A Room with a View or *Rear Window*? Hedonic prices of the Parisian real-estate.

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Motivations

- Within a small area, real-estate prices experience large variations: the price per square meter of flats sold in Paris (105 km^2) in 2008 varied by a factor of two
- Goal of hedonic models: explain individual choices and prices by the differentiation of the goods
- Real-estate: intrinsic characteristics **but also** localization, neighbourhood quality, job accessibility, amenities, etc.

What are the prices of extrinsic housing characteristics?

Contribution

- Estimation of the implicit prices using the discontinuity designs using administrative boundaries when it is possible and very local fixed effects when it is not.
- Unique dataset about neighbourhood attributes: use of geocoded data
- Simultaneous estimations in order to directly compare the valuations for the different neighbourhood attributes
- We show that spatial correlation disappears when we include enough data to describe the housing environment

Hedonic prices interpretation

Question: How much a buyer of a flat located in a very noisy neighborhood is willing to pay for a reduction of ten decibels down?

- Around the equilibrium
- Prices of the different characteristics
- Indication of the variation of utility of the buyers when a characteristic experiences a marginal change

Question: What is the impact on the price of the global reduction of noise in Paris ?

- To go further:
  - the characteristics of the buyers and their income
  - identification hypothesis, see Ekeland et al. (2004)

Empirical analysis

Application to the Parisian real-estate

Table: Descriptive statistics of the sample

	Price per square meter	Surface	Number of rooms	Number of transactions
2008	6639.79 (1929.7)	50.84 (36.45)	2.4 (1.3)	18,803
2009	6351.79 (1822.52)	51.82 (35.68)	2.43 (1.29)	16,119
2010	7059.67 (1996.08)	54.1 (37.87)	2.49 (1.32)	19,565
Total	6705.36 (1944.67)	52.3 (36.77)	2.44 (1.3)	54,487

Source: Bien database

Description of the house

- Intrinsic characteristics: surface, number of rooms, number of bathrooms, elevator, floor, terrace, date of construction,...
- Job accessibility
- Access to public transportation network
- Noise
- Crime
- Quality of the assigned public junior high school
- Local amenities
- Neighbourhood characteristics (Census data)
- Fiscal revenue in the close neighbourhood

Job accessibility by car

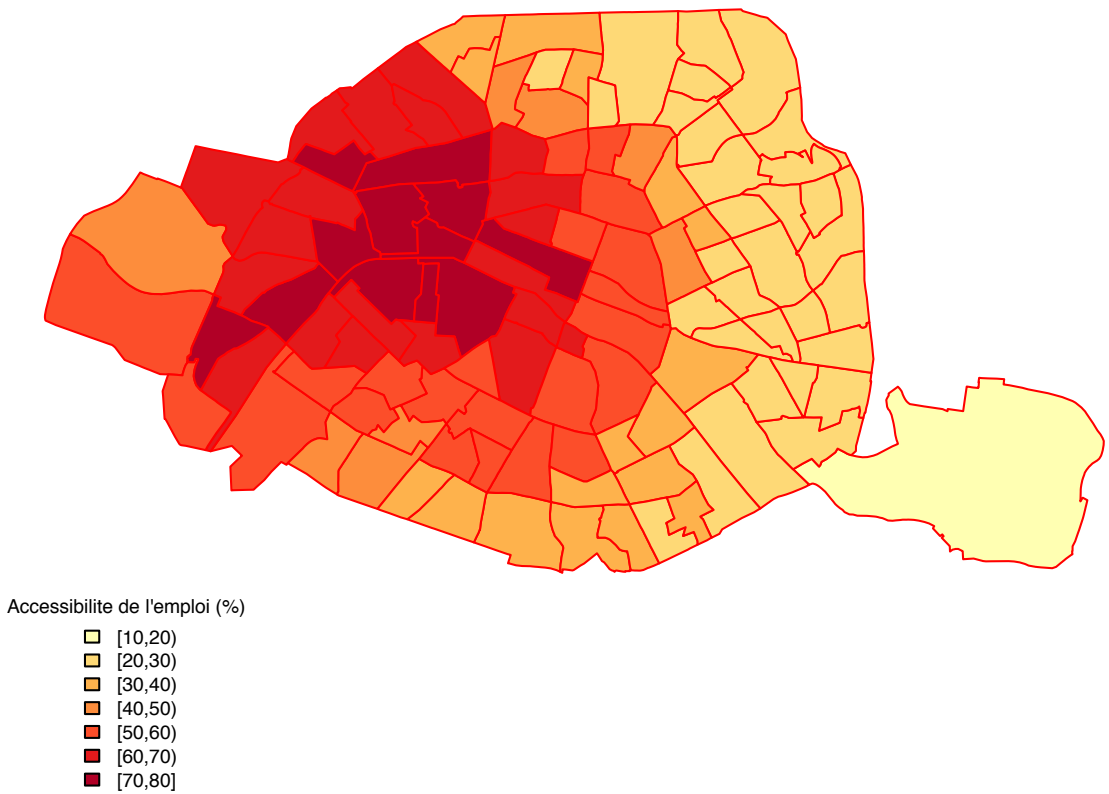

Figure: Percentage of jobs located in Ile-de-France accessible in less than 30 minutes car drive (Driea, Insee (CLAP))

