Evaluating the aggregate housing stock and the differential rent in the Nord-Pas-de-Calais region

Jérôme Hubert*, Hakim Hammadou† and Hubert Jayet‡

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Abstract

In this paper, we provide an estimate of the value of the housing stock and the differential rent in all the municipalities of the French region Nord-Pas-de-Calais. This estimate rests upon an original method. This method starts from a hedonic regression applied on an exhaustive dataset of all the real estate transactions for the period 2005-2012. Then, the hedonic regression is applied on an exhaustive dataset of all the real estate properties for estimating their value and the differential rent.[1]

PRELIMINARY VERSION, NOT TO BE QUOTED

Keyworlds: Housing prices, hedonic analysis, urban surplus

JEL Classification: R1, D6

1 Introduction

Hedonic analysis of housing prices is now well developed and a large number of recent studies use it for providing valuation of housing caracteristics, particularly the environmental characteristics linked to amenities and the provision of public goods. A typical case is pollution (see the surveys in Maslianskaïa-Pautrel (2009) and Kolhase (1991)]). Bowse and Ihlandfeldt (2001), Clark (2006) and Li and Saphores (2012) dealed with the air and noise pollution emitted by the transport infrastructures. Tyrvainen (2006), Schultz and King (2001), Espey and Owusu-Edudei K (2001), McConnell and Walls (2005) studied the geographical and landscape amenities such as the forests, urban green and water areas. Plenty of results are now available at the microeconomic level on the determinants of housing prices, using them for estimating the hedonic price of amenities and local public goods.

*LEM UMR 9221, Universite de Lille

†LEM UMR 9221, Universite de Lille

‡LEM UMR 9221, Universite de Lille

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Our knowledge of the macroeconomic value of the housing stock is however much poorer. There are very few studies trying to evaluate the housing stock or the aggregate value of land for a city, a region or a country. Zhang and Arnott (2015) apart, all of them use national accounts, deriving the value of land as a residual. There are however good reasons for evaluating real estate property at the city or regional level. Zhang and Arnott (2015) provide three of them: evaluating land as a factor of production, evaluating land as a tax base, assessing the importance of the real proporty market as a channel through which macroeconomic shocks can affect macroeconomic performance.

We add a fourth reason. An important results from urban economic theory is that, within urban agglomerations, the price of a real estate good capitalizes the willingness to pay of agents for benefitting from the amenities, externalities and local public goods to which access is provided by the real estate (see Brasington (2002)). This capitalization phenomenon justifies the introduction of external characteristics in the hedonic analysis of the price of land and housing. But it also leads to the conclusion that, at the macroeconomic level, the aggregate value of real estate goods provides a good measure of the surplus genarated by an urban area. More precisely, the aggregate differential rent, defined as the value of real estate goods in excess of their oportunity cost, provides a relevant measure of the economics surplus generated by the urban area.

Our contribution is to propose a method for evaluating the aggregate value of the housing stock at the city or regional level, using microeconomic data on real estate properties. Therefore, our main aim is the same as Zhang and Arnott (2015), which is the only paper similar to ours. There are, however, important differences between their work and our contribution. They used a database providing information of the assessed value of land parcels, the assessed value being calculated by assessment officers. As mentioned Zhang and Arnott, the weakness of this dataset is that "a parcel's assessed value in a particular year is not an estimate of its current market value, even though the underlying assessment principle is market value, but is instead determined by a formula that sets a parcel's assessed value at the time of the property's most recent sale equal to the sales prices at that time, and then updates its assessed value annually based on a formula". Instead of employing assessed value, we estimate the market value of housing units using the results of an hedonic regression based on an exhaustive description of all the real estate transactions in the region Nord Pas de Calais, for a fairly long period (2005- mid 2013). Using this estimated hedonic regression, we are able to provide a sufficiently robust estimate of all the housing units in the region and then of the aggregate value.

In the second section of the paper, we briefly present the theory and the methodology of our analysis. Then, in the third section, we briefly describe the geographical context of the region Nord-Pas-de-Calais and the dataset we are using for our hedonic regression. The fourth section is devoted to the presentation of the results from the hedonic regression. The fifth section presents our estimation of the aggregate value of the regional housing stock and of the differential rent. The last section concludes.

2 Theory and Methodology

2.1 Theory

Housing is a differentiated good, with two main factors of differentiation. First, each housing unit is characterized by its internal attributes that describe its size and structure and then its ability to provide housing services: number of rooms, floor space, garden,... Second, each housing unit is characterized by its external attributes that influence the utility of leaving there, but are not characteristics of the good itself: accessibility to the city center and other facilities, environmental quality, social environment,... Most of the external characteristics are associated to local public goods and externalities that are used by the inhabitants.

Then, the price of an housing unit depends upon both its internal and external characteristics, $P = P(H, G)$, where H is the vector of internal characteristics and G is the vector of external characteristics. In the standard Alonso-Muth-Mills urban model, external attributes reduce to accessibility to the central business district (CBD): the lower the accessibility to the CBD, the higher the commuting costs, the lower the price of housing. Then, housing prices decrease from the city center to the city edge; moreover, in an opened city, the city edge is determined by the equality of the housing price to the opportunity cost of housing.

This observation leads to the introduction of the concept of *differential rent*, which is the difference between the price of a home and its opportunity cost. Let us remind that, beyond the city edge, housing price equals the opportunity cost. Then, at market equilibrium, the differential rent may be interpreted as the willingness to pay for leaving in that home and benefitting from accessibility to the CBD instead of leaving outside the city. Aggregating the differential rents for all the housing units located in the urban area, we get the aggregate differential rent. This aggregate differential rent is a monetary measure of the surplus provided by the public goods and amenities provided by the city.

Measuring the aggregate value of housing and the aggregate differential land rent is of interest for several reasons. In most developed countries, housing values is the main asset used for local taxes, for two reasons. The first one is that housing is an immobile good, so that taxing housing does not generate inefficiencies linked to mobility across jurisdictions. The second one is that, for local planners to be efficient, the production of local public goods and amenities must be financed using taxes on land because, through the formation of differential rents, land and housing units capitalize the value generated by these local public goods (Kuroda (1994)). Moreover, following the Henry George's theorem (see *Progress and Poverty : An inquiry into the Cause of Industrial Depressions and of Increase of Want with Increase of Wealth : The Remedy* (1879)), in an optimal city, local public goods must be financed out of a confiscatory tax on differential rents and the cost of these public goods equals the aggregate amount of differential rents.

Moreover, as noted above, the aggregate differential rent is a monetary measure of the surplus provided by the existence of the city, through the public goods and amenities it provides. Then, measuring differential rents allows us to evaluate the value generated by cities and to analyse the factors that are at the source of this value.

