Spurious effects of good intentions: Housing public policies, financial constraints and residential location choice in Paris region

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Outline

- Residential segregation in literature
- Joint model of residential & tenure choice
- Introduction of borrowing constraints
- Econometric modelling
- Data and results
- Simulation & policy implications
- Conclusion

Residential segregation

- Can be explained by a Tiebout-like (1956) mechanism which leads the richest households to concentrate in some parts of the City

  - induces an increase in housing price in these parts of the city, which excludes poor households

- Segregation is exacerbated if rich households value "social" positive externalities of living close to rich neighbors (Bénabou 1995)

Monocentric model

- Income has a larger positive effect on the valuation of accessibility to CBD than on demand for dwelling size (Alonso 1964, Mills 1967, Muth 1969, Wheaton 1977)

- Brueckner-Thisse-Zenou 1999:
  - If CBD offers more amenities than suburbs, like in Paris, rich HH tend to concentrate in the CBD and poor households in the suburbs
  - If the amenities are rather concentrated in the suburbs, like in Detroit, rich HH tend to concentrate in the suburbs and poor households in the CBD

- Missing elements in this model:
  - Jointness of tenure choice and residential location decisions
  - Borrowing constraints

Structural model

- Household Utility depends on:
  - Consumption *C* of a composite good
  - Housing surface *H*
  - Local amenities *z*, sum-up in a 1-dimension function $\psi(z)$
  - Tenure status *S* = Rent or Own

$$U\left(C,H;z;S\right) = \beta^S \cdot \psi\left(z\right) + (1-\beta^S).\left[\gamma^S.\ln C + \left(1-\gamma^S\right).\ln H\right]$$

  - Commuting cost *t(d)* depends on distance *d* to CBD
 - Dwelling price $\pi^S(d,z)$ depends on distance *d* and on amenities *z*
  - (Intertemporal) Budget constraint: $C + \pi^S(d,z) \cdot H + t(d) \leq y_i$
  - Income y_i ; maximum borrowable amount A_i^{own}
- Borrowing constraint $\pi^{own}(d,z).H \leq A_i^{own}$
- Often, no borrowing constraint for renting: $A_i^{rent} = +\infty$

Joint choice of tenure, type and location without borrowing constraints

all households

1st step: Tenure status

buy

rent

2nd step: Dwelling type

house

flat

house

flat

3rd step: Location

commune 1

commune 2

...

commune 1

commune 2

...

commune 1

commune 2

...

commune 1

commune 2

...
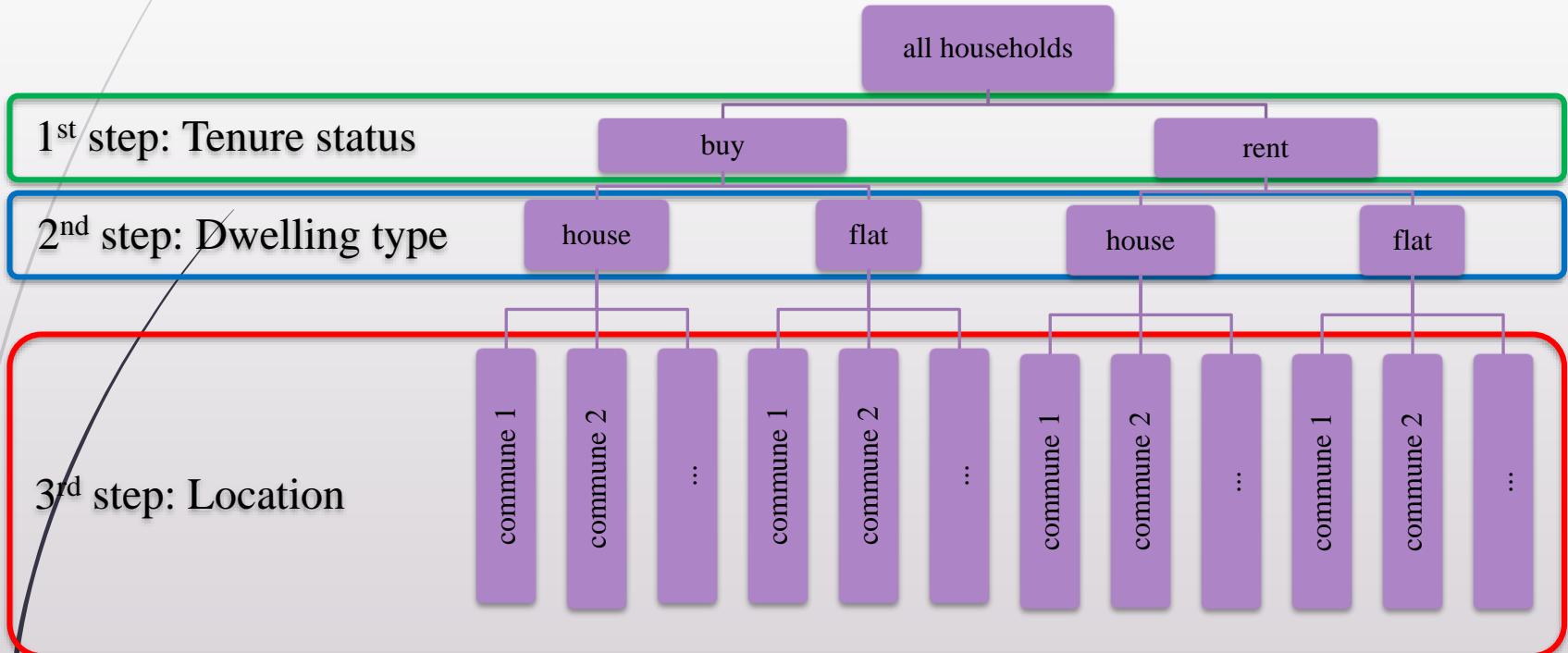
Backward induction

- **3rd step**: choose optimal values of *C* and *H* to maximize utility *U*(.), given *d*, *z*, *S*, and y_i conditional on budget constraint and Borrowing constraint

$$\underset{C,H}{Max}\, U\left(C,H;z;S\right) \;\; s.t. \;\; C + \pi^S(d,z)\cdot H + t(d) \leq y_i\,; \pi^S(d,z).H \leq A_i^S$$

$$\rightarrow C^*\left(d,z,S,y_i,A_i^S\right), H^*\left(d,z,S,y_i,A_i^S\right)$$

  - *Indirect Utility* $\; U^*\left(d,z;S;y_i,A_i^S\right) \equiv U\left(C^*\left(d,z,S,y_i,A_i^S\right), H^*\left(d,z,S,y_i,A_i^S\right);z;S\right)$