Job accessibility by public transportation

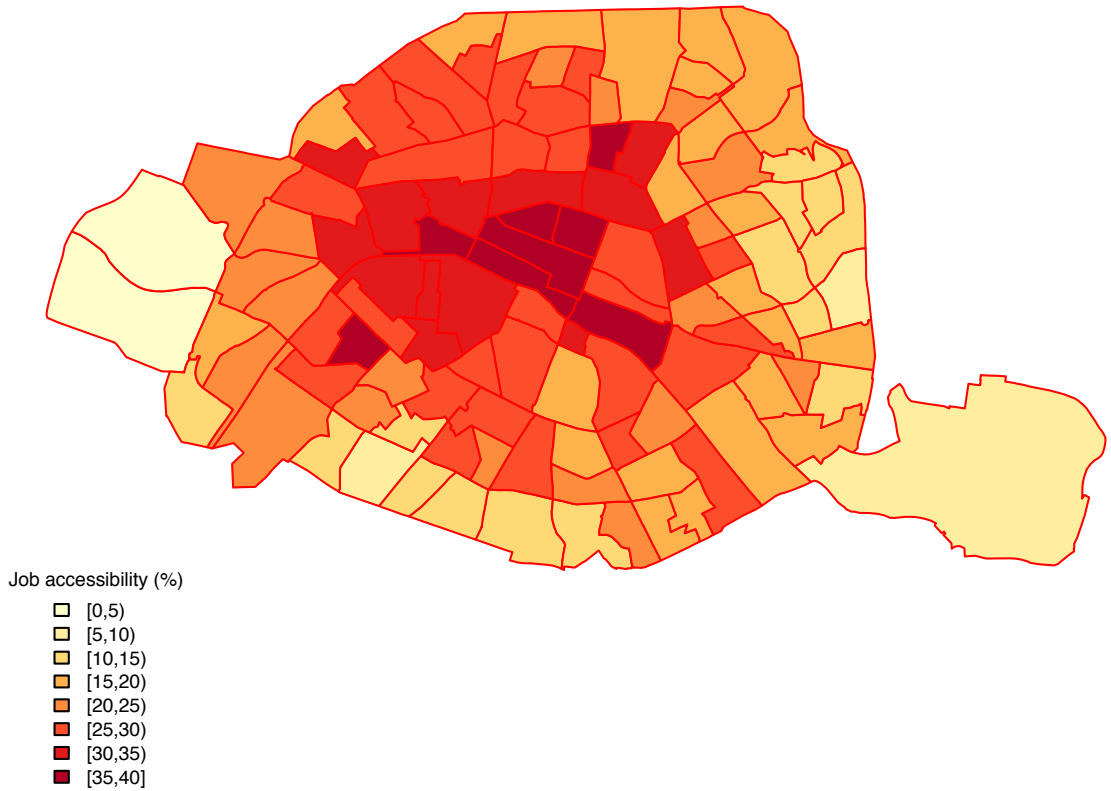

Figure: Percentage of jobs located in Ile-de-France accessible in less than 30 minutes in PT (Driea, Insee (CLAP))

Access to public transportation network

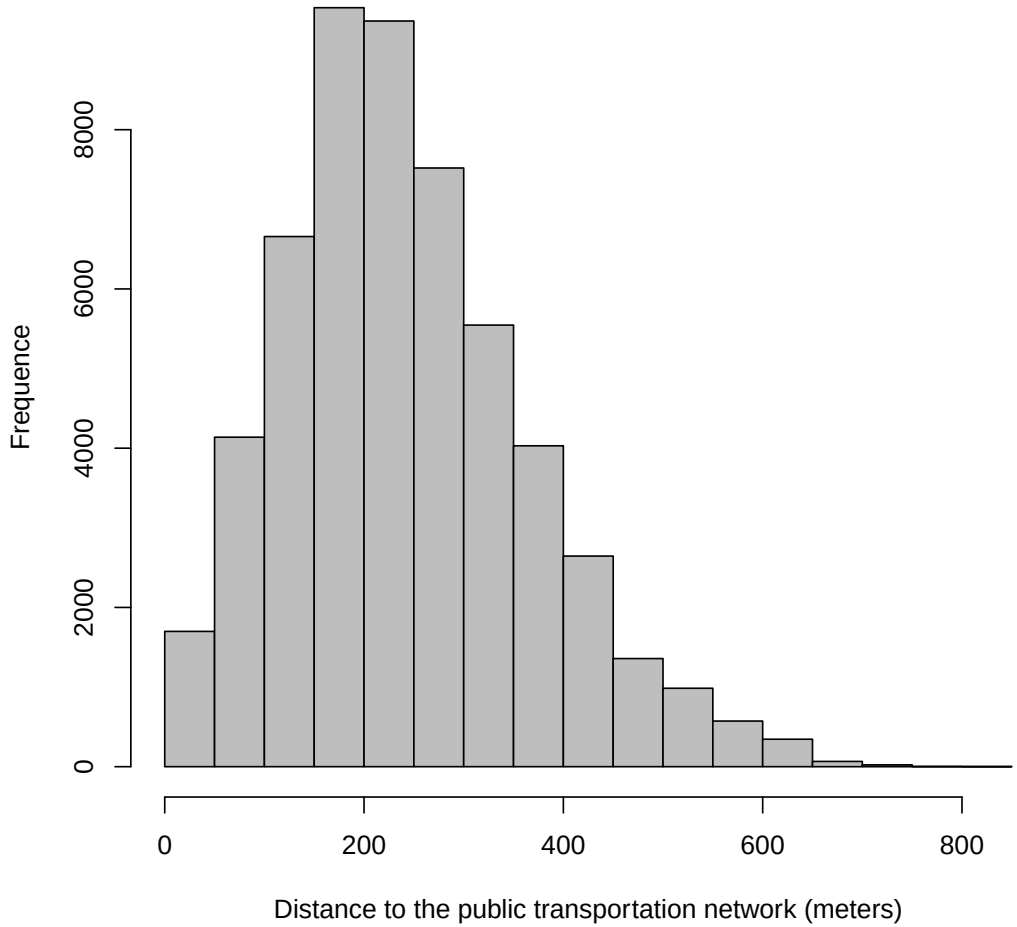

Figure: Minimal distances from the metro (RATP, SNCF)