2.2 Methodology

Our evaluation uses a two-stages methodology. In the first stage, we use data on housing transactions for estimating an hedonic price function allowing to estimate prices of housing units knowing their internal and external characteristics. In a second stage, we use the estimated hedonic price function on an exhasutive data base describing all the housing units existing in the Nord-Pas-de-Calais Region for estimating the price of these goods and the part ot this price corresponding to the differential rents. Then, we aggregate the results at the municipal and agglomeration levels.

In the first stage, we use the DVF database ("Déclarations des Valeurs foncières") for estimating the following hedonic regression:

$$ln(P_{ij}) = \alpha_j + \zeta_t + H_{ij}\beta + G_{ij}\gamma + \epsilon_{ij} \tag{1}$$

where, P_{ij} is the price of the housing good i located in municipality j the city in which it is located, H_{ij} is a vector of internal characteristics of the good, and G_{ij} is a vector of distances to local public goods available in municipality j, for example schools. When a local public good is missing, the variable is set to zero. The coefficient α_j is a municipal fixed effect, the coefficient ζ_t is a time dummy, while β and γ are vectors of coefficients measuring the marginal impact of a change in characteristics on the log of price.

In the second stage, we use the "fichiers fonciers 2013". This dataset covers all the housing units and land parcels within the region Nord-Pas-de-Calais, providing the standard physical and spatial characteristics of each good. Then, using the estimated hedonic regression, we get the estimated price at the date of the reference period:

$$\hat{P}_{ij} = \exp\left(\hat{\alpha}_j + H_{ij}\hat{\beta} + G_{ij}\hat{\gamma}\right) \tag{2}$$

For calculating the differential rent we need to provide an estimation of the opportunity cost. We start from the fact that, outside the city, in an environment where there are no public goods, there is no differential rent and then the price of a housing unit equals its opportunity cost. Then, as we are outside urban areas, α_j is set to a reference value corresponding to the average value estimated for remote rural areas, say $\hat{\alpha}_0$; ζ_t is set to the value for a reference period, τ, which is the first term of year 2005; and the vector G_{ij} is set to 0, as there is no access to any public good. Then, the estimated opportunity cost is:

$$\hat{c}_{ij} = \exp\left(\hat{\alpha}_0 + \zeta_\tau + H_{ij}\hat{\beta}\right) \tag{3}$$

and then the estimated differential rent is

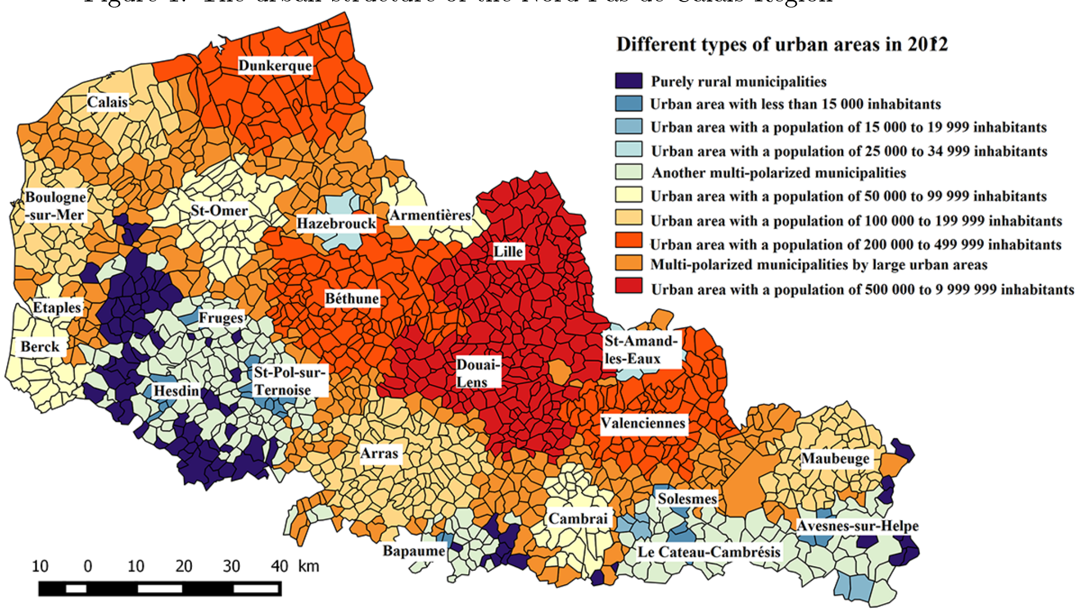
$$\hat{P}_{ij} - \hat{c}_{ij} = \exp\left(\hat{\alpha}_j + \zeta_\tau + H_{ij}\hat{\beta} + G_{ij}\hat{\gamma}\right) - \exp\left(\hat{\alpha}_0 + \zeta_\tau + H_{ij}\hat{\beta}\right) \tag{4}$$

3 The Data and the Geographical context

3.1 The geographical area

The Nord-Pas-de-Calais Region is at the extreme North of France, along the Channel Sea and the Belgian border. With a population of more than 4 million inhabitants and a surface of 12,500 squared kilometers, it is one of the most populated and one of the most urbanized French Region. Nearly 80% of the population lives in urban areas above 100,000 inhabitants (Lille, Douai-Lens, Valenciennes, Béthune, Dunkerque, Boulogne-sur-Mer, Maubeuge, Arras and Calais see the map in Figure, 1). With nearly 25% of the population, 75% of the regional GDP and about half of the companies, the metropolis of Lille is the demographic, political and economic heart of the area.

Figure 1: The urban structure of the Nord-Pas-de-Calais Region



The French National Statistical Institute (INSEE) uses a typology for classifying municipalities along the urban-rural gradients. This typology defines four main types of poles of areas: large poles (at least 10,000 jobs), medium sise poles (5000 to 10000 jobs) small poles (1500 to 5000 thousand jobs) and non polarized areas. For each type of pole, the typology distinguishes between the core area, the periphery, and multipolarized municipalities (depending upon several poles). The result of this typology for the region is presented in Appendix A, 9.

In 2011, there were approximatively 1.8 million housing units in Nord-Pas-de-Calais, nearly 90% being a main residence, 3% secondary residences and 6% being vacant. With 56.2% of owner-occupant, the Region is close to the national average.

3.2 The data

For our first stage analysis, we use the DVF files for the Nord-Pas-de-Calais Region. These files exhaustively include all the transfers of real estate property within the Region. We have acces to the files for the years 2005 to the first half of 2013. The files include all types of property transfers, on all type of real estate properties, which amounts to 548,338 observations.We keep sales of housing properties: 278,380 sales of houses and 72,693 sales of apartments. Then, we excluded properties with more than one dwelling or including business premises. We also dropped transactions with unrealistic values (e.g. non positive prices). Our final file includes 263,096 houses and 55 626 appartments. The spatial distribution of these transactions is displayed in Figure 2. As one may expect, transactions are heavily concentrated in the main urban areas of the Region. This is even more true for flats: almost all of them are located in urban areas, particularly in the Lille metropolis.

