n^{WR}(j,i)$: generalized commuting cost between residential location i and workplace j
- The choices of i and j are de facto related through the generalized commuting cost $C_n^{WR}(j,i)$ and cannot be assumed independent.

Moving up the decision tree

- Individual-specific attractiveness of workplace *i*

$$S_n(j) = \mu_n^1 \ln\left(\sum_{k'=1,\dots,K;N_{k'j}>0}^{K} \exp\left(\delta_n^1 + \delta_n^0 \ln\left(N_{k'j}\right)\right)\right)$$

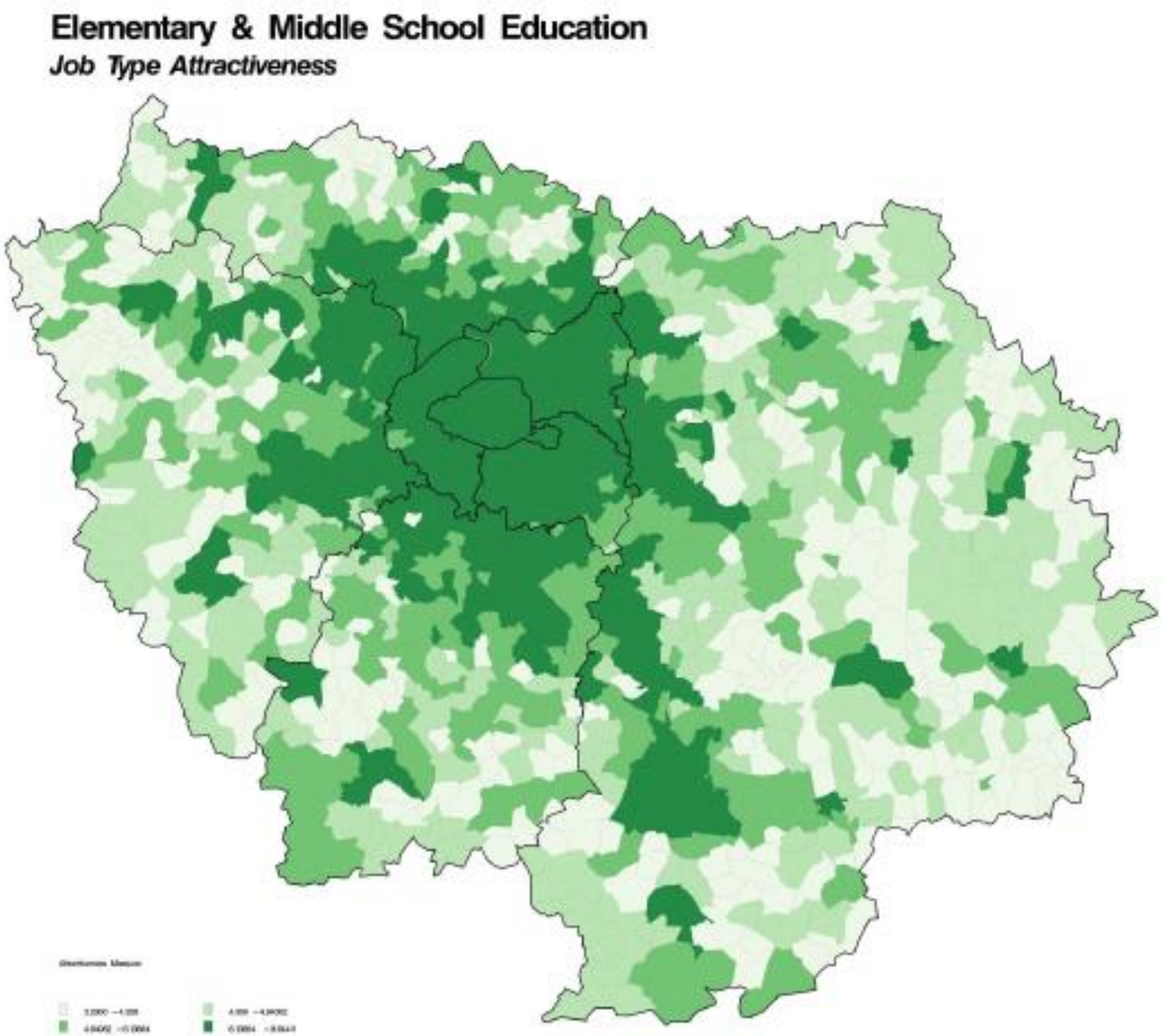
➔more efficient than the usual total #jobs N_j for explaining workplace choice, especially for higher education levels

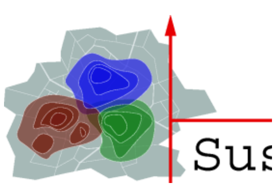
- Individual-specific accessibility to jobs from residential location *i*

$$LS_n(i) = \mu_n^2 \ln\left(\sum_{j'\in J_i} \exp\left(\frac{V_n^W(j';X_n,Z_{j'}) - C_n^{WR}(j',i) + S_n(j')}{\mu_n^2}\right)\right)$$

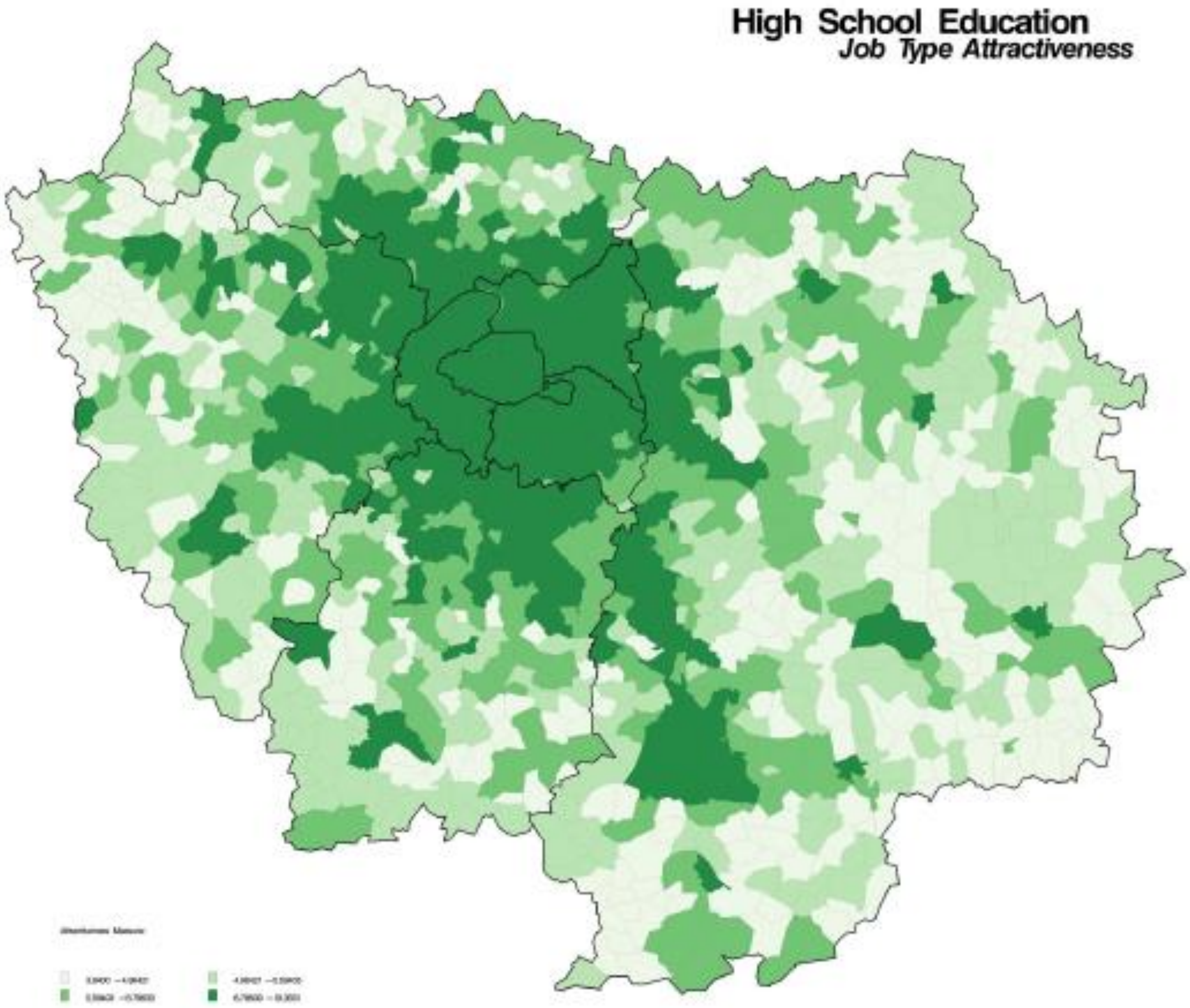
➔ more efficient than the usual accessibility measure for explaining residential location , especially for higher education levels