Noise

Figure: Night level of noise (en dB), BruitParif

Crime

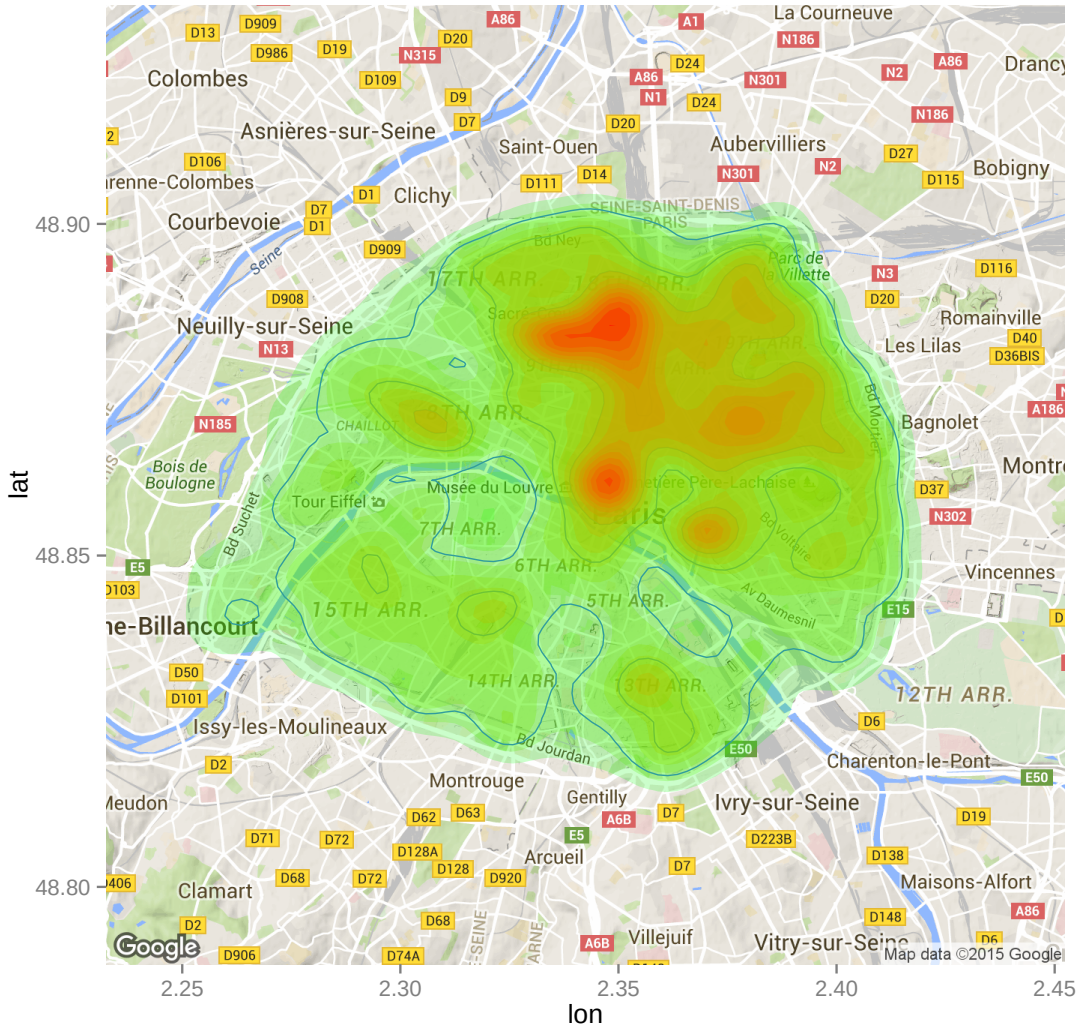

Figure: Physical violence density, ONDRP

Crime: Counting procedure

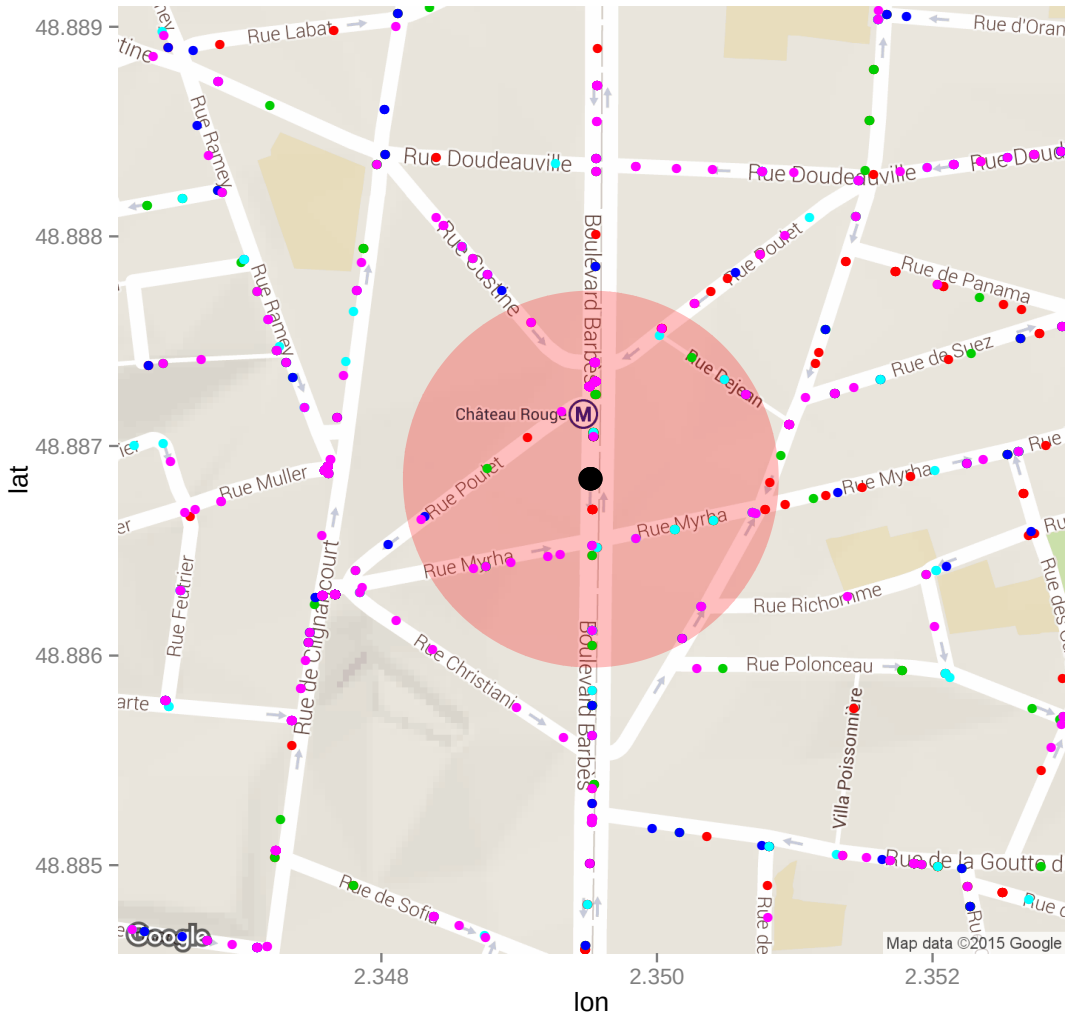

Figure: Counting procedure of crime

Quality of the assigned school

Figure: Success rate at the final exam in the Parisian public junior high school zones

Source: Paris City Council, DEPP

Method

$$\log(p) = f(S) + \beta_1 X_1 + \beta_2 X_2 + \mathbb{1}_L + \epsilon \quad (1)$$

where

- S is the surface
- X_1 the intrinsic characteristics of the hosue
- X_2 the characteristics of the neighbourhood

In some estimations we add:

- $\mathbb{1}_L$ a very local dummy

Local fixed effects

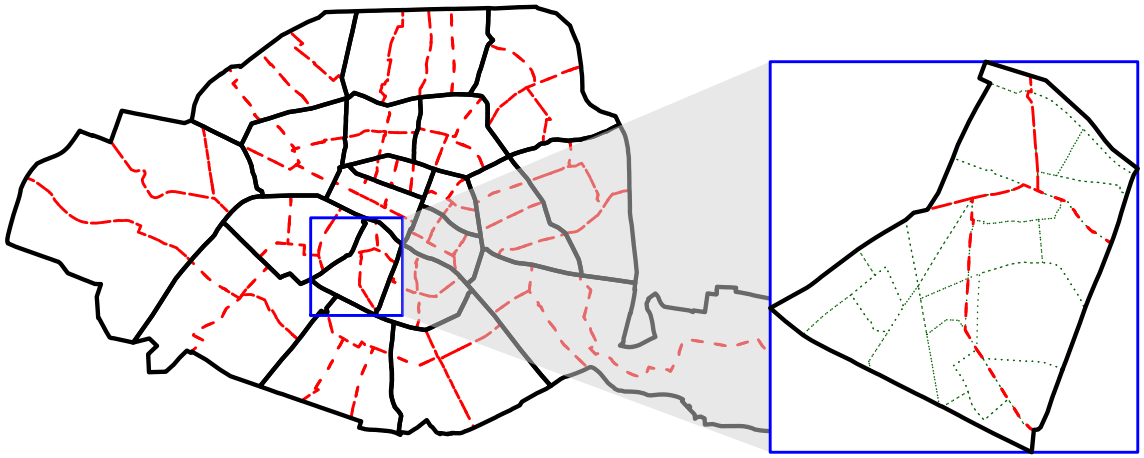

Figure: Parisian administrative districts

Notes: Continuous boundaries correspond to the limits of the arrondissements, dotted lines correspond to the limits of the *grands quartiers* and dashed lines correspond to the limits of the IRIS. In the blue box, we focus on the *VI*$^{\text{ème}}$ arrondissement.

Results: explained variance

Table: Variance explained by the different groups of characteristics

Estimator	Without Fixed Effects			IRIS Fixed Effects		
Variables	Surface log(price) (1)	House Char. log(price) (2)	Neigh. Char. log(price) (3)	Surface log(price) (4)	House Char. log(price) (5)	Neigh. Char. log(price) (6)
R^2 explained variance	0.850	0.866	0.912	0.908	0.922	0.923
R^2 adjusted	0.850	0.866	0.912	0.906	0.921	0.921
Surface (polynomial)	Yes	Yes	Yes	Yes	Yes	Yes
Years and months	Yes	Yes	Yes	Yes	Yes	Yes
House characteristics	No	Yes	Yes	No	Yes	Yes
Neighborhood characteristics	No	No	Yes	No	No	Yes
Number of observations	54395	54395	54395	54395	54395	54395

Standard errors in parentheses
* p<0.10. ** p<0.05. *** p<0.010

Results: surface

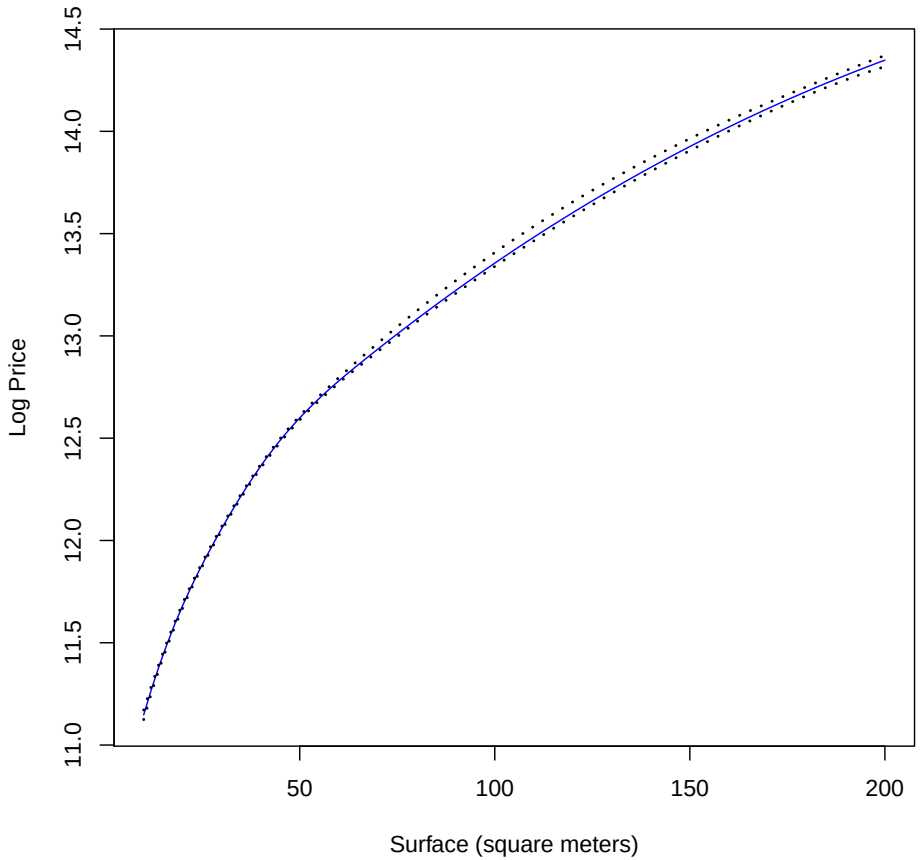

Figure: Hedonic price of the surface

Results: magnitude of the effects

Variable	Standard deviation of the variable	ΔX	Effect in price %
Surface	36.5	$+1$ m^2	1.1 %
Floor	2.94	2^d vs Floor	7.5 %
Elevator	-	Yes vs No	2.1 %
Job accessibility Plus	16.74 %	+16.74 %	2.2 %
Transport accessibility Plus	122 m	500m vs 378 m	-0.01 %
Noise Plus	-	More than 65dB vs Less than 50dB	-0.01 %
Crime (100m) Plus	63.5	+63.5 infractions	-0.03 %
School quality Plus	9.34 %	+9.34 % of success	1.04 %

