

Chapter 5: Estimating the hedonic equation, practical application

5.1 Estimating the hedonic equation in two steps

The vector of relative prices of the characteristics is obtained after two estimation steps, where the second step reduces the influence of extreme values. The aim is to achieve a more robust estimation of the coefficients of relative prices.

See Appendix 3 for new additions in version 3 on model specification.

Step 1: determining the estimation stock

An estimation of the basic model is carried out, using the reference stock for each stratum, as mentioned in Chapter 3.

After this first estimation, extreme observations are eliminated, associated with a large residual in absolute value which has little compatibility with the postulated model. The aim is to produce a robust estimation of the coefficients of the model, which is less sensitive to the specific characteristics of the data sample used. In this way, the empirical distribution of the residuals is closer to a normal law $(0, \sigma^2)$, for which the frequency of very large observations in proportion to the standard deviation (more than 3 standard deviations) and in absolute value is negligible.

There are several methods that can be used to detect these points. Here, we use the standardised residuals method. We standardise estimated residual $\hat{\epsilon}_i$ using the standard deviation of estimated variance $\hat{\epsilon}_i$. Using this method, it is possible to detect non-standard observations in cases where the estimated residual \hat{r}_i from observation i is too large.

The formula for calculation for observation i is therefore:

$$\hat{r}_i = \frac{\hat{\epsilon}_i}{\hat{s}\sqrt{1-h_{ii}}} \quad (5.1)$$

where \hat{s} : the square root of estimated variance of $\hat{\epsilon}_i$ equal to $\hat{s}^2 = \frac{\sum_{i=1}^n \hat{\epsilon}_i^2}{n - (k + 1)}$

n : number of observations

$k+1$: number of parameters of the econometric equation

$\hat{\epsilon}_i$, : estimated residuals of the regression

$h_{ii} = x_i'(X'X)^{-1}x_i$: lever effect of observation i

The amount (5.1) follows a Beta law if the numerator and the denominator are independent. This amount shows whether the standardised residual \hat{r}_i is atypical or not and acts as a test statistic for the hypotheses:

H0: observation i is not atypical;

H1: observation i is atypical.

After carrying out the regression, we remove from the estimation stock all observations where the standardised residual \hat{r}_i is not included in the interval $-2 < \hat{r}_i < 2$, for a significance level of $\alpha=0.05$. At the end of this step, we have a new estimation stock which can give a more robust estimation of the hedonic model.

Step 2: refining specification to make it parsimonious

A new estimation of the econometric equation was carried out on the estimation stock from step 1. The aim of step 2 was to reduce the number of explanatory variables and thus increase the validity and the robustness of the model. Thus at the same time, we reduce the risk of colinearity between variables, a risk that increases with a greater number of variables and which increases the dependency of the estimated values to the available sample. The logic behind the selection of variables is to bring into the equation only variables that are most correlated with the explanatory variable. We are therefore looking for a combination of variables which, when associated with the explanatory variable, give a high R^2 when the model is estimated. There are various methods for selecting variables; we used the ascending method, known as the Forward method.

The Forward method is a step-by-step method, where variables are added one after the other. At each step we use an entry test for the variable in the equation (Fisher's test). The process starts with a model with no variables at step 0. At step 1, we choose the variable that most accounts for the increase in the explained variation. The process stops when none of the remaining variables satisfies the entry conditions (entry threshold fixed at 0.5) or, in other words, when no variable has a test value above this threshold. The entry threshold [French *seuil*] for the j^{th} variable corresponds to a Fisher's test: we compare the sum of the squares (SSE_{M1}) of the complete model ($M1$) made up of the first j variables, with the sum of the squares (SSE_{M2}) of model ($M2$) limited to the first $j-1$ variables, i.e.:

$$Seuil_{Variable_j} = \frac{(SSE_{M1} - SSE_{M2})}{SSE_{M2} / (n - k - 1)}$$

where n is the number of observations and k is the number of variables in the model.

5.2. Numerical examples

We present below six examples of models, successively for apartments and houses in three different strata each time. In each model and for each descriptive variable, a reference property was chosen, which defines the reference modality. In the second "robust" step, the estimation procedure as described in the previous paragraph is based on a Forward approach. Variables are introduced progressively in the model, according to their explanatory power (that is to say, their contribution to the reduction of the sample variance of the error terms of the regression).

Following this step, a number of variables have not been introduced in the equation due to their influence not significantly different from the associated reference modality. The lines marked "ns" in the tables below correspond to these unselected modalities. For example, in Table 5.1, the final model is obtained after 49 variables were added to the constant exploratory in 48 exploratory steps. This model is satisfactory insofar 73.1% of the variance in prices per square meter (in logarithm) are associated with these 49 variables, describing the properties and therefore taken into account by the model.

5.2.1. Examples of regressions (2009-2010 stock)

Apartments

Table 5.1 - Apartments in stratum 3 in Paris Region, excluding Paris

($R^2 = 0.731$; $s = 0.190$;⁴⁶ number of observations: 8,059 – 48 steps in FORWARD)

Variables	Coefficient	Standard deviation	P-value
(Intercept)	7.844	0.009	0.000
Year 2009	-0.045	0.004	0.000
Year 2010		Reference	

⁴⁶ s is the mean quadratic error (or root mean square deviation).

Variables	Coefficient	Standard deviation	P-value
January	-0.025	0.008	0.002
February	-0.033	0.007	0.000
March	-0.052	0.007	0.000
April	-0.042	0.007	0.000
May	-0.038	0.008	0.000
June	-0.018	0.007	0.006
July	-0.023	0.006	0.000
August	ns	-	-
September	ns	-	-
October	ns	-	-
November	ns	-	-
December		Reference	
Before 1850	ns	-	-
1850 – 1913	0.108	0.034	0.002
1914 – 1947	0.078	0.022	0.000
1948 – 1969		Reference	
1970 – 1980	-0.032	0.005	0.000
1981 – 1991	0.022	0.005	0.000
1992 – 2010	0.115	0.006	0.000
Construction period unknown	ns	-	-
0 bathrooms	ns	-	-
1 bathroom		Reference	
2+ bathrooms	0.018	0.008	0.032
0 cellar		Reference	
1+ cellar	0.041	0.004	0.000
0 garage		Reference	
1 garage	0.071	0.006	0.000
2+ garages	0.113	0.008	0.000
Ground floor		Reference	
1 st floor	ns	-	-
2 nd floor	ns	-	-
3 rd floor	ns	-	-
4 th floor with lift	-0.034	0.005	0.000
4 th floor without lift	ns	-	-
Floor space per room of studios <20 sq.m.	-0.050	0.017	0.003
Floor space per room of studios 20-30 sq.m.		Reference	
Floor space per room of studios >30 sq.m.	-0.103	0.013	0.000
Floor space per room of 2-room apt. <17 sq.m.	0.157	0.018	0.000
Floor space per room of 2-room apt. 17-24 sq.m.		Reference	
Floor space per room of 2-room apt. >24 sq.m.	-0.124	0.008	0.000
Floor space per room of 3-room apt. <18 sq.m.	0.061	0.017	0.000
Floor space per room of 3-room apt. 18-22 sq.m.		Reference	
Floor space per room of 3-room apt. >22 sq.m.	-0.081	0.007	0.000
Floor space per room of 4-room apt. and more <17 sq.m.	ns	-	-
Floor space per room of 4-room apt. 17-21 sq.m.		Reference	
Floor space per room of 4-room apt. and more >21 sq.m.	-0.059	0.007	0.000
Studio in neighbourhood 1	0.293	0.014	0.000
2 rooms in neighbourhood 1	0.145	0.010	0.000
3 rooms in neighbourhood 1		Reference	
4 rooms in neighbourhood 1	-0.102	0.010	0.000
5+ rooms in neighbourhood 1	-0.253	0.016	0.000
Studio in neighbourhood 2	0.141	0.018	0.000
2 rooms in neighbourhood 2	-0.043	0.012	0.000
3 rooms in neighbourhood 2	-0.209	0.009	0.000
4 rooms in neighbourhood 2	-0.308	0.010	0.000
5+ rooms in neighbourhood 2	-0.419	0.015	0.000
Studio in neighbourhood 3	0.338	0.015	0.000
2 rooms in neighbourhood 3	0.181	0.011	0.000
3 rooms in neighbourhood 3	0.033	0.010	0.001
4 rooms in neighbourhood 3	-0.091	0.011	0.000
5+ rooms in neighbourhood 3	-0.193	0.022	0.000