Attractiveness measure by education





Attractiveness measure by education



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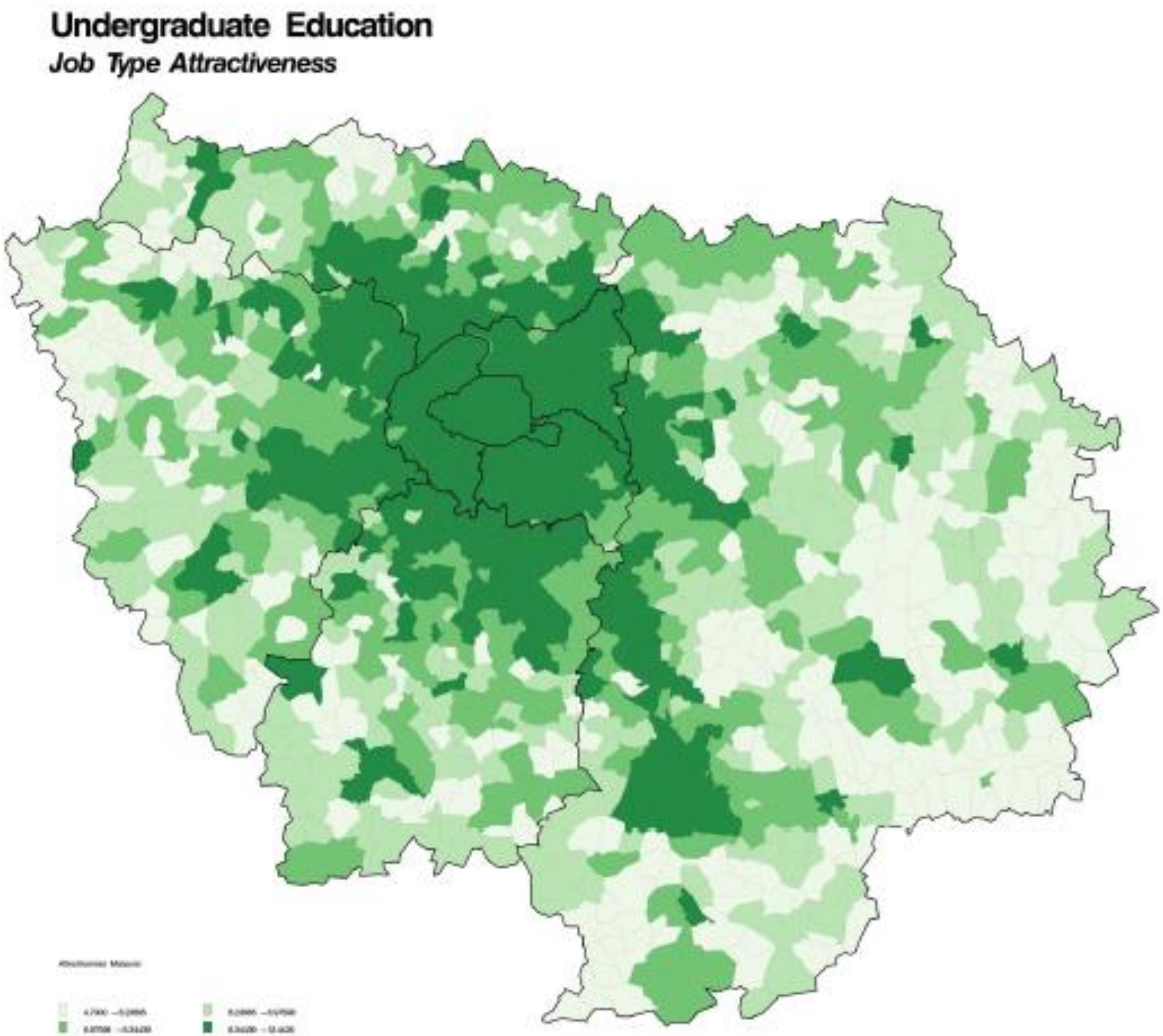
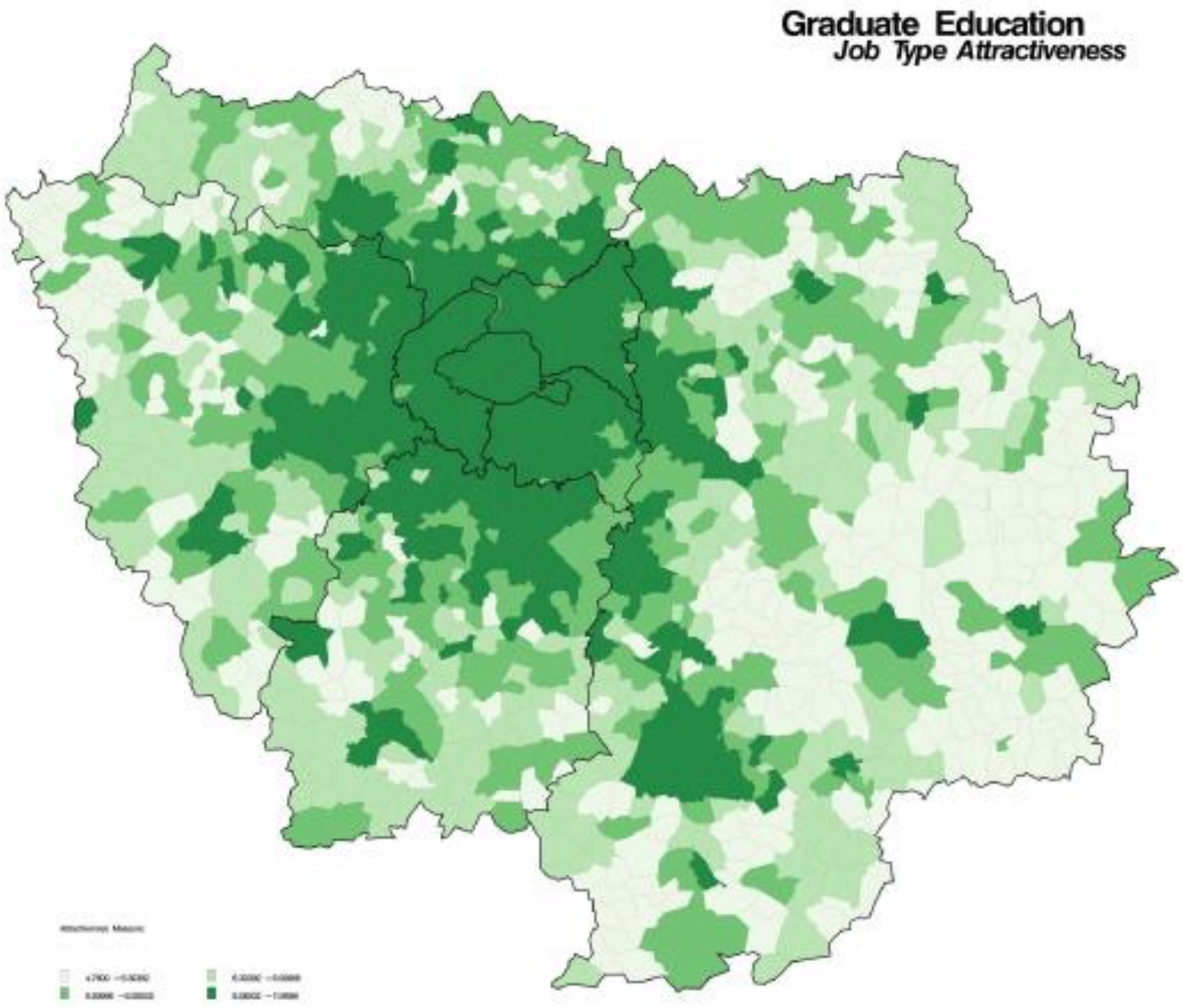
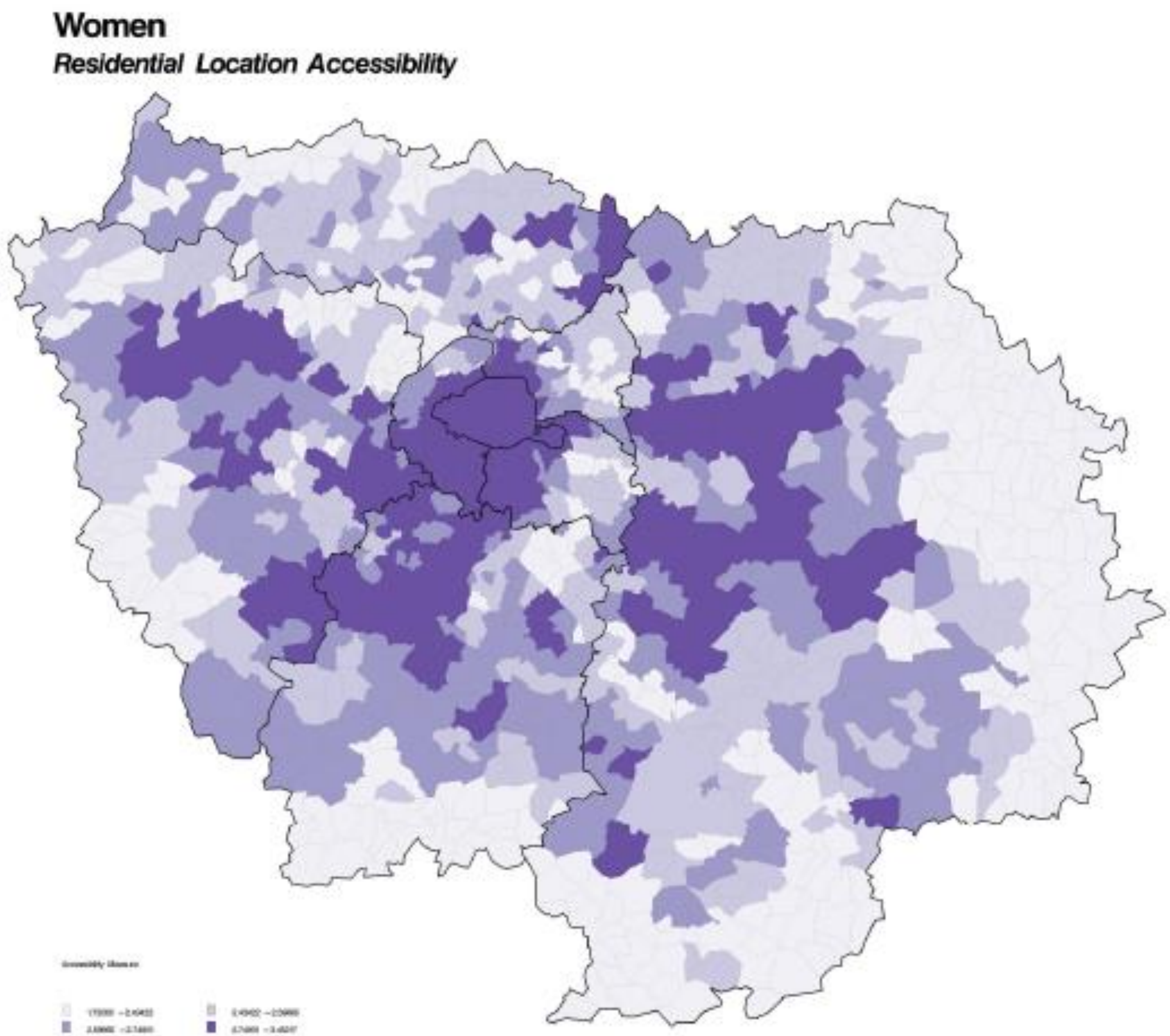
Attractiveness measure by education