Figure 2: Number of transactions

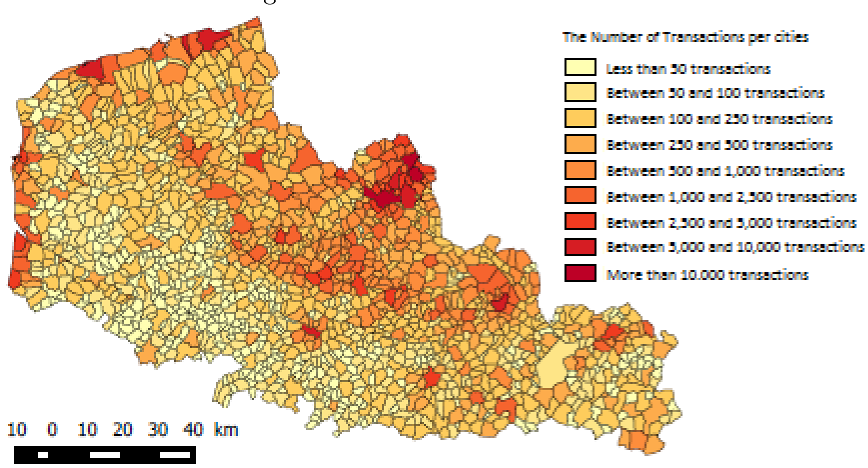
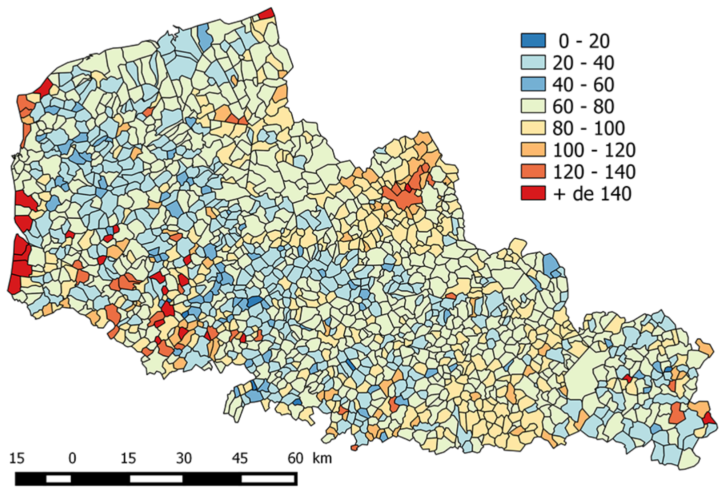


Figure 3 displays transaction rates per 1,000 inhabitants. Apart the Lille urban area, the most active housing markets are on the coast of the Channel sea, particularly on its Southern part, where the seaside resort of Le Touquet-Hardelot is located. For each transaction, the information available includes the standard housing characteristics: type of house and size. We also know the address, which allows us to geolocated the good. Then, we calculate the distance to the main public facilities available locally , using a geographical information system. For calculating the distances, we use the dataset "occcupation des sols

2009", where we can find the location of many amenities. We decided to take into account only those which correspond to the public infrastructures and the most common natural amenities. Adding more amenities does not add more information, because of the high correlation it generates between independent variables.

Figure 3: Number of transactions per 1000 inhabitants



For our second stage analysis and the calculation of the aggregate land rents, we use the "fichiers fonciers" (Land Use files). This dataset is the electronic version of the French official land registry, managed by the French administration. For every municipality, it provides an exhaustive description of all the real estate goods existing. The fact that the land registries are used for legal and fiscal purposes implies that the information available in the Land Uses files is of vary high quality and really exhaustive. Moreover, the Land Use files have been used for providing additional information on the transactions included in the DVF file, so that we are sure that the description of the goods is the same in both files.

Using the Land Use files, we find that, in 2013, there were slightly less than 2.5 millions of real estate goods in the Region Nord-Pas-de-Calais. Approximatively half of them were houses (54%), nealy a quarter were flats (23%). The remaining properties are small goods linked to other real estate goods (typically, garages) representing 16% of the real estate goods, and business premises (7%). For selecting the sample that we use for our analysis, we choice the same criteria as for the DVF files. These criteria leaded to the exclusion of less that 1% of the housing units (houses and flats) available in the Land Use files. The final sample includes 1,334,884 houses and 564,134 flats.

Because both the DVF file and the Land Use file are exhaustive, it is possible to use them for calculating the percentage of the housing stock that was sold (and bought) during the period 2005- mid 2013. The spatial distribution of this

Figure 4: Percentage of the housing stock with a transaction during the period 2005-2013

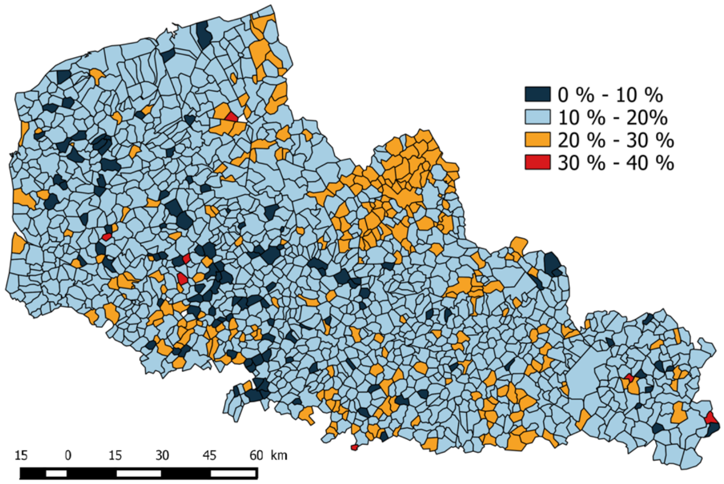


Table 1: Comparison between the DVF files and the Land Use files

	Houses		Flats	
	DVF	Land Use	DVF	Land Use
Number of rooms	4.3 (1.4)	5.0 (1.5)	2.4 (1.1)	2.9 (1.4)
Room size	22.3 (7.7)	19.3 (5.6)	24,0 (8.4)	20,6 (6.5)
Terrace	0.03 (0.18)	0.07 (0.26)	0.07 (0.3)	0.05 (0.2)
Garage	0.53 (0.5)	0.62 (0.5)	0.45 (0.5)	0.47 (0.5)
Swimming pool	0.07 (0.03)	0.09 (0.04)		
Year of construction	1931 (83)	1942 (51)	1963 (47)	1960 (47)

Standard deviations in parentheses

percentage is displayed in Figure 4. Again, the most active labour markets are the urban ones, particularly in the Lille urban areas.