Results: a Room with a View

Table: Influence of the type of streets

Estimator	Without Fixed Effects		IRIS Fixed Effects	
Variables	log(prix) (1)	log(prix) (2)	log(prix) (3)	log(prix) (4)
Boulevard	-0.0067	-0.0010	-0.0121**	-0.0091
	(0.0120)	(0.0079)	(0.0055)	(0.0059)
Impasse	-0.0457***	-0.0087	-0.0070	-0.0083
	(0.0167)	(0.0085)	(0.0077)	(0.0077)
Square	0.0673***	0.0384***	0.0382***	0.0390***
	(0.0192)	(0.0129)	(0.0123)	(0.0124)
Quay	0.0955**	0.0851***	0.1051***	0.1059***
	(0.0450)	(0.0283)	(0.0217)	(0.0216)
Street	ref.	ref.	ref.	ref.
Years and months	Yes	Yes	Yes	Yes
Characteristics of the house	Yes	Yes	Yes	Yes
Characteristics of the neighbourhood	No	Yes	No	Yes
Number of observations	54,395	54,395	54,395	54,395
R^2	0.867	0.912	0.923	0.923
R^2 adj	0.867	0.912	0.921	0.921

Standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.010

Spatial correlation

Table: Spatial correlation indexes

	Prices	Residuals 1	Residuals 2	Residuals 3
Moran index	0.167	0.275	0.079	0.001
p.value of Moran's test	0.000	0.000	0.000	0.709
Mantel index	0.048	0.059	-0.002	-0.014
p.value of Mantel's test	0.005	0.005	0.687	0.960
House characteristics	No	Yes	Yes	Yes
Neighbourhood characteristics	No	No	Yes	Yes
Fixed effects	No	No	No	Yes

Notes: The p-values correspond to the test of the presence of spatial correlation in the data.

Spatial correlation

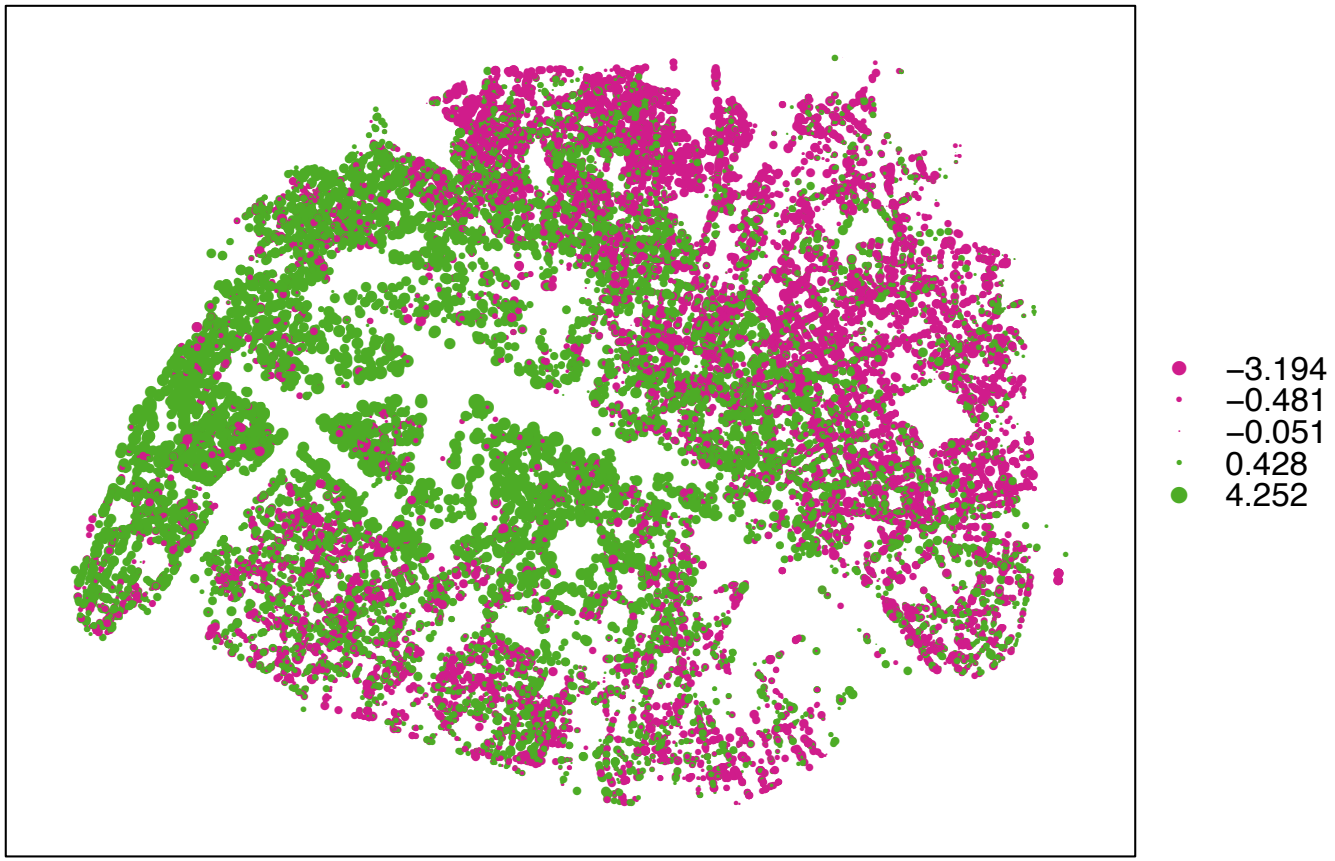

Figure: Spatial distribution of prices (in log)