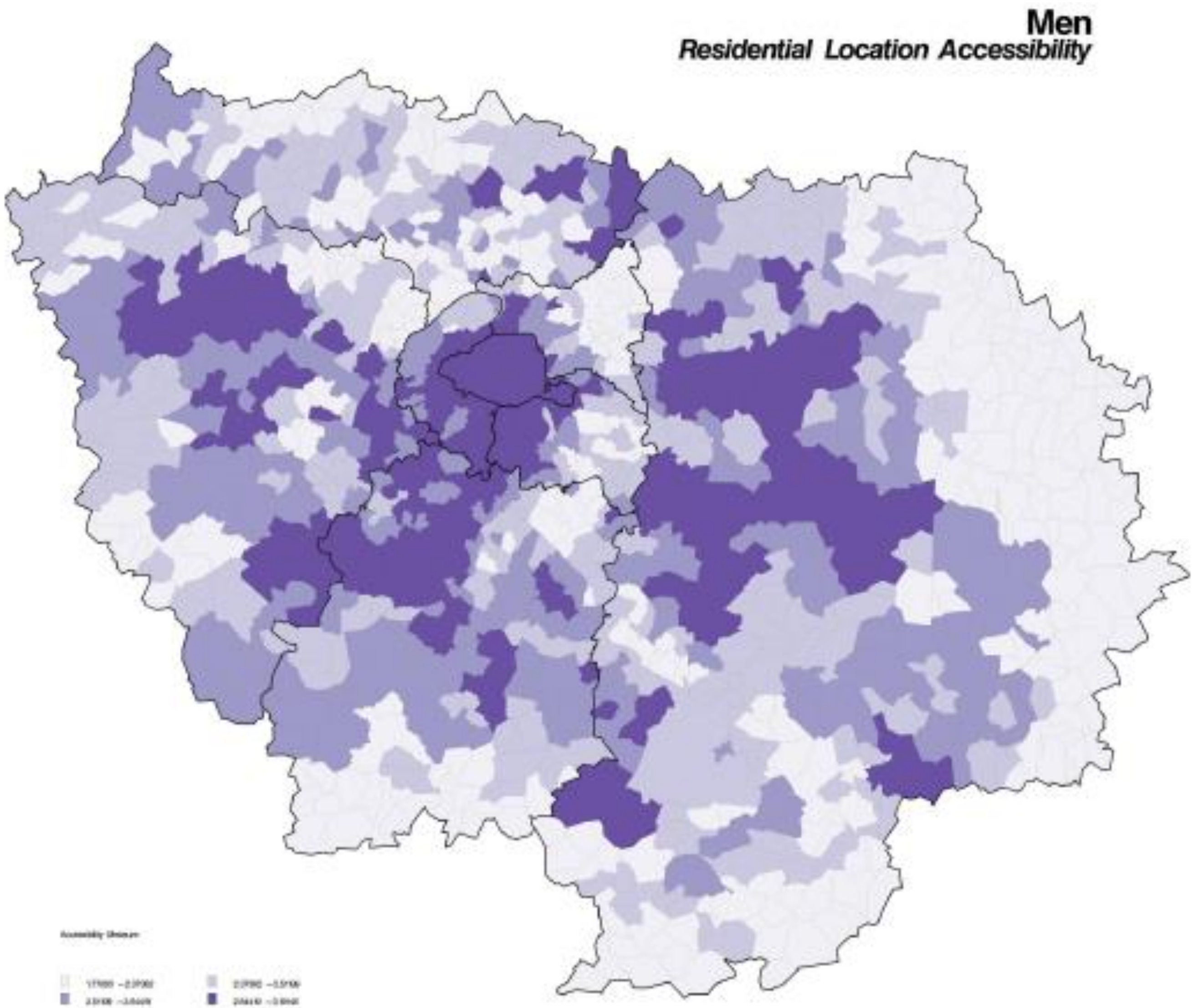
Attractiveness measure by education



Accessibility measure by gender



Accessibility measure by gender



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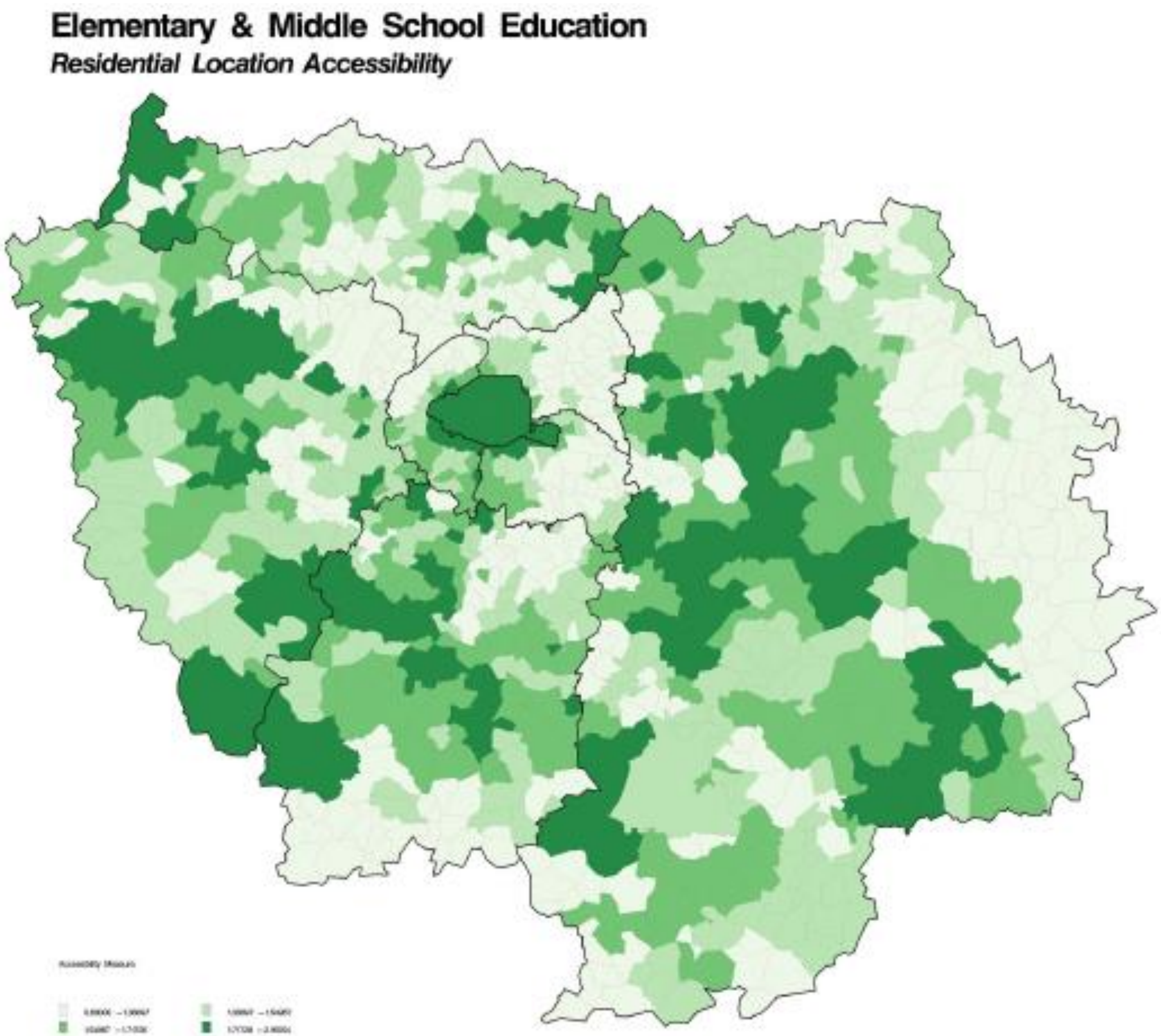
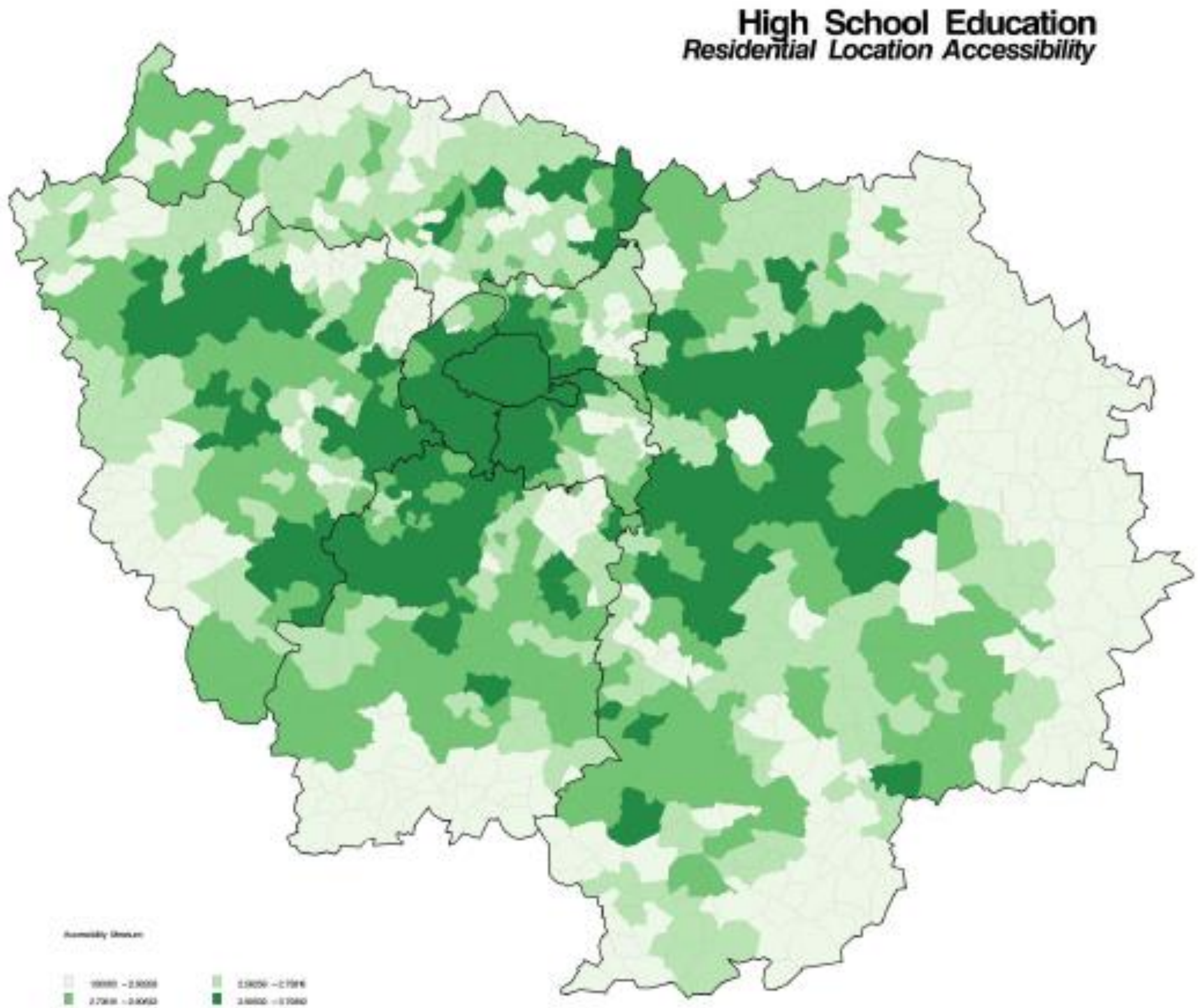
Accessibility measure by education