Table (1) compares the average characteristics of houses and flats included in both files. There are small differences only. The main one is the period of construction for houses: on average, houses in the DVF file (and then houses that have been sold during that period) are ten years older than the houses in the Land Use files. Housing units in the DVF files have slithgly less rooms, but the rooms are slightly larger. We can not control if these similarities is really robust because that would require to build a probit model with Land Use files data. But i'ts impossible for us to identify DVF transactions if this former. But we are thinking that characteristics are the main reasons to buy a home but principally its location.

4 The main results from hedonic estimation

4.1 Internal characteristics

The results for the estimated impact of the hedonic charateristics are displayed in Appendix B, Table 6. The elasticities with respect to lot size and to the average room size are significant but largely below unity. As expected, increasing the number of rooms increases the price, the effect of an additional room decreasing with the number of rooms. These results are in line with the literature (see Marchand et Skhiri (1995)). The period of construction also has a highly significant effect, the oldest housing units being cheaper than the youger ones. The price of a house built after 2000 is higher by 30% than the price of a similar house built in the first half of the 20^{th} century. This result is in line with results for Quebec (See Dubé *et al.* (2011)) or for the French metropolis of Marseilles (see Bono *et al.* (2008)). The presence of a terrace, a garage or a swimming pool also has a significantly positive impact (for similar results, seed Cavailhès (2005), Goodman et Thibodeau (1998,2003)).

With regard to the apartments (Appendix B, Table 7), we find rather similar results. The estimated impact of the average room size is similar and the impact of an additional room is also significantly positive and decreasing with the number of rooms. Terraces and garages have a higher impact.

4.2 External characteristics

Before looking at the impact of external characteristics, let us remind that our model includes a complete set of municipal effects. Then, the impact of characteristics differentiating municipalities globally (for example, the fact that there is a secondary school or a railway station) is included in the municipal effect. Then, the estimated coefficients of our regression measure the impact of the proximity to local public goods and amenities within the same municipality, for example the impact of being close to a school within a municipality where a school is available. For a complete analysis of the impact of local public goods and amenities, we also need to analyse their impact on the estimated municipal effects. This analysis is not carried out here, as the main aim of this paper is to measure the differential rent. It is left out for a parallel paper.

The estimation results for the external characteristics are displayed in Appendix C, Table 8. Most estimated impacts conform to expectations or to results available elsewhere in the literature. Proximity to facilities that can be considered as disamenities has a negative impact on prices: cemeteries, dumps, highspeed railway lines and motorways, prisons, high collective housing (above 30 m high) , industrial or shopping areas, brownfields, police stations, coal heaps. These results are in line with Nelson et al. (1997), Ready (2005) and Lim and Missios (2007) for dumps. The negative impact of proximity to railway lines and motorways can be attributed to the noise and pollution they generate (see also Nelson and al. (1997), Bowes and Ihlanfeldt (2001), Clark (2006) and Li and Saphores (2012)). A similar explanation may be found for industrial or shopping areas and police stations. Even if the proximity to a shopping area makes shopping easier, this benefit is outweighted by the negative consequences of traffic induced by the shopping area. The impact of coal heaps has always been subject to debate. Coal heaps are considered as an historical heritage from the coal mining era, which leads to give them a positive value. At the same time, coal heaps have a negative impact on their local environment; clearly, the later effect dominates the former. A similar effect has been found by Brossard and alii (2007).

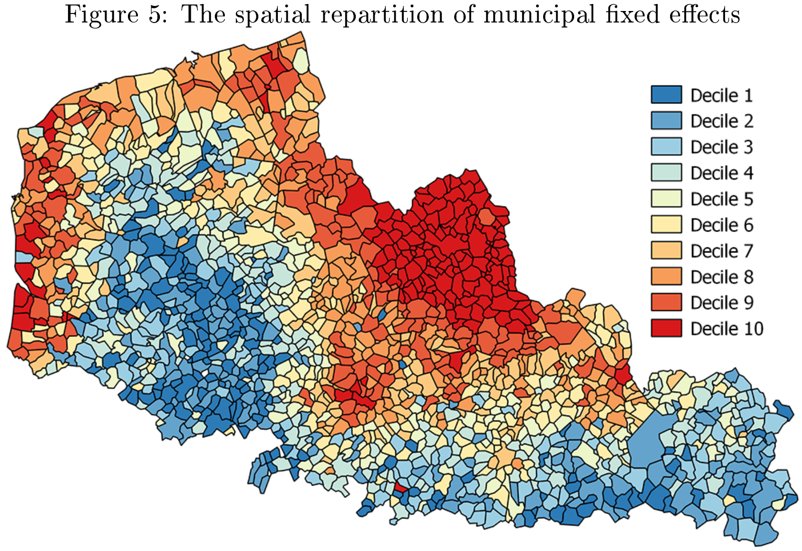
Conversely, proximity to facilities that can be considered as amenities is positively valued: leisure areas, schools and universities, the sea, hospitals, fire stations, churches, museums, railway stations. Wadell et al. (1993) also find a positive impact of proximity to hospitals. The positive impact of universities is also found by Wadell and al. (1993) and Kashian and Rockwell (2013). About the proximity to the sea, our results are in line with Bono and al. (2007) and Dantas and al. (2010).

With regard to the apartments (Appendix C, Table 9), overall we find the same signs as for the houses. There are some differences, that may be explained by the fact that almost all the apartments are located in large urban areas.

4.3 Fixed effects

The spatial repartition of the estimated fixed effects is displayed in the map of Figure 5.

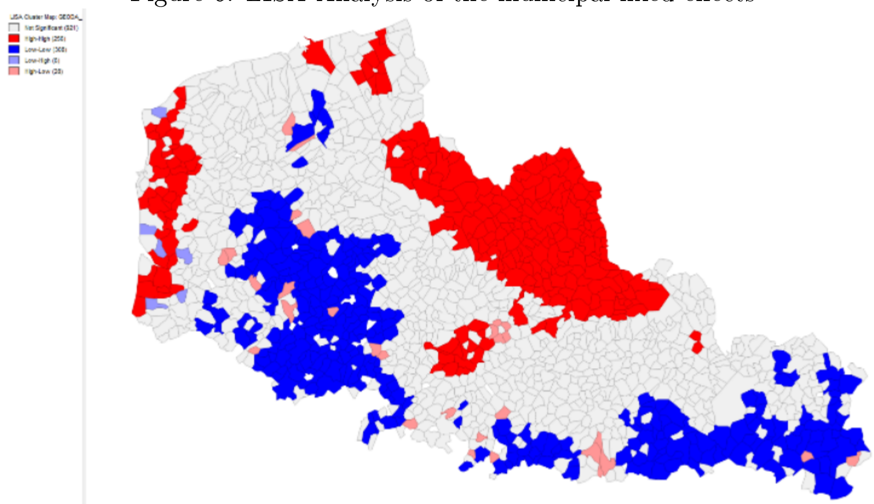
Figure 5: The spatial repartition of municipal fixed effects



Municipal effects are highest in three areas. The main one corresponds to the extended Lille urban area, extended to the South toward the city of Arras and to the West toward the city of Hazebrouck. The other two areas are on the coast. At the extreme South, price effects are high in the area of Le Touquet and Hardelot, which is a well known seaside resort. Northern from this area, we find the area around the cities of Boulogne and Calais, corresponding to the Channel Tunnel. Conversely, fixed effects are lowest mainly in two areas, both located in the Southern part of the region, and both corresponding to its most rural part.