Variables	Coefficient	Standard deviation	P-value
Studio in neighbourhood 4	0.346	0.017	0.000
2 rooms in neighbourhood 4	0.174	0.012	0.000
3 rooms in neighbourhood 4	0.019	0.009	0.039
4 rooms in neighbourhood 4	-0.132	0.010	0.000
5+ rooms in neighbourhood 4	-0.232	0.015	0.000
Studio in neighbourhood 5	0.410	0.030	0.000
2 rooms in neighbourhood 5	0.302	0.016	0.000
3 rooms in neighbourhood 5	0.214	0.011	0.000
4 rooms in neighbourhood 5	0.079	0.014	0.000
5+ rooms in neighbourhood 5	ns	-	-

Table 5.2 - Apartments in stratum 7502 in Paris

($R^2 = 0.280$; $s=0.190$; number of observations: 13,702 - 58 steps in FORWARD)

Variables	Coefficient	Standard deviation	P-value
(Intercept)	8.717	0.008	0.000
Year 2009	-0.118	0.003	0.000
Year 2010		Reference	
January	-0.101	0.007	0.000
February	-0.101	0.007	0.000
March	-0.115	0.007	0.000
April	-0.097	0.007	0.000
May	-0.098	0.007	0.000
June	-0.079	0.006	0.000
July	-0.056	0.006	0.000
August	-0.048	0.007	0.000
September	-0.036	0.006	0.000
October	-0.032	0.006	0.000
November	-0.019	0.007	0.006
December		Reference	
Before 1850	0.072	0.011	0.000
1850 – 1913	0.035	0.004	0.000
1914 – 1947	0.034	0.005	0.000
1948 – 1969		Reference	
1970 – 1980	0.020	0.006	0.001
1981 – 1991	0.054	0.010	0.000
1992 – 2010	0.070	0.010	0.000
Construction period unknown	0.037	0.005	0.000
0 bathrooms	-0.056	0.007	0.000
1 bathroom		Reference	
2+ bathrooms	0.045	0.009	0.000
Number of bathrooms unknown	-0.027	0.005	0.000
0 cellar		Reference	
1+ cellars	ns	-	-
0 garage		Reference	
1 garage	ns	-	-
2+ garages	0.062	0.019	0.001
Ground floor		Reference	
1 st floor	0.013	0.005	0.017
2 nd floor	0.037	0.005	0.000
3 rd floor	0.041	0.005	0.000
4 th floor with lift	0.056	0.005	0.000
4 th floor without lift	0.045	0.009	0.000
Floor space per room of studios <20 sq.m.	0.036	0.007	0.000
Floor space per room of studios 20-30 sq.m.		Reference	
Floor space per room of studios >30 sq.m.	-0.025	0.009	0.007
Floor space per room of 2-room apt. <17 sq.m.	ns	-	-
Floor space per room of 2-room apt. 17-24 sq.m.		Reference	
Floor space per room of 2-room apt. >24 sq.m.	ns	-	-
Floor space per room of 3-room apt. <18 sq.m.	-0.024	0.006	0.000
Floor space per room of 3-room apt. 18-22 sq.m.		Reference	
Floor space per room of 3-room apt. >22 sq.m.	ns	-	-

Variables	Coefficient	Standard deviation	P-value
Floor space per room of 4-room apt. and more <17 sq.m.	ns	-	-
Floor space per room of 4-room apt. 17-21 sq.m.		Reference	
Floor space per room of 4-room apt. and more >21 sq.m.	0.023	0.008	0.003
Studio in neighbourhood 1	-0.010	0.007	0.167
2 rooms in neighbourhood 1	-0.025	0.006	0.000
3 rooms in neighbourhood 1		Reference	
4 rooms in neighbourhood 1	ns	-	-
5+ rooms in neighbourhood 1	ns	-	-
Studio in neighbourhood 2	0.237	0.014	0.000
2 rooms in neighbourhood 2	0.219	0.011	0.000
3 rooms in neighbourhood 2	0.223	0.014	0.000
4 rooms in neighbourhood 2	0.193	0.021	0.000
5+ rooms in neighbourhood 2	0.285	0.032	0.000
Studio in neighbourhood 3	0.073	0.008	0.000
2 rooms in neighbourhood 3	0.074	0.006	0.000
3 rooms in neighbourhood 3	0.092	0.007	0.000
4 rooms in neighbourhood 3	0.081	0.010	0.000
5+ rooms in neighbourhood 3	0.089	0.014	0.000
Studio in neighbourhood 4	0.173	0.014	0.000
2 rooms in neighbourhood 4	0.131	0.010	0.000
3 rooms in neighbourhood 4	0.129	0.013	0.000
4 rooms in neighbourhood 4	0.101	0.019	0.000
5+ rooms in neighbourhood 4	ns	-	-
Studio in neighbourhood 5	0.051	0.010	0.000
2 rooms in neighbourhood 5	0.036	0.007	0.000
3 rooms in neighbourhood 5	0.092	0.008	0.000
4 rooms in neighbourhood 5	0.098	0.011	0.000
5+ rooms in neighbourhood 5	0.110	0.017	0.000
Studio in neighbourhood 6	-0.022	0.011	0.035
2 rooms in neighbourhood 6	-0.037	0.008	0.000
3 rooms in neighbourhood 6	-0.035	0.010	0.001
4 rooms in neighbourhood 6	-0.066	0.015	0.000
5+ rooms in neighbourhood 6	-0.071	0.025	0.004

Table 5.3 - Apartments in Toulouse

(R² = 0.57; s=0.17; number of observations: 5,538 - 70 steps in FORWARD)

Variables	Coefficient	Standard deviation	P-value
(Intercept)	7.505	0.013	0.000
Year 2009	-0.053	0.005	0.000
Year 2010		Reference	
January	-0.023	0.009	0.011
February	-0.051	0.010	0.000
March	-0.038	0.009	0.000
April	-0.048	0.010	0.000
May	-0.026	0.009	0.007
June	ns	-	-
July	ns	-	-
August	ns	-	-
September	ns	-	-
October	ns	-	-
November	ns	-	-
December		Reference	
Before 1850	0.103	0.024	0.000
1850 – 1913	0.144	0.018	0.000
1914 – 1947	0.130	0.017	0.000
1948 – 1969		Reference	
1970 – 1980	0.001	0.010	0.883
1981 – 1991	0.084	0.010	0.000
1992 – 2010	0.080	0.009	0.000
Construction period unknown	0.076	0.009	0.000
0 bathrooms	0.026	0.013	0.044
1 bathroom		Reference	
2+ bathrooms	0.084	0.015	0.000
Number of bathrooms unknown	ns	-	-