Accessibility measure by education



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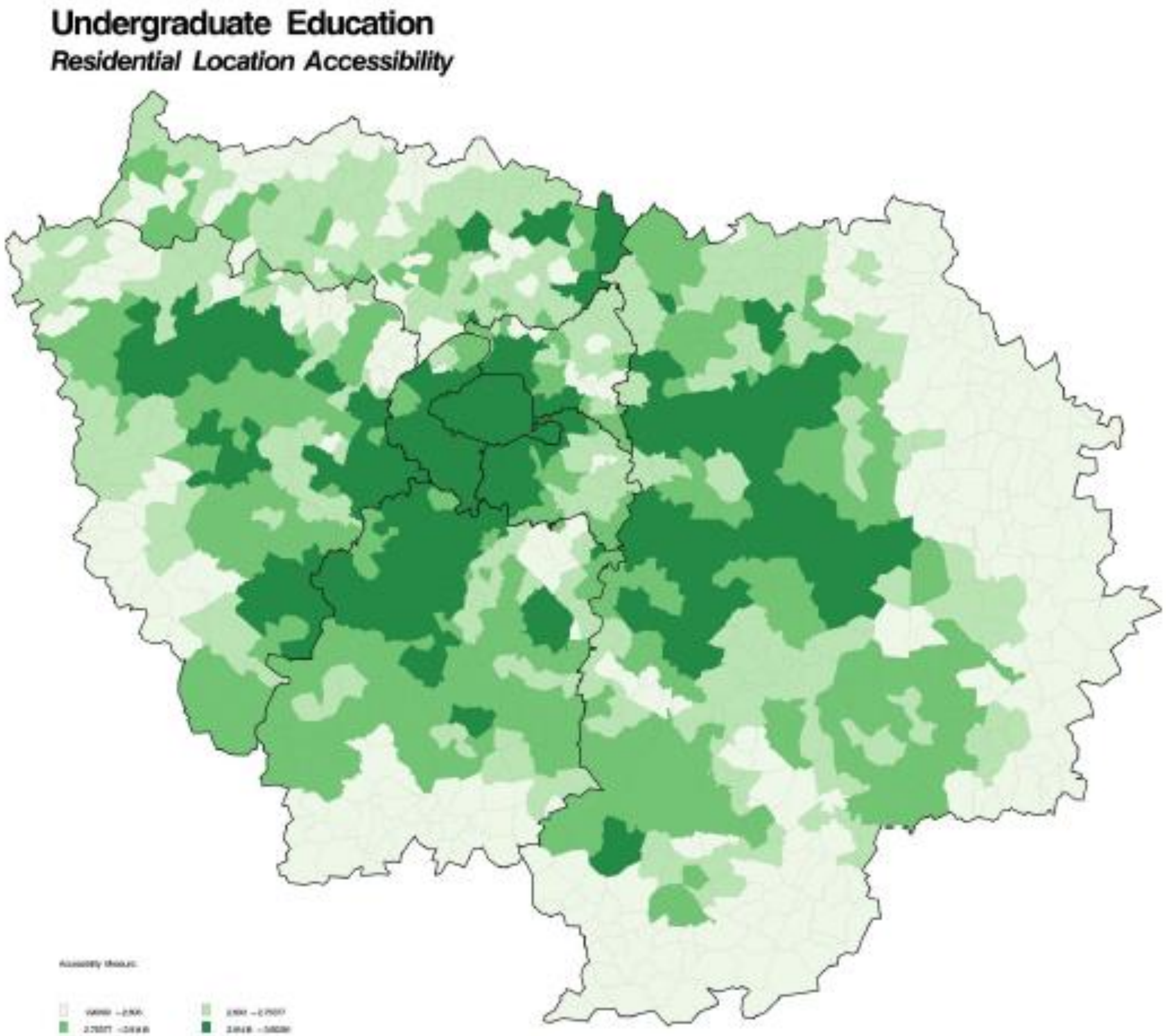
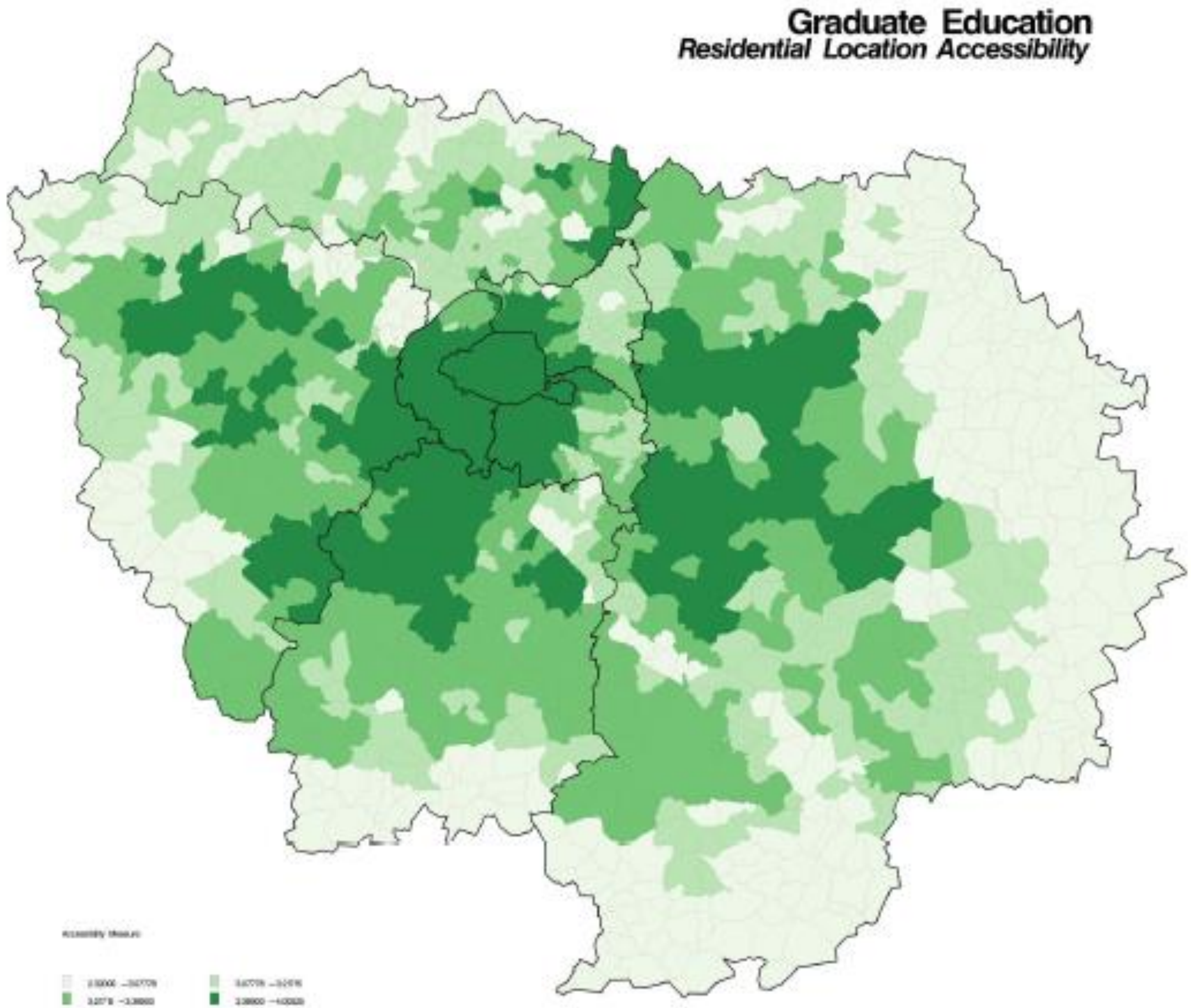