- **2nd step:** choose *d* and *z* to maximize indirect utility $U^*\left(d,z;S;y_i,A_i^S\right)$

$$\rightarrow d^*\left(S;y_i,A_i^S\right), z^*\left(S;y_i,A_i^S\right)$$

  - *Further Indirect Utility* $\; U^{**}(S;y_i,A_i^S) \equiv U^*\left(d^*\left(S;y_i,A_i^S\right), z^*\left(S;y_i,A_i^S\right);S;y_i\right)$

- **1st step**: choose the optimal tenure status $S^*\left(y_i, A_i^{own}, A_i^{rent}\right)$, which gives the largest further-indirect utility

Ambiguous effect on residential segregation

No constraint: prefer to buy moderately far from Paris

Moderate constraint: still prefer to buy farther away

Severe constraint: cannot buy anyway, prefer to rent closer
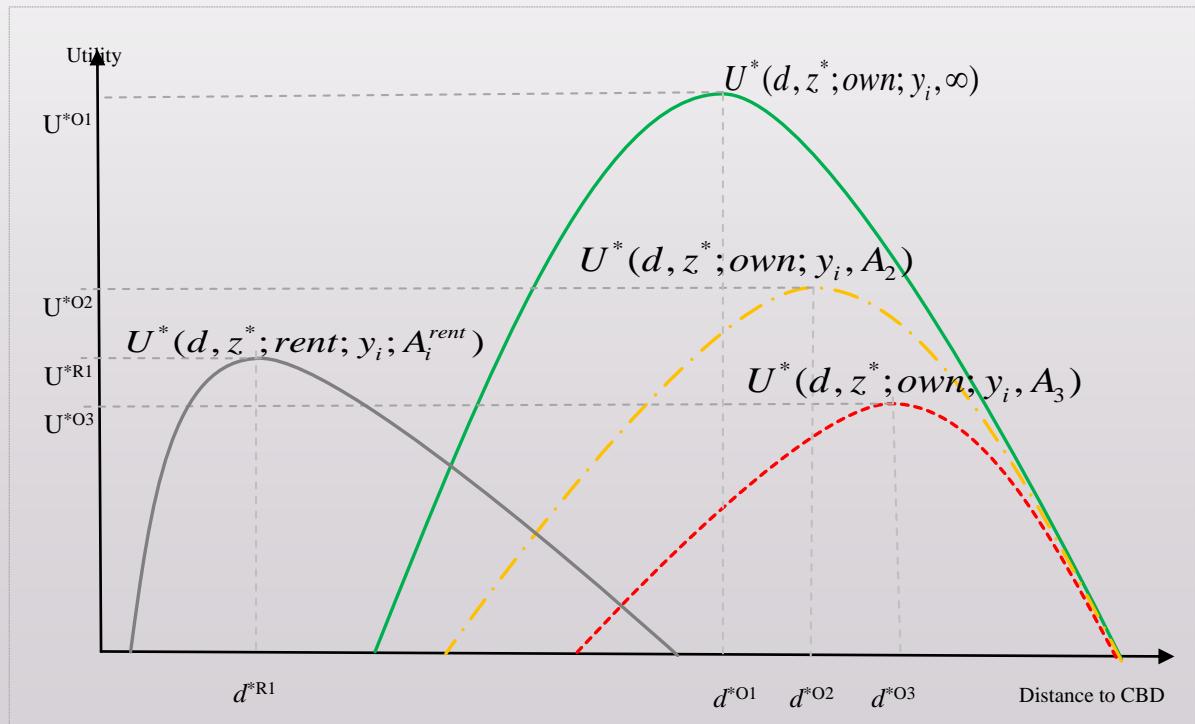
Joint choice of tenure, type and location without borrowing constraints