Variables	Coefficient	Standard deviation	P-value
0 cellar		Reference	
1+ cellars	-0.064	0.006	0.000
Number of cellars unknown	ns	-	-
0 garage		Reference	
1 garage	0.077	0.006	0.000
2+ garages	0.155	0.011	0.000
Ground floor		Reference	
1 st floor	ns	-	-
2 nd floor	ns	-	-
3 rd floor	ns	-	-
4 th floor with lift	-0.019	0.006	0.003
4 th floor without lift	ns	-	-
Floor space per room of studios <20 sq.m.	0.144	0.014	0.000
Floor space per room of studios 20-30 sq.m.		Reference	
Floor space per room of studios >30 sq.m.	-0.103	0.013	0.000
Floor space per room of 2-room apt. <17 sq.m.	0.082	0.012	0.000
Floor space per room of 2-room apt. 17-24 sq.m.		Reference	
Floor space per room of 2-room apt. >24 sq.m.	-0.047	0.010	0.000
Floor space per room of 3-room apt. <18 sq.m.	ns	-	-
Floor space per room of 3-room apt. 18-22 sq.m.		Reference	
Floor space per room of 3-room apt.>22 sq.m.	0.023	0.009	0.016
Floor space per room of 4-room apt. and more <17 sq.m.	ns	-	-
Floor space per room of 4-room apt. 17-21 sq.m.		Reference	
Floor space per room of 4-room apt. and more >21 sq.m.	0.058	0.011	0.000
Good condition		Reference	
Needs work	-0.062	0.010	0.000
Needs renovation	-0.187	0.019	0.000
Condition unknown	-0.037	0.006	0.000
Without terrace or balcony		Reference	
With terrace(s) or balcony(ies)	0.049	0.005	0.000
Studio in neighbourhood 1	0.176	0.021	0.000
2 rooms in neighbourhood 1	0.010	0.019	0.597
3 rooms in neighbourhood 1		Reference	
4 rooms in neighbourhood 1	-0.249	0.019	0.000
5+ rooms in neighbourhood 1	-0.248	0.030	0.000
Studio in neighbourhood 2	0.303	0.018	0.000
2 rooms in neighbourhood 2	0.194	0.018	0.000
3 rooms in neighbourhood 2	0.096	0.021	0.000
4 rooms in neighbourhood 2	ns	-	-
5+ rooms in neighbourhood 2	ns	-	-
Studio in neighbourhood 3	0.534	0.021	0.000
2 rooms in neighbourhood 3	0.522	0.022	0.000
3 rooms in neighbourhood 3	0.520	0.022	0.000
4 rooms in neighbourhood 3	0.482	0.032	0.000
5+ rooms in neighbourhood 3	0.468	0.029	0.000
Studio in neighbourhood 4	0.277	0.027	0.000
2 rooms in neighbourhood 4	0.219	0.020	0.000
3 rooms in neighbourhood 4	0.114	0.020	0.000
4 rooms in neighbourhood 4	0.148	0.022	0.000
5+ rooms in neighbourhood 4	0.096	0.044	0.031
Studio in neighbourhood 5	0.233	0.029	0.000
2 rooms in neighbourhood 5	0.145	0.020	0.000
3 rooms in neighbourhood 5	0.056	0.017	0.001
4 rooms in neighbourhood 5	0.002	0.020	0.916
5+ rooms in neighbourhood 5	ns	-	-
Studio in neighbourhood 6	0.185	0.027	0.000
2 rooms in neighbourhood 6	0.063	0.015	0.000
3 rooms in neighbourhood 6	-0.017	0.015	0.254
4 rooms in neighbourhood 6	-0.097	0.019	0.000
5+ rooms in neighbourhood 6	-0.149	0.044	0.001

Variables	Coefficient	Standard deviation	P-value
Studio in neighbourhood 7	0.274	0.028	0.000
2 rooms in neighbourhood 7	0.188	0.018	0.000
3 rooms in neighbourhood 7	0.084	0.017	0.000
4 rooms in neighbourhood 7	-0.043	0.019	0.020
5+ rooms in neighbourhood 7	-0.126	0.032	0.000
Studio in neighbourhood 8	0.202	0.026	0.000
2 rooms in neighbourhood 8	0.104	0.020	0.000
3 rooms in neighbourhood 8	0.047	0.020	0.021
4 rooms in neighbourhood 8	-0.066	0.024	0.006
5+ rooms in neighbourhood 8	-0.131	0.040	0.001
Studio in neighbourhood 9	0.384	0.015	0.000
2 rooms in neighbourhood 9	0.313	0.014	0.000
3 rooms in neighbourhood 9	0.277	0.014	0.000
4 rooms in neighbourhood 9	0.252	0.016	0.000
5+ rooms in neighbourhood 9	0.322	0.021	0.000

Table 5.4 - Apartments in Lyon

($R^2 = 0.44$; $s=0.17$; number of observations: 7,168 – 69 steps in FORWARD)

Variables	Coefficient	Standard deviation	P-value
(Intercept)	7.947	0.010	0.000
Year 2009	-0.086	0.004	0.000
Year 2010		Reference	
January	-0.050	0.009	0.000
February	-0.054	0.009	0.000
March	-0.062	0.008	0.000
April	-0.047	0.008	0.000
May	-0.044	0.008	0.000
June	-0.025	0.007	0.000
July	ns	-	-
August	ns	-	-
September	ns	-	-
October	ns	-	-
November	ns	-	-
December		Reference	
Before 1850	0.102	0.014	0.000
1850 – 1913	0.079	0.009	0.000
1914 – 1947	0.041	0.009	0.000
1948 – 1969		Reference	
1970 – 1980	-0.031	0.008	0.000
1981 – 1991	0.061	0.008	0.000
1992 – 2010	0.132	0.008	0.000
Construction period unknown	0.050	0.006	0.000
0 bathroom	ns	-	-
1 bathroom		Reference	
2+ bathrooms	0.040	0.009	0.000
Number of bathrooms unknown	-0.041	0.009	0.000
0 cellar		Reference	
1+ cellar	ns	-	-
Number of cellars unknown	ns	-	-
0 garage		Reference	
1 garage	0.044	0.005	0.000
2+ garages	0.092	0.010	0.000
Ground floor		Reference	
1 st floor	0.035	0.007	0.000
2 nd floor	0.053	0.007	0.000
3 rd floor	0.045	0.007	0.000
4 th floor with lift	0.056	0.006	0.000
4 th floor without lift	ns	-	-

Variables	Coefficient	Standard deviation	P-value
Floor space per room of studios <20 sq.m.	0.097	0.018	0.000
Floor space per room of studios 20-30 sq.m.		Reference	
Floor space per room of studios >30 sq.m.	-0.127	0.011	0.000
Floor space per room of 2-room apt. <17 sq.m.	0.038	0.015	0.011
Floor space per room of 2-room apt. 17-24 sq.m.		Reference	
Floor space per room of 2-room apt. >24 sq.m.	-0.057	0.008	0.000
Floor space per room of 3-room apt. <18 sq.m.	0.060	0.012	0.000
Floor space per room of 3-room apt. 18-22 sq.m.		Reference	
Floor space per room of 3-room apt.>22 sq.m.	ns	-	-
Floor space per room of 4-room apt. and more <17 sq.m.	ns	-	-
Floor space per room of 4-room apt. 17-21 sq.m.		Reference	
Floor space per room of 4-room apt. and more >21 sq.m.	0.032	0.007	0.000
Good condition		Reference	
Needs work	-0.104	0.007	0.000
Needs renovation	-0.199	0.014	0.000
Condition unknown	-0.020	0.005	0.000
Without terrace or balcony		Reference	
With terrace(s) or balcony(ies)	0.023	0.005	0.000
Studio in neighbourhood 1	0.134	0.021	0.000
2 rooms in neighbourhood 1	0.036	0.014	0.014
3 rooms in neighbourhood 1		Reference	
4 rooms in neighbourhood 1	ns	-	-
5+ rooms in neighbourhood 1	ns	-	-
Studio in neighbourhood 2	0.258	0.025	0.000
2 rooms in neighbourhood 2	0.145	0.020	0.000
3 rooms in neighbourhood 2	0.048	0.018	0.007
4 rooms in neighbourhood 2	0.064	0.021	0.002
5+ rooms in neighbourhood 2	0.073	0.029	0.010
Studio in neighbourhood 3	0.069	0.015	0.000
2 rooms in neighbourhood 3	-0.049	0.011	0.000
3 rooms in neighbourhood 3	-0.096	0.010	0.000
4 rooms in neighbourhood 3	-0.121	0.011	0.000
5+ rooms in neighbourhood 3	-0.134	0.015	0.000
Studio in neighbourhood 4	0.155	0.022	0.000
2 rooms in neighbourhood 4	0.059	0.015	0.000
3 rooms in neighbourhood 4	ns	-	-
4 rooms in neighbourhood 4	ns	-	-
5+ rooms in neighbourhood 4	ns	-	-
Studio in neighbourhood 5	-0.081	0.022	0.000
2 rooms in neighbourhood 5	-0.111	0.017	0.000
3 rooms in neighbourhood 5	-0.199	0.014	0.000
4 rooms in neighbourhood 5	-0.260	0.016	0.000
5+ rooms in neighbourhood 5	-0.286	0.022	0.000
Studio in neighbourhood 6	0.123	0.026	0.000
2 rooms in neighbourhood 6	ns	-	-
3 rooms in neighbourhood 6	-0.155	0.013	0.000
4 rooms in neighbourhood 6	-0.227	0.012	0.000
5+ rooms in neighbourhood 6	-0.199	0.016	0.000
Studio in neighbourhood 7	0.232	0.019	0.000
2 rooms in neighbourhood 7	0.139	0.014	0.000
3 rooms in neighbourhood 7	0.114	0.012	0.000
4 rooms in neighbourhood 7	0.085	0.014	0.000
5+ rooms in neighbourhood 7	0.100	0.015	0.000
Studio in neighbourhood 8	ns	-	-
2 rooms in neighbourhood 8	-0.072	0.012	0.000
3 rooms in neighbourhood 8	-0.134	0.011	0.000
4 rooms in neighbourhood 8	-0.199	0.014	0.000
5+ rooms in neighbourhood 8	-0.161	0.019	0.000
Studio in neighbourhood 9	0.057	0.020	0.004
2 rooms in neighbourhood 9	-0.096	0.013	0.000
3 rooms in neighbourhood 9	-0.201	0.012	0.000
4 rooms in neighbourhood 9	-0.273	0.013	0.000
5+ rooms in neighbourhood 9	-0.332	0.019	0.000