Accessibility measure by education



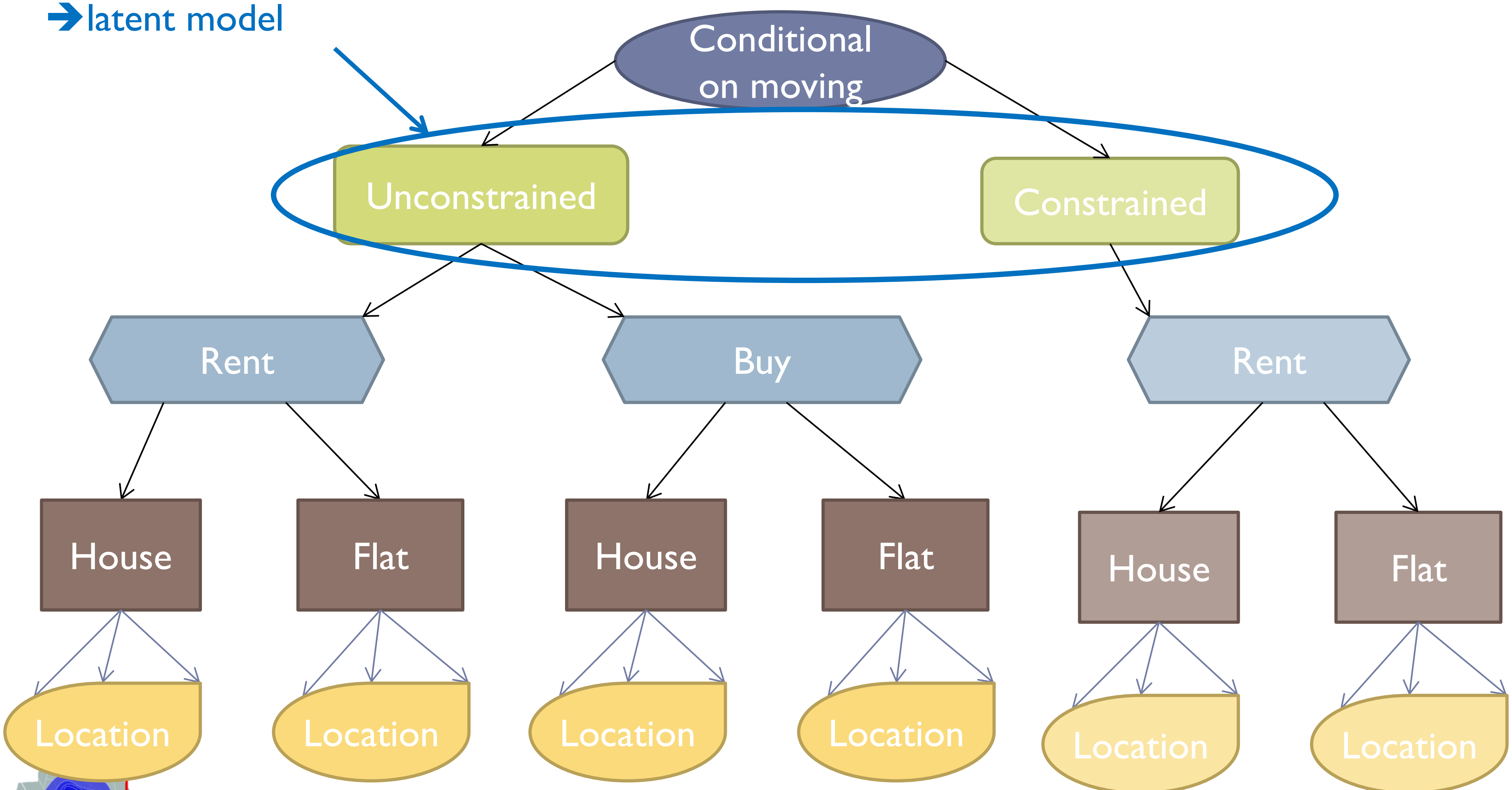
Model 2:
Tenure status, dwelling type, residential location & borrowing constraints