all households

1st step: Tenure status — buy — rent

2nd step: Dwelling type — house — flat — house — flat

3rd step: Location — commune 1 — commune 2 — … — commune 1 — commune 2 — … — commune 1 — commune 2 — … — commune 1 — commune 2 — …
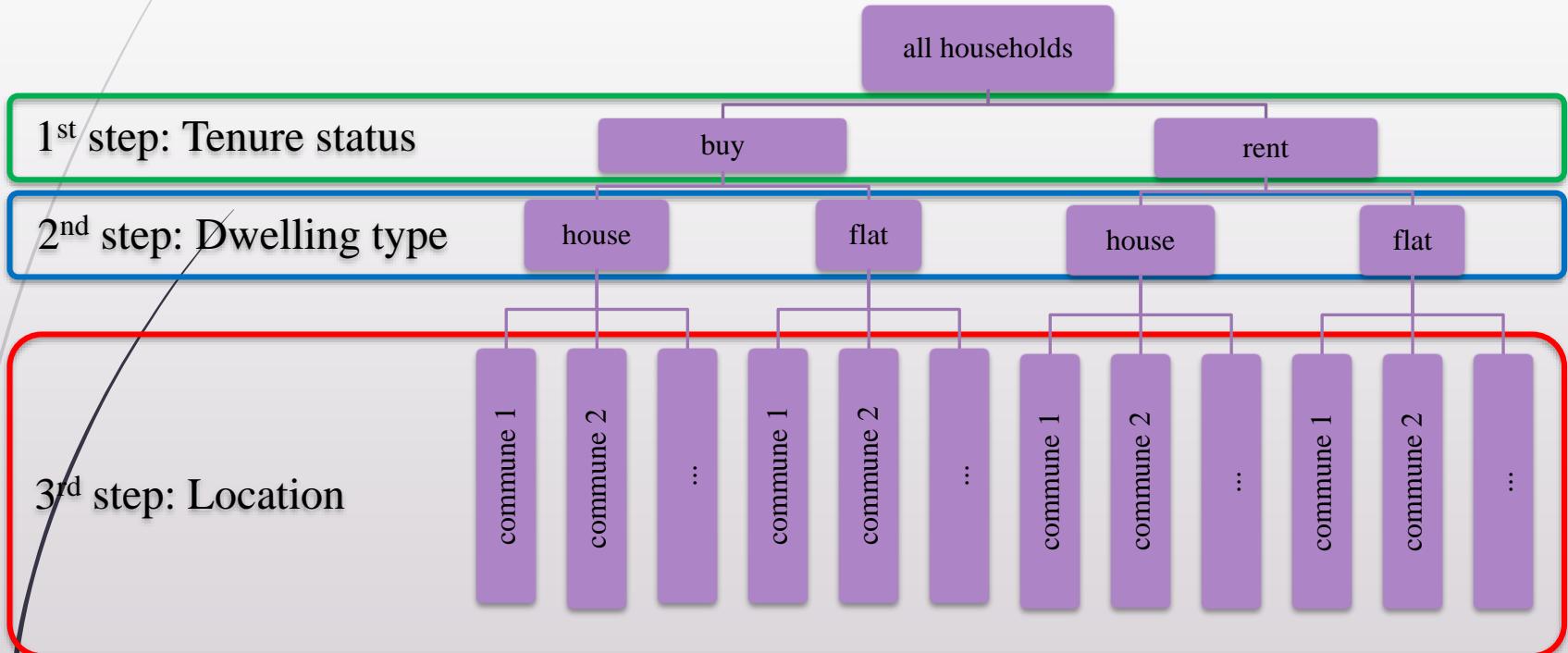
Latent choice set
with borrowing constraints
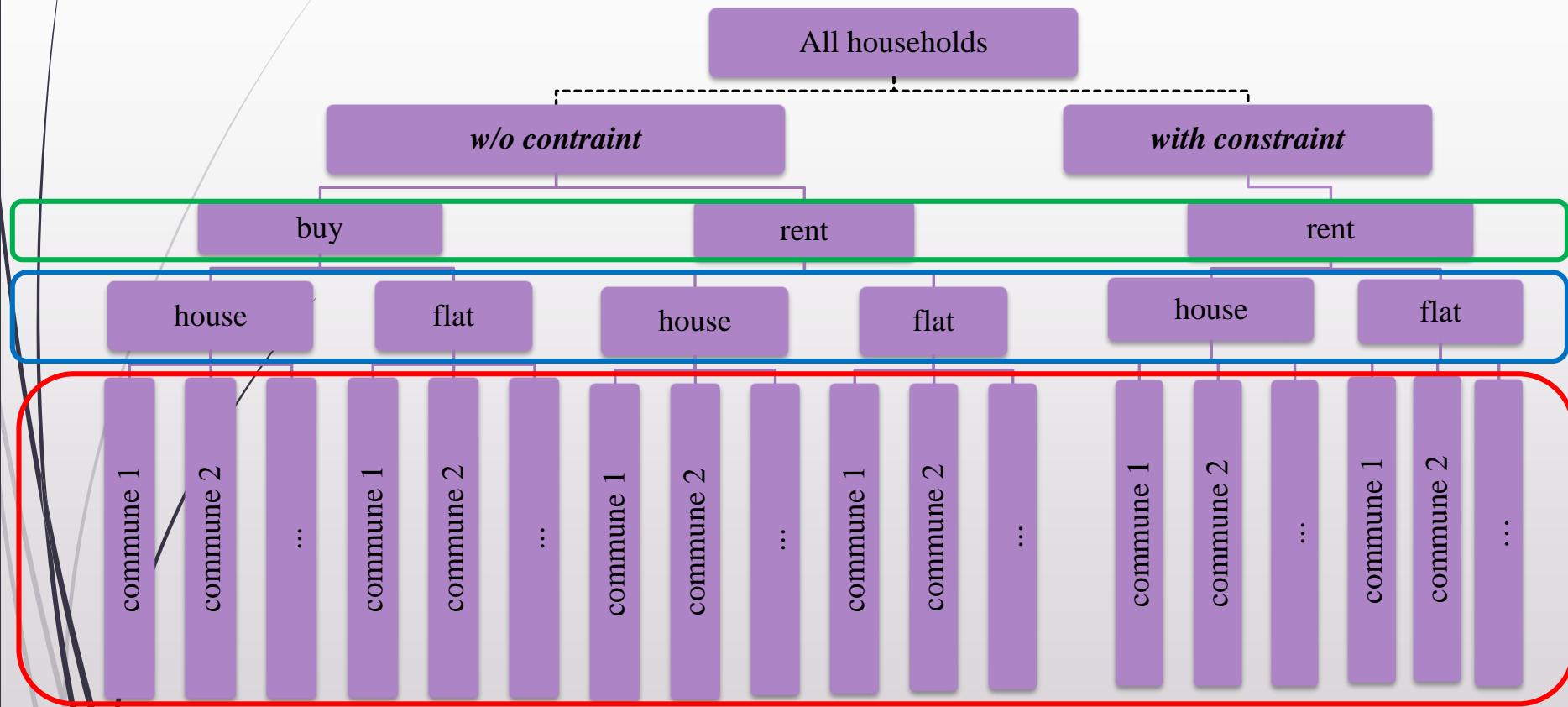
Lower level (3rd step): location

Probability that household *i* chooses location *j* conditionnal on tenure status *S* and dwelling type *T:*

$$P_i(j|T,S) = \frac{\exp(\mu_{ST} \cdot V_{ij}^{ST})}{\sum_{k \in K(S,T)} \exp(\mu_{ST} \cdot V_{ik}^{ST})} \quad \text{with} \quad V_{ij} = \underset{price}{-\alpha_i \ln p_j^{ST}} + \underset{local\ amenities}{Z_j.\beta_i + X_{ij}.\lambda}$$

▶ *choice set K(S,T)* contains 725 pseudo-communes (adjacent small communes aggregated)

Upper and Intermediate levels: tenure status (1st step) and dwelling type (2nd step)