Houses

Table 5.5 – Houses in stratum 5 in Paris Region ⁴⁷

(R² = 0.678; s=0.190; number of observations: 7120 - 34 steps in FORWARD)

Variables	Coefficient	Standard deviation	P-value
(Intercept)	9.995	0.052	0.000
Living space (sq.m.)	0.353	0.012	0.000
Plot size (sq.m.)	0.148	0.003	0.000
Year 2009	-0.049	0.003	0.000
Year 2010		Reference	
January	ns	-	-
February	-0.019	0.007	0.005
March	-0.016	0.007	0.024
April	-0.019	0.007	0.005
May	-0.016	0.007	0.014
June	ns	-	-
July	ns	-	-
August	ns	-	-
September	ns	-	-
October	ns	-	-
November	ns	-	-
December		Reference	
Before 1913	ns	-	-
1914 – 1947	ns	-	-
1948 – 1969	-0.019	0.008	0.000
1970 – 1980	-0.018	0.005	0.000
After 1980	0.037	0.004	0.000
Period of construction unknown		Reference	
0 bathroom	-0.163	0.032	0.000
1 bathroom		Reference	
2 bathrooms	0.050	0.004	0.000
3+ bathrooms	-0.078	0.013	0.000
0 cellar		Reference	
1 cellar	0.026	0.005	0.000
2+ cellars	ns	-	-
0 garage	-0.036	0.005	0.000
1 garage		Reference	
2+ garages	0.039	0.006	0.000
1 floor	-0.041	0.005	0.000
2 floors		Reference	
3+ floors	ns	-	-
Up to 3 rooms in neighbourhood 1	-0.059	0.009	0.000
4 rooms in neighbourhood 1		Reference	
5 rooms in neighbourhood 1	ns	-	-
6 rooms in neighbourhood 1	0.024	0.007	0.000
7+ rooms in neighbourhood 1	0.042	0.009	0.000
Up to 3 rooms in neighbourhood 2	ns	-	-
4 rooms in neighbourhood 2	-0.033	0.007	0.000
5 rooms in neighbourhood 2	-0.037	0.006	0.000
6 rooms in neighbourhood 2	-0.028	0.008	0.000
7+ rooms in neighbourhood 2	-0.040	0.011	0.000
Up to 3 rooms in neighbourhood 3	0.120	0.021	0.000
4 rooms in neighbourhood 3	0.169	0.010	0.000
5 rooms in neighbourhood 3	0.158	0.008	0.000
6 rooms in neighbourhood 3	0.188	0.012	0.000
7+ rooms in neighbourhood 3	0.182	0.016	0.000
Up to 3 rooms in neighbourhood 4	0.139	0.017	0.000
4 rooms in neighbourhood 4	0.112	0.013	0.000
5 rooms in neighbourhood 4	0.129	0.012	0.000
6 rooms in neighbourhood 4	0.153	0.014	0.000
7+ rooms in neighbourhood 4	0.188	0.022	0.000

⁴⁷ In this example, the variable “number of buildings” does not appear. This variable is present in only one stratum.

Table 5.6 – Houses in suburbs of Lille

(R² = 0.85; s=0.17; number of observations: 6,702 - 75 steps in FORWARD)

Variables	Coefficient	Standard deviation	P-value
(Intercept)	8.689	0.047	0.000
Living space (sq.m.)	0.531	0.011	0.000
Plot size (sq.m.)	0.180	0.004	0.000
Year 2009	-0.053	0.004	0.000
Year 2010		Reference	
January	-0.040	0.009	0.000
February	ns	-	-
March	-0.021	0.009	0.018
April	-0.033	0.009	0.000
May	-0.026	0.009	0.004
June	-0.016	0.007	0.026
July	ns	-	-
August	ns	-	-
September	ns	-	-
October	ns	-	-
November	ns	-	-
December		Reference	
Before 1913	-0.064	0.011	0.000
1914 – 1947	-0.039	0.009	0.000
1948 – 1969	-0.008	0.009	0.421
1970 – 1980	0.041	0.010	0.000
After 1980	0.137	0.010	0.000
Period of construction unknown		Reference	
0 bathrooms	ns	-	-
1 bathrooms		Reference	
2+ bathrooms	0.123	0.007	0.000
Presence of basement	0.019	0.005	0.000
No basement		Reference	
0 garage	-0.055	0.005	0.000
1 garage		Reference	
2+ garages	0.026	0.008	0.002
1 floor	ns	-	-
2 floors		Reference	
3+ floors	-0.016	0.005	0.002
Good condition	0.029	0.006	0.000
Needs work	-0.138	0.007	0.000
Needs renovating	-0.357	0.012	0.000
Condition unknown		Reference	
Up to 3 rooms in neighbourhood 1	ns	-	-
4 rooms in neighbourhood 1		Reference	
5 rooms in neighbourhood 1	0.116	0.017	0.000
6 rooms in neighbourhood 1	0.170	0.023	0.000
7+ rooms in neighbourhood 1	0.252	0.034	0.000
Up to 3 rooms in neighbourhood 2	ns	-	-
4 rooms in neighbourhood 2	ns	-	-
5 rooms in neighbourhood 2	0.076	0.019	0.000
6 rooms in neighbourhood 2	ns	-	-
7+ rooms in neighbourhood 2	ns	-	-
Up to 3 rooms in neighbourhood 3	ns	-	-
4 rooms in neighbourhood 3	-0.039	0.017	0.021
5 rooms in neighbourhood 3	ns	-	-
6 rooms in neighbourhood 3	ns	-	-
7+ rooms in neighbourhood 3	-0.142	0.072	0.047
Up to 3 rooms in neighbourhood 4	-0.088	0.029	0.003
4 rooms in neighbourhood 4	ns	-	-
5 rooms in neighbourhood 4	-0.092	0.022	0.000
6 rooms in neighbourhood 4	-0.201	0.040	0.000
7+ rooms in neighbourhood 4	ns	-	-