Spatial correlation

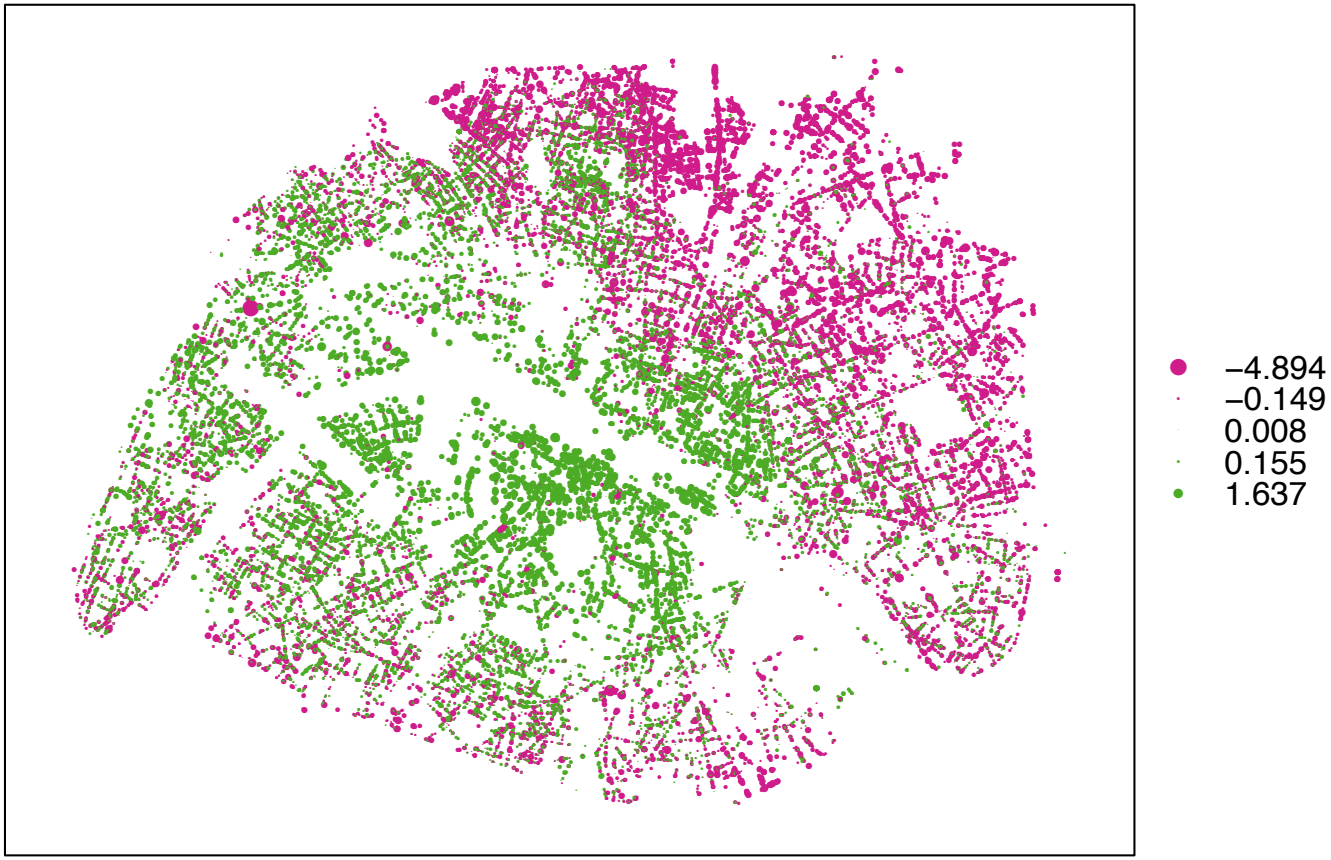

Figure: Spatial distribution des résidus (regression on the intrinsic characteristics of the house)

Spatial correlation

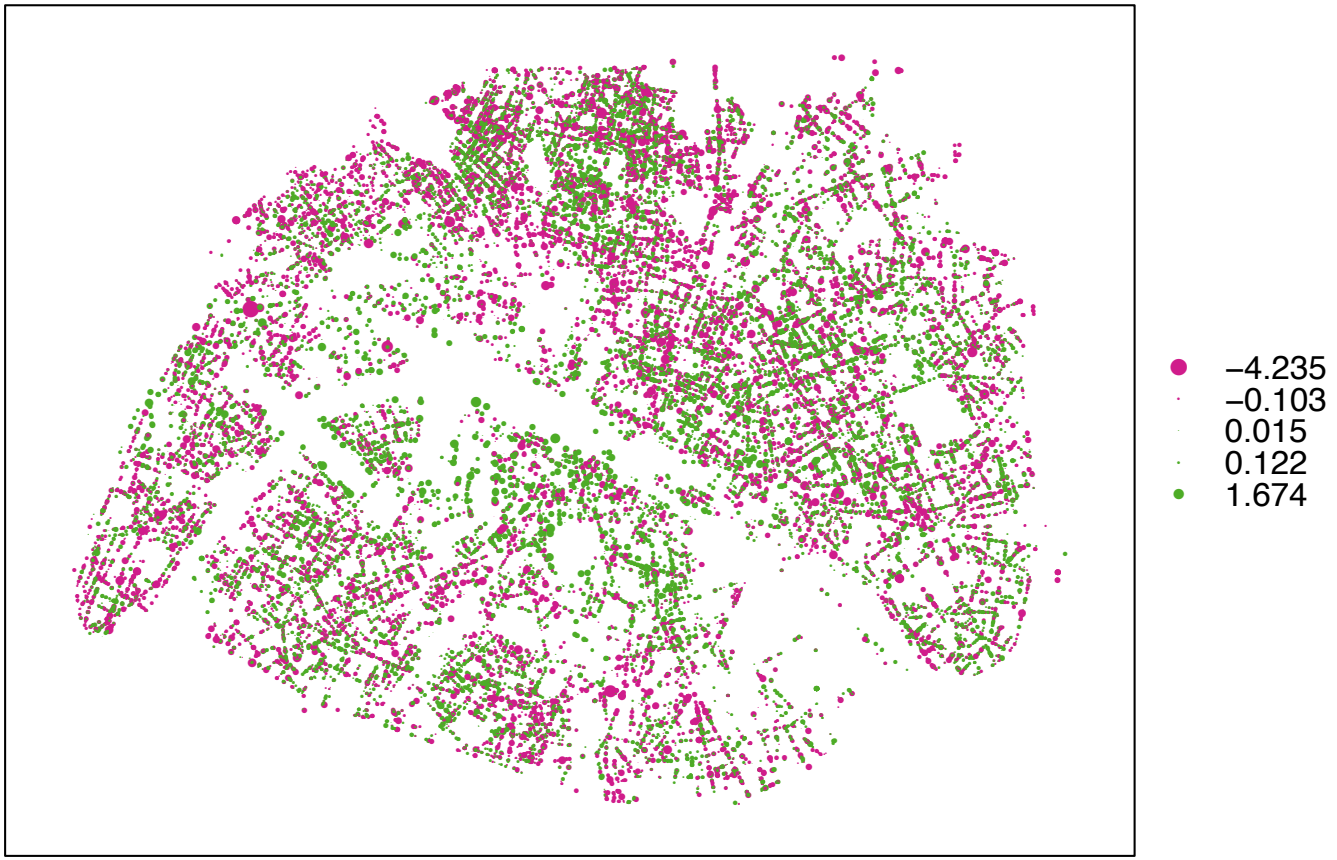

Figure: Spatial distribution des résidus (regression on the intrinsic and extrinsic characteristics of the house)