Without borrowing constraints
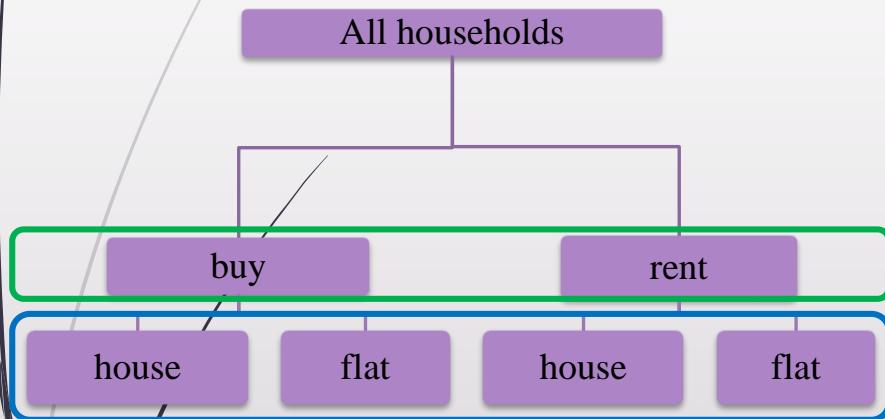
With borrowing constraints
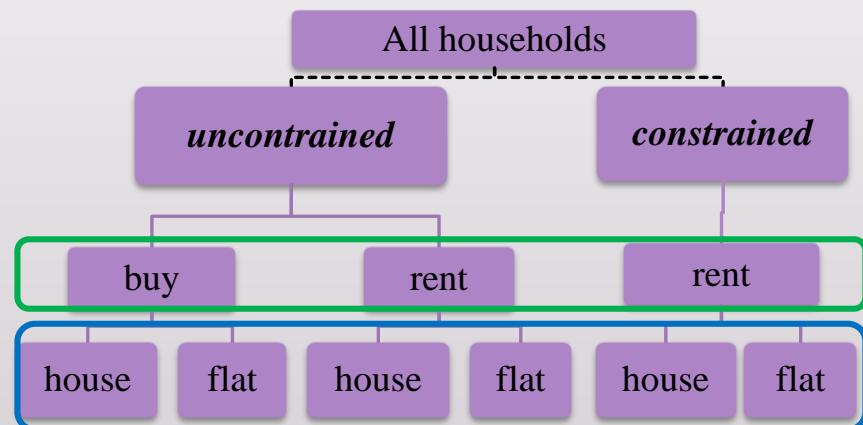
Data used: French 1999 census in Paris region

- 11 million inhabitants

- 2% of the surface of France

- 19% of population

- 22% of the jobs

- 8 "départements" (counties)

- 1300 "cities" (communes)

- aggregated into 725 pseudo-communes
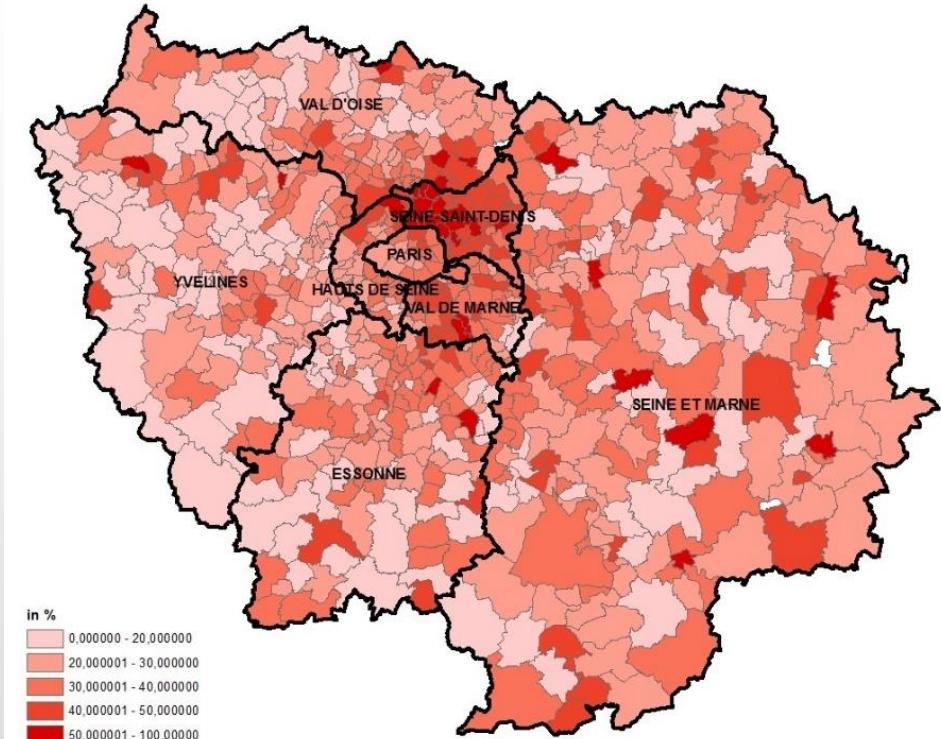
Poor households concentrated in eastern and northern suburbs (darker colours for larger % of poor households)

All analysis conducted on "movers" sample

Hedonic price regression & instrumentation 1

|	house								flat							
	buy				rent				buy				rent			
	new		old		new		old		new		old		new		old	
Intercept	9,665	***	9,438	***	4,553	***	4,451	***	9,560	***	9,262	***	4,409	***	4,343	***
Paris	-		-		-		-		0,184		0,197		-0,007		-0,042	
Essonne (91)	-0,064	**	-0,074	***	-0,022		-0,057	***	-0,031		-0,071	***	-0,039	**	-0,054	***
Hauts-de-Seine (92)	0,092	***	0,173	***	0,091	***	0,123	***	0,196	***	0,181	***	0,119	***	0,143	***
Seine-Saint-Denis (93)	-0,168	***	-0,188	***	0,008		0,006		-0,082	**	-0,154	***	0,033		0,006	
% build before 1915	0,003	**	0,003	**	0,004	***	0,004	***	0,029		0,003	***	0,004	***	0,003	***
% build in 1915-1967	0,001		-0,001		0,001	**	-0,000		0,005	***	0,000		0,000		-0,000	
% build after 1989	0,000		-0,001		-0,001		0,000		0,001		0,002	*	-0,000		0,001	*
Airport noise	0,003		0,008		-0,032		-0,013		-0,000		-0,020		-0,006		-0,022	
Density	0,016	***	0,010	***	0,010	***	0,009	***	0,005	**	0,003		0,007	***	0,005	***

Hedonic price regression & instrumentation 2

	house								flat							
	buy				rent				buy				rent			
	new		old		new		old		new		old		new		old	
Fraction of surface with:																
Urban renewal zone	-0.027		-0.164		0.018		-0.084		-0.342	**	-0.292	**	-0.194	*	-0.189	*
Public gardens	0.340	***	0.345	***	0.261	***	0.222	***	0.344	***	0.428	***	0.263	***	0.257	***
Water	0.166		0.131		-0.044		-0.071		0.235	*	0.208	*	-0.003		-0.010	
Forest	0.140	***	0.172	***	0.067	*	0.095	***	0.112	**	0.143	***	0.091	***	0.088	***
Public administration	0.167		0.450	*	0.180		0.160		0.582	***	0.620	***	0.240	*	0.305	**
Infrastructures	0.925		0.460		0.454		0.582		0.665		0.404		0.389		0.535	
Hospitals	0.665	**	0.107		0.356		0.230		0.376		0.150		0.197		0.282	
Sport areas	0.342	*	0.129		0.174		0.102		0.234		0.099		0.109		0.097	
accomodation tax rate	-0.011	***	-0.007	***	-0.007	***	-0.003		-0.007	**	-0.007	***	-0.004	**	-0.003	*
# Railway stations	0.000		-0.000		0.003		0.004		0.008	*	0.005		0.008	***	0.006	**
# Subway stations	0.001		0.004		0.003		0.006	*	0.004		0.005		0.008	**	0.006	*
Distance_close	-0.001		-0.005		0.010		0.007		-0.005		-0.004		0.003		0.006	
Distance_far	0.007		-0.001		0.002		-0.001		0.006		-0.002		0.001		0.001	
Firms tax rate : instrument	0.006	**	0.006	**	0.006	***	0.006	***	0.003		0.005	*	0.005	***	0.006	***
% of firm tax devoted to commune	-0.700	***	-0.620	***	-0.537	***	-0.652	***	-0.474	**	-0.585	***	-0.548	***	-0.694	***
R²	0.592		0.602		0.606		0.663		0.753		0.679		0.705		0.647	
R² adjusted	0.554		0.564		0.569		0.631		0.730		0.649		0.678		0.615	
# observations	267		267		267		267		287		287		287		287	