These fixed effects are highly spatially autocorrelated, which leads us to make a LISA analysis. The results from LISA analysis are displayed in the Figure 6. We can see in the LISA Significance Map (Appendix D, Figure 10) that all autocorrelated effects are hightly significant.

Figure 6: LISA Analysis of the municipal fixed effects



5 Evaluation of the land rent and the differential rent

5.1 Differential rent stock analysis

If we adapt the Ricardican rent theory (1817) to housing, we may consider that aggregate differential rent corresponds to the difference between housing's actual value an theoretical value of the same goods if they are localized on the less valued site of the Nord-Pas-de-Calais. On average, the less valued localization is in an area with a small living space which does not get amenities. The municipality's average coefficient of rural areas (rural pole areas for flat because there is not enough goods in simple rural area) will be used to estimate the houses' theoretical prices.

We use the Land Use files for calculating the global value of the regional housing stock and the aggregate differential rent, using the formulas (2) and

(4). The main results are displayed in Table (2).

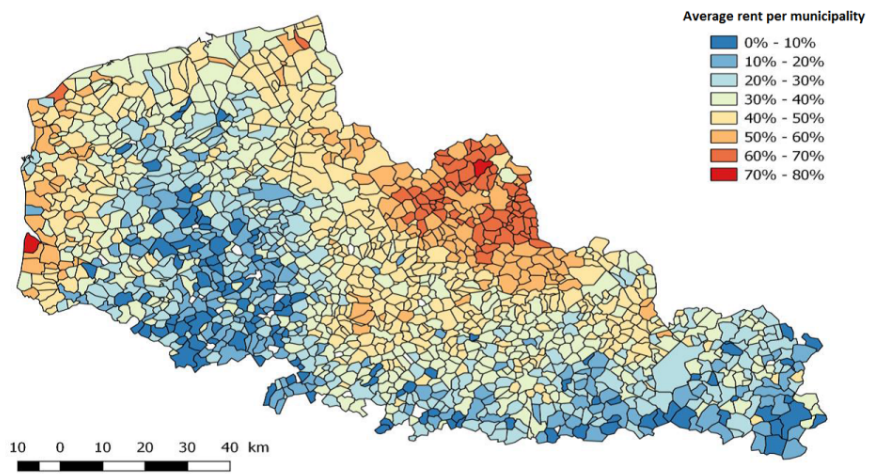
Table 2: Aggregate Land Rent: Main Results

	All	Houses	Flats
Number	1,899	1,335 (70.3%)	564 (29.7%)
Global value	357.8	292.4 (81.7%)	65.4 (18.3%)
Differential rent	161.7	141.3 (87.4%)	20.4 (12.6%)
Share of the diff. rent	45.2%	48.3%	31.2%
Unit value	0.191	0.219	0.126
Unit diff rent	0,085	0,106	0.039

Monetary values are in billions of Euros

The aggregate value of the housing stock is estimated at 358 billion euros, which corresponds to 88,000 euros per inhabitant. It is between three and four times the regional GDP, estimated by INSEE at around 100 billion euros in 2012. This aggregate value is shared at 82% by houses and 18% by flats. There is no possibility to make a direct comparison between the housing stock value and capital stock value. No information is available on the capital stock at the regional level. However, starting from the value of the national capital stock which is available in the national accounts and multiplying it by the share of the region in the national added value, we find 355 billion euros as a rough approximation. Then, the regional housing stock has approximately the same aggregate value as the regional capital stock. As for the aggregate differential rent, it is estimated at 161 billion euros, which represents around 45% of the housing stock aggregate value. The share of the differential rent is higher for houses than for flats: it represents 48% of the housing stock value for houses and 31% for flats. Then, the share of apartments in the aggregate differential rent, which is estimated at 13%, is lower than its share in the aggregate value of the housing stock (18%). There are important differences between municipalities, as one can see from Figure 7. In the most rural areas of the region, as expected, the share of the differential rent is estimated to be close to zero. Conversely, in the Lille urban Area and in the seaside resort Le Touquet-Hardelot (Western coast, along the Channel Sea), the high value of housing implies that the share of the differential rent may be very high. Often exceeding 50%. All the coastal municipalities don't have the same value. The northern part of the « Opale Coast » seems to be less valued than southern part. However, the most important urban areas are in the northern part. That can be explained by the fact that the majority of touristic areas of the Nord-Pas-de-Calais are localized in the southern part of the sea coast. It's interesting to observe that it is not services which are localized inside big urban areas (transport network, educative services, public administrationn cultural infrastructures) which produce the largest differential rent, but public services linked to municipality's visual acceptability and maintining of natural amenities which are around (especially sea cost). This is important to keep in mind that the most important part of housing which are in these municipalities's stock are not primary residences. So

Figure 7: Share of the differential rent in the value of the housing stock in the Nord-Pas-de-Calais



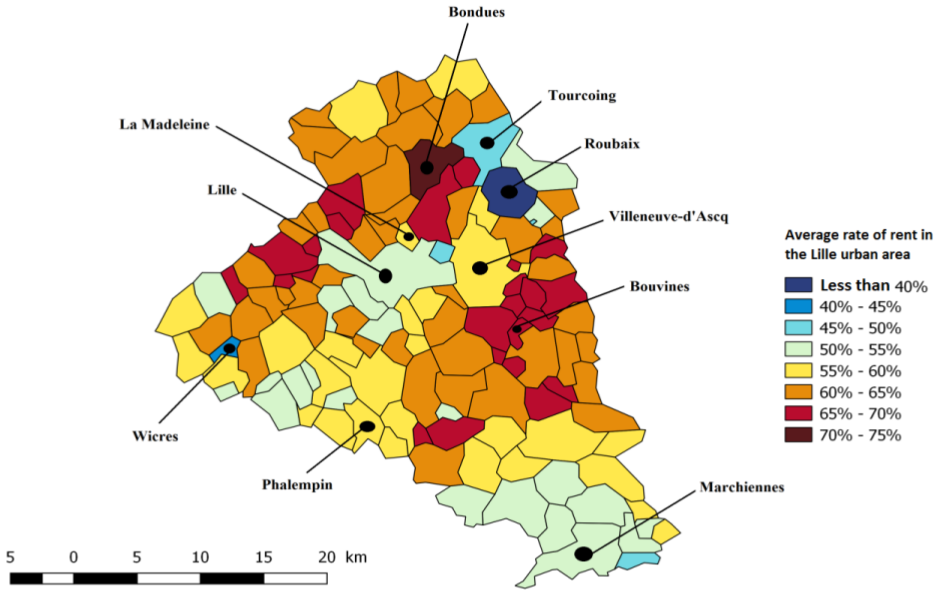
it is normal that desired amenities in touristic areas by households are not the same as those expected by households which search an accomadation in a large urban area. This difference of behaviour about household preferences is not because their heterogeneity but the kinds of housing researched. As expected, less valued areas are those which are not localized close to touristic areas nor close to urban areas. These areas do not benefit from sufficient incentive to attract households who want to have an access to natural areas or a sufficient public services supply.