Spatial correlation

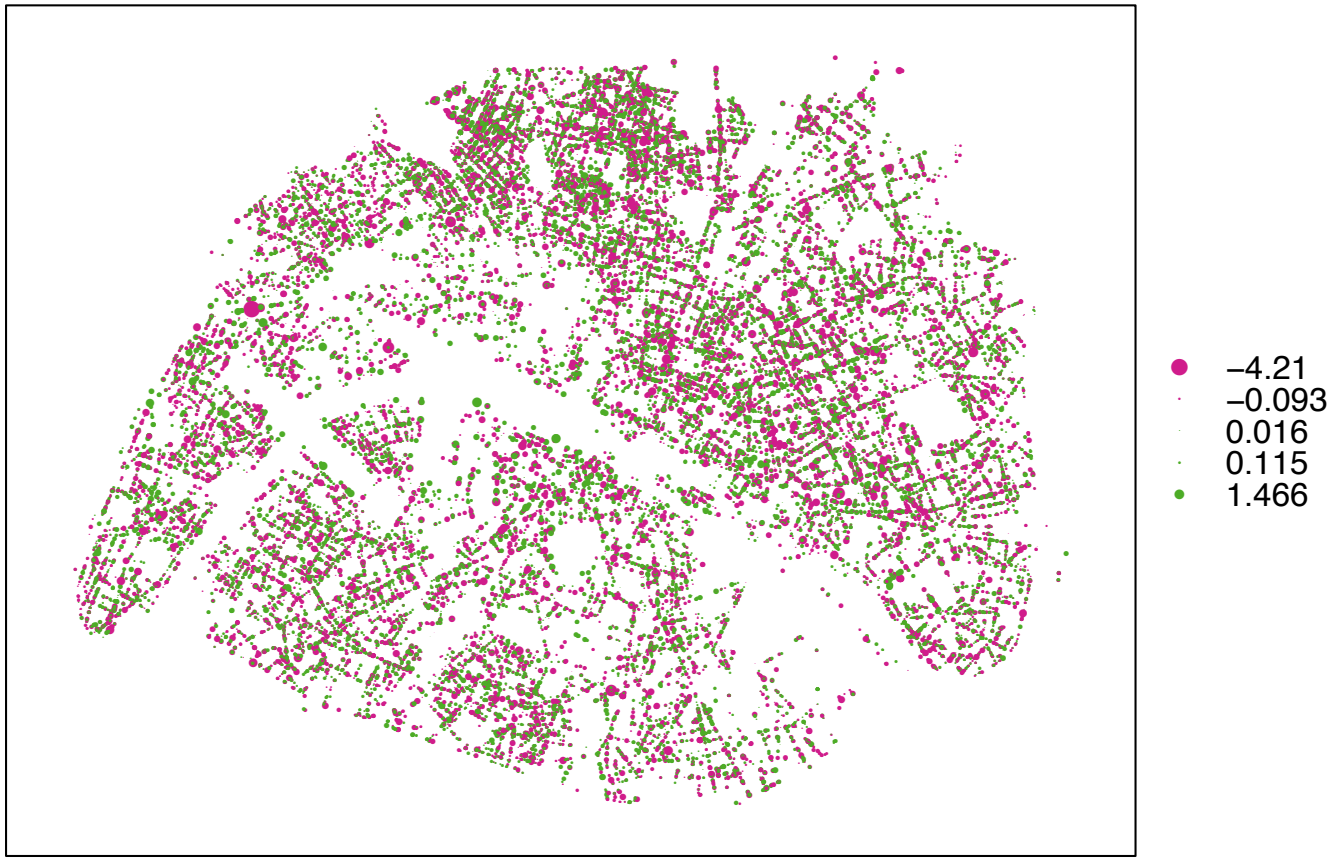

Figure: Spatial distribution of the residuals (regression on the intrinsic and extrinsic characteristics of the house with local fixed effects)

Conclusion

- **Significant and substantial** influence of some neighbourhood characteristics on real-estate price:
  - better assigned school
  - accessibility of jobs
- **Significant but small** influence of others:
  - crime

- Work in progress
  - match the transaction file with fiscal files to obtain the fiscal income of the buyers
  - estimate the demand parameters

Results: job accessibility

Table: Hedonic price of job accessibility

Estimator	Without Fixed Effects		*Grand-quartier* Fixed Effects	
Variables	log(price) (1)	log(price) (2)	log(price) (3)	log(price) (4)
Job accessibility by public transport	0.001	0.002***	0.003***	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Job accessibility by car	0.007***	0.001***	0.004***	0.003***
	(0.000)	(0.000)	(0.001)	(0.001)
Years and months	Yes	Yes	Yes	Yes
Surface (polynomial)	Yes	Yes	Yes	Yes
Characteristics of the house	Yes	Yes	Yes	Yes
Characteristics of the neighborhood	No	Yes	No	Yes
Number of observations	54395	54395	54395	54395
R2	0.893	0.912	0.913	0.916
R2 adj	0.893	0.912	0.913	0.916

Standard errors in parentheses

* p<0.10. ** p<0.05. *** p<0.010

Notes: The job accessibility is measured as a % of jobs located in *Ile-de-France* that are accessible in less than 30 minutes.