3rd Step: MNL location choice (1/3)

	rent		buy	
	flat	house	flat	house
Seine-et-Marne (77)	0.295 ***	0.455 ***	0.424 ***	2.096 ***
Yvelines (78)	0.302 ***	0.446 ***	0.826 ***	1.915 ***
Essonne (91)	0.328 ***	0.374 ***	0.565 ***	2.018 ***
Hauts-de-Seine (92)	0.090	0.477 ***	0.186 ***	1.345 ***
Seine-Saint-Denis (93)	-0.223 ***	2.170 ***	-0.180 ***	2.760 ***
Val de Marne (94)	-0.036	1.655 ***	0.279 ***	2.328 ***
Val d'Oise (95)	0.257 ***	0.449 ***	0.719 ***	2.006 ***
Corrective term	-0.873 ***	-1.086 ***	-0.835 ***	-0.913 ***
Log(N)	0.958 ***	0.787 ***	1.069 ***	0.811 ***
Log(price)	-0.699 ***	-0.073	-0.785 ***	-1.419 ***
Log(price)*(age-20)/10	-0.390 ***	-0.354 ***	-0.093 ***	0.012
Log(price)* centered log income	3.762 ***	0.661 ***	4.049 ***	4.078 ***
Same district	2.125 ***	2.748 ***	2.007 ***	2.452 ***
Same district *centered log income	-0.783 ***	-0.521 ***	-0.715 ***	-0.428 ***
Same district*(age-20)/10	0.138 ***	0.120 ***	0.149 ***	0.194 ***
Accommodation tax rate	-0.003 ***	-0.017 ***	0.003	-0.017 ***
Accommodation tax rate *centered log income	-0.030 ***	0.022 ***	-0.006	0.053 ***
Number railway stations	0.009 ***	-0.006	-0.008 ***	-0.048 ***
Number railway stations*centered log income	0.022 ***	0.065 ***	0.024 ***	0.121 ***
Number subway stations	0.001	-0.006	-0.016 ***	-0.008
Number subway stations*centered log income	0.028 ***	-0.026 ***	0.003	0.022 ***
Airport noise	-0.024 **	-0.090 ***	0.181 ***	-0.020

3rd Step: MNL location choice (2/3)

	rent				buy			
	flat		house		flat		house	
Fraction of surface with: forest	0.064	***	-0.173	***	0.216	***	-0.020	
forest*#children	-0.188	***	0.497	***	0.374	***	-0.066	
public gardens	0.212	***	-0.454	***	0.131		-0.585	***
public gardens*#children	0.212	***	0.660	***	0.247	**	0.682	***
lake	-0.805	***	-0.739	***	-0.307	**	-0.870	***
lake/river*#children	0.236	***	0.359		0.585	***	-0.424	**
urban renewal zone	0.118	**	-0.246		0.137		-0.123	
public administration	0.504	***	-1.357	***	0.166		-1.963	***
infrastructures	-0.168		-0.290		-2.675	***	-0.877	*
hospitals	-0.125	*	0.639	*	-0.665	***	-0.325	
sport areas	-0.059		-0.166		1.324	***	0.623	***
% build before 1915	-0.012	***	0.004	**	-0.013	***	-0.001	
% build in 1915-1967	-0.001	***	0.002	***	-0.004	***	0.005	***
% build after 1989	0.001		0.009	***	0.006	***	0.009	***

3rd Step: MNL location choice (3/3)

	rent				buy			
	flat		house		flat		house	
Homogamy_poor	0.391	***	1.494	***	-2.984	***	1.840	***
Homogamy_middle income	0.682	***	1.258	***	-0.389	*	4.844	***
Homogamy_rich	2.591	***	3.182	***	3.780	***	2.901	***
Homogamy_young	3.396	***	-2.540	***	2.613	***	-3.152	***
Homogamy_middle age	-0.107		-0.423	**	-0.516	***	-0.205	
Homogamy_old	0.625	***	0.944		4.029	***	1.664	***
Homogamy_1-person hh	3.173	***	1.828	***	3.539	***	1.134	***
Homogamy_2-person hh	0.256		1.976	***	1.499	***	3.033	***
Homogamy_+2-person hh	2.447	***	1.966	***	0.406	***	0.263	**
Homogamy_no-active hh	0.598	***	0.750		4.228	***	1.778	***
Homogamy_1-active hh	1.433	***	-1.159	***	1.324	***	-2.929	***
Homogamy_2-active hh	0.674	***	1.193	***	1.720	***	2.824	***
Homogamy-foreign head	6.601	***	3.968	***	7.079	***	6.251	***
pseudo-R²	0.2991		0.1862		0.2986		0.2104	
log-likelihood	-711184		-60810		-136373		-119248	
# observations (households)	368931		27127		70437		54637	

Upper and intermediate levels: Nested logit model

Estimation of lower level => inclusive value by nest:

$$I_{iT}^{S} = \ln\left(\sum_{k \in K(S,T)} \exp(\mu_{ST} \cdot V_{ik}^{ST}) \right)$$

Probability to choose (S,T): $\qquad P_i(T,S) = P_i(T|S) \times P_i(S)$ with

▶ $P_i(T|S) = \dfrac{\exp\left[\lambda_S \cdot \left(V_{i,T}^S + \dfrac{1}{\mu_{ST}} . I_{i,T}^S \right) \right]}{\displaystyle\sum_{t=house, flat} \exp\left[\lambda_S \cdot \left(V_{it}^S + \dfrac{1}{\mu_{St}} . I_{it}^S \right) \right]}$