Sophie Dantan and Nathalie Picard,
Part of Sophie's PhD dissertation, to be defended in 2013

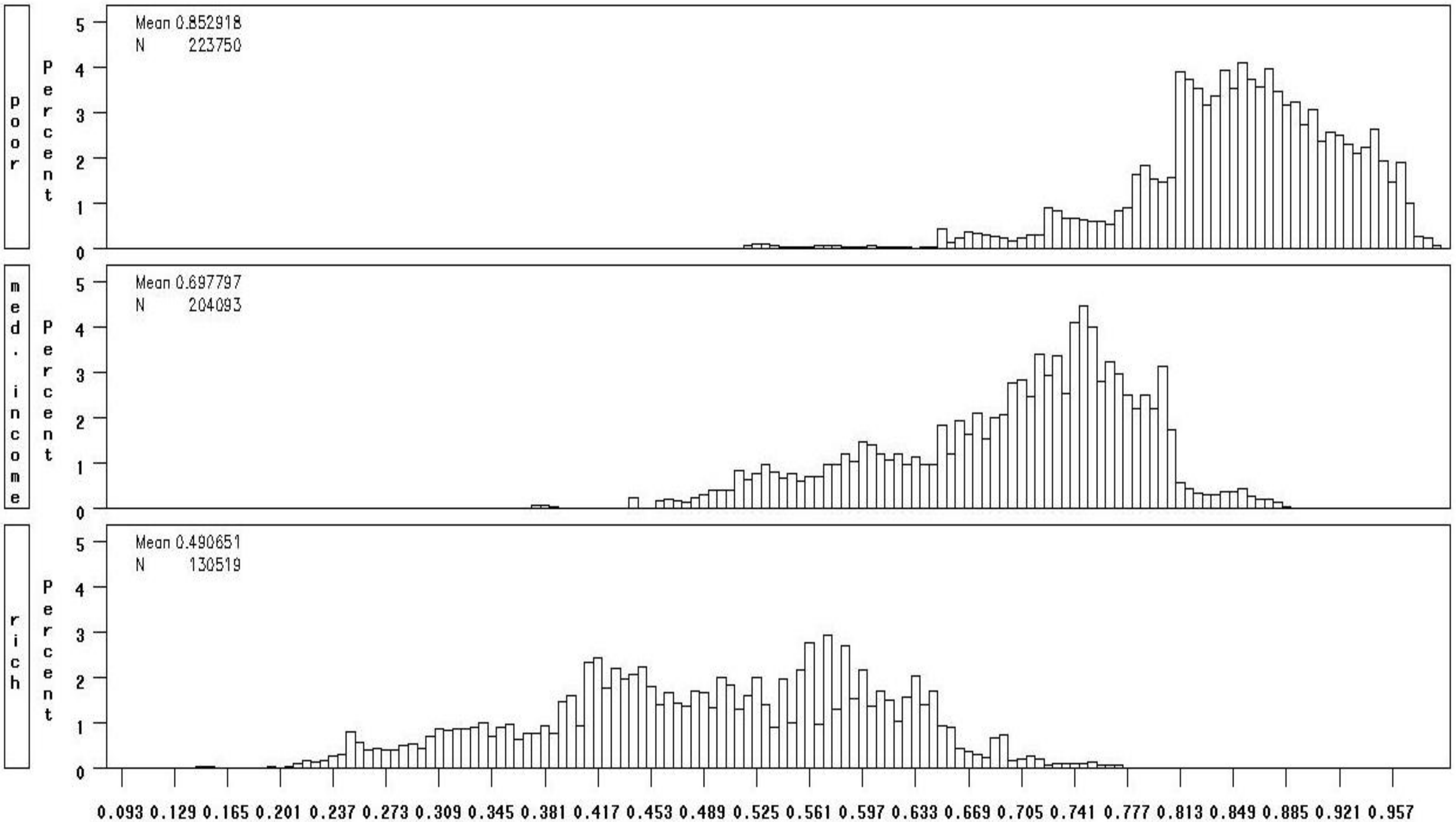
Decisions selected from the full tree

Not a decision; unobserved typology

➔latent model



Distribution of the probability to be constrained for Poor/Medium/Rich



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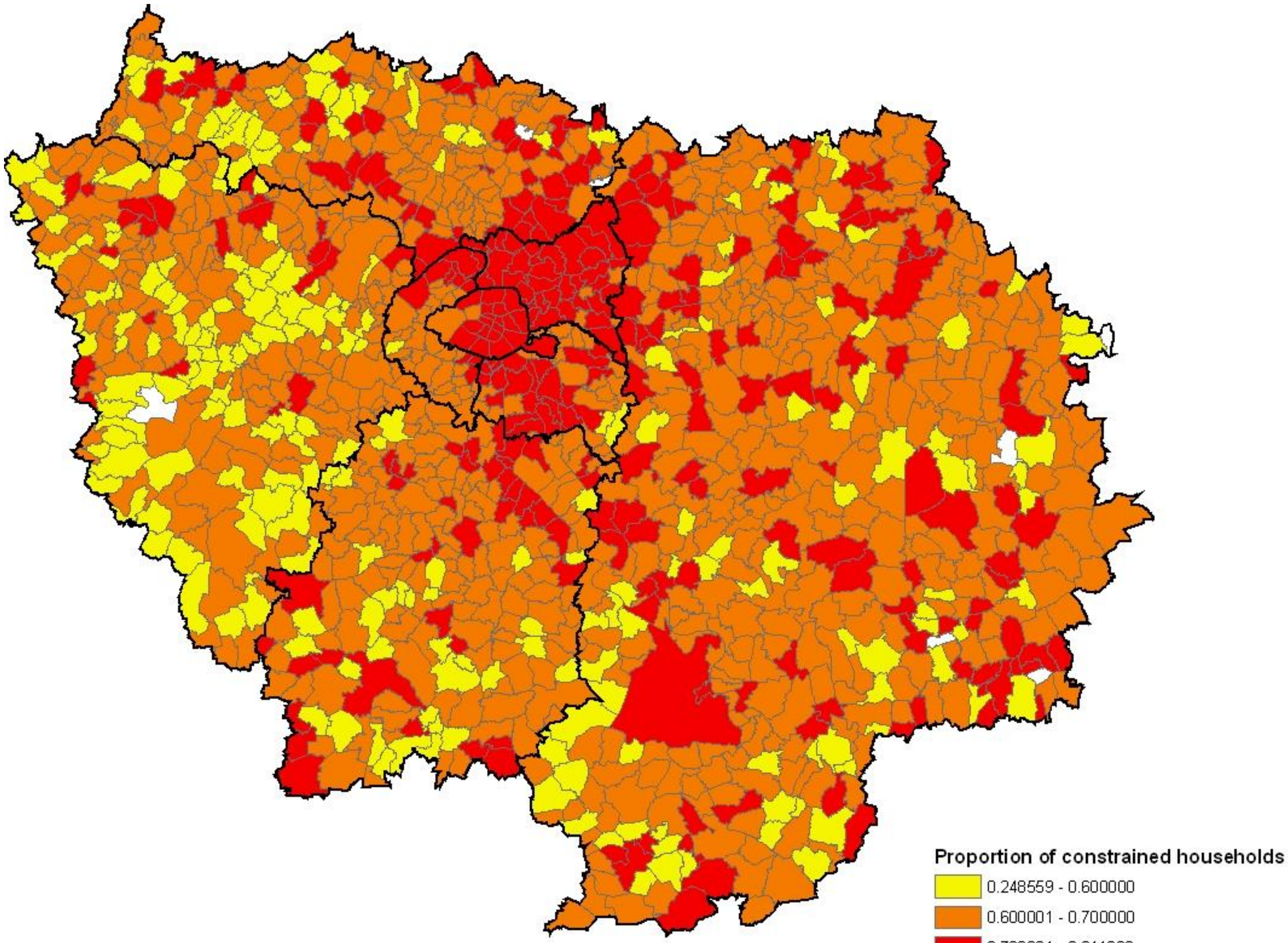
Proportion of constrained households, by commune