Results: transport accessibility

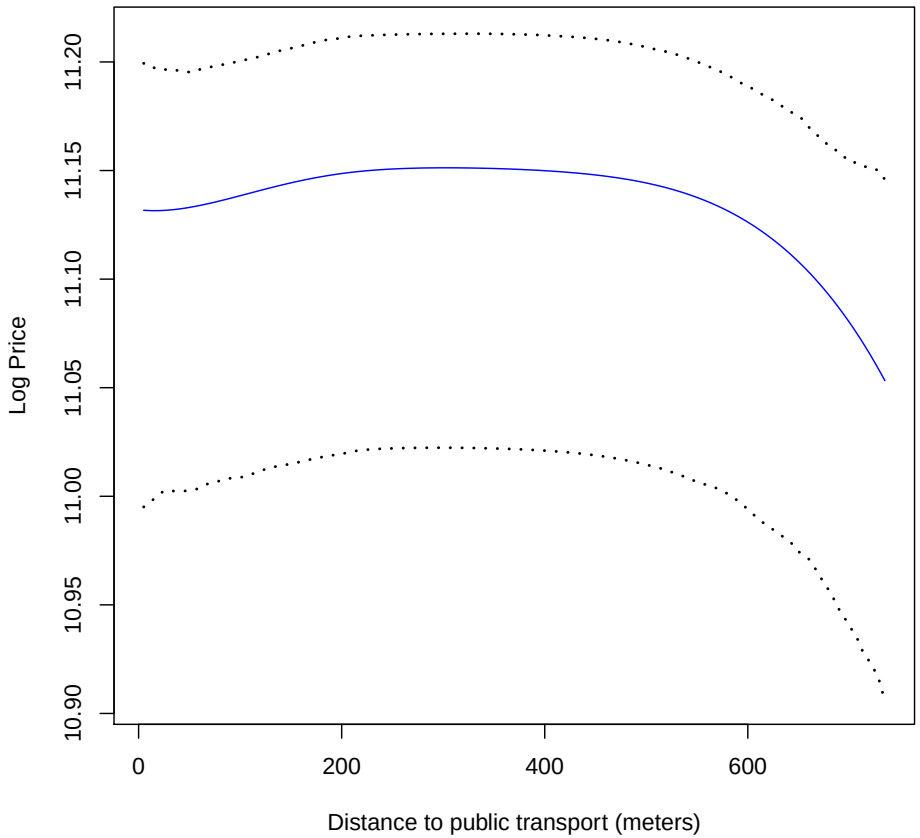

Figure: Hedonic price of the distance to metro

Results: noise

Table: Noise and housing value

Estimator	Without Fixed Effects		Grand Quartier Fixed Effects		IRIS Fixed Effects	
Variables	log(price) (1)	log(price) (2)	log(price) (3)	log(price) (4)	log(price) (5)	log(price) (6)
Less than 50 dB	ref.	ref.	ref.	ref.	ref.	ref.
Between 50dB(A) and 55dB(A)	-0.001	-0.004	0.006	0.003	0.001	0.001
	(0.008)	(0.004)	(0.005)	(0.004)	(0.004)	(0.004)
Between 55dB(A) and 60dB(A)	-0.024***	-0.004	0.000	0.002	0.004	0.004
	(0.008)	(0.005)	(0.006)	(0.005)	(0.004)	(0.004)
Between 60dB(A) and 65dB(A)	-0.039***	-0.013**	-0.011*	-0.007	-0.006	-0.005
	(0.009)	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)
More than 65dB(A)	-0.100***	-0.044**	-0.047***	-0.032*	-0.008	-0.007
	(0.036)	(0.019)	(0.018)	(0.017)	(0.014)	(0.014)
Close to a calm zone ($<$ 200 m)	0.030***	0.012*	0.012	0.012*	0.006	0.007
	(0.011)	(0.007)	(0.008)	(0.006)	(0.006)	(0.006)
Close to a green space ($<$ 200 m)	0.036***	0.018***	0.006	0.004	0.002	0.002
	(0.010)	(0.005)	(0.007)	(0.005)	(0.005)	(0.004)
Years and months	Yes	Yes	Yes	Yes	Yes	Yes
Surface (polynomial)	Yes	Yes	Yes	Yes	Yes	Yes
Characteristics of the house	Yes	Yes	Yes	Yes	Yes	Yes
Characteristics of the neighborhood	No	Yes	No	Yes	No	Yes
Number of observations	54395	54395	54395	54395	54395	54395
R2	0.868	0.912	0.912	0.917	0.923	0.923
R2 adj	0.868	0.912	0.912	0.916	0.921	0.921

Standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.010

Results: crime

Table: Crime and housing value

Estimator	Without Fixed Effects				IRIS Fixed Effects			
Variables	log(price) (1)	log(price) (2)	log(price) (3)	log(price) (4)	log(price) (5)	log(price) (6)	log(price) (7)	log(price) (8)
Number of infractions in a 100 m radius (*100)	-0.029***		-0.010***		-0.006**		-0.005*	
	(0.006)		(0.003)		(0.002)		(0.003)	
Number of burglaries in a 100 m radius (*100)		0.058		0.014		-0.099**		-0.093**
		(0.084)		(0.050)		(0.039)		(0.038)
Number of thefts without violence in a 100 m radius (*100)		0.264***		0.020**		-0.001		0.001
		(0.029)		(0.010)		(0.008)		(0.008)
Number of thefts with violence in a 100 m radius (*100)		-0.288***		0.029		0.033		0.035
		(0.066)		(0.040)		(0.028)		(0.028)
Number of violences in a 100 m radius (*100)		-0.529***		-0.081**		-0.026		-0.025
		(0.081)		(0.037)		(0.026)		(0.026)
Number of IRAS in a 100 m radius (*100)		-0.005		-0.042***		-0.027**		-0.024*
		(0.032)		(0.015)		(0.013)		(0.013)
Years and months	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Surface (polynomial)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Characteristics of the house	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Characteristics of the neighborhood	No	No	Yes	Yes	No	No	Yes	Yes
Number of observations	54395	54395	54395	54395	54395	54395	54395	54395
R2	0.867	0.874	0.912	0.912	0.922	0.922	0.923	0.923
R2 adj	0.867	0.874	0.912	0.912	0.921	0.921	0.921	0.921

Standard errors in parentheses

* p<0.10. ** p<0.05. *** p<0.010

Notes: IRAS are mainly infractions linked to drugs and immigration.

Retour

Results: school quality

Table: Hedonic prices of school quality

Estimator	Without Fixed Effects		IRIS Fixed Effects	
Variables	log(price) (1)	log(price) (2)	log(price) (3)	log(price) (4)
Success rate	0.0067***	-0.0002	0.0002	0.0002
	(0.0007)	(0.0005)	(0.0004)	(0.0004)
Success rate with honours	0.0058***	0.0000	-0.0002	-0.0002
	(0.0008)	(0.0005)	(0.0006)	(0.0006)
Success rate × Two rooms or more	0.0009	0.0011**	0.0007*	0.0006*
	(0.0006)	(0.0004)	(0.0004)	(0.0004)
Success rate with honours × Two rooms or more	0.0010*	0.0010**	0.0013***	0.0013***
	(0.0005)	(0.0005)	(0.0004)	(0.0004)
Years and months	Yes	Yes	Yes	Yes
Surface (polynomial)	Yes	Yes	Yes	Yes
Characteristics of the house	Yes	Yes	Yes	Yes
Characteristics of the neighborhood	No	Yes	No	Yes
Number of observations	54395	54395	54395	54395
R2	0.886	0.912	0.923	0.923
R2 adj	0.886	0.912	0.921	0.921

Standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.010