▶ $P_i(S) = \dfrac{\exp\left[\phi \cdot (V_{i,S} + \dfrac{\phi}{\lambda_S} . I_{iS}) \right]}{\displaystyle\sum_{s=own,rent} \exp\left[\phi \cdot \left(V_{is} + \dfrac{\phi}{\lambda_s} . I_{is} \right) \right]}$ with $I_{iS} = \ln\left(\sum_{t=own,rent} \exp\left(\lambda_S \cdot V_{it}^S + \dfrac{\lambda_S}{\mu_{St}} \cdot I_{it}^S \right) \right)$

Dwelling type

Dwelling type	W/o constraint				With constraint			
	own		rent		own		rent	
Inclusive value (house)	0.451	***	0.510	***	0.397	***	0.519	***
Inclusive value (flat)	0.176	***	0.455	***	0.283	***	0.454	***
Intercept (house)	-0.596	***	-3.330	***	0.135	***	-3.407	***
centered log income (house)	-10.577	***	5.662	***	-4.462	***	5.625	***
# children <3 years (house)	0.772	***	0.267	***	0.878	***	0.243	***
# children aged 3 to 6 (house)	0.861	***	0.338	***	0.928	***	0.325	***
# children aged 7 to 11 (house)	0.725	***	0.311	***	0.763	***	0.300	***
# children aged 12 to 16 (house)	0.601	***	0.292	***	0.619	***	0.284	***
# children aged 17 to 18 (house)	0.501	***	0.245	***	0.514	***	0.234	***

Tenure status 1

	Without constraint	With constraint
Tenure status		
Inclusive value (own)	0.451***	1.837***
Inclusive value (rent)	0.316***	1.560***
Intercept (own)	-0.694***	3.899***
centered log income	0.529***	-10.376***
Foreign	-0.402***	-0.815***
# children <3 years	0.120***	0.836***
# children aged 3 to 6	0.149***	1.400***
# children aged 7 to 11	0.052***	0.692***
# children aged 12 to 16	0.014	0.739***
# children aged 17 to 18	-0.009	0.702***
hh head's employment status: permanent-contract worker		
self-employed	0.158***	0.118**
temporary-contract	-0.828***	0.167**
public-contract	-0.102***	0.066
retired	0.215***	-1.382***
unemployed	-0.778***	0.811***
inactive	-0.054**	-1.200***

Probability to be constrained and goodness of fit

	w/o constraint	With constraint
Probability to be constrained		
Intercept		1.628***
centered log income		-1.418***
hh head's employment status: permanent-contract worker		-
self-employed		-0.070***
temporary-contract		0.802***
public-contract		0.088***
retired		-0.886***
unemployed		0.811***
inactive		-0.395***
1 car in hh		-0.754***
2 cars in hh		-1.485***
Pseudo-R²	0.4197	0.4326
Log-likelihood	-419,249.25	-409,881
#observations	521,132	521,132

Distribution of Probability to be constrained, by income category
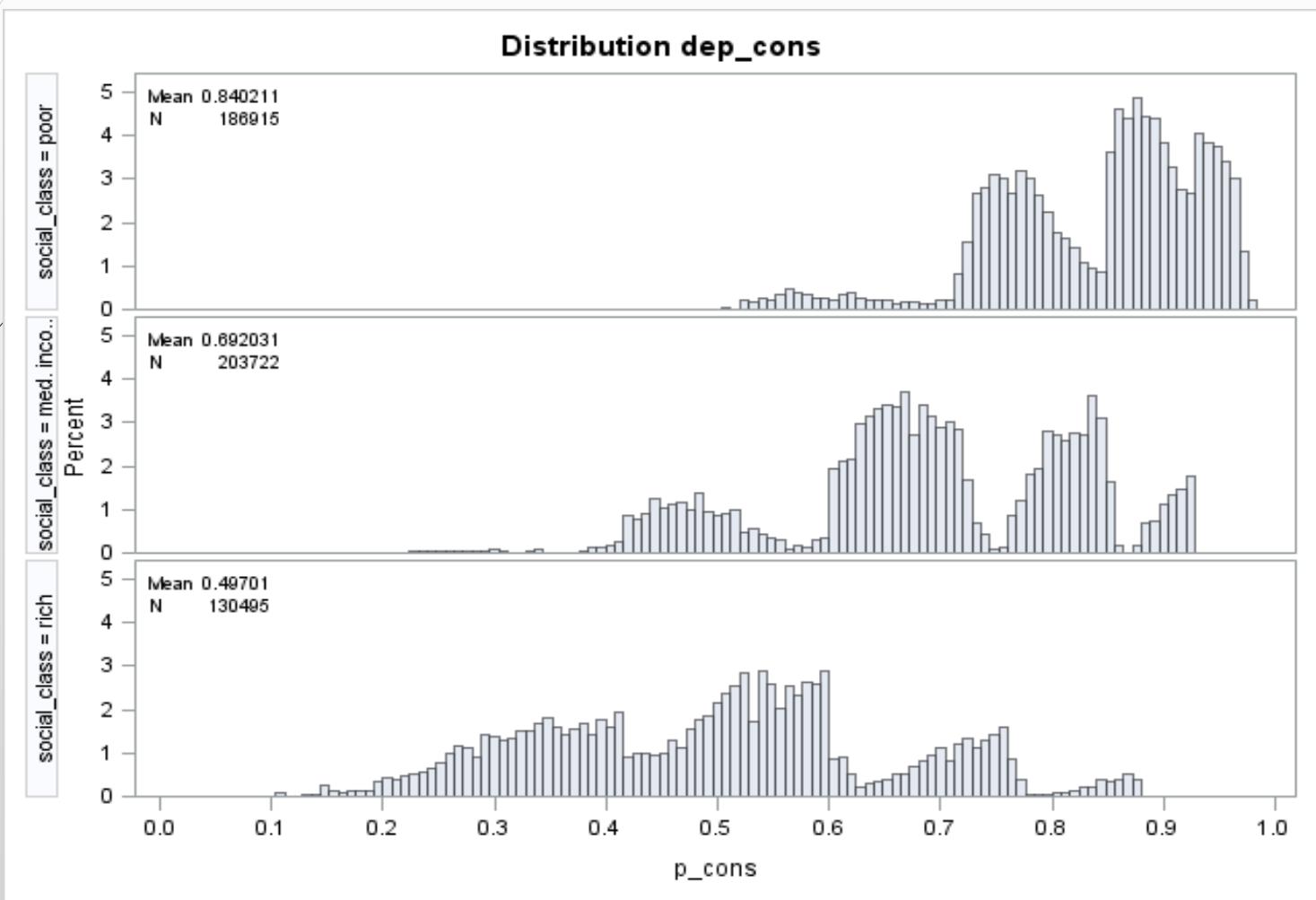
% of constrained households

probability to be constrained
- 0,331217 - 0,550000
- 0,550001 - 0,650000
- 0,650001 - 0,750000
- 0,750001 - 0,806170