The list of the 20 municipalities where the share of the differential land rent is highest is displayed in Appendix E. Table 10. This list illustrates an important point: apart Le Touquet-Paris Plage (a well-known seaside resort), all these municipalities are in the Lille urban areas, but most of them are not within the core of the metropolis. They rather are located in the suburbs. This is likely to be a specificity of the city structure in the Nord-Pas-de-Calais region compared to elsewhere in France.

In this region, the urban areas centers do not concentrate the richest populations; they may host poor populations, moreover hard hit by the economic crisis this former industrial region suffers from. The richest populations locate in the suburbs, and their concentration generates (or attracts) local amenities and high valued public goods. We presents the case of The urban areas of Lille in Figure 8.

It shows the average differential rent share in the housing values at the municipal level. With a few exceptions as Roubaix and Tourcoing, all the municipalities of the Lille urban area generate a rent share around 60% of their housing stock. With 72%, Bondues is the municipality with the highest resultt. Lille is one of the less valued municipalities. In the usual way showed in the

Figure 8: Share of the differential rent in the value of the housing in the Lille urban area



Alonso-Muth-Mills model, the rent decreases with the distance from the downtown. This figure show that the Lille urban area does not share this view. In fact, the A-M-M is verified for most distant municipalities as in the south but that is not true for those which are close around the municipality of Lille. This is likely to be a specificity of the city structure in the Nord-Pas-de-Calais region compared to elsewhere in France: in Nord-Pas-de-Calais, the city centers do not concentrate the richest populations; they may host poor populations, moeover hard hit by the economic crisis this former industrial region suffers from. The richest populations locate in the suburbs, and their concentration generates (or attracts) local amenities and high valued public goods. Then, if the Lille metropolis is clearly a source of surplus, this surplus does not necessary appear in the city center, even if the activities located in the city sector are an important factor generating this surplus; it appears in the municipalities attracting the most productive workers, that are located in the residential suburbs. For example, the so-called « BMW triangle » (Bondues, Mouvaux Wasquehal) is composed by municipalities which are among the best municipalities about high-skilled population (more than 15% of the population). These three municipalities have a significant school supply, a golf and many publi parks. There is also, in the south of Lille, the « Pévèle Carembault » area which has a rural landscape, an important cultural heritage and a transport network which makes possible to go to Lille fastly. The phenomena that we show is in two-way process because these are amenities which give direction to the wealthy house-

Table 3: Differences between the main types of areas

Code	Type of area	Rent share	Rent per sqm
111	Core of a large pole	52,98%	1 240,55 €
112	Periphery of a large pole	49,48%	1 243,82 €
120	Multipolarized area (large poles)	38,62%	817,78 €
211	Core of a medium size pole	21,34%	304,21 €
212	Periphery of a medium size pole	14,18%	224,37 €
221	Core of a small pole	22,19%	356,06 €
222	Periphery of a small pole	24,46%	458,58 €
300	Multipolarized area (small poles)	19,03%	311,33 €
400	Area outside poles	22,30%	392,04 €

holds. Conversely, we note that poor household are gathering to municipalities as Roubaix or Tourcoing.

Table 3 is a further illustration of this point. We sue the ZAUER typology presents above. For each area, we evaluated the differential land rent per square meter. Clearly, the main difference is between large poles (more than 10,000 jobs) and all the other areas, the differential land rent per square meter being much higher in the large poles and their periphery than in other areas. And there is no much difference between the core of the large poles and their periphery.

Our information on property sales being exhaustive, it is interesting to measure the rotation of the housing stock generated by sales. Table 4 displays the main results. For an average year, the aggregate value of housing sold is 5.38 billions euros, which represents 1.44% of the aggregate value of the housing stock. The number of transactions corresponding to 2.02% of the number of houses, the value of sales is slightly lower than the value of the average house. Moreover, for sales, the aggregate differential rent represents only 35% of their global value and is only 1.15% of the aggregate dfferential rent for the whole housing stock. Then, sales are located in areas where the differential rent is lower.

There are striking differences between houses and flats. For an average year, only 1.26% of the stock of flats is sold, while it is the case for 2.32% of the stock of houses. We attribute this difference to the importance of rented housing in the stock of houses. Houses used for rent, and particularly public housing, are seldom solded. Comparing the share of sold flats in the stock of flats (1.14%) with the share of sold flats in the value of the stock (1.24%), we find that housing that are sold have a lower value than the average housing. Last, the average share of the differential rent is much lower for sales of houses and flats. Goods sold are those that generate the lowest level of rent.. This suggests that the less "interesting" properties are those that are on the market.

Table 4: The average value of sales per year

	All	Houses	Flats
Global value	5.38	4.59	0.79
Differential rent	1.86	1.63	0.23
Share of sales (Number)	2.02%	2.32%	1.26%
Share of sales (Value)	1.44%	1.57%	1.24%
Share of sales (Diff rent)	1.15%	1.16%	1.14%
Average share of the diff rent	34.66%	35.55%	29.46%

Values are in billions of euros

5.2 Differential rent flow analysis

To analyze the differential rent flow, we estimate sales considered during the first stage of our methodology. On average, 1,51% of the regional housing stock value was subject to a transaction each year. This statistic is more important for house than for flats. However, we note that there is the same logic for each kinds of goods during our analysis period (see Appendix F. 11). Overall, 12.84% of the stock value was subject to a transaction during the period. This statistic is more important for houses (13.35%) than for flats (10.56%). However, results are similaire for the rate of differential rent. Indeed, 9.82% of the housing differential rent stock was generated by transactions and 9.65% for flats. This is due to the fact that price of houses which are sold are composed of a less important share of differential rent (around 35%) than average (around 48%) of the global house stock. Regarding to flats, the result is different because goods which are subject to transaction generated a differential rent close to the average of the global flat stock. Surprisingly, this statistics are stable during the 8.5 years of our period. The economic crisis of 2008 did not have any consequences and the diminution of the transaction quantity did not be achieved at the expense of goods which generated fewer differential rent (see Table 5).