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Computing the effect of borrowing constraint on location choice

- Probability of tenure status $s=o,r$, dwelling type $d=h,f$ and location j, for HH n
- With constraint

$$P_n(o,d,j) = P_n(u)\cdot P_n(o|u)\cdot P_n(d|o)\cdot P_n(j|o,d)$$

$$P_n(r,d,j) = P_n(u)\cdot P_n(r|u)\cdot P_n(d|r)\cdot P_n(j|r,d)$$

$$+ P_n(c)\cdot \underbrace{\qquad\qquad}_{1} P_n(d|r)\cdot P_n(j|r,d)$$

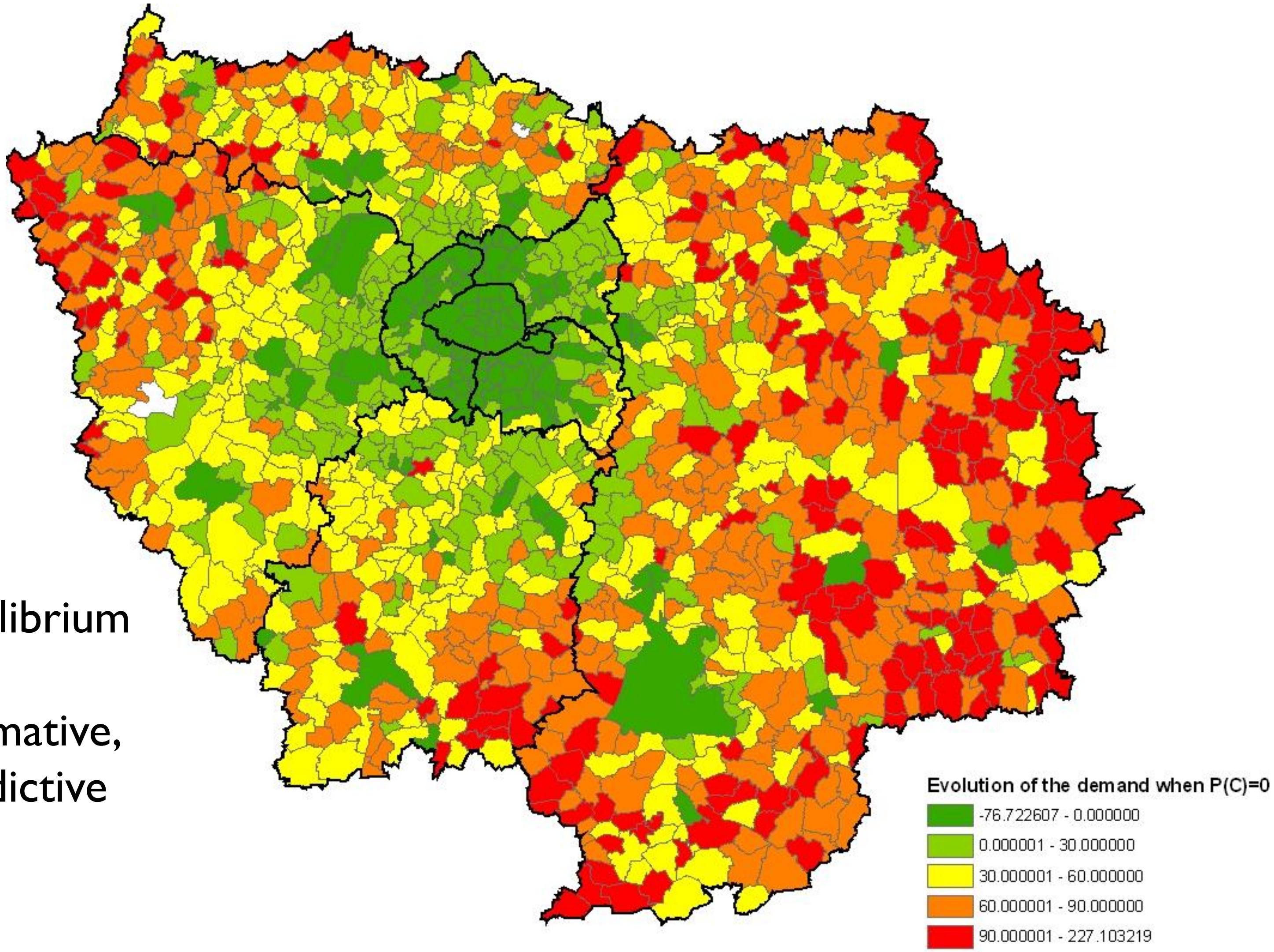
- Without constraint

$$P_n(s,d,j) = P_n(s)\cdot P_n(d|s)\cdot P_n(j|s,d)$$

$$P_n(h|o) > P_n(h|r) \text{ and } P_n(j|o,d) > P_n(j|o,d) \text{ in far away suburbs}$$

- ➔shift from flats to houses & from CBD to far away suburbs

Differential in demand if there were no borrowing constraints



No equilibrium effect
➔ Normative, not predictive

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Model 3:
Couple Residential location and spouses workplaces

Pierre-André Chiappori, André de Palma, Ignacio Inoa, Nathalie Picard

Motivation and objectives

- Understand and predict couples location choices
- Role of local amenities and spouses workplaces (commuting time, commuting cost)
- Pareto-optimality of residential location
- Respective weights of spouses in negotiation process
- Disentangle bargaining powers from values of time
- Measure the specific influence of each explanatory variable on bargaining powers and on values of time

Spouses' utility functions

- Dwelling characteristics and local amenities Z
- Dwelling price (per m²) P
- Cost of commuting time t^g: function of individual-specific value of time
- Daily consumption of private d^g and public good d^c
- Additively separable utilities:

$$U^g = \underbrace{V^g(P, Z)}_{\text{HH location= Long term decision}} - \underbrace{c^g(t^g)}_{\text{Commuting cost also depends on workplace, which is subject to random shocks}} + \underbrace{\phi^g(d^g, d^c)}_{\text{Daily consumption= Short term decision}}, g = m, f$$

HH location=
Long term decision

Commuting cost also
depends on workplace,
which is subject to
random shocks

Daily consumption=
Short term decision

No reliable intertemporal commitment One Pareto weight for each part: μ_1, μ_2, μ_3

A partially optimal household location would then maximize:

$$\underbrace{V(P,Z)}\ -(1-\mu)\,c^m(t^m)-\mu\,c^f\left(t^f\right)$$

μ_1, V^m, V^f cannot be disantangled
➔ $V(P,Z)$ alltogether

Pareto weight specific to each decision

Unobserved, easy to optimize daily
➔omitted

Household location choice: select location *j* which maximizes

$$V(P_j, Z_j) - (1\text{-}\mu)c^m(t_j^m) - \mu\, c^f(t_j^f)$$

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Econometric specification and minimum distance estimator