Variables	Coefficient	Standard deviation	P-value
Up to 3 rooms in neighbourhood 5	0.096	0.038	0.013
4 rooms in neighbourhood 5	0.197	0.021	0.000
5 rooms in neighbourhood 5	0.190	0.018	0.000
6 rooms in neighbourhood 5	0.308	0.028	0.000
7+ rooms in neighbourhood 5	0.344	0.032	0.000
Up to 3 rooms in neighbourhood 6	ns	-	-
4 rooms in neighbourhood 6	ns	-	-
5 rooms in neighbourhood 6	-0.064	0.023	0.006
6 rooms in neighbourhood 6	ns	-	-
7+ rooms in neighbourhood 6	ns	-	-
Up to 3 rooms in neighbourhood 7	0.129	0.047	0.006
4 rooms in neighbourhood 7	0.170	0.027	0.000
5 rooms in neighbourhood 7	0.236	0.024	0.000
6 rooms in neighbourhood 7	0.335	0.032	0.000
7 rooms in neighbourhood 7	0.472	0.044	0.000
Up to 3 rooms in neighbourhood 8	0.164	0.032	0.000
4 rooms in neighbourhood 8	0.212	0.016	0.000
5 rooms in neighbourhood 8	0.242	0.016	0.000
6 rooms in neighbourhood 8	0.234	0.020	0.000
7+ rooms in neighbourhood 8	0.421	0.025	0.000
Up to 3 rooms in neighbourhood 9	0.150	0.035	0.000
4 rooms in neighbourhood 9	0.154	0.022	0.000
5 rooms in neighbourhood 9	0.219	0.024	0.000
6 rooms in neighbourhood 9	0.191	0.030	0.000
7+ rooms in neighbourhood 9	0.295	0.036	0.000
Up to 3 rooms in neighbourhood 10	ns	-	-
4 rooms in neighbourhood 10	0.045	0.021	0.032
5 rooms in neighbourhood 10	ns	-	-
6 rooms in neighbourhood 10	ns	-	-
7+ rooms in neighbourhood 10	0.230	0.078	0.003
Up to 3 rooms in neighbourhood 11	-0.295	0.023	0.000
4 rooms in neighbourhood 11	-0.200	0.013	0.000
5 rooms in neighbourhood 11	-0.187	0.013	0.000
6 rooms in neighbourhood 11	-0.158	0.020	0.000
7+ rooms in neighbourhood 11	-0.195	0.024	0.000
Up to 3 rooms in neighbourhood 12	0.074	0.032	0.020
4 rooms in neighbourhood 12	0.144	0.019	0.000
5 rooms in neighbourhood 12	0.084	0.020	0.000
6 rooms in neighbourhood 12	0.175	0.029	0.000
7+ rooms in neighbourhood 12	0.135	0.045	0.003
Up to 3 rooms in neighbourhood 13	-0.114	0.025	0.000
4 rooms in neighbourhood 13	-0.086	0.014	0.000
5 rooms in neighbourhood 13	-0.107	0.017	0.000
6 rooms in neighbourhood 13	-0.128	0.030	0.000
7+ rooms in neighbourhood 13	-0.144	0.058	0.014
Up to 3 rooms in neighbourhood 14	-0.063	0.023	0.006
4 rooms in neighbourhood 14	ns	-	-
5 rooms in neighbourhood 14	-0.030	0.012	0.015
6 rooms in neighbourhood 14	ns	-	-
7+ rooms in neighbourhood 14	ns	-	-
Up to 3 rooms in neighbourhood 15	ns	-	-
4 rooms in neighbourhood 15	ns	-	-
5 rooms in neighbourhood 15	ns	-	-
6 rooms in neighbourhood 15	ns	-	-
7+ rooms in neighbourhood 15	ns	-	-
Up to 3 rooms in neighbourhood 16	-0.062	0.019	0.001
4 rooms in neighbourhood 16	ns	-	-
5 rooms in neighbourhood 16	ns	-	-
6 rooms in neighbourhood 16	ns	-	-
7+ rooms in neighbourhood 16	ns	-	-
Up to 3 rooms in neighbourhood 17	ns	-	-
4 rooms in neighbourhood 17	0.059	0.013	0.000
5 rooms in neighbourhood 17	0.118	0.011	0.000
6 rooms in neighbourhood 17	0.132	0.015	0.000
7+ rooms in neighbourhood 17	0.153	0.021	0.000

Table 5.7 – Houses in suburbs of Bordeaux

(R² = 0.67; s=0.19; number of observations: 3 818 - 53 steps in FORWARD)

Variables	Coefficient	Standard deviation	P-value
(Intercept)	9.414	0.074	0.000
Living space (sq.m.)	0.534	0.017	0.000
Plot size (sq.m.)	0.074	0.005	0.000
Year 2009	-0.063	0.006	0.000
Year 2010		Reference	
January	-0.030	0.014	0.034
February	-0.054	0.014	0.000
March	-0.078	0.013	0.000
April	-0.044	0.013	0.001
May	-0.058	0.013	0.000
June	-0.026	0.011	0.015
July	ns	-	-
August	0.022	0.011	0.040
September	ns	-	-
October	ns	-	-
November	ns	-	-
December		Reference	
Before 1913	0.073	0.021	0.001
1914 – 1947	0.067	0.012	0.000
1948 – 1969	ns	-	-
1970 – 1980	ns	-	-
After 1980	0.066	0.008	0.000
Period of construction unknown		Reference	
0 bathrooms	ns	-	-
1 bathrooms		Reference	
2+ bathrooms	0.082	0.009	0.000
Presence of basement	0.036	0.015	0.013
No basement		Reference	
0 garage	-0.030	0.007	0.000
1 garage		Reference	
2+ garages	0.038	0.013	0.004
1 floor	0.017	0.007	0.013
2 floors		Reference	
3+ floors	ns	-	-
Good condition	0.014	0.007	0.041
Needs work	-0.102	0.013	0.000
Needs renovating	-0.324	0.020	0.000
Condition unknown		Reference	
Up to 3 rooms in neighbourhood 1	ns	-	-
4 rooms in neighbourhood 1		Reference	
5 rooms in neighbourhood 1	0.091	0.021	0.000
6 rooms in neighbourhood 1	0.117	0.027	0.000
7+ rooms in neighbourhood 1	0.151	0.034	0.000
Up to 3 rooms in neighbourhood 2	ns	-	-
4 rooms in neighbourhood 2	0.029	0.019	0.128
5 rooms in neighbourhood 2	ns	-	-
6 rooms in neighbourhood 2	ns	-	-
7+ rooms in neighbourhood 2	ns	-	-
Up to 3 rooms in neighbourhood 3	ns	-	-
4 rooms in neighbourhood 3	ns	-	-
5 rooms in neighbourhood 3	ns	-	-
6 rooms in neighbourhood 3	ns	-	-
7+ rooms in neighbourhood 3	-0.090	0.042	0.031
Up to 3 rooms in neighbourhood 4	0.068	0.026	0.010
4 rooms in neighbourhood 4	0.106	0.026	0.000
5 rooms in neighbourhood 4	0.086	0.030	0.004
6 rooms in neighbourhood 4	0.156	0.043	0.000
7+ rooms in neighbourhood 4	ns	-	-