Table 5: Global and differential stock flow from 2005 to mid 2013.

Year	Global transaction value	Stock share subjected to a transaction	Differential rent subjected to a transaction	Share of differential rent stock	Average differential rent share in housing subjected to a transaction
2005	4.60	1,29%	1,62	1,00%	35,18%
2006	5,57	1.56%	1.94	1.20%	34.85%
2007	6.11	1.71%	2.13	1.32%	34.95%
2008	5.43	1.52%	1.88	1.16%	34.54%
2009	4.40	1.23%	1.53	0.94%	34.70%
2010	6.16	1.72%	2.13	1.32%	34.64%
2011	6.24	1.74%	2.14	1.32%	34.32%
2012	5.17	1.45%	1.77	1.10%	34.31%
mid-2013	2.04	0.57%	0.70	0.43%	34.22%
Total	45.72	12.84%	15.85	9.80%	34.66%

Values are in billions of euros

Overall, there were an average differential rent flow of 1.86 billions each year. That represents around 2% of the regional GDP. According to fiscal datas (from INSEE), the amount of entire local taxes withdrawn by municipalities was around 1.8 billions euros. That is equivalent to the average differential rent flow. This result is very interesting according to the so called “Henry George Taxe”.

6 Conclusion

This first evaluation gives an idea of the importance of the housing stock and of its determinants. Several results are worth noting. First, the global value of the housing stock in the Nord-Pas-de-Calais Region is close to a rough evaluation of the capital stock, which implies that the housing stock is a very important componant of the region wealth and may have macroeconomic implications. Second, half this value comes from the diffential rent, which implies that a very large part of the value of the housing stock is determined by the urban environment, which in turn is heavily influenced by economic policies and urban policies.

Third, the spatial repartition of the differential rent is clearly linked to the regional urban structures. The highest values appear in seaside resorts (and, more generally, in touristic areas) and in residential areas close to the Lille metropolitan areas. Therefore, for differential rents to be high in a municipality, this municipality must be connected to a dynamic urban area and must be able to attract the highest level social groups working in this area. The city centers do not look to have a specific advantage, which may be explained by the specific history or the region, where de-industrialisation led to the concentration of poor people in city centers.

The preliminary results of this first version need to be completed. First, we still have to analyse the main determinants of the differential rent, comparing the various urban areas of the region with each other. Second, our analysis has focussed on housing units only, neglecting undeveloped land. Information is available in our dataset on transactions on undeveloped land by status, so that we hope being able to look at the value of undeveloped land, focussing more specifically on that part of undeveloped land that is developable. There may be also some work to carry out on business property.

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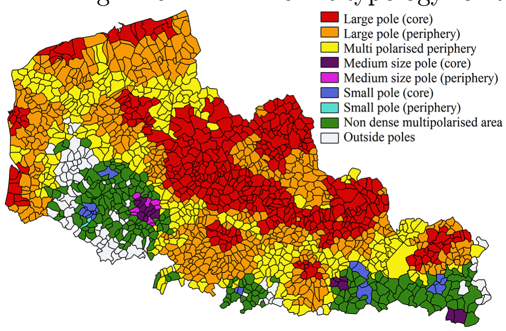
Appendix

Appendix A.

Figure 9: The ZAUER typology for the Nord-Pas-de-Calais Region



Appendix B.

Table 6: Estimated coefficients of the internal characteristics of houses

Internal characteristics	MCO		SEM	
	Coefficient	t-Statistic	Coefficient	t-Statistic
Land area (logged)	0.184***	145.70	0.125***	127.87
Average room size	0.0189***	137.56	0.191***	139.79
Number of rooms				
One	-1.181***	-123.92	-1.194***	-123.65
Two	-0.499***	-110.51	-0.511***	-111.40
Three	-0.185***	-69.36	-0.196***	-71.27
Four	*Reference*			
Five	0.109***	47.90	0.113***	47.68
Six	0.211***	64.67	0.218***	65.06
Seven	0.316**	59.44	0.317***	59.46
Eight and more	0.475***	66.71	0.477***	68.77
Period of construction				
Before 1900	-0.029***	-10.86	-0.021***	-7.59
From 1900 to 1944	*Reference*			
From 1945 to 1969	0.014***	5.28	0.027***	8.99
From 1970 to 1979	0.111***	31.68	0.127***	32.42
From 1980 to 1989	0.150***	40.55	0.163***	39.91
From 1990 to 1999	0.223***	45.82	0.251***	47.97
2000 and after	0.257***	48.63	0.289***	62.69
Amenities				
Terrace	0.062***	12.55	0.067***	13.18
Garage	0.109***	49.34	0.123***	54.07
Swimming pool	0.224***	8.36	0.229***	8.32
Height				
Single floor	-0.093***	-5.41	-0.082***	-4.81
Two floors	-0.011***	-4.43	-0.009***	-3.47
Three floors	*Reference*			
Four floors or more	0.101***	5.93	0.044**	2.50

Table 7: Estimated coefficients of the internal characteristics of flats

Internal characteristics	MCO		SEM	
	Coefficient	t-Statistic	Coefficient	t-Statistic
Average room size 0.019*** -100.32 0.019*** 77.99	0.019***	-100.32	0.019***	77.99
Number of rooms				
One -0,527*** -100.32 -0,528*** -98.11	-0.527***	-100.32	-0.528***	-98.11
Two	*Reference*			
Three 0,327*** 71.18 0,327*** 71.91	0.327***	71.18	0.327***	71.91
Four 0,511*** 84.93 0,518*** 84.91	0.511***	84.93	0.518***	84.91
Five 0.710*** 76.49 0.69.5*** 73.76	0.710***	76.49	0.695***	73.76
Period of construction				
Before 1945 0.056*** 8.46 -0,026*** -3.83	0.056***	8.46	-0.026***	-3.83
From 1945 to 1969	*Reference*			
From 1970 to 1979 0.053*** 7.58 0,054*** -6.85	0.053***	7.58	0.054***	-6.85
From 1980 to 1989 0.089*** 9.01 0,014 1.37	0.089***	9.01	0.014	1.37
From 1990 to 1999 0.129*** 15.95 0,064*** 7.97	0.129***	15.95	0.064***	7.97
2000 and after 0.246*** 28.86 0.152*** 17.82	0.246***	28.86	0.152***	17.82
Amenities				
Terrace 0.080*** 10.31 0.071*** 8.78	0.080***	10.31	0.071***	8.78
Garage 0.172*** 28.86 0.157*** 33.91	0.172***	28.86	0.157***	33.91
Height				
Single floor -0.063*** -7.6 -0.039*** -4.30	-0.063***	-7.6	-0.039***	-4.30
Two floors -0.078*** -5.52 -0.060*** -3.72	-0.078***	-5.52	-0.060***	-3.72
Three floors	*Reference*			
Four floors or more 0.056*** -6.71 -0.038*** -4.25	0.056***	-6.71	-0.038***	-4.25

Appendix C.