VAL D'OISE

SEINE-SAINT-DENIS

PARIS

YVELINES

HAUTS DE SEINE

VAL DE MARNE

SEINE ET MARNE

ESSONNE
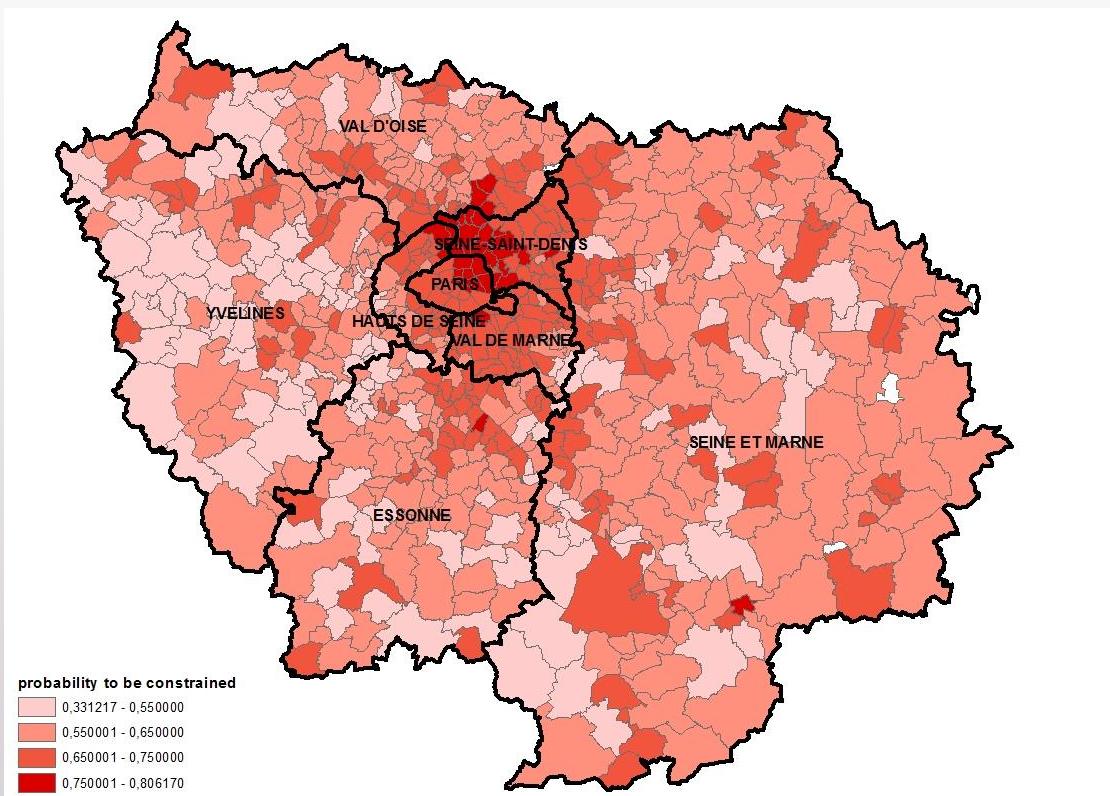
Variation in demand induced by setting to 0 the proba to be constrained

for all households

for poor households

evolution of demand in %
- -33,567909 - -10,000000
- -9,999999 - 0,000000
- 0,000001 - 10,000000
- 10,000001 - 20,000000
- 20,000001 - 111,521797
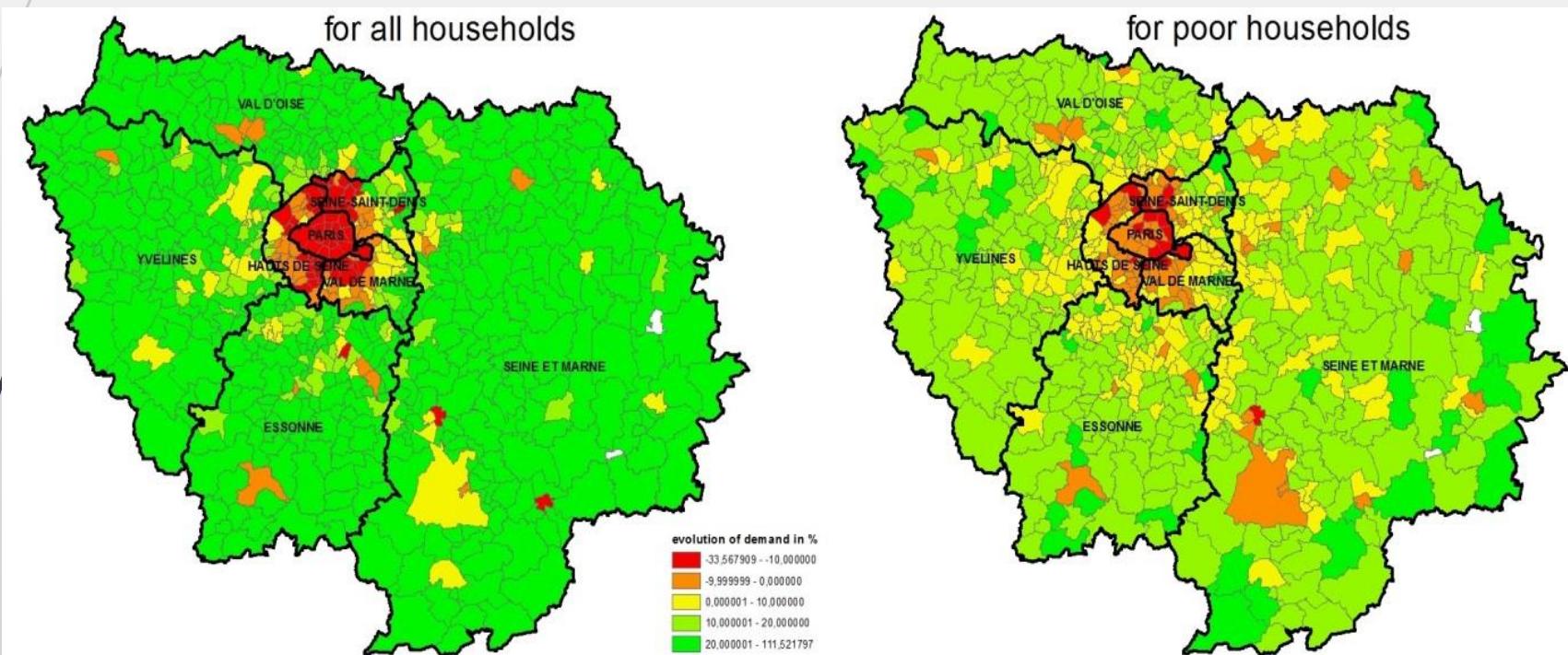
Social composition of population: actual versus preferred alternative