Variables	Coefficient	Standard deviation	P-value
Up to 3 rooms in neighbourhood 5	-0.117	0.031	0.000
4 rooms in neighbourhood 5	-0.065	0.022	0.003
5 rooms in neighbourhood 5	-0.069	0.022	0.002
6 rooms in neighbourhood 5	-0.108	0.042	0.011
7+ rooms in neighbourhood 5	ns	-	-
Up to 3 rooms in neighbourhood 6	-0.103	0.019	0.000
4 rooms in neighbourhood 6	-0.161	0.015	0.000
5 rooms in neighbourhood 6	-0.145	0.018	0.000
6 rooms in neighbourhood 6	-0.126	0.028	0.000
7+ rooms in neighbourhood 6	-0.239	0.045	0.000
Up to 3 rooms in neighbourhood 7	-0.282	0.023	0.000
4 rooms in neighbourhood 7	-0.181	0.015	0.000
5 rooms in neighbourhood 7	-0.166	0.015	0.000
6 rooms in neighbourhood 7	-0.112	0.022	0.000
7+ rooms in neighbourhood 7	-0.180	0.035	0.000
Up to 3 rooms in neighbourhood 8	-0.062	0.022	0.004
4 rooms in neighbourhood 8	-0.064	0.015	0.000
5 rooms in neighbourhood 8	0.011	0.016	0.480
6 rooms in neighbourhood 8	ns	-	-
7+ rooms in neighbourhood 8	0.074	0.028	0.008
Up to 3 rooms in neighbourhood 9	-0.136	0.028	0.000
4 rooms in neighbourhood 9	-0.076	0.017	0.000
5 rooms in neighbourhood 9	-0.044	0.015	0.004
6 rooms in neighbourhood 9	-0.053	0.019	0.005
7+ rooms in neighbourhood 9	0.033	0.025	0.184

5.2.2. Quality of hedonic regressions

The quality of the hedonic regressions is usually measured by the determination coefficient R^2 , which ranges from 0 to 1. The higher the coefficient, the greater the regression's predictive power. For cross-sectional individual data, good values for R^2 are roughly 0.25-0.4 for 1,000 to 3,000 observations and about twenty explanatory variables. This is the level of quality that we observe here for the various strata. Remember that the dependent variable is the Napierian logarithm of the price per sq. m. for apartments and of the property price for houses.

Apartments

Table 5.8 – Quality of regressions and number of observations from estimation stock by stratum: Paris Region, apartments

Stratum	Steps	R^2	Estimation stock
1	45	0.478	5,348
2	48	0.635	2,860
3	48	0.731	4,615
4	52	0.601	9,287
5	52	0.508	11,833
6	58	0.519	17,154
7	28	0.681	3,225
8	51	0.640	8,667
9	39	0.292	11,139
10	50	0.415	16,746
7501	47	0.501	8,463
7502	58	0.280	13,702
7503	56	0.397	9,895
7504	32	0.393	4,251
7505	38	0.338	5,626
Total			132,811

Table 5.9 – Quality of regressions and number of observations from estimation stock by stratum: Provinces, apartments

Stratum	Steps	R ²	Estimation stock
Agglomération de Genève - Annemasse (partie française)	42	0,47	1 876
Agglomération de Bayonne	53	0,54	2 253
Banlieue de Toulon	57	0,60	3 895
Banlieue de Lyon	64	0,54	4 993
Banlieue de Marseille-Aix-en-Provence	49	0,60	1 939
Antibes	32	0,36	1 480
Cannes	49	0,49	2 470
Cannet	23	0,39	1 121
Menton	16	0,27	761
Nice	69	0,43	8 251
Banlieue de Nice	71	0,46	4 671
Marseille	86	0,59	6 289
Caen	23	0,48	993
Dijon	58	0,54	2 434
Besançon	32	0,46	1 806
Brest	45	0,43	1 750
Toulouse	70	0,57	5 538
Bordeaux	55	0,37	2 537
Banlieue de Bordeaux	46	0,60	2 058
Agde	23	0,41	1 412
Montpellier	48	0,45	1 947
Rennes	47	0,59	2 507
Tours	30	0,54	1 181
Grenoble	60	0,56	2 351
Banlieue de Grenoble	42	0,53	2 163
Saint-Etienne	17	0,32	1 490
Nantes	56	0,45	3 472
Agglomération de Saint-Nazaire	26	0,74	865
Banlieue de Nantes	32	0,65	1 081
Orléans	39	0,52	1 259
Reims	41	0,57	1 558
Nancy	25	0,25	1 484
Banlieue de Nancy	33	0,43	1 181
Metz	31	0,40	1 308
Lille	47	0,59	2 366
Banlieue de Lille (partie française)	40	0,59	2 032
Clermont-Ferrand	26	0,42	1 284
Pau	19	0,31	1 375
Strasbourg	39	0,50	2 422
Banlieue de Strasbourg (partie française)	30	0,43	1 302
Agglomération de Mulhouse	18	0,42	944
Lyon	69	0,44	7 168
Villeurbanne	30	0,46	1 854
Agglomération de Chambéry	25	0,47	1 244
Annecy	30	0,52	1 186
Banlieue de Annecy	35	0,63	1 269
Le Havre	34	0,50	1 269
Rouen	40	0,44	1 356
Banlieue de Rouen	25	0,56	795
Toulon	41	0,43	1 960
Littoral Grand Nord (Régions 31,22)	45	0,74	2 042
Littoral de Normandie (Région 25, 23)	49	0,65	2 249
Littoral Bretagne Est (départ. 35,56)	50	0,66	1 974
Littoral Bretagne Ouest (départ. 22,29)	41	0,65	1 735
Littoral Pays de la Loire (Région 52)	28	0,38	1 069
Littoral Sud-Ouest (Régions 54,72)	49	0,46	2 695
Littoral Languedoc-Roussillon Sud (départ. 11,66 et 34)	38	0,44	2 252
Littoral Languedoc-Roussillon Sud (départ. 34, 30)	40	0,58	1 612
Littoral Provence-Alpes-Côte d'Azur Ouest (départ. 13, 83)	28	0,25	1 374
Littoral Provence-Alpes-Côte d'Azur Est (départ. 83,06)	43	0,62	2 324
Stations de ski de Tarentaise	34	0,66	1 887

Stratum	Steps	R ²	Estimation stock
Stations de ski de Maurienne, Val d'Arly, Beaufortin, les Bauges, Chablais, Giffre, Les Bornes et Chartreuse.	37	0,45	1 809
Stations de ski de Mont-Blanc et Aravis.	40	0,65	1 417
Stations de ski de l'Isère	29	0,57	1 149
Autres communes du Nord sauf Picardie, à revenu faible	24	0,28	1 758
Autres communes du Nord sauf Picardie, à revenu moyen	49	0,47	1 880
Autres communes du Nord sauf Picardie, à revenu élevé	34	0,37	1 514
Autres communes de l'Ouest sauf Pays de la Loire, à revenu faible	44	0,51	2 563
Autres communes de l'Ouest sauf Pays de la Loire, à revenu élevé	23	0,38	1 747
Autres communes du Limousin et d'Auvergne, à revenu faible	33	0,52	1 605
Autres communes du Limousin et d'Auvergne, à revenu élevé	35	0,44	1 620
Autres communes de Picardie, à revenu faible	44	0,62	2 029
Autres communes de Picardie, à revenu élevé	24	0,38	1 222
Autres communes du Centre, à revenu faible	40	0,59	1 999
Autres communes du Centre, à revenu élevé	34	0,49	1 546
Autres communes de Bourgogne, à revenu faible	36	0,50	1 407
Autres communes de Bourgogne, à revenu élevé	27	0,42	1 336
Autres communes de Lorraine, à revenu faible	38	0,44	1 768
Autres communes de Lorraine, à revenu élevé	27	0,28	1 713
Autres communes d'Alsace, à revenu faible	32	0,48	1 861
Autres communes d'Alsace, à revenu élevé	23	0,36	1 316
Autres communes de Franche-Comté, à revenu faible	51	0,49	1 578
Autres communes de Franche-Comté, à revenu élevé	28	0,33	1 341
Autres communes du Pays de la Loire, à revenu faible	36	0,40	1 696
Autres communes du Pays de la Loire, à revenu élevé	35	0,62	1 518
Autres communes du Midi-Pyrénées, à revenu faible	51	0,70	2 414
Autres communes du Midi-Pyrénées, à revenu élevé	26	0,43	1 655
Autres communes Du Rhône-Alpes-Est, à revenu faible	27	0,37	2 068
Autres communes Du Rhône-Alpes-Est, à revenu moyen	32	0,52	1 852
Autres communes Du Rhône-Alpes-Est, à revenu élevé	36	0,38	2 456
Autres communes Du Rhône-Alpes-Ouest, à revenu faible	41	0,57	2 210
Autres communes Du Rhône-Alpes-Ouest, à revenu élevé	45	0,53	2 368
Autres communes du Sud-Est (Languedoc-Roussillon et PACA), à revenu faible	34	0,38	2 133
Autres communes du Sud-Est (Languedoc-Roussillon et PACA), à revenu élevé	39	0,38	3 250
Autres communes de Provence-Alpes-Côte d'Azur Nord, à revenu faible	44	0,51	1 738
Autres communes de Provence-Alpes-Côte d'Azur Nord, à revenu moyen	34	0,60	1 598
Autres communes de Provence-Alpes-Côte d'Azur Nord, à revenu élevé	35	0,50	1 448
TOTAL			197 995