Table 8: Estimated coefficients of the external characteristics of houses

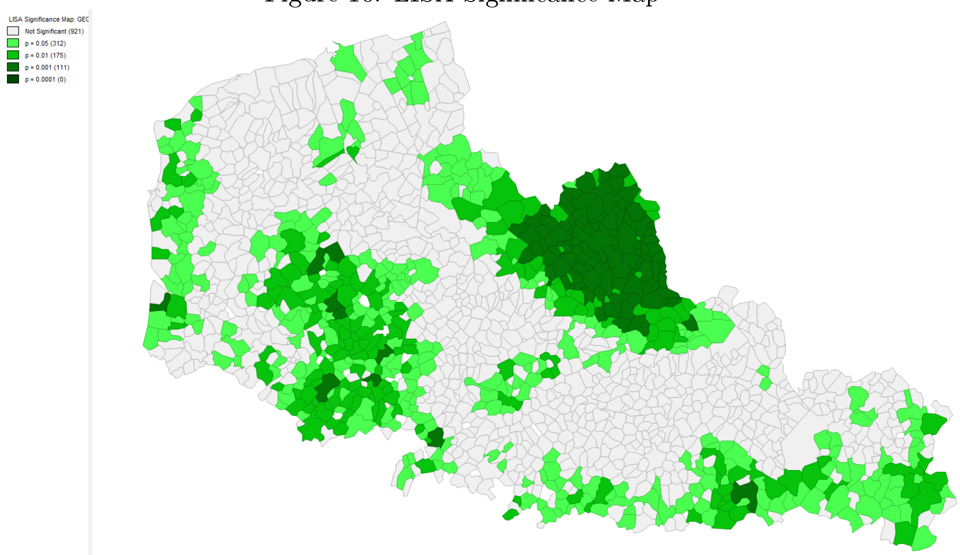
External characteristics	MCO		SEM	
	Coefficient	t-Statistic	Coefficient	t-Statistic
Cemetary (<=200m)	-0,036***	-3.96	-0.031***	-3.47
Distance to a waste disposal				
less than 300m	-0.030***	-4.82	-0.026***	-3.08
300m to 600m	-0.023***	-5.82	-0.020***	-3.57
600m to 1200m	-0.010***	-3.99	-0.013***	-3.31
Higher than 1200m	*Reference*			
University (<=2000m)	0.028***	7.16	0.016***	2.70
LGV railway line (<=200m)	-0.142***	-8.23	-0.080***	-3.48
Motorway (<=300m)	-0.014**	-2.27	-0.025**	-2.92
Hospital (<=1000m)	0.047***	17.16	0.040***	9.72
Prison (<=300m)	-0.090***	-3.27	0.066*	-1.73
Fire place (<=200m)	0.021***	3.79	0.018**	2.35
Hight collective housing (<=300m)	-0.018***	-7.11	-0.018***	-4.90
Church (<=100m)	0.022***	6.08	0.008*	1.93
Industrial area (<=100m)	-0.033***	-7.85	-0.027***	-5.63
Museum (<=300m)	0.048***	7.50	0.035***	3.93
Shopping district	-0.012***	-3.72	-0.014***	-3.09
Distance to a Coal Heap				
Less than 1000m	-0.091***	-11.56	-0.068***	-5.94
1000m to 2000m	-0.055***	-8.22	-0.044***	-4.62
More than 2000m	*Reference*			
Brownfield (<=300m)	-0.030***	-7.63	-0.034***	-6.22
Distance to sea				
Less than 1000m	0.324***	18.72	0.291***	11.30
1000m to 2000m	0.178***	11.49	0.164***	7.20
2000m to 3000m	0.130***	8.53	0.130***	5.86
3000m to 4000m	0.083***	5.60	0.079***	3.77
Higher than 4000m	*Reference*			
Distance to				
Secondary school	-0.00001542***	-5.82	-0.00001322***	-3.14
Railway station	0.00000633***	2.79	0.00001343***	3.76
Police station	-0.00001425***	-5.54	-0.00000865**	-2.13

Table 9: Estimated coefficients of the external characteristics of flats

External characteristics	MCO		SEM	
	Coefficient	t-Statistic	Coefficient	t-Statistic
Brownfield (<=500m)	-0,052***	-9.70	-0,046***	-4.84
Park (<=500m)	-0,027***	-6.06	-0,014*	-1.74
University (<=500m)	-0,0463***	-7.46	-0,0314***	-2.71
Hospital (<=1000m)	0,044***	7.47	0,038***	3.51
Hight collective housing (<=200m)	-0,013***	-2.83	-0,031***	-4.34
Church (<=50m)	-0,022***	-1.99	-0,041***	-2.96
Museum (<=500m)	0,080***	15.60	0,079***	8.31
Leisure (<=300m)	-0,022***	-4.57	-0,022***	-2.84
Lake (<=500m)	0,057***	7.33	0,022***	1.67
Sea (<=1000m)	0,127***	6.70	0,110***	5.52
Distance to				
Primary school	0,00014083***	12.96	0,0001473***	12.96
Police station	-0,00002565***	-4.23	-0,00002666**	-4.23

Appendix D.

Figure 10: LISA Significance Map



Appendix E.

Table 10: The 20 municipalities with the highest rate of differential land rent

Urban area	**Global value**	**Diff rent**	**Rent Share**	**Rent/sqm**
	euro billions		**%**	**euros 1000**
Bondues	4.52	3.50	72.91	3.70
Le Touquet-Paris-Plage	2.08	1.56	72.21	3.37
Gruson	0.13	0.10	69.87	2.90
Bouvines	0.23	0.17	69.50	2.88
Lompret	0.41	0.29	68.96	2.75
Ennetières-en-Weppes	0.29	0.20	68.26	2.71
Louvil	0.23	0.16	68.13	2.68
Sailly-lez-Lannoy	0.49	0.34	68.09	2.66
Anstaing	0.23	0.16	67.79	2.64
Péronne-en-Mélantois	0.17	0.11	67.72	2.64
Mouvaux	0.09	0.07	67.66	2.62
Verlinghem	0.21	0.14	67.11	2.61
Tourmignies	0.14	0.10	66.88	2.59
Genech	0.14	0.10	66.87	2.54
Chéreng	5.68	4.07	66.83	2.52
Halluin	2.04	1.46	66.67	2.50
Sainghin-en-Mélantois	0.33	0.22	66.64	2.48
Cobrieux	0.23	0.16	66.41	2.47
Forest-sur-Marque	0.39	0.27	66.39	2.46
Mérignies	1.91	1.29	66.11	2.46

Appendix F.

Figure 11: Evolution of the stock share which was subject to a transaction for each kinds of housing from 2005 to 2012