	Actual choices			Preferred choices		
	Poor	Med.	Rich	Poor	Med.	Rich
Paris (75)	36.07%	37.60%	26.32%	30.04%	41.16%	28.81%
Hauts-de-Seine (92)	32.96%	37.47%	29.56%	30.48%	38.86%	30.66%
Seine-St Denis (93)	44.91%	40.57%	14.52%	46.08%	39.71%	14.21%
Val de Marne (94)	37.61%	39.78%	22.61%	38.03%	39.51%	22.45%
Seine-et-Marne (77)	33.47%	42.89%	23.63%	36.64%	40.85%	22.51%
Yvelines (78)	32.84%	37.13%	30.03%	37.82%	34.38%	27.80%
Essonne (91)	35.45%	40.26%	24.29%	39.36%	37.82%	22.82%
Val d'Oise (95)	34.17%	41.34%	24.48%	38.86%	38.40%	22.74%

Distribution of tenure, type & location: actual versus preferred alternative

			Actual choices				Preferred choices				Change in poor households' demand	
			all	Poor	Med.	Rich	all	Poor	Med.	Rich		
Paris (75)	flat	rent	22.90	25.01	22.46	20.58	8.20	8.43	8.12	8.00	-5.95%	-2.33%
		own	3.69	1.79	3.20	7.16	12.58	11.90	11.69	14.94	3.63%	
	house	rent	0.24	0.26	0.20	0.27	0.06	0.06	0.05	0.09	-0.07%	
		own	0.12	0.05	0.07	0.32	0.32	0.24	0.22	0.60	0.07%	
Hauts-de-Seine (92)	flat	rent	11.28	6.67	5.21	2.92	1.38	1.77	1.27	1.00	-2.95%	-0.53%
		own	2.44	0.63	0.88	1.00	3.03	4.01	2.78	2.03	2.27%	
	house	rent	0.44	0.77	1.19	1.17	0.23	0.16	0.22	0.34	-0.10%	
		own	0.71	0.78	3.12	3.85	6.94	4.22	9.20	7.28	0.25%	

Distribution of tenure, type & location: actual versus preferred alternative

			Actual choices				Preferred choices				Change in poor households' demand	
			all	Poor	Med.	Rich	all	Poor	Med.	Rich		
Seine-St-Denis (93)	flat	rent	7.73	8.00	6.25	5.07	1.82	2.13	1.59	1.73	-2.88%	-0.23%
		own	1.16	1.17	1.52	2.84	5.96	7.37	4.87	5.64	2.37%	
	house	rent	0.58	0.65	1.00	1.58	0.24	0.14	0.20	0.47	-0.16%	
		own	0.95	0.63	2.06	4.19	5.48	3.35	6.00	7.73	0.90%	
Val-de-Marne (94)	flat	rent	7.27	6.80	5.19	3.17	1.42	1.79	1.30	1.07	-2.31%	0.07%
		own	1.57	0.84	1.08	1.35	3.96	5.40	3.42	2.73	2.04%	
	house	rent	0.46	0.47	0.76	0.95	0.16	0.10	0.15	0.28	-0.10%	
		own	0.86	0.54	1.98	3.03	4.73	2.93	5.77	5.67	0.44%	

Distribution of tenure, type & location: actual versus preferred alternative

			Actual choices				Preferred choices				Change in poor households' demand	
			all	Poor	Med.	Rich	all	Poor	Med.	Rich		
Essonne (91)	flat	rent	5.26	11.94	11.21	10.46	3.68	3.70	3.51	3.92	-1.79%	
		own	1.06	1.20	2.11	4.71	7.82	7.53	7.09	9.38	1.64%	0.56%
	house	rent	0.71	0.35	0.42	0.60	0.11	0.08	0.09	0.18	-0.13%	
		own	1.73	0.18	0.50	1.78	1.68	0.87	1.47	3.17	0.86%	
Seine-et-Marne (77)	flat	rent	5.16	10.82	7.54	3.60	2.05	2.78	1.89	1.23	-1.76%	
		own	0.82	1.13	1.34	0.92	5.04	7.75	4.53	1.94	1.21%	0.47%
	house	rent	1.03	0.56	0.66	0.48	0.12	0.11	0.11	0.13	-0.22%	
		own	2.47	0.53	1.27	1.03	3.13	3.04	3.91	2.04	1.23%	
Yvelines (78)	flat	rent	6.58	8.93	7.31	4.82	2.11	2.50	2.01	1.70	-2.11%	
		own	1.73	1.07	1.61	2.22	5.63	6.76	5.31	4.50	2.23%	0.91%
	house	rent	1.02	0.36	0.48	0.56	0.10	0.07	0.09	0.16	-0.18%	
		own	2.08	0.29	0.93	1.57	2.34	1.51	2.74	2.94	0.97%	
Val d'Oise (95)	flat	rent	4.58	5.78	4.62	2.81	1.19	1.46	1.09	0.94	-1.55%	
		own	0.99	0.73	1.02	1.29	3.65	4.74	3.30	2.61	1.44%	0.61%
	house	rent	0.73	0.53	0.81	0.89	0.16	0.11	0.15	0.25	-0.15%	
		own	1.67	0.54	1.97	2.81	4.69	2.98	5.87	5.30	0.87%	

Conclusions and policy insights

- Ambiguous theoretical results concerning the effect of borrowing constraints on residential location: A household which cannot borrow to buy in its preferred location may either
    1. rent a dwelling closer to CBD or
    2. buy a dwelling farther away from CBD
- Our simulations show that, on average, 2. dominates 1.
- Public policies envisaged in France:
    - Zero-interest-rate loans guaranted by the State
    - 100 000 € House (subsidies)
- … intended to alleviate borrowing constraints for poor/medium class HH would
    - induce poor households to buy in the outer ring
    - exacerbate urban sprawl
    - worsen social mix