Houses

Table 5.10 - Quality of regressions and number of observations from estimation stock by stratum: Paris Region, houses

Stratum	Steps	R ²	Estimation stock
1	53	0.795	5,977
2	24	0.693	1,652
3	41	0.654	11,314
4	37	0.681	5,423
5	34	0.678	7,120
6	37	0.644	9,974
7	39	0.622	11,115
Total			52,575

Table 5.11 - Quality of regressions and number of observations from estimation stock by stratum: Provinces, houses

Stratum	Steps	R ²	Estimation stock
Unité Urbaine d'Avignon	19	0,73	953
Unité Urbaine de Béthune	29	0,72	2 005
Unité Urbaine de Metz	23	0,66	1 254
Unité Urbaine de Douai-Lens	32	0,72	3 436

Stratum	Steps	R ²	Estimation stock
Unité Urbaine de Toulon	33	0,69	2 136
Unité Urbaine de Lyon	26	0,68	4 003
Banlieue de Marseille-Aix-en-Provence	35	0,72	2 067
Unité Urbaine de Nice	36	0,67	2 895
Marseille	24	0,78	910
Unité Urbaine de Dijon	16	0,74	892
Unité Urbaine de Brest	17	0,64	1 001
Toulouse	14	0,67	860
Banlieue de Toulouse	22	0,73	2 221
Bordeaux	25	0,78	1 087
Banlieue de Bordeaux	53	0,67	3 818
Unité Urbaine de Montpellier	13	0,71	701
Unité Urbaine de Rennes	19	0,70	1 059
Unité Urbaine de Tours	24	0,75	1 424
Unité Urbaine de Grenoble	19	0,72	933
Nantes	17	0,74	1 107
Unité Urbaine de Saint-Nazaire	18	0,67	835
Banlieue de Nantes	35	0,78	2 514
Unité Urbaine de Orléans	26	0,76	1 685
Unité Urbaine de Reims	13	0,76	715
Unité Urbaine de Nancy	26	0,67	1 954
Lille	18	0,77	825
Unité Urbaine de Maubeuge (partie française)	18	0,72	1 049
Tourcoing	12	0,73	1 011
Unité Urbaine de Dunkerque	21	0,69	760
Unité Urbaine de Valenciennes (partie française)	31	0,70	2 357
Banlieue de Lille (partie française)	75	0,85	6 702
Unité Urbaine de Calais	14	0,73	1 040
Unité Urbaine de Clermont-Ferrand	17	0,75	963
Le Mans	24	0,77	1 258
Le Havre	24	0,71	864
Unité Urbaine de Rouen	36	0,81	2 332
Amiens	20	0,80	1 196
Littoral du Finistère et des Côtes d'Armor, à revenu très faible	15	0,60	1 266
Littoral du Finistère et des Côtes d'Armor, à revenu faible	17	0,59	1 062
Littoral du Finistère et des Côtes d'Armor, à revenu moyen	13	0,59	981
Littoral du Finistère et des Côtes d'Armor, à revenu élevé	15	0,62	1 087
Littoral d'Ille-et-Vilaine, et du Morbihan, à revenu très faible	24	0,61	1 084
Littoral d'Ille-et-Vilaine, et du Morbihan, à revenu faible	17	0,63	1 063
Littoral d'Ille-et-Vilaine, et du Morbihan, à revenu moyen	18	0,59	919
Littoral d'Ille-et-Vilaine, et du Morbihan, à revenu élevé	14	0,57	1 073
Littoral du Nord-Pas-de-Calais et des deux Normandie, à revenu très faible	26	0,68	1 297
Littoral du Nord-Pas-de-Calais et des deux Normandie, à revenu faible	16	0,58	1 315
Littoral du Nord-Pas-de-Calais et des deux Normandie, à revenu moyen	18	0,58	1 366
Littoral du Nord-Pas-de-Calais et des deux Normandie, à revenu élevé	19	0,66	1 215
Littoral Méditerranéen, à revenu faible	24	0,72	1 457
Littoral Méditerranéen, à revenu moyen	18	0,75	1 054
Littoral Méditerranéen, à revenu élevé	30	0,70	1 106
Littoral de Loire-Atlantique, Vendée et Charente-Maritime, à revenu faible	35	0,65	2 211
Littoral de Loire-Atlantique, Vendée et Charente-Maritime, à revenu élevé	23	0,67	1 742
Littoral de Gironde, des Landes et des Pyrénées-Atlantiques, à revenu faible	28	0,63	1 558
Littoral de Gironde, des Landes et des Pyrénées-Atlantiques, à revenu élevé	24	0,66	1 111
Stations de Ski d'Isère, Savoie et Haute-Savoie	31	0,68	1 664
Autres communes d'Indre et d'Indre-et-Loire, à revenu faible	18	0,70	859
Autres communes d'Indre et d'Indre-et-Loire, à revenu moyen	24	0,72	1 165
Autres communes d'Indre et d'Indre-et-Loire, à revenu élevé	22	0,70	1 247
Autres communes d'Eure-et-Loir, à revenu faible	35	0,66	1 544
Autres communes d'Eure-et-Loir, à revenu moyen	25	0,67	1 557
Autres communes d'Eure-et-Loir, à revenu élevé	30	0,66	1 639
Autres communes du Loiret, à revenu faible	23	0,68	1 369
Autres communes du Loiret, à revenu moyen	19	0,68	1 278
Autres communes du Loiret, à revenu élevé	22	0,68	1 410
Autres communes du Loir et Cher, à revenu faible	26	0,73	1 532
Autres communes du Loir et Cher, à revenu élevé	26	0,70	1 518
Autres communes du Cher, à revenu faible	20	0,74	995
Autres communes du Cher, à revenu élevé	34	0,78	1 042