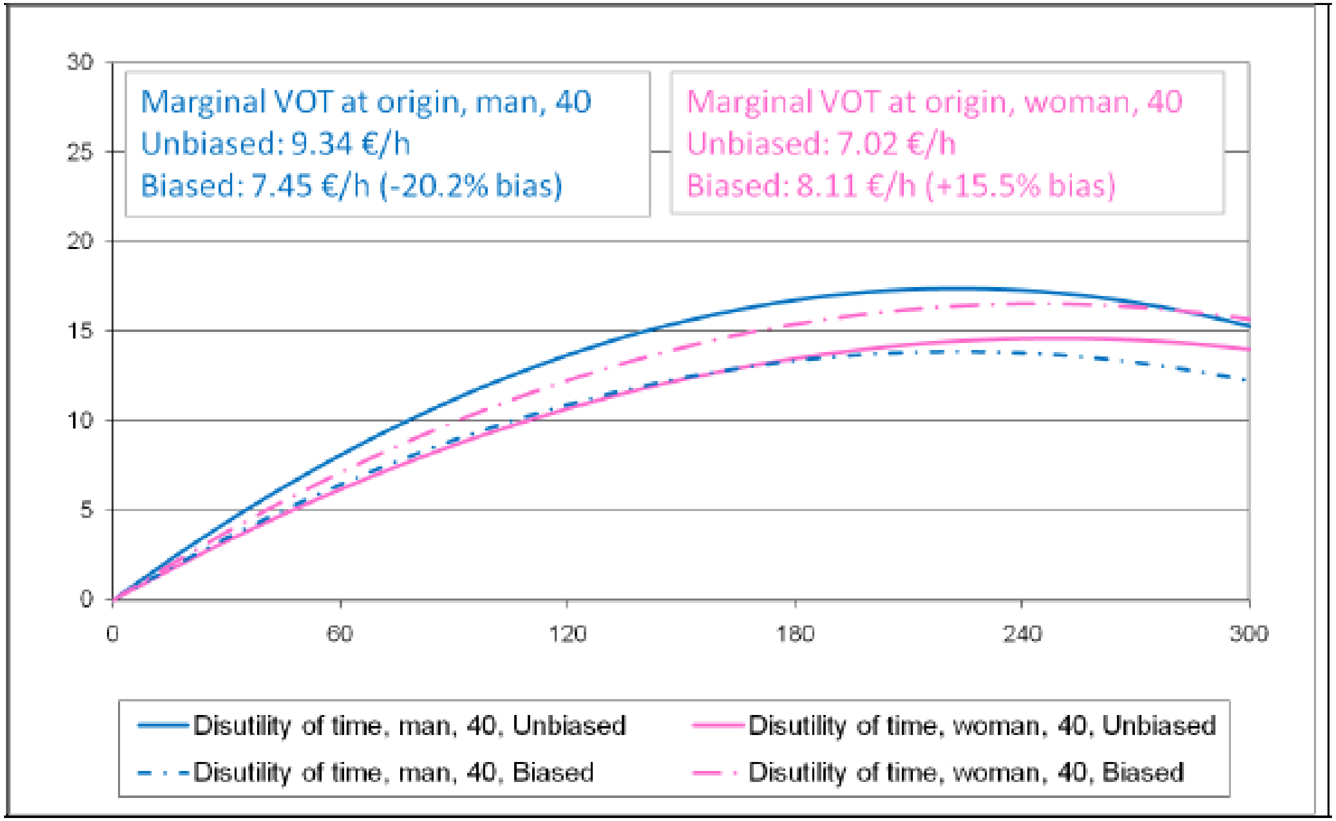
- Quadratic specification of commuting costs $c^g(t^g)$ with individual-specific time preferences
- Linear specification on Pareto weight

$$
\begin{aligned}
&\textstyle\sum_k v_k\left(y^c, X^c, X^m, X^f\right) Z_{k,j} - v_P\left(y^c\right) \ln P_j \\
&- \left[1/2 - \textstyle\sum_k \left(\mu_k^f X_k^f - \mu_k^m X_k^m\right) - \sum_l \mu_l^c X_l^c\right] \cdot \\
&\left[\left\{a_0^m + \textstyle\sum_k a_k^m X_k^m + \sum_l a_l^m X_l^c\right\} t^m + \left\{b_0^m + \sum_k b_k^m X_k^m + \sum_l b_l^m X_l^c\right\} (t^m)^2\right] \\
&- \left[1/2 + \textstyle\sum_k \left(-\mu_k^m X_k^m + \mu_k^f X_k^f\right) + \sum_l \mu_l^c X_l^c\right] \cdot \\
&\left[\left\{a_0^f + \textstyle\sum_k a_k^f X_k^f + \sum_l a_l^f X_l^c\right\} t^f + \left\{b_0^f + \sum_k b_k^f X_k^f + \sum_l b_l^f X_l^c\right\} \left(t^f\right)^2\right] + \varepsilon_j
\end{aligned}
$$

- Imposes restrictions on coefficients in MNL model
- ➔direct estimation is by far too cumbersome
- ➔minimum distance estimator
  - From reduced form parameters to structural parameters
  - Test Pareto-optimality of residential location
  - Correct the bias in estimated values of time

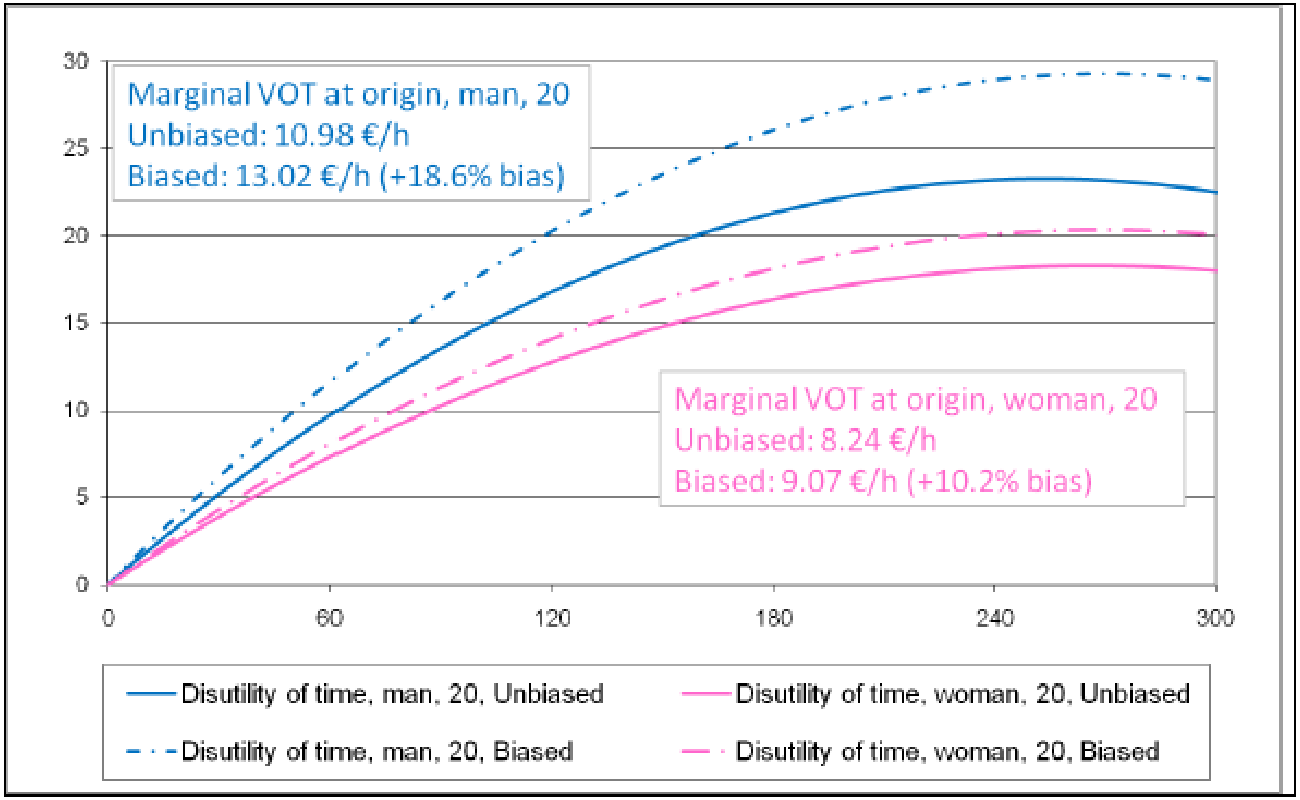
Correcting biases in VOT

Figure 1: Magnitude of bias in VOT (40 years old)



Correcting biases in VOT

Figure 2: Magnitude of bias in VOT (20 years old)



Future

Ongoing and future developements planned in Paris case study, incl. theoretical developments

- Integration of demographic module
  - Endogenous HH formation and evolution
- Dynamics of location choices
- Nested choices of tenure status, dwelling type, residential and job location
- Capacity constraints
- Borrowing constraints
- Explicit modelling of affordable housing
  - Strong capacity constraints
- Computation of indicators to measure
  - inequalities, social mixity and household welfare

Future developments in Paris case study

- Modeling interactions within households
  - Joint modeling of residential and professionnal location
  - Individual-specific travel time to actual job or accessibility to potential jobs
  - Collective decisions: diverging preferences and constraints for location, and bargaining power
- Match between labor supply and demand
  - Worker chooses workplace depending on actual home-job travel time
    - Improved OD matrix beyond 4-step model
  - Aggregate demand by establishment
    - Better models and predicts aggregation of jobs
    - agglomeration effects
  - Explicit modeling of stakeholders
- Interactions with or integration of a CGE model