Stratum	Steps	R ²	Estimation stock
Autres communes de Savoie et de Haute-Savoie, à revenu faible	30	0,71	1 636
Autres communes de Savoie et de Haute-Savoie, à revenu moyen	29	0,64	1 594
Autres communes de Savoie et de Haute-Savoie, à revenu élevé	29	0,61	1 529
Autres communes de Rhône-Alpes Ouest, à revenu très faible	26	0,69	1 905
Autres communes de Rhône-Alpes Ouest, à revenu faible	35	0,69	2 079
Autres communes de Rhône-Alpes Ouest, à revenu moyen	25	0,67	1 936
Autres communes de Rhône-Alpes Ouest, à revenu élevé	24	0,61	1 998
Autres communes de l'Ain, à revenu faible	25	0,65	2 028
Autres communes de l'Ain, à revenu élevé	29	0,70	2 315
Autres communes de l'Isère, à revenu faible	22	0,61	1 910
Autres communes de l'Isère, à revenu élevé	35	0,64	2 006
Autres communes de Champagne-Ardenne Nord, à revenu faible	27	0,69	1 377
Autres communes de Champagne-Ardenne Nord, à revenu moyen	40	0,64	1 558
Autres communes de Champagne-Ardenne Nord, à revenu élevé	28	0,68	1 583
Autres communes de Champagne-Ardenne Sud, à revenu faible	31	0,68	1 505
Autres communes de Champagne-Ardenne Sud, à revenu élevé	28	0,68	1 533
Autres communes de la Somme, à revenu faible	25	0,67	1 225
Autres communes de la Somme, à revenu moyen	20	0,70	1 459
Autres communes de la Somme, à revenu élevé	28	0,74	1 547
Autres communes de l'Aisne, à revenu très faible	28	0,74	1 564
Autres communes de l'Aisne, à revenu faible	33	0,73	1 716
Autres communes de l'Aisne, à revenu moyen	26	0,68	1 678
Autres communes de l'Aisne, à revenu élevé	33	0,74	1 794
Autres communes de l'Oise, à revenu faible	26	0,71	1 270
Autres communes de l'Oise, à revenu moyen	21	0,64	1 357
Autres communes de l'Oise, à revenu élevé	16	0,68	1 376
Autres communes de Seine-Maritime, à revenu faible	25	0,73	1 544
Autres communes de Seine-Maritime, à revenu moyen	23	0,71	1 811
Autres communes de Seine-Maritime, à revenu élevé	29	0,70	1 600
Autres communes de l'Eure, à revenu faible	35	0,65	1 856
Autres communes de l'Eure, à revenu moyen	26	0,64	1 698
Autres communes de l'Eure, à revenu élevé	17	0,66	1 779
Autres communes de Basse-Normandie, à revenu très faible	31	0,68	1 862
Autres communes de Basse-Normandie, à revenu faible	31	0,67	2 082
Autres communes de Basse-Normandie, à revenu moyen	46	0,73	2 166
Autres communes de Basse-Normandie, à revenu élevé	30	0,68	2 251
Autres communes de Bourgogne Est (21,71), à revenu faible	25	0,67	2 043
Autres communes de Bourgogne Est (21,71), à revenu moyen	24	0,61	2 116
Autres communes de Bourgogne Est (21,71), à revenu élevé	30	0,71	2 237
Autres communes de Bourgogne Ouest (89,58), à revenu faible	21	0,69	1 058
Autres communes de Bourgogne Ouest (89,58), à revenu moyen	26	0,62	1 257
Autres communes de Bourgogne Ouest (89,58), à revenu élevé	21	0,62	1 564
Autres communes du Pas-de-Calais, à revenu faible	28	0,67	1 776
Autres communes du Pas-de-Calais, à revenu moyen	28	0,70	1 617
Autres communes du Pas-de-Calais, à revenu élevé	28	0,72	1 932
Autres communes du Nord, à revenu très faible	25	0,73	1 595
Autres communes du Nord, à revenu faible	27	0,72	1 624
Autres communes du Nord, à revenu moyen	33	0,71	1 705
Autres communes du Nord, à revenu élevé	28	0,78	1 706
Autres communes de Lorraine Ouest (55,88), à revenu faible	28	0,68	1 807
Autres communes de Lorraine Ouest (55,88), à revenu élevé	30	0,64	1 836
Autres communes de Lorraine Est (54,57), à revenu faible	31	0,56	1 813
Autres communes de Lorraine Est (54,57), à revenu moyen	37	0,56	1 913
Autres communes de Lorraine Est (54,57), à revenu élevé	38	0,62	2 098
Autres communes d'Alsace, à revenu faible	24	0,61	1 174
Autres communes d'Alsace, à revenu moyen	32	0,62	1 316
Autres communes d'Alsace, à revenu élevé	25	0,69	1 436
Autres communes de Franche-Comté, à revenu faible	25	0,64	2 097
Autres communes de Franche-Comté, à revenu moyen	27	0,64	2 181
Autres communes de Franche-Comté, à revenu élevé	29	0,64	2 386
Autres communes du Pays de la Loire Nord, à revenu très faible	35	0,72	2 241
Autres communes du Pays de la Loire Nord, à revenu faible	28	0,71	2 275
Autres communes du Pays de la Loire Nord, à revenu moyen	47	0,76	2 502
Autres communes du Pays de la Loire Nord, à revenu élevé	41	0,76	2 427
Autres communes de Loire-Atlantique, à revenu faible	27	0,66	2 202
Autres communes de Loire-Atlantique, à revenu élevé	33	0,75	2 163

Stratum	Steps	R ²	Estimation stock
Autres communes de Vendée, à revenu faible	24	0,70	1 413
Autres communes de Vendée, à revenu élevé	28	0,71	1 525
Autres communes de Bretagne du Nord, à revenu faible	31	0,68	2 195
Autres communes de Bretagne du Nord, à revenu moyen	43	0,70	2 342
Autres communes de Bretagne du Nord, à revenu élevé	32	0,73	2 243
Autres communes de Bretagne du Sud, à revenu faible	32	0,71	2 364
Autres communes de Bretagne du Sud, à revenu élevé	30	0,69	2 739
Autres communes de Poitou-Charentes Sud, à revenu faible	33	0,67	2 389
Autres communes de Poitou-Charentes Sud, à revenu élevé	41	0,70	2 921
Autres communes de Poitou-Charentes Nord, à revenu faible	20	0,69	1 505
Autres communes de Poitou-Charentes Nord, à revenu moyen	30	0,70	1 654
Autres communes de Poitou-Charentes Nord, à revenu élevé	32	0,71	1 682
Autres communes d'Aquitaine du Nord-est, à revenu faible	20	0,66	2 016
Autres communes d'Aquitaine du Nord-est, à revenu élevé	28	0,67	1 923
Autres communes d'Aquitaine du Sud-ouest, à revenu faible	44	0,60	2 276
Autres communes d'Aquitaine du Sud-ouest, à revenu élevé	31	0,64	2 448
Autres communes de Gironde, à revenu faible	33	0,69	1 671
Autres communes de Gironde, à revenu élevé	29	0,65	1 971
Autres communes de Midi-Pyrénées du Nord, à revenu faible	14	0,69	1 113
Autres communes de Midi-Pyrénées du Nord, à revenu moyen	16	0,71	1 462
Autres communes de Midi-Pyrénées du Nord, à revenu élevé	23	0,67	1 731
Autres communes de Midi-Pyrénées du Sud, à revenu faible	23	0,71	1 470
Autres communes de Midi-Pyrénées du Sud, à revenu moyen	24	0,66	1 553
Autres communes de Midi-Pyrénées du Sud, à revenu élevé	32	0,71	1 805
Autres communes du Limousin, à revenu faible	22	0,73	1 894
Autres communes du Limousin, à revenu élevé	34	0,71	1 998
Autres communes d'Auvergne, à revenu faible	18	0,65	1 408
Autres communes d'Auvergne, à revenu moyen	25	0,64	1 738
Autres communes d'Auvergne, à revenu élevé	28	0,71	2 067
Autres communes du Languedoc-Roussillon, à revenu très faible	22	0,72	1 724
Autres communes du Languedoc-Roussillon, à revenu faible	16	0,74	1 530
Autres communes du Languedoc-Roussillon, à revenu moyen	23	0,72	1 909
Autres communes du Languedoc-Roussillon, à revenu élevé	29	0,70	1 717
Autres communes de Provence-Alpes-Côte d'Azur du Nord, à revenu faible	19	0,68	1 517
Autres communes de Provence-Alpes-Côte d'Azur du Nord, à revenu élevé	21	0,72	1 621
Autres communes de Provence-Alpes-Côte d'Azur du Sud, à revenu faible	20	0,74	1 354
Autres communes de Provence-Alpes-Côte d'Azur du Sud, à revenu moyen	14	0,76	1 368
Autres communes de Provence-Alpes-Côte d'Azur du Sud, à revenu élevé	19	0,71	1 322
TOTAL